Research on the Measurement of High-Quality Development Level of Cultural Industry in Shandong Province

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ABSTRACT
With the vigorous development of cultural industry, there are some problems in the development of cultural industry in Shandong Province, such as large investment, low efficiency, unbalanced resource allocation, lack of human resources and weak public cultural awareness. How to maintain the high-quality sustainable development of cultural industries in Shandong Province has become the focus of regional management decision makers. The measurement and heterogeneity of high-quality development level of cultural industry in Shandong Province have been studied many times by experts in China and abroad, and its theoretical basis and research methods have also been demonstrated and adopted many times. Based on this, this study puts forward DEA-Malmquist index analysis method to study. Under the premise of drawing on the research status at home and abroad and the research of experts and scholars, this study constructs a set of research index system and research model of high-quality development of cultural industry from the perspective of input-output efficiency, and puts forward some suggestions for the transformation and upgrading of cultural industry in Shandong Province.

Keywords: *Shandong Province, Cultural Industry, High-quality Development, DEA Model.*

1. INTRODUCTION

In recent years, the cultural industry in Shandong Province has made great progress, and the scale of the industry has been growing, which has made contributions to the transformation of old and new kinetic energy and the structural reform of the supply side. However, compared with some areas with relatively developed cultural industries, the cultural industry in Shandong Province still has some defects. The unbalanced allocation of cultural industry resources in Shandong Province, the less development of private enterprises and individual enterprises, the drawbacks of extensive operation, the low output efficiency and the lack of human resources have affected the improvement of its high-quality development level.

The existing experts and scholars have conducted extensive research on the high-quality development of cultural industries in Shandong Province, mainly focusing on the construction of evaluation index system, quality evaluation, competition and status quo[1-2]. However, the existing research focuses more on the index system, weight design and evaluation model construction, ignoring the different output caused by input differences, and does not measure the input-output efficiency of cultural industries[3-4]. Based on this, this study introduces DEA-Malmquist index model to measure the quality from the perspective of economic production function, which can provide reference for the quality measurement and policy formulation of cultural industry in the same type of region.

2. MODELS AND DATA

2.1. DEA-Malmquist index model

The DEA method is the data envelopment analysis, and the core of the DEA method is efficiency. Efficiency is the ratio of output variable to input variable. The model is used to analyze multiple decision-making units of output and input, and the optimal value of efficiency is calculated. This method does not require a fixed weight of input and output

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items, but is derived from the combination of relevant indicators and data. Therefore, the theoretical model of this method can directly establish data and refer to the model for analysis. DEA-Malmquist index model uses input and output variable efficiency analysis, which decomposes the change of total factor productivity into two parts: technical efficiency change and technological progress. When the index is greater than 1, it proves that total factor productivity has improved in unit time; conversely decline.

2.2. Indicators

In the process of index selection, through reading a lot of literature, combined with the current situation of high-quality development of cultural industry in Shandong Province, from the availability and representative of indicators, comprehensive screening persuasive indicators.

This study choose to represent the labor force of cultural industry practitioners (people), can represent capital investment in cultural industry funds (billions), can reflect the total investment in cultural industry assets (billions) as input variables.

The main business income directly reflects the high-quality development level of cultural industry in a region, which is overall representative. Therefore, the main business income of cultural industry (billion yuan) is selected as the output variable.

Regional GDP, cultural industry R&D funding and cultural industry R&D personnel input as environmental variables.

Most of the data in this study come from "*Statistical Yearbook of Shandong Province 2020*", "*Analysis of the Development of Cultural Industry in Shandong Province*", "*Statistical Bulletin of National Economic and Social Development of Shandong Province*", municipal government websites and other public information. Among them, Laiwu City has been incorporated into Jinan City in 2019, the data on Laiwu are attributed to the unified calculation of Jinan City.

3. RESULTS ANALYSIS

Using DEA model and Malmquist index model, this study first calculates the changes of technical efficiency and technological progress, then calculates the changes of pure technical efficiency and scale efficiency, and finally calculates total factor productivity. Using DEAP2.1 software, according to DEA-Malmquist index model to calculate the total factor productivity of 17 cities in Shandong Province, the results are shown in Table 1, in which *effch* is the change of technical efficiency; *techch* is technological progress; *pech* is pure technical efficiency; sech is the change of scale efficiency; *tfpch* is total factor productivity.

