*Pol. J. Environ. Stud. Vol. 32, No. 2 (2023), 1675-1688*
DOI: *10.15244/pjoes/156904* ONLINE PUBLICATION DATE: 2023-02-08

*Original Research*

# An Empirical Study on Measurement and Influencing Factors of High Quality Development Level of Listed Companies in Digital Music Industry

**Yuhao Lin[1]*, Guohao Zhao[2]**

[1]School of Music and Film & Television, Tianjin Normal University, Tianjin 300382, China
[2]School of Economics and Management, Civil Aviation University of China, Tianjin, 300300, China

*Received: 28 October 2022*
*Accepted: 25 November 2022*

## Abstract

Developing a green economy is the focus of China's industrial restructuring, and the digital music industry contributes to the transformation and upgrading of the green economy. This paper focuses on the core problem of the high quality development efficiency of digital music industry and constructs the super-efficiency DEA model of non-parametric estimation and Malmquist index model of dynamic comparison respectively. The paper empirically analyzes the high quality development efficiency of digital music industry by using 2695 observation data of listed companies from 2011 to 2021. The results show that: (1) The high quality development efficiency of digital music industry is relatively high, but there are great differences within the industry. The overall efficiency interval is 0.363,2.251. (2) The high-quality growth effect of the digital music industry is significant, increasing year by year. Malmquist index is 1.2218, maintaining an average annual positive growth of 22.18%. (3) It is necessary for digital music industry to increase investment in technological innovation and promote high-quality and sustainable growth of the industry. 57.14% of enterprises are inefficient in technological progress. (4) Both internal and external factors have significant influence on the high quality development level of digital music. Both Logit model and OLS regression model pass the robustness test.

**Keywords**: green economy, digital music, super efficiency model, Malmuquist model

## Introduction

Environmental pollution and resource waste have become difficult problems in global governance. In 2015, the United Nations Framework Convention on Climate Change (UNFCCC) was issued at the Paris Climate Conference, and sustainable development became a world consensus. In 2018, the Chinese government made it clear that it would shift its economic focus to greener and more intensive development. Meanwhile, the 14th Five-Year Plan and 2035 Vision outline also point out that green development should be

*e-mail: Duxue6688@126.com

promoted to promote harmonious coexistence between man and nature. The development of strategic emerging industries represented by the digital music industry has become the main direction of green economy.

As an important part of strategic emerging industries, the digital music industry helps to promote the construction of spiritual civilization, stimulate the charm of national culture, and is a key force to promote the prosperity of advanced socialist culture [1]. With the iteration of Internet technology and the booming growth of the digital economy, the content production, media and user habits of traditional music have undergone profound changes. Since 2000, the digital music industry has flourished with the opening of specialized music websites. MP3 equipment, mobile phone ringback tones, QQ music, Douyin, Kuaishou and other products have been promoted, and digital music has gradually broken through the constraints of traditional material media, with cassette as the typical traditional products phased out. The development of entertainment talent shows, live music broadcasts, online concerts and other projects constitute a new circle of the music industry. According to statistics, as of February 2022, the number of digital music users in China exceeded 630 million, accounting for more than 70 percent of the total number of Internet users. Because 5 g, WiFi, the popularity of smartphones and other technical applications, mobile music, network music industries such as optimization of resources integration, and live with cargo, O2O performance, electricity music become more mature business model, such as digital music industry has gradually constructed "music +" industrial cluster, consumer demand, the innovation service process is to stimulate the emerging formats.

Despite the strong development momentum of the digital music industry, there are still some problems that cannot be ignored: relying on the high input of resource elements, but obtaining low economic output, the overall performance is not high development efficiency, and the phenomenon of resource redundancy is common [2]. The Sixth Plenary Session of the 19th CPC Central Committee further clearly proposed to continuously promote the quality and efficiency of the industrial economy, and to promote the high-quality growth of the digital music industry is a key issue for the current and future of the industry.

Around the development of the digital music industry, some scholars from the value chain, intellectual property rights, development model and other aspects of in-depth research. Based on the value chain structure theory, Jiang Ling and Fu Xiaomin (2019) compared the traditional music industry and analyzed the internal relationships between different subjects in the digital music industry [3]. Han Shaojun (2017) analyzed the characteristics of streaming music services and selected cases to analyze the core competitiveness and key factors of NetEase and Kugou Music [4]. Huang Guoqun and Meng Na (2017) constructed the RCOV expression model to systematically analyze the resources, values and organizational capabilities of the digital music industry, and sorted out the relationship between interests [5]. Cao Yang and Zhao Jingfeng (2013) established a game model based on intellectual property rights governance of digital music, proposed a four-in-one interest balance mechanism, and pointed out that the governance efficiency of digital music should be improved [6]. Yao Linqing and Li Jarong (2015) empirically analyzed the relationship between copyright protection and the music industry using panel data, and believed that moderately loose policies were conducive to promoting the vitality of the industry [7]. Liu Jia and Yang Yongzhong (2014) analyzed different music industry models in India, South Korea and the United States, and compared the model differences from technical, economic and social aspects [8]. Long Jun (2020) analyzed the competition mode of exclusive license of digital music copyright under policy regulation, and proposed to reduce the competition risk by introducing restrictive organization and management mode [9]. Si Si (2018) studied the issue of music copyright protection in short videos, focusing on the analysis of how to regulate the digital music copyright environment [10]. These studies have carried out scientific thinking on the development status and realistic dilemmas of the digital music industry.

The problem of high-quality development is a new problem in the transformation and upgrading of China's industrial structure. The research on the measurement of the level of high-quality development is still a new field. However, systematic theories on the measurement of efficiency have been formed at home and abroad. There are two different approaches to efficiency measurement: parameter estimation (SFA) and data envelopment (DEA). Considering that DEA is an efficiency model with relative effectiveness, it has the advantage of avoiding subjective bias caused by parameter estimation and is widely used. Farrell (1957) first put forward the idea of production efficiency [11]. In 1978, Charnes et al. gave the expression of CCR model and implemented a quantitative method to evaluate the relative effectiveness [12]. In 1984, Banker et al. proposed the BCC model [13]. These two models become classical DEA models, which do not set specific production functions and treat the intermediate process of input-output as a "black box". Later, on the basis of these two models, scholars also made some improvements, such as the FG model (non-increasing returns) [14]. ST model (non-decreasing returns) [15] and so on. At the same time, many scholars use DEA model to empirically study green development efficiency, energy efficiency, innovation efficiency and so on. Liu Ru et al. (2022) used the SBM-DEA model to analyze the green development efficiency of Chinese cities [16]. Fandan et al. (2022) constructed the MinDS model to calculate the energy efficiency of cities and examined the impact of different policies on efficiency according to the difference method [17]. Zhou Fuli et al.

(2022) estimated the green economic efficiency of the Yellow River Basin using a two-stage DEA model, and analyzed the industrial characteristics of different regions [18]. Feng Shuhui et al. (2022) measured the circulation efficiency of Internet commerce based on CCR model [19]. Song Yuegang et al. (2022) empirically analyzed the technological innovation efficiency of the industry by using the DEA-Malmquist model [20, 21].

