Research on Evaluation and Countermeasures of Infomatization Level of Wuhan City Circle

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Abstract   Accelerating the development of informatization is a effective way to transform science and education advantages of Wuhan City Circle (in China) to innovate the development patterns, and to enhance regional competitiveness.into development advantages, This paper uses the national informatization index system to measure the level of infomatization in Wuhan City Circle (in China), draws a conclusion that the level of infomatization in Wuhan City Circle (in China) is relatively not high.
Key words   Wuhan City Circle (in China); Informatization; Measure

1 Introduction

In recent years, the city informatization development environment of Wuhan City Circle 1+8 (in China)has been further improved; infrastructure of informatization has been gradually improved; the level of infomatization of businesses and society has been significantly improved, but there are also problems like enterprise information services lacking scale effect, information resources sharing network being not well organized. Taking quantitative evaluation for the level of informatization in Wuhan City Circle (in China) is beneficial to analyze the main problems and constraints in the process of informatization of city circle, and to proposing a targeted policy suggestion.

2 Literature Review

The concept of informatization originated in Japan in 1967 and it was formally proposed by Japan's science and technology and economic research group. It was a combination of the Western theory and the reality of Japanese. The so-called « inversion » refers to the process that things transform from one state into another state, and informatization is precisely the process that industrial economy was transformed into the information economy ; industrial social was evolved into the information society. Measurement methods of informatization began in the 60s of 20th century. More representative methods are Machlup method, Borat method, informatization index method, the ITU index system method and information society index method of International Data Corporation, Earth's economy – three factors parameter model method [1]. As time moves forward, it can be said that some theoretical models or methods are relatively mature, but some methods are also the results of re-innovation on the basis of the previous accord with their reality by a number of domestic and foreign scholars, there are some imperfections.

3 Evaluation Principles and Evaluation Index System

3.1 Construction basic principles of measurement index system

The core of index system measurement method is the construction of index system. An index system of measuring the level of informatization should follow the following principles :
(1) The indicators should comprehensively reflect the main features

Informatization measurement index system should closely link to content of informatization, and strive to measure informatization with wide-ranging and multiple angles, to make description comprehensively as far as possible. The index system can reflect informatization level of China and its every region from various angles. This informatization is consistent with informatization in this article, which is not limited to purely economic structures and information technology. The key of this issue is the confirmation of information meaning, which refers to the achievement of the purpose of accurate measurement through analyzing all aspects.
(2) Indicator should be comparable

Informatization process is a long process ; the selected indicators should last for a long time and have same content and scope of indicators.
(3) The indicator should have the availability

This is a big research difficulty of statistical index system. As it involves a longer span of

informatization and changes rapidly ; it is very difficult to fully reflect the main features without distortion.

(4) The informatization index system should be suitable to developmental stage of informatization in Wuhan city circle

There is a big gap between the level of informatization in Wuhan city circle and level of informatization in developed countries. Measurement system of foreign developed countries has some reasonableness, but it may not be appropriate to measure the level of informatization in Wuhan city circle, therefore it needs careful consideration.

Based on the above principles, some adjustments are to be made based on national informatization index system, to include information policies and regulations, to achieve measurement of the level of informatization in Wuhan City Circle purposes by combining quantitative analysis with qualitative analysis.

3.2 The specific measurement index system

The reason of using national informatization index system[2] to measure the level of informatization of Wuhan city circle (in China) is that this index system takes full account of China's realities, proposing a relatively authoritative informatization index system measurement.

Table 1 Index System for Evaluating Standards of Infomatization of Wuhan City Circle (in China)

Standards of infomatization	A. Development and utilization of information resources	1.Weekly telecast time per thousand people
		2.The number of internet surfer per thousand people
		3.The number of fixed telephone owned by per hundred people
		4.The number of fiber user per thousand people
		5.The number / length of microwave line station
		6.The number of satellite site
		7.The number of cable television per thousand people
	B. Construction of information network	8.The number of internet surfer per ten thousand people
		9.Total capacity of office exchanges
		10.The number of website per thousand people
		11.The number of Internet employees per thousand people
		12.The value of business transactions of postal and telecommunication services
	C. Application of information technology	13.The turnover of electronic commerce
	D. Information technology and industry development	14.The proportion of business information technology fixed investment accounted for fixed assets investment over the same period
		15.The added value of information industry
		16.The proportion of information industry R & D expenditure accounts for the total national R & D expenditure
		17.The proportion of the investments into constructing infrastructural facilities of information industry accounted for the total investments into constructing infrastructural facilities
		18.The number of patent authorization per thousand people
	E. Talents of infomatization	19.The proportion of middle school and college graduates

4 Evaluation of Informatization Level

4.1 Method of evaluation

Use PCA (principal component analysis) and FAHP (fuzzy analytic hierarchy process) to determine the weight of measurement of informatization level in Wuhan City Circle (in China)[3]; arrive at a conclusion of informatization level index in Wuhan City Circle (in China). First, handle all parts of the data with non-quantification. Non-quantification method will use the national informatization index system and measurement method [4]. Second, the weight will be determined by using the method of

expert reviews to get fuzzy matrix, after consistent fuzzy matrix is to be constructed; finally the weight of all parts is to be calculated by FAHP. Finally, make simple weighted arithmetic average between the standard value after indicator variables of non-dimensionalization and the weight, to get the overall index.