Table 1. Changes and decomposition of total factor productivity of cultural industry in Shandong Province

City	Effch	Techch	Pech	Sech	Tfpch
Jinan	1.530	0.577	1.000	1.530	0.883
Qingdao	1.811	0.600	1.000	1.811	1.087
Zibo	1.943	0.502	1.936	1.003	0.976
Zaozhuang	1.559	0.382	0.894	1.744	0.596
Dongying	1.235	0.354	1.000	1.235	0.437
Yantai	2.245	0.440	1.278	1.756	0.988
Weifang	1.582	0.457	1.012	1.563	0.723
Jining	1.156	0.796	0.980	1.180	0.920
Taian	2.636	0.311	1.947	1.354	0.819
Weihai	2.559	0.403	2.022	1.265	1.031
Sunshine	1.844	0.432	1.000	1.844	0.797
Linyi	2.785	0.356	2.594	1.074	0.991
Texas	1.904	0.445	1.481	1.286	0.847
Liaocheng	1.000	0.687	1.000	1.000	0.687
Binzhou	1.608	0.384	1.000	1.608	0.617
Heze	2.253	0.476	1.374	1.639	1.073
Mean value	1.706	0.444	1.252	1.362	0.757

3.1. Time Analysis

From the specific changes, from 2018 to 2019, the technical efficiency and technological progress of cultural industries in 17 cities of Shandong Province fluctuated greatly, as shown in Table 2. Among them, technical efficiency shows a growth of about 70%, pure technical efficiency shows a growth of 25 %, and scale efficiency shows a growth of 36%. However, technological progress shows a negative growth of about 60%, so the total factor productivity shows a downward trend. The technical efficiency is decomposed into scale efficiency and pure technical efficiency. It is not difficult to see that the improvement of scale efficiency contributes the most, and the change index is about 20%-30%. It can be seen that technology plays an important role in the development of cultural industry. Therefore, technological progress is an important factor. In the process of high-quality development of Shandong cultural industry, we should increase technological input, pay attention to the output of technology, improve the technical system and improve technical efficiency. Technological innovation is also very important for the development of cultural industry. Only technological progress can drive the overall development, and technological progress needs further attention.

Table 2. Total Factor Productivity Change and Decomposition of Cultural Industry in 17 Cities of Shandong Province from 2018 to 2019

Year	Effch	Techch	Pech	Sech	Tfpch
2018-2019	1.706	0.444	1.252	1.362	0.757
Mean value	1.706	0.444	1.252	1.362	0.757

3.2. Spatial Analysis

1. Firstly, it is analyzed from the perspective of two circles and four zones. The *tfpch* is total factor productivity. Taking Jinan as the center, it can be seen that the adjacent cities are $0.216<tfpch<1.084$, the development of total factor productivity is unbalanced, and there is a big difference between cities. In particular, Laiwu' s *tfpch* is only 0.216, the input of related factors is not enough, and the technical efficiency is in a negative growth, which greatly reduces the average value of each factor in the province. The $0.650<tfpch<0.867$ of Dezhou, Liaocheng and Tai' an are in the middle development stage of the whole province. If the input of each index is increased, the future development prospect is extremely broad. The overall level of high-quality development of cultural industry in Jinan metropolitan area is good, but the development is uneven.

The total factor productivity of Dongbin metropolitan area is relatively low, especially the *tfpch* of Dongying is 0.437. However, the input of Dongying is in the middle stage, and there is a phenomenon of high input and low output. Total factor productivity of Jining and Heze is in the high stage, and technical efficiency and scale efficiency also showed positive growth, but the technical progress of the two showed negative growth. Therefore, both in the future development process, should strengthen technological innovation and technological equipment updates, and should improve the relevant system, the development of advantageous resources, avoid extensive development. The *tfpch* of Zaozhuang is 0.569. Based on the relevant data, Zaozhuang has relatively low input and low output.

The urban area of Linri is $0.650 < tfpch < 1.084$. In general, the total factor productivity of the two is in the middle and high stage. The overall level of high-quality development of cultural industry in urban areas in Japan is high. Further progress can be made in future development if investment is balanced or economic and technological inputs are enhanced and improved.

With the rapid development of Yanwei metropolitan area and Qingdao metropolitan area, total factor productivity has reached a high stage. If combined with the advantages of local coastal areas, increase investment in relevant indicators, develop coastal culture and form their own cultural characteristics, the operating income of cultural industry will be higher. If its coastal advantages are combined with the promotion of local cultural organizations, the cultural industry will eventually lead to a substantial increase in GDP and promote the overall development of the national economy.