High-quality growth of the digital music industry is an important part of promoting the development of China's cultural and creative industry. Domestic research has carried out useful analysis on the development status of the digital music industry, but most of the research is qualitative analysis, and most of the research is based on policy and macro level. At the same time, foreign studies have accumulated a wealth of theories and methods in the aspect of efficiency evaluation, especially the data envelopment estimation method is widely used. In order to estimate the level of high quality development efficiency of digital music industry, this paper intends to use non-parametric estimation method to study the high quality development efficiency of digital music industry from the perspective of static and dynamic efficiency. At the same time, the data of listed companies are selected for empirical test. The possible marginal contributions are as follows: first, the index system for measuring the high quality development level of the digital music industry is constructed. The current research on this issue is still in the exploratory stage at home and abroad, and no unified standard has been formed yet. Second, different from the classical CCR and BCC models, this paper will construct a super-efficiency DEA model for efficiency estimation. The biggest advantage of this method is that it can compare the efficiency of relatively effective decision-making units. Third, the panel data of listed companies are selected to empirically estimate the high-quality development efficiency of different enterprises, and valuable conclusions are obtained from the micro perspective. Fourthly, logit model and OLS regression model are used to test the internal and external influencing factors.

## Material and Methods

### Measurement Model of High Quality Development Level of Digital Music Industry

#### *Efficiency Calculation Based on Super SBM Model*

If the classical BCC and CCR models are used to estimate the high quality development efficiency of the digital music industry, it may appear that if the efficiency values of some decision-making units (DMUs) are located above the production frontier, and the value is 1.0, then the efficiency of these DMUs cannot be compared. In order to solve this problem, Tone (2001,2002) proposed SBM model and Super SBM model [22-23], the main idea is that if a DMU is to be estimated, the DMU should be excluded from the decision set. In this paper, we use this model to measure the listed companies in the digital music industry and give full play to the advantages of this model.

The reference Tone [22-23], Wu Chunyou et al. [24] Based on the research, the expression of Super SBM model can be obtained:

If there are n listed digital music companies as independent decision units (DUM), the input factor of some enterprise j is $x_j$, and the output factor is $y_j$. Then the efficiency value $\xi$ of this enterprise can be calculated. And let $n_j$ be a linear combination of each input or output. $s_i^-$ and $s_i^+$ represent the slack variables for each DMU.

$$\begin{aligned} &\min \xi \\ &\sum_{\substack{j=1 \\ j\neq j_0}}^{n} n_j x_{ji} + s_i^- = \xi_{x_{i0}}, i = 1,2,...,m, \\ &\sum_{\substack{j=1 \\ j\neq j_0}}^{n} n_j y_{ji} - s_i^+ = \xi_{y_{i0}}, i = 1,2,...,s, \\ &n_j, s_i^-, s_i^+ \geq 0 \end{aligned} \tag{1}$$

In the above model (1), if $\xi \geq 1$ and $s_i^- = s_i^+$, then it means that the decision-making unit is above the production frontier, and the efficiency is effective. If $\xi < 1$ and $s_i^- \neq 0$, $s_i^+ \neq 0$, then it indicates that the DMU is inefficiently effective, that is, the scale or technology is ineffective.

#### *Efficiency Decomposition Based on Malmuqist Model*

The Surper SBM model is a static measurement method, which can estimate the relative effectiveness of different decision making units well. However, Surper SBM is mainly used to estimate the cross-sectional data, and it cannot compare the efficiency changes in different periods. In 1953, Malmquist index method was proposed, and later, Caves et al. further proposed a specific estimation expression [24, 25]. Therefore, the Malmquist index method can be used to analyze the technological progress and scale efficiency of the high-quality development efficiency of the digital music industry.

This paper mainly refers to Fare et al. [26] (1994), Yang Zuyi [27] (2016) et al. to construct the output-oriented Malmquist index model of the digital music industry. The specific expression is as follows:

$$M_0(x^T, y^T, x^{T+1}, y^{T+1}) = \left[ \frac{D_0^T(x^{T+1}, y^{T+1})}{D_0^T(x^T, y^T)} \times \frac{D_0^{T+1}(x^{T+1}, y^{T+1})}{D_0^{T+1}(x^T, y^T)} \right]^{1/2} \tag{2}$$

Using formula (2), the Malmquist index of digital music listed companies from period T to period T+1 can be calculated, and are used to represent the input and output vectors of each listed company. $(x^T, y^T)(x^{T+1}, y^{T+1})D_0{}^T$ Represents the distance function in period T of the reference set by selecting the DMU in period T. Accordingly, represents the distance function of selecting the DMU in period T as the distance function of the reference set. $D_0{}^T$ If, it means that the efficiency of listed digital music enterprises has achieved positive growth; $M_0(x^T, y^T, x^{T+1}, y^{T+1})>1$ If, it indicates that the efficiency of listed digital music enterprises has achieved negative growth; $M_0(x^T, y^T, x^{T+1}, y^{T+1})<1$ If, it indicates that the efficiency level of listed digital music enterprises is unchanged. $M_0(x^T, y^T, x^{T+1}, y^{T+1}) = 1$.

As for equation (2), it can be further obtained through non-parametric estimation: $D_0{}^T(x^T, y^T)$

$$[D_0^T(x_k^T, y_k^T)]^{-1} = \max \xi^{k'}$$
$$\xi_{k'} y_{k',m}^T \le \sum_{k'=1}^{K} \lambda_{k'}{}^T y_{k',m}^T$$
$$s.t. \quad x_{k',n}^T \ge \sum_{k'=1}^{K} \lambda_{k'}^T x_{k',n}^T$$
$$\lambda_{k'}^T \ge 0 \tag{3}$$

In the above equation (3), the input factor used to represent the production of the KTH digital music enterprise in period T is n, and the output factor is. $x^T_{k',\ n}\, y^T_{k',\ m}$ Where n represents the type of input and m represents the type of output. $\lambda_{k'}{}^T$ Represents the corresponding weight. $D_0{}^T(x^{T+1}, y^{T+1})$, and can be obtained in a similar way. $D_0{}^{T+1}(x^{T+1}, y^{T+1})$ $D_0{}^{T+1}(x^T, y^T)$ Finally, the technical efficiency index can be further decomposed into the product of the pure technical efficiency index and the technical progress index. Due to space limitation, the relevant decomposition will not be described here.

### *Logit Model and OLS Regression Model Considering the Influencing Factors*

Logit model can be considered to analyze the internal influencing factors of high quality of listed companies in the digital music industry. Logit model is a kind of discrete mathematical analysis model, which was first proposed by Fechner in 1860, and then extended by prof. warner, mainly applied to carry out binary choice analysis in the field of transportation. Since 1970, Logit model has been widely used and plays an important role in scientific management decision making. [28] In this paper, the measurement value of high quality level of listed companies in digital music industry obtained by Super SBM model is in two states: less than 1 or equal to 1, that is, the efficiency is effective or ineffective, which conforms to the conditions of binary discrete decision model. Therefore, in the analysis of the input factors as the independent variable of the Logit model, efficiency value as the dependent variable.

Reference is made to relevant domestic studies [29]. The Logit model with the high quality level of listed companies in the digital music industry as the dependent variable and the input variable of Super SBM model as the independent variable can be obtained. The general expression of the model is as follows:

$$Y = \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + ...\alpha_n X_n + \mu$$

In the above model, Y represents the measure value of high quality level of listed companies in the digital music industry. If the efficiency value of BCC measure is greater than 1, then, otherwise; $Y = 1$ $Y = 0$ ($X_1$, $X_2$, $X_3$, ...$X_n$) Represents n input indicators; ($\alpha_1$, $\alpha_2$, $\alpha_3$, ...$\alpha_n$) Denotes the coefficient to be estimated; $\mu$ Denotes the error value.

