Information Systems and Economics (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/infse.2025.060116
ISSN 2523-6407 Vol. 6 Num. 1

Construction of the Deconstruction Mathematical Model of Enterprise Marketing Economy under the Condition of Low-carbon Economy

Boyun Lv[1,a], Bahao Li[1,b,*]

[1]*School of Economics, Jiujiang University, Jiujiang City, Jiangxi Province, China*
[a]*bournewaters@163.com*, [b]*793225151@qq.com*
[*]*Corresponding author*

Keywords: Low-Carbon Economy, Corporate Marketing, Economic Analysis, Mathematical Models

Abstract: Enterprise economic analysis is the basis of entrepreneurial decision-making and a powerful tool to improve the company's economic efficiency. Currently, the Chinese market is in the early stages of splitting, bidding and opening. Enterprises enter the stage of market-oriented operation, so as to expand the autonomy of production and operation. Only through effective economic analysis can companies optimize resource allocation, reduce operating costs, and maximize market performance. Through the research and experiment on the establishment of the mathematical model of enterprise marketing economic analysis under the condition of low-carbon economy (LCE), the experimental data show that: From 1995 to 2009, the national average energy consumption elasticity coefficient of enterprises was 0.62, while the average level of Inner Mongolia enterprises was 0.99, which was 0.37 higher than the national average. After the optimization of the mathematical model constructed under the condition of LCE, the dependence of the economic growth of Inner Mongolia enterprises on energy consumption is gradually slowing down. It shows that Inner Mongolia enterprises have achieved certain results in energy saving and emission reduction.

1. Introduction

The 16th National Congress of the Communist Party of China made it clear that "economic development should be encouraged, supported and resolutely guided", and answered various policy and institutional issues affecting economic development. China's economic development is now entering an important stage. The country's basic policy of taking the state as the pillar and the common development of multi-subject economy has laid the institutional foundation for the rapid development of enterprises. The strategic adjustment of the state-owned economic structure and the adjustment of the state-owned economy have paved the way for investment and enterprise development. Comprehensively adjusting the economic policies of the party and the state is an important strategic decision to liberate and develop productive forces, and has been widely

recognized by the whole society. Preliminary practical experience shows that this policy has a strong incentive effect on the sustained and stable growth of China's economy.

With the development of Chinese society, the issue of economic development has become an important issue in the country's economic development, not just the issue of the enterprise itself. The participation of enterprises in social security is a necessary condition for the socialist market economy. It is of great significance to promote the fair distribution and normal flow of labor, protect the legitimate rights and interests of laborers, and promote the healthy and rapid development of enterprises. The establishment and development of the enterprise social security system has had a favorable impact on the development of China's economy. In academia, research on the economic and social security system is still in its infancy.

Through the research on the construction of the mathematical model of enterprise marketing economic analysis under the condition of LCE, after analyzing the experimental research data of enterprise economy under the condition of LCE, it is found that: Natural resource enterprises in Inner Mongolia pay more and more attention to the advertisement of low-carbon products, and low-carbon advertising expenses account for about 50%. They hope to gain market and reputation by promoting low carbon products to raise public awareness. The implementation of low carbon management is not particularly obvious to enterprises, most of which consume less than 15% of their energy. Some companies invest very little in pollutant emissions, but others invest quite effectively in this regard. After the optimization of the mathematical model constructed under the condition of LCE, the marketing economy of the enterprise develops more smoothly.

2. Related Work

This paper studies some techniques of mathematical models of economic analysis, which can be fully applied to the research in this field. Mohammed studied the Maintenance Highway Economic Demand System (HERS) model to enable analytical experiments based on biennial conditions of national highways, bridges, and traffic [1]. Pol T D argued that cost benefit analysis (CBA), as an economic decision support tool, has been widely used to assess climate change requiring reconsideration of flood risk management strategies [2]. Kopp M analyzed different electricity purchase options for electrolysis plants through economic evaluation. Three options are analyzed, namely purchasing electricity on the European electricity exchange, obtaining excess electricity from direct marketing companies, and participating in the control reserve market [3]. Ahmad J mainly studied the technical and economic feasibility of grid-connected hybrid microgrid system for local residents near Chakhor City, Punjab Province, Pakistan. And investigate the potential of the power generation system to generate electricity by mixing wind, photovoltaic and biomass [4]. Zhang Q studied the technical feasibility and economic applicability of the low-temperature air source heat pump heating method, and compared it with the conventional heating method [5]. These methods provide some references for our research, but due to the short time and small sample size of the relevant research, they have not been recognized by the public.