2. Conduct an overall analysis from low to high starting from the overall phase division.

Dongying, Laiwu $0.216 < tfpch < 0.433$, in the first phase. There are many reasons, first, both for cultural industry practitioners and funding inputs are very low; second, there is no timely in-depth reform of cultural related systems. Therefore, the level is very low, failed to keep up with the overall pace. Zaozhuang, Binzhou $0.433 < tfpch < 0.650$, in the second stage. Based on the comprehensive research and investigation, it can be found that the employees and total assets of cultural industries in Zaozhuang and Binzhou are equivalent, with poor input and low relative output. At the same time, the two have no prominent industrial characteristics and cannot form their own advantages. Ultimately, negative growth in total factor productivity

occurs. Weifang, Taian, Rizhao, Liaocheng, Dezhou 0.650 < *tfpch* < 0.867, in the third stage. Among them, Weifang' s technological progress in negative growth, resulting in negative growth in total factor productivity. Tai' an tourism culture has a comparative advantage, but personnel and funding is not high, the lack of talent for project planning. Overall sunshine investment is low, failed to use coastal advantages to develop cultural development projects, the government is not enough for institutional policy advocacy. Liaocheng, Dezhou belong to the inland plain area, at the same time the lack of relevant cultural characteristics, cultural industry is not enough attention, thought conservative phenomenon, the internal structure of the industry is not balanced. If the investment in cultural industry can be increased and relevant cultural projects can be developed, the development of the five regions will be improved qualitatively. Jinan, Zibo, Yantai, Jining, Linyi, Weihai and Heze are 0.867 < *tfpch* < 1.084, in the fourth stage. Their personnel, funds and total assets investment is relatively high, but technology is not innovative, policy is not perfect, the overall development is still poor. Qingdao 1.084 < *tfpch* < 1.307, in the fifth stage. Qingdao is located in coastal areas, and is a modern metropolis, whether personnel, funds or total assets investment is very high. Policy and institutional reforms are also relatively timely. Human, financial and material inputs are relatively balanced, characteristic industries have advantages. And with preferential national policies, promote the development of the overall cultural industry.

Overall, the level of high-quality development of cultural industries in coastal areas is high, the central region tends to intermediate stage, and the western inland development is poor. In the process of promoting the transformation and upgrading of cultural industries, Shandong Province should formulate development policies according to the development characteristics of cultural industries in different regions, local conditions and the advantages of various regions.

4. CONCLUSIONS

17 cities in Shandong Province are rich in cultural resources. In order to further understand the current situation of cultural industry in Shandong Province and promote the high-quality development of cultural industry in Shandong Province, this study uses DEA-Malmquist model to analyze the technical efficiency of cultural industry in 17 cities in Shandong Province, and draws the following conclusions:

1. The overall level of input-output efficiency of cultural industry in 17 cities of Shandong Province is low, the highest value of technical efficiency is Linyi 2.785, the lowest value is Laiwu 0.859, the average is 1.706; the highest value of technological progress is Jining 0.796, the lowest value is Laiwu 0.251, the average is 0.444; the highest value of pure technical efficiency is Linyi 2.594, the lowest value is Zaozhuang 0.894, and the average value is 1.252. The highest value of scale efficiency is sunshine 1.844, the lowest value is Laiwu 0.859, and the average value is 1.362. The lowest value of total factor productivity is Laiwu 0.216, the highest value is Qingdao 1.087, the average is 0.757.

2. At present, the total factor productivity of high-quality development of cultural industry in Shandong Province is in the order of east, middle and west. There are still problems in the cultural industry of each city, such as unbalanced resource allocation, low quality of operation, large regional differences in development and serious polarization. The high-quality development of cultural industry in Shandong Province needs further improvement in policy, technology, talents and funds.

3. According to the current results and conclusions, from 2018 to 2019, the overall level of high-quality development of cultural industries in 17 cities of Shandong Province has made significant progress, but there are individual imbalances in resource allocation, imperfect high-quality development system of cultural industries and unbalanced input and output, resulting in a decline in the overall level of Shandong Province. Therefore, in the future development process, we should change these deficiencies as soon as possible, speed up the transformation of industrial development, create a high-end cultural industry platform, and jointly promote the high-quality development of cultural industry in Shandong Province.

AUTHORS' CONTRIBUTIONS

Jiaming Wang: Writing-original draft, Conceptualization, Supervision. Shuyan Liu: Formal analysis. Yunfei Zhang: Data curation. Xueyi Du: Formal analysis. Chengyao Lin: Data curation.

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