In order to further explore the external factors affecting the high quality level of listed companies in the Chinese music industry, this paper will also use the classical OLS regression model for analysis. The Super SBM model is mainly used as the dependent variable, and the OLS regression model with several external environmental factors as the independent variables is constructed. Due to space limitation, the principle and expression of the model are not listed.

## Measurement Index and Sample Statistics

### *The Scope of Digital Music Industry*

The definition of digital music includes two kinds: narrow sense and broad sense. The narrow sense of digital music mainly refers to the immaterial form of music spread based on Internet technology. The broad sense of digital music usually includes music formed in the production, storage and promotion of music content, this paper mainly adopts the broad definition. Therefore, the digital music industry mainly includes a collection of indirect and direct participation in digital music manufacturing, promotion, marketing and other activities.

According to the supply and demand side of digital music products, the stakeholders of the digital music industry can be obtained, which mainly include music content manufacturers, related service providers, commercial entertainment event organizers, music copyright service providers and music service buyers. The specific content is shown in Fig. 1.

According to Fig. 1, the chain of digital music industry has three key links from top to bottom: content service users. → → In the upstream, content producers around digital music gather stars, music companies and record producers. In order to realize the digitalization and marketing of music content. Digital

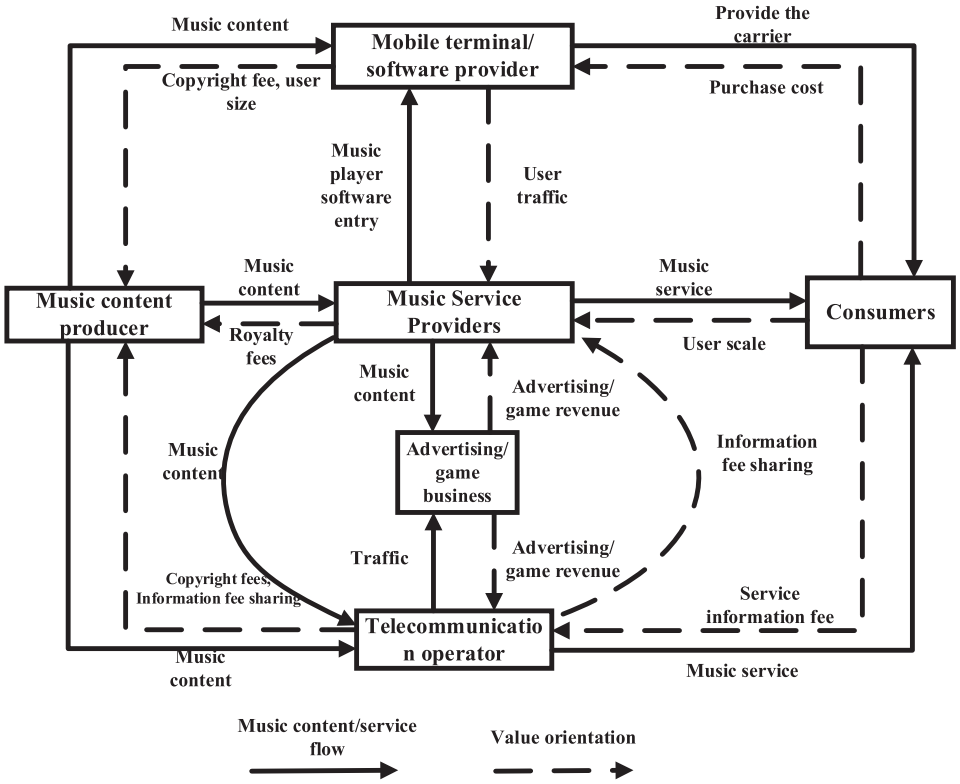


Fig. 1. Composition of digital music industry chain.

music content service providers in midstream mainly include technology operation service providers such as mobile telecom, which mainly undertake the function of transforming music content into digital products, such as ring back tones, short video background music, network songs, etc. As an important medium and carrier of digital music transmission, the midstream digital music content service providers realize digital transformation with Internet technology as the core. Finally, digital music content consumers are at the downstream of the industry. Users influence the development of the digital music industry by purchasing services and market feedback.

### *Index Selection*

High-quality development has become a hot issue in the industrial economy. Due to different research perspectives, there are differences in the connotation and definition of high-quality development. In this paper, the connotation of high quality development efficiency of digital music industry is mainly based on C-D production function theory, and the specific characteristics of digital music industry are fully considered. Therefore, the input indexes for the measurement of the high quality development level of the digital music industry mainly consider the input of capital, manpower and land. In the selection of output index, the innovation level and the cultivation of kinetic energy of the industry are mainly Based on the availability of data, the scientific nature and rationality of indicators and other factors, refer to the relevant domestic research basis [30, 31], the input-output index system of high-quality development efficiency of the digital music industry determined in this paper is shown in Table 1.

Input index: In terms of capital factors, current liabilities and net cash flow generated from operating activities are selected as the three-level index. Among them, current liabilities mainly measure the financing quality of the digital music industry, and the net cash flow generated by operating activities represents the operating quality of the industry. The compensation payable to employees is selected as the three-level index of human factors, which mainly investigates the quality of human capital of the industry. The land factor is measured by the total assets. Usually, the larger the assets, the greater the industrial input.

Output index: Intangible assets are selected as the three-level index of innovation level. The level of intangible assets can usually reflect the level of innovation achievements of the industry. At the same time, the operating revenue and operating profit are selected as the third-level indicators of kinetic energy cultivation. The income and profit respectively reflect the quantity and quality of the output results of high-quality industrial development.

### *Data Sources and Descriptive Statistics of Samples*

The research objects of this paper are listed companies related to the digital music industry.

Table 1. Index system for measuring the high quality development level of digital music industry.

| Level indicators | The Secondary indicators | Level 3 indicators | Unit | Code name | Symbol |
|---|---|---|---|---|---|
| Input | Capital | Current liabilities | Yuan | Totcurlia | TCA |
| | | Net cash flow from operating activities | Yuan | NCFbyope | NCF |
| | Human | Staff pay payable | Yuan | Empsalpay | EPP |
| | Land | Total assets | Yuan | Totass | TAS |
| Output | Level of innovation | Intangible assets | Yuan | Intanass | INTS |
| | The kinetic energy to foster | Operating income | Yuan | OpePrf | NEP |
| | | Operating profit | Yuan | Incmope | INCP |

Table 2. Descriptive statistics of the study sample.

| Index | Obs | Max | Min | Mean | STD |
|---|---|---|---|---|---|
| TCA | 385 | 13666075171 | 3091070.91 | 1827254377 | 2164293975 |
| NCF | 385 | 3692549365 | 995487948.1 | 458968670.9 | 695844290 |
| EPP | 385 | 1134029190 | 20175.04 | 91252177.72 | 159048109 |
| TAS | 385 | 45138309450 | 80672098.59 | 6404437194 | 7564373583 |
| INTS | 385 | 6443675156 | 32033.32 | 202633761.3 | 543200861 |
| NEP | 385 | 21125971175 | 114856852.4 | 2596549674 | 3143850052 |
| INCP | 385 | 3743299081 | - 6931388401. | 246143583.6 | 859973757 |

According to Fig. 1, the composition includes music content providers and music service providers. Specifically, it includes digital music companies, media games, visual media, film and television theaters, digital technology companies and portal websites. The input and output data of listed companies in the digital music industry are obtained from the GTA Financial Database, and the base period of the data is selected as 2011-2021. The qualified samples were selected according to the main body of the digital music industry chain, and then the seriously missing data were eliminated according to the integrity of the data, and the linear interpolation method was used to supplement and improve some samples without serious missing. Table 2 shows the descriptive statistical results of the research data, and 35 eligible listed companies with a total of 2695 observations are obtained.