4.2 Index system data

Based on the above index system, measure the level of informatization in the Wuhan City Circle (in China) and make a statistics of each index of nine cities including Wuhan (in China), which is shown in Table 2.

Table 2　Data of Index System for Evaluating Level of Infomatization in Wuhan City Circle (in China)

Indicator	Indicator Unit	Data Results
1.Weekly telecast time per thousand people	Ten thousand hour/week	0.3599
2.The number of internet surfer per thousand people	Household	2.9881
3.The number of fixed telephone owned by per hundred people	Per	14.1857
4.The number of fiber user per thousand people	Household	15.9246
5.The number / length of microwave line station	Station/ kilometer	0.0433
6.The number of satellite site	Per	142
7.The number of cable television per thousand people	Per	206.9247
8.The number of internet surfer per ten thousand people	Household	51.3729
9.total capacity of office exchanges	Ten thousand	266
10.The number of website per thousand people	Per	0.2389
11.The number of Internet employees per thousand people	Per	1.7517
12.The value of business transactions of postal and telecommunication services	Hundred million Yuan	354
13.The turnover of electronic commerce	Hundred million Yuan	5.9080
14.The proportion of business information technology fixed investment accounts for fixed assets investment over the same period	Percentage	3.5036
15.The added value of information industry accounts for the GDP	Percentage	8.9001
16.The proportion of information industry R & D expenditure accounts for the total national R & D expenditure	Percentage	2.1710
17.The proportion of the investments into constructing infrastructural facilities of information industry accounts for the total investments into constructing infrastructural facilities	Percentage	86.3637
18.The number of patent authorization per thousand people	Per	12.88
19.The proportion of middle school and college graduates	Percentage	58.09
20.The number of scientific research personnel per thousand people	per	62.84

Second, get an expert to score matrix. Here three-dimensional degree scaling is used to get the following data (see Table 3):

Table 3　1~7 Indicator's Fuzzy Matrix

	1	2	3	4	5	6	7
1	0.5	0	1	0	0	0.5	0.5
2	1	0.5	1	0.5	1	1	1
3	0	0	0.5	0	0.5	0.5	0.5
4	1	0.5	1	0.5	0.5	1	1
5	1	0	0.5	0.5	0.5	1	1
6	0.5	0	0.5	0	0	0.5	0
7	0.5	0	0.5	0	0	1	0.5

Based on FAHP, through MATLAB iteration [5], with an accuracy of 0.0001, the number of iterations is 10. The above data is used for the index value and expert score matrix, to get the fuzzy consistent matrix. According to the FAHP, it can get to the second decision-making index and the third layer weight, and then get the second level information index and the total information index according to the simple weighted arithmetic average.

4.3 Measurement results

We can get weight of every layer calculated by MATLAB, which is shown in Table 4, through the calculation method of national informatization index system; finally we draw a conclusion that the overall informatization index in the Wuhan City Circle (in China) is 35.41.

Table 4   Index Weight of Wuhan City Circle(in China)

Level of Infomatization in Wuhan City Circle											
A							B				
0.0888							0.0888				
1	2	3	4	5	6	7	8	9	10	11	12
0.0904	0.2780	0.0775	0.2314	0.1662	0.0661	0.0904	0.1604	0.1997	0.1294	0.4452	0.0653
C	D					E					
0.2126	0.2671					0.3427					
13	14	15	16	17	18	19	20				
1	0.1095	0.2661	0.3452	0.0686	0.2107	0.7500	0.2500				

Data Sources: calculating based on MATLAB FAHP

5 Conclusions

It can be seen from the calculating results that the score of development and utilization of information resources and construction of information network in Wuhan City Circle (in China) is low, just 0.0888, and the scores of application of information technology and information technology industry development are not high, just 0.2126 and 0.2671; the highest score is the infomatization talent, which is 0.3427. Generally speaking, the level of infomatization in Wuhan City Circle (in China) is low, and it needs to be further strengthened in many ways. In particular, information technology should constantly develop to high technology through the technology development and utilization.

In addition, in terms of second-level indexes of infomatization, the number of fixed telephone owned by per hundred people, the number of fiber user per thousand people, the number of Internet employees per thousand people, the proportion of the added value of information industry accounts for the GDP, the proportion of information industry R&D expenditure accounts for the total national R&D expenditure, the proportion of middle school and college graduates per thousand people and some other indicators weight are relatively large. With the development of infomatization, the Internet has gradually replaced the telephone; GDP and share of R & D activities of information industry are constantly increasing; the academic requirements of the employees will continue to increase. At present, many industry professionals in the Wuhan City Circle (in China) are basically graduates from universities and secondary specialized schools; it is necessary to further improve scientific achievements, apply the achievements into informatization construction, and continuously promote the development of infomatization level in Wuhan City Circle (in China).

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