## Results and Discussion

### Results of Static Measurement of High Quality Development Level of Digital Music Industry

#### *Overall Efficiency Analysis*

The super-efficiency DEA model and MAX DEA software can be used to calculate the relevant results of the static measurement of the high quality development level of listed companies in the digital music industry from 2011 to 2021. The specific values are shown in Table 3.

According to the results, the efficiency value of 14 enterprises is lower than 1.0, and the average efficiency of these enterprises is 0.674, and the overall efficiency interval is [0.363, 0.998]. Hubei Radio and Television, Guangxi Radio and Television, Shaanxi Radio and Television Network and Wasu Media Holdings had the lowest efficiency values, which were 0.363, 0.425, 0.484 and 0.550, respectively, less than 0.6. This indicates that, for these enterprises, if the current input and output levels remain unchanged, the overall efficiency improvement space of the enterprises is greater than 0.4. Correspondingly, among the sample enterprises, there are 21 enterprises whose efficiency value is greater than 1.0, accounting for 60% of the total, and the efficiency interval is [1.020, 2.251]. Among them, The efficiency values of China Film, Kai Ying Network, Huayi Brothers Media, Hangzhou Electric Soul network, Oriental Pearl New media, Mango hypermedia, Beijing Enlight Media, Simi media, Great Wall animation enterprises are 1.424, 1.442, 1.483, 1.505, 1.560, 1.838, 1.863, 1.932, 2.251. This shows that with the encouragement of national policies and the pursuit of capital, digital music enterprises maintain good growth, high quality development efficiency, input-output portfolio is above the production frontier, and the overall input of enterprises gets a high output level.

Table 3. Static measurement results of high quality development efficiency of listed companies in the digital music industry.

| The serial number | The company | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | The mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | The fly entertainment | 2.379 | 1.256 | 0.920 | 1.027 | 1.240 | 0.811 | 0.712 | 0.460 | 0.531 | 0.605 | 1.036 | 0.998 |
| 2 | Beijing Enlight Media | 2.774 | 2.100 | 2.474 | 1.792 | 1.869 | 1.700 | 2.668 | 2.745 | 0.855 | 1.167 | 0.346 | 1.863 |
| 3 | The Great Wall anime | 2.149 | 1.135 | 2.515 | 2.547 | 2.939 | 1.436 | 2.149 | 2.510 | 2.485 | 2.167 | 2.729 | 2.251 |
| 4 | The Oriental pearl tower | 1.414 | 1.343 | 1.536 | 1.964 | 1.640 | 2.910 | 1.983 | 1.580 | 1.160 | 0.697 | 0.930 | 1.560 |
| 5 | Guangxi Radio and Television | 0.403 | 0.494 | 0.484 | 0.428 | 0.467 | 0.533 | 0.499 | 0.362 | 0.385 | 0.334 | 0.282 | 0.425 |
| 6 | Guangzhou Jinyi Film and Television | 0.531 | 0.591 | 0.706 | 0.686 | 0.701 | 1.023 | 0.953 | 1.086 | 0.844 | 0.618 | 0.399 | 0.740 |
| 7 | Hangzhou Electric Soul network | 2.610 | 2.536 | 2.205 | 1.398 | 1.272 | 1.022 | 0.893 | 2.063 | 0.817 | 1.014 | 0.721 | 1.505 |
| 8 | Hubei Radio and Television | 0.392 | 0.390 | 0.446 | 0.430 | 0.374 | 0.379 | 0.358 | 0.339 | 0.324 | 0.287 | 0.280 | 0.363 |
| 9 | Wasu Media Holdings | 0.610 | 0.682 | 0.611 | 0.724 | 0.393 | 0.439 | 0.486 | 0.514 | 0.531 | 0.532 | 0.531 | 0.550 |
| 10 | Huawen Media Investment | 1.412 | 1.478 | 1.301 | 1.542 | 0.781 | 1.121 | 0.569 | 0.628 | 1.232 | 0.601 | 2.519 | 1.198 |
| 11 | Huayi Brothers Media | 2.010 | 1.770 | 2.213 | 2.517 | 1.493 | 1.216 | 2.068 | 0.688 | 1.254 | 0.608 | 0.476 | 1.483 |
| 12 | Ji media, | 0.734 | 0.943 | 0.788 | 0.882 | 0.495 | 0.408 | 0.373 | 0.444 | 0.548 | 0.627 | 0.358 | 0.600 |
| 13 | Jiangsu radio and television | 0.782 | 0.813 | 1.005 | 0.864 | 0.383 | 0.311 | 0.534 | 0.561 | 0.554 | 0.513 | 0.470 | 0.617 |
| 14 | The giant network | 2.535 | 2.457 | 1.000 | 2.772 | 0.906 | 1.128 | 0.682 | 1.073 | 0.656 | 0.841 | 1.084 | 1.376 |
| 15 | Kai ying network | 1.463 | 2.549 | 1.173 | 0.653 | 2.183 | 1.381 | 2.076 | 0.637 | 0.767 | 1.078 | 1.906 | 1.442 |
| 16 | Mango super media | 1.575 | 1.565 | 1.457 | 1.252 | 1.221 | 1.404 | 2.271 | 2.791 | 2.474 | 2.119 | 2.090 | 1.838 |
| 17 | Notoginseng and entertainment | 0.513 | 0.691 | 1.718 | 0.480 | 0.506 | 1.332 | 1.337 | 1.149 | 2.681 | 2.787 | 2.419 | 1.419 |
| 18 | Shaanxi Radio and Television Network | 0.452 | 0.486 | 0.534 | 0.521 | 0.416 | 0.399 | 0.409 | 0.333 | 0.401 | 0.604 | 0.771 | 0.484 |
| 19 | Shanghai film | 0.604 | 0.808 | 0.676 | 0.763 | 0.595 | 0.629 | 0.670 | 0.823 | 0.558 | 1.367 | 0.313 | 0.710 |
| 20 | Shanghai Xinhua Media | 1.098 | 0.682 | 0.727 | 0.583 | 0.312 | 0.329 | 0.405 | 0.333 | 2.230 | 0.352 | 0.223 | 0.661 |
| 21 | Shenzhen Tianwei Video | 1.452 | 1.274 | 1.497 | 1.311 | 1.211 | 0.833 | 0.860 | 0.800 | 0.787 | 0.564 | 0.632 | 1.020 |
| 22 | Vision (China) | 2.105 | 1.268 | 1.001 | 0.728 | 0.740 | 0.724 | 0.662 | 0.839 | 1.603 | 1.409 | 1.403 | 1.135 |
| 23 | Think the media | 1.454 | 1.688 | 2.254 | 2.182 | 2.115 | 1.979 | 2.327 | 2.138 | 0.888 | 2.039 | 2.190 | 1.932 |
| 24 | Days entertainment Figures | 0.734 | 1.147 | 0.713 | 2.277 | 0.492 | 0.788 | 0.730 | 0.461 | 0.459 | 2.296 | 1.655 | 1.068 |
| 25 | A perfect world | 0.626 | 0.808 | 0.709 | 1.320 | 0.571 | 0.652 | 1.012 | 1.185 | 0.657 | 0.759 | 0.727 | 0.820 |
| 26 | Wanda cinema | 1.403 | 1.294 | 1.385 | 1.803 | 0.974 | 0.893 | 1.063 | 1.096 | 1.259 | 0.753 | 0.870 | 1.163 |

Table 3. Continued.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | New National Pulse number | 0.626 | 0.912 | 0.708 | 0.976 | 1.441 | 1.194 | 1.385 | 0.807 | 1.655 | 1.698 | 1.096 | 1.136 |
| 28 | Starglow Interactive Entertainment | 0.705 | 2.021 | 2.417 | 1.073 | 1.521 | 1.338 | 1.322 | 1.076 | 0.968 | 1.053 | 0.881 | 1.307 |
| 29 | Happy Blue Ocean Film and Television | 0.522 | 1.395 | 1.380 | 0.383 | 0.628 | 0.686 | 0.512 | 1.352 | 0.918 | 0.390 | 0.295 | 0.769 |
| 30 | Swimming race network | 0.624 | 0.819 | 1.393 | 1.672 | 0.975 | 0.780 | 0.648 | 1.021 | 0.571 | 0.880 | 0.968 | 0.941 |
| 31 | Zhejiang Daily Digital Culture | 0.835 | 0.694 | 0.688 | 0.811 | 0.838 | 1.098 | 1.975 | 1.573 | 1.230 | 1.146 | 0.917 | 1.073 |
| 32 | Zhejiang Huace Film and Television | 0.962 | 0.788 | 1.399 | 0.753 | 2.891 | 2.811 | 0.629 | 0.518 | 0.424 | 0.875 | 0.624 | 1.152 |
| 33 | Zhejiang China media | 1.412 | 1.068 | 0.931 | 0.651 | 0.875 | 0.722 | 0.704 | 0.642 | 0.555 | 0.410 | 0.414 | 0.762 |
| 34 | Zhejiang Tom Cat | 1.398 | 1.203 | 1.031 | 0.842 | 1.285 | 1.404 | 0.948 | 0.799 | 0.638 | 1.284 | 0.911 | 1.068 |
| 35 | The Chinese film | 1.877 | 1.643 | 1.479 | 1.749 | 0.890 | 0.966 | 1.009 | 1.689 | 1.621 | 0.504 | 2.240 | 1.424 |

*Analysis of Industrial Efficiency by Region*

According to the different regions where different enterprises are located, the high-quality development level of digital music industry in different regions can be obtained. As shown in Fig. 2, Sichuan, Hunan, Beijing, Hainan and Shanghai have the highest efficiency values, which are 2.092, 1.838, 1.398, 1.198 and 1.156, respectively. This indicates that the digital music industry in these regions has the highest input-output level, and enterprises can obtain higher output with smaller input. The calculated values are basically consistent with the actual values in these regions. Take Sichuan Province as an example, the province's digital music industry has developed rapidly in recent years. In 2021, the output value of digital music exceeded 26.6 billion yuan, achieving a positive growth of 33 percent. From the number of digital music

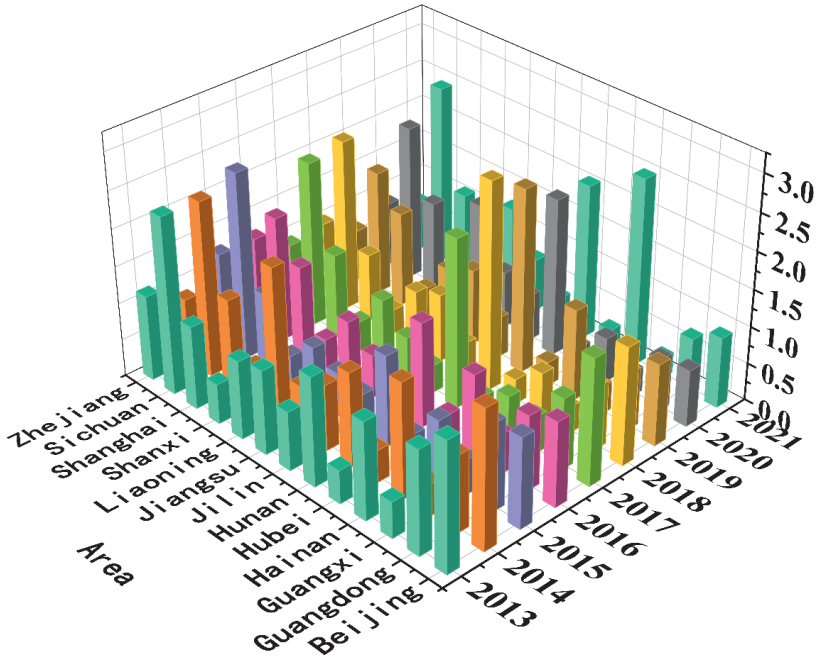


Fig. 2. Results of high-quality development efficiency of industries in different regions.

enterprises, more than 350, in the leading position in the country, digital music production enterprises continue to grow, built a brand influence of live entertainment base. The average efficiency of the digital music industry in Jiangsu, Jilin, Shaanxi, Guangxi and Hubei provinces is less than 1.0, which is 0.840, 0.600, 0.484, 0.425 and 0.363 respectively.

This indicates that these enterprises have large input redundancy and insufficient resource utilization efficiency, which needs to be improved and improved urgently. Therefore, there are obvious differences in efficiency between different regions, which is related to the importance that different regional governments attach to the digital music industry, and also related to regional cultural characteristics.

*Results of Dynamic Efficiency Measurement of High-Quality Development of Digital Music Industry*

In order to further study the dynamic changes of financing efficiency of listed companies in the digital music industry, the Malmuqist model can be used to analyze the relative effectiveness of the efficiency of the research samples. Since the Malmuqist model mainly compares the efficiency changes of period T+1 and period T, the obtained Malmuqist index includes 10 periods. From 2011 to 2021, the measured Malmuqist index results are shown in Table 4. Related results of the model are mainly calculated by MAX DEA software to obtain the Malmquist index, EC and TC values.

(1) From the analysis of the overall situation of the development of the digital music industry, the Malmquist index of the digital music industry as a whole was 1.2218 from 2011 to 2021, greater than 1.0, indicating that the industry as a whole maintained an average annual positive growth of 22.18%. Meanwhile, the technical efficiency index is 1.3426, indicating that the technical efficiency has achieved a 34.26% growth, and the technical progress index is 1.036, achieving a 0.36% growth. According to the results, the growth of technical efficiency index is much greater than that of technical progress index. This shows that since 2011, the high-quality growth of the digital music industry has been mainly achieved by the expansion of the industry scale, with less disruptive technological innovation. This is highly consistent with the actual situation of the industry's development. Since 2011, mobile Internet technology has been applied, 3G, 4G and 5G networks are increasingly popular, and the digital music industry continues to achieve technological iteration with the development of smartphones and smart networks. However, from the perspective of technological innovation, these technological advances are less significant than the changes in the era of non-intelligent networks and artificial intelligence. With the increase of capital investment and the growth of industry scale, the digital music industry achieves high-quality output.

(2) Analysis of Malmquist index is the result of EC and TC. Fig. 3 shows the results of changes of MI index, EC index and TC index from 2011 to 2021. From the perspective of trend, the three indices showed the result of „U" or inverted „U" shape. From 2011 to 2016, the Malmquist index generally increased first and then decreased, and from 2016 to 2021, the Malmquist index continued to increase first and then decreased. The changes of EC index and TC index were consistent with Malmquist index. The above results show that although the growth trend of the digital music industry is positive, it is affected by technological, financial and environmental changes in the specific process. For example, since the outbreak of COVID-19 in 2020, some regions have been affected by the epidemic, and consumers have been fighting the epidemic at home, leading to an increase in the demand for online music. In the first half of 2022, Shanghai was hit by the epidemic, and in the home stage, Liu Geng Hong and

Table 4. Malmquist Index of Digital Music Industry and its decomposition (2011-2021).

| During the period of | Malmquist index | Technical Efficiency Index | Technical Progress Index | Index of pure technical efficiency | Scale efficiency index |
|---|---|---|---|---|---|
| 2011-2012. | 1.264 | 1.323 | 0.991 | 0.884 | 1.194 |
| 2012-2013. | 1.818 | 1.674 | 1.01 | 1.123 | 1.537 |
| 2013-2014. | 1.18 | 1.135 | 1.273 | 0.889 | 1.385 |
| 2014-2015. | 1.317 | 1.368 | 1.165 | 0.965 | 1.139 |
| 2015-2016. | 0.944 | 1.033 | 0.926 | 0.947 | 1.093 |
| 2016-2017. | 1.188 | 1.568 | 0.965 | 0.938 | 1.022 |
| 2017-2018. | 1.276 | 1.773 | 1.015 | 0.928 | 1.031 |
| 2018-2019. | 0.887 | 1.15 | 0.959 | 0.937 | 1.031 |
| 2019-2020. | 1.148 | 1.224 | 0.952 | 1.15 | 0.979 |
| 2020-2021. | 1.196 | 1.178 | 1.104 | 0.921 | 1 |
| The mean | 1.2218 | 1.3426 | 1.036 | 0.9682 | 1.1411 |

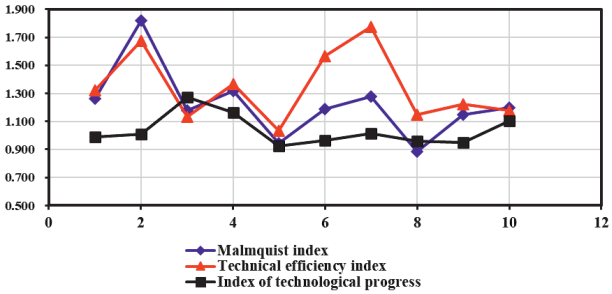


Fig. 3. Malmquist index and its decomposition.

other live videos were sought after by consumers, and the demand for digital music content products increased.

(3) From the perspective of specific enterprises, if the efficiency value of all 35 sample enterprises is investigated, it can be seen that the technical efficiency index of 20 enterprises is higher than the technical progress index, accounting for 57.14% of the total. This indicates that 42.86% of the enterprises' high-quality development efficiency is more significantly driven by technological progress factors; the efficiency improvement of 57.14% enterprises is not significantly affected by technological factors, which also indicates that there is still room for continuous improvement in the digital music industry driven by technological innovation. Fig. 4 shows the Malmuqist index, technical efficiency index, technological progress index, pure technical efficiency index and scale efficiency index of the sample enterprises. From the overall curve, the curve of scale efficiency index changes significantly, while the pure technical efficiency index changes more smoothly, which further indicates that it is necessary for enterprises to further increase technological investment and promote the development of industries with higher quality by relying on technological innovation.

## Analysis of the Impact of the High Quality Development Level of the Digital Music Industry

### *Internal Influencing Factors Analysis Based on Logit Model*

The Logit model mainly uses utility theory to analyze the selection problem. Based on the principle of Logit model, this paper empirically analyzes the internal factors affecting the high quality development level of listed companies in the digital music industry. The input data of 2021 and the Super SBM model value are mainly used for fitting analysis, and the relevant results are shown in Table 5.

According to the model estimation results, the binary Logit regression analysis with current liabilities, net cash flow generated from operating activities, employee compensation payable, total assets and intangible assets as independent variables and Super SBM efficiency value as dependent variable shows good model fitting effect. As can be seen from the above table, it means that current liabilities, net cash flow generated from operating activities, employee compensation payable, total assets and intangible assets can explain the 0.15 change in Logit. As can be seen from the above table, the model formula is: ln(p/ 1-P) = 0.167-0.0051*TCA + 0.0083*NCF + 0.0096*EPP + 0.0027*TAS + 0.0061*INTS (where p represents the probability that Logit is 1 and 1-P represents the probability that Logit is 0). The final concrete analysis shows that:

The regression coefficient value of current liabilities is -0.0051, showing significance ($p = 0.001<0.01$), which means that current liabilities will have a negative impact on the efficiency value of Super SBM.

The regression coefficient value of net cash flow generated from operating activities was 0.0083, showing significance ($p = 0.000<0.01$), indicating that the net

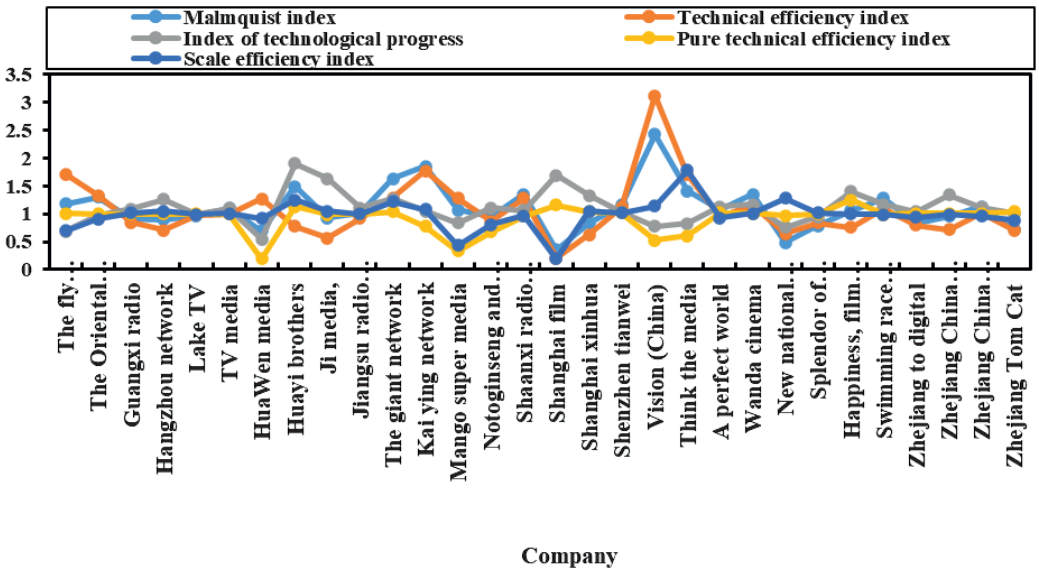


Fig. 4. Malmquist Index of digital music enterprises and its decomposition in 2020-2021.

Table 5. Summary of binary Logit regression analysis results

| Item | Regression coefficient | Standard error | *Z value* | Wald chi-square | *P values* | The OR value | The OR 95% CI |
|---|---|---|---|---|---|---|---|
| TCA | 0.0051 | 0 | 2.627 | 0.393 | 0.001 | 0.85 | 1.000 ~ 1.000 |
| NCF | 0.0083 | 0 | 2.005 | 0 | 0.000 | 0.76 | 1.000 ~ 1.000 |
| EPP | 0.0096 | 0 | 2.494 | 2.231 | 0.002 | 0.62 | 1.000 ~ 1.000 |
| TAS | 0.0027 | 0 | 2.238 | 1.532 | 0.000 | 0.38 | 1.000 ~ 1.000 |
| INTS | 0.0061 | 0 | 2.424 | 2.027 | 0.005 | 0.96 | 1.000 ~ 1.000 |
| Intercept | 0.167 | 0.572 | 1.893 | 0.086 | 0.007 | 1.182 | 0.385 ~ 3.627 |

Dependent variable: $\xi$
McFadden R squared: 0.152
Cox & Snell R squared: 0.190
Nagelkerke R square: 0.254

cash flow generated from operating activities did not have an impact on the efficiency value of Super SBM.

The regression coefficient value of employee compensation payable was 0.0096, showing significance (p = 0.002<0.01), indicating that employee compensation payable had an impact on the efficiency value of Super SBM.

The regression coefficient value of total assets was 0.0027, showing significance (p = 0.000<0.01), indicating that total assets had an impact on the efficiency of Super SBM.

The regression coefficient value of intangible assets was 0.0061, showing significance (p = 0.005<0.01), indicating that intangible assets had an impact on the efficiency value of Super SBM.

Further, White test and BP test were performed on the model results. According to the model results, the results of White heteroscedastic test and BP heteroscedastic test showed that the null hypothesis was rejected and the model did not have heteroscedastic. $p$ = 0.005<0.01 $p$ = 0.007<0.01 Therefore, the model can be considered to be robust.

### *Analysis of the Influence of External Environmental Factors*

Table 5 shows that will AGDP, HCL, CPP, MPP, FDI1, NEP, FDI2 OLS regression analysis as independent variables, and using the Robust stable standard error regression method to study, can be seen from the chart, the model of R value of 0.979, Means AGDP, HCL, CPP, MPP, FDI1, NEP, FDI2 could explain 97.91% of the DEA reasons for such changes.

Table 6. Heteroscedastic test results.

| White heteroscedastic test | | BP heteroscedastic test | |
|---|---|---|---|
| chi-square | *p* | chi-square | *p* |
| 10 | 0.005 | 6.93 | 0.007 |

The F-test of the model showed that the model passed the F-test (F = 206.647, p = 0.005<0.05), indicating that at least one of AGDP, HCL, CPP, MPP, FDI1, NEP, and FDI would have an impact on the Super SBM value, and the formula of the model was: = 12.071 + 0.0022 + 0.0035 * * AGDP HCL - CPP MPP + 0.0031 + 0.002 * 0.172 * * NEP + 0.0053 * FDI. $\xi$' The final concrete analysis shows that:

The regression coefficient value of AGDP was 0.0022, showing significance (t = 1.96, p = 0.006<0.01), indicating that AGDP would not affect the efficiency value. The regression coefficient value of HCL was 0.0035, showing significance (t = -2.449, p = 0.011<0.05), indicating that HCL had an impact on the efficiency value. The regression coefficient value of CPP was -0.172, showing significant (t = -2.508, p = 0.012<0.01), indicating that CPP would have an impact on the efficiency value. The regression coefficient value of MPP was 0.005, which was not significant (t = 1.489, p = 0.121>0.05), indicating that MPP would not have a significant impact on the efficiency value. The regression coefficient value of NEP was 0.0031, showing significance (t = 2.449, p = 0.000<0.01), indicating that NEP would have a significant impact on the efficiency value. The regression coefficient value of FDI was 0.0053, but it did not show significance (t = 1.689, p = 0.091>0.05), indicating that FDI would not have a significant impact on the efficiency value.

In conclusion, AGDP, HCL, CPP and NEP all had an effect on Super SBM value, while MPP and FDI had no significant effect.

## Conclusions

The digital music industry has become an important organizational part of strategic emerging industries and a key field in promoting the transformation and upgrading of economic and industrial structure. With the dual encouragement of the market and the

Table 7. OLS regression analysis results.

| | Regression coefficient Coef | Standard error of Std. Err | *t* | *p* | 95% CI | *R2* | Adjust R 2 | *F* |
|---|---|---|---|---|---|---|---|---|
| Constant | 14.02 | 8.73 | 1.606 | 0.207 | 3.090~31.129 | 0.973 | 0.92 | *F (6, 3) = 18.364, p = 0.018* |
| AGDP | 0.0022 | 0.01 | 1.96 | 0.006 | 0.000~0.023 | | | |
| HCL | 0.0035 | 0.00 | 2.449 | 0.011 | 0.000~0.030 | | | |
| CPP | 0.172 | 0.114 | 2.508 | 0.012 | 0.397~0.052 | | | |
| MPP | 0.005 | 0.005 | 1.489 | 0.121 | 0.005~0.015 | | | |
| NEP | 0.0031 | 0.002 | 2.449 | 0.000 | 0.030~0.010 | | | |
| FDI | 0.0053 | 0.113 | 1.689 | 0.091 | 0.080~0.020 | | | |

Dependent variable: ξ
D - W value: 2.672
* * * p<0.05 p<0.01

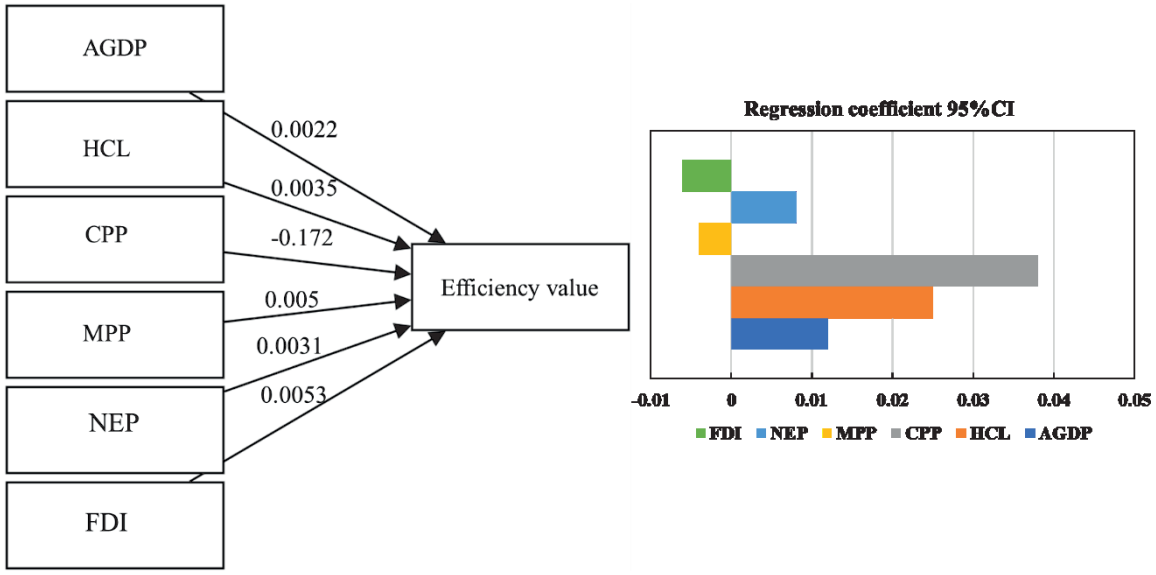


Fig. 5. Influence coefficient of external environment.

government, the digital music industry has shown a good momentum of development. Promoting high-quality development of the digital music industry is an important task for industrial economic development in the new era. Based on C-D production function theory, this paper comprehensively applied super-efficiency DEA estimation model and Malmquist model to scientifically evaluate the measurement of high-quality development level of digital music industry, selected listed companies in the digital music industry from 2011 to 2021 for empirical analysis, and obtained the following conclusions:

First, the high quality development level of the digital music industry is relatively high, but there are large differences within the industry. On the whole, 60% of the 35 sample enterprises have an efficiency value greater than 1.0, which is considered efficient and effective. However, the overall efficiency range is [0.363, 2.251], and the maximum value is 6.2 times of the minimum value, showing significant heterogeneity. In addition, according to the calculation results by region, Sichuan, Hunan, Beijing and other regions have the highest efficiency value, while Guangxi and Hubei have the lowest efficiency value, and the differences among regions are also obvious. This shows that China's digital music industry has a good momentum of high-quality development, but there are still many enterprises in the reform stage, and the scale and efficiency need to be improved in both directions.

Second, the high-quality growth effect of the digital music industry is remarkable, and it is growing year by year. From 2011 to 2021, the Malmquist index of the digital music industry as a whole was 1.2218, greater than 1.0, indicating that the industry as a whole maintained an average annual positive growth of 22.18%. At the same time, the growth of technical efficiency index is much greater than that of technological progress index. The technical efficiency

index is 1.3426, indicating that the technical efficiency has achieved 34.26% growth, and the technical progress index is 1.036, achieving 0.36% growth.

Third, it is necessary for the digital music industry to increase investment in technological innovation to promote high-quality and sustainable growth of the industry. The changes of MI index, EC index and TC index are all the results of "U" or inverted "U" shape changes. 42.86% of the enterprises' high quality development efficiency is more significantly driven by technological progress. 57.14% of the enterprises' efficiency improvement is not significantly affected by technological factors, which also indicates that there is still room for continuous improvement in the digital music industry driven by technological innovation.

Fourthly, both internal and external factors have a significant impact on the high quality development level of digital music. According to the results of Logit model estimation, TCA, NCF, EPP, TAS, and INTS all have significant effects, and the significance level is greater than 95%, that is, all input variables have significant effects on the efficiency value. According to the results of the multiple regression model, AGDP, HCL, CPP, NEP all have an impact on the Super SBM value, while MPP and FDI have no significant impact. External environmental factors are conducive to improving the high quality development level of digital music industry.

## Conflict of Interest

The authors declare no conflict of interest.

## References


1. LAN X. 40 Years of Chinese Music Industry: Review and Prospect, Research of National Arts, 34, 94, **2021**.
2. LI S., ZHOU X., WU Z. Measurement and analysis of ecological quality of provincial industry based on high-quality development: A case study of Shaanxi Province. East China Economic Management, **35** (11), 77, **2021**.
3. JIANG L., FU X. On the High-quality Development of China's Digital Music Industry – Based on the perspective of industrial value chain structure, Journal of Nanjing University of the Arts (Music and Performance), (02), 116, **2020**.
4. HAN S. Observation and Thinking of Digital Music Industry – Analysis based on streaming music, People's Music, (04), 66, **2017**.
5. HUANG G., MENG N. Research on the Characteristics and Innovation Path of Digital Music Business Model in China - from the perspective of RCOV framework, Journal of Harbin University of Commerce: Social Science Edition, (4), 10, **2017**.
6. CAO Y., ZHAO J. China Digital Music Industry Intellectual property governance mechanism construction, China Circulation Economy, **27** (09), 65, **2013**,.
7. YAO L., LI J. An Empirical study on the relationship between copyright protection and music industry , Modern Communication (Journal of Communication University of China), **37**, 110, **2015**.
8. LIU J., YANG Y. Comparative Analysis of music industry development in the US, Korea and India and its Enlightenment to China, Science and Technology Management Research, **34**, 171, **2014**.
9. LONG J. Competition risk and Regulation Method of Exclusive License of Digital Music Copyright, Journal of Huazhong University of Science and Technology (Social Science Edition), **34**, 83, **2020**.
10. SI S. On Digital Music Copyright Protection of short video Platform, Journal of Southwest University of Political Science and Law, **20**, 113, **2018**.
11. FARRELL M. The Measurement of Productive Efficiency, Journal of the Royal Statistical Society, Series A (General), **120**, 253, **1958**.
12. CHARNES A., Cooper W., RHODES E. Measuring the efficiency of decision making units, European Journal of Operational Research, **02**, 429, **1978**.
13. BANKER R., CHARNES A., COOPER W. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis, Management Science, **30**, 1078, **1984**.
14. FARE R., GROSSKOP S. A nonparametric cost approach to scale efficiency, Journal of Parametric Economics, **87** (4), 594, **1985**.
15. SEIFORD L., THRALL R. mathematical programming approach to frontier analysis, Journal of Economics, **33**, 105, **1990**.
16. LIU R., WEI L. Local government competition, industrial agglomeration and regional green development efficiency: An analysis based on spatial correlation and spillover perspective. Exploration of Economic Issues (01), 79, **2022**.
17. FAN D., LIU T. Impact mechanism and heterogeneity of low-carbon city pilot policies on total factor energy efficiency, Industrial Economics Review (02), 93, **2022**.
18. ZHOU F., HAI P., WANG X. Spatial-temporal evolution of green development efficiency in the Yellow River Basin: Based on multi-period two-stage DEA model. Journal of Desert Research, **42** (03), 95, **2022**.
19. FENG S., ZHU F. The heterogeneous impact of consumption structure upgrading on industrial structure upgrading: Also on the moderating effect of Internet commercial circulation efficiency, China Circulation Economy, **36** (04), 19, **2022**.
20. SONG Y., ZHANG X. Measurement of innovation efficiency in China's high-tech industries, Statistics and Decision, **38** (10), 86, **2022**.
21. TANG J., QIN F. Measurement and driving factors of China's high quality economic development level. Statistics and Decision, **38** (07), 87, **2022**.
22. TONE K. A slacks – Based Measure of Efficiency in Data Envelopment Analysis, European Journal of Operational Research (130), 498, **2001**.
23. WANG X.,WANG J., WANG X., et al. An Envelopment Analysis of Data envelopment using an envelopment method. The Operational Research, **143** (1), 32, **2002**.
24. WU C., WU Q. Research on Energy efficiency Evaluation Model based on super-efficiency DEA , Chinese Journal of Management, **06** (11), 1460, **2009**.
25. QI Y., ZHANG M., LI T. Evaluation of integration and sharing efficiency of innovation resources in Jiangsu based on Malmquist index. China Soft Science (10), 101, **2013**.
26. YANG Z. Research on the efficiency of cultural industry and its Influencing factors: Based on DEA-Malmquist

index method and Sys-GMM method, Macroeconomic Research (06), 96, **2016** .
27. FARE R., GROSSSKOPF S., NORRIS M. Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries: Reply, American Economic Review (87), 1040, **1997**.
28. LI S., CHEN C., XU J. Evaluation and Analysis of Financing efficiency of China's New Energy Vehicle industry – an empirical study based on DEA-Logit model, Science and Technology Management Research, **36** (18), 57, **2016**.
29. XIONG Z., ZHAN B., LIN X. Financial support efficiency of strategic emerging industries based on DEA and Logit model. Systems Engineering, **29** (06), 35, **2011**.
30. CUI G. Measurement and evaluation of high quality development level of Chinese industry, Statistics and Decision, **38** (05), 85, **2022**.
31. QU L.,WANG L., JI H. Measurement and analysis of high quality development of regional manufacturing industry in China, Quantitative & Technical Economics Research, **38** (09), 45, **2021**.