Based on the low-carbon economic conditions, we have reviewed the following relevant materials to optimize the research on the mathematical model of economic analysis. Lou S studied on the basis of a LCE, with the goal of minimizing power generation costs, CO2 emission costs and V2G service subsidies, and established a coordinated operation model of electric vehicles and systems [6]. Serrano-Puente D studied changes in the structure of the economy, the increasing relevance of less energy-intensive sectors, and the increased use of less carbon-intensive primary energy products [7]. Faerber LA outlines how current distribution grid pricing can be revised for the transition to smart grids in a low carbon economy [8]. Dou X believed that the comprehensive promotion of low-carbon economic development is the key to solving increasingly serious

environmental problems, and the development of LCE requires specific institutional and capacity conditions [9]. Winiewski P assessed the role and importance of agriculture and rural areas (including forestry) in developing a LCE at the local level based on the concept of sustainable development [10]. Holm T studied how vocational education and training and higher education can contribute to a green and LCE in Finland [11]. These methods provide sufficient literature basis for our research on the establishment of mathematical models for enterprise marketing economic analysis under the condition of LCE.

3. Methods of Constructing the Mathematical Model of Enterprise Marketing Economic Deconstruction under the Condition of Low Carbon Economy

3.1 Deconstruction of Low-Carbon Economic Conditions

With the acceleration of industrialization, the global environment has undergone tremendous changes, and global warming has become one of the factors affecting people's lives. Developing a low-carbon economy has become the country's top priority, but this goal has long been a difficult problem for China. The concept of a low-carbon economy was first proposed in the British Energy White Paper in 2003. It aims to reduce high-carbon energy consumption and greenhouse gas emissions through innovation and promote the coordinated development of the economy, society and the environment. Its connotation includes: low emissions, low energy consumption, low pollution and high efficiency as principles; the goal is to coordinate the development of the economy and the environment; emphasize energy conservation and emission reduction; improve energy efficiency and increase the proportion of clean energy; attach importance to technological innovation and institutional innovation.

The low-carbon economic development model constructed by some scholars is highly recognized for the LCE model. The LCE development model is shown in Figure 1:

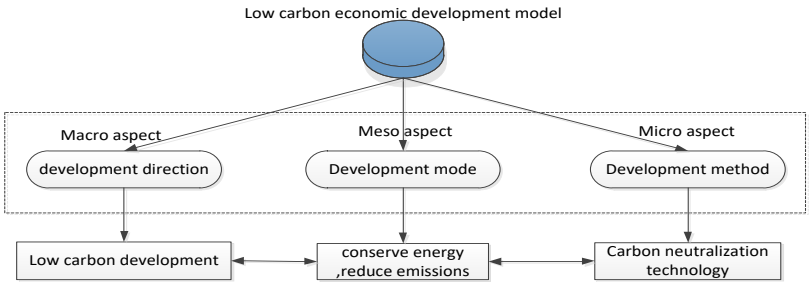

Figure 1. Low-carbon economy development model

The low-carbon economic development model is based on the low-carbon concept and promotes economic growth by replacing the traditional model with a new low-carbon green development model. The low-carbon economy is regarded as the fourth technological revolution, and the new energy economy has become a strategic frontier in international competition and may become the engine of the fourth industrial revolution.

The regional innovation system in a low-carbon economy (LCE) involves functional elements like information transmission and energy conversion, with each unit having a specific ecological niche. The system operates through competition and cooperation among these units.

A low-carbon economy boosts carbon trading and financial innovation. Global carbon markets saw $64 billion in transactions in 2007, double the previous year, benefiting developed countries through emissions trading.

In economic analysis, factor subtraction isolates variables to examine specific influences. Methods like Laplace and Diesel factorization are commonly used for this purpose.

The Diesel factorization formula is as follows:

First differentiate over time:

$$dz/dt = d(mn)/dt = n(dm/dt) + m(dn/dt) = mn(d1ym) + mn(d1yn) \tag{1}$$

Re-integration can be obtained:

$$\Delta z = \int_0^t mn(d1ym/dt) + \int_0^t mn(d1yn/dt) \tag{2}$$

According to the approximate calculation formula, it can be got:

$$\int_0^t mn(d1ym/dt) = [\alpha(m_0 n_0) + \beta(m_t n_t)](1ym_t - 1ym_0) \tag{3}$$

$$\int_0^t mn(d1yn/dt) = [\alpha(m_0 n_0) + \beta(m_t n_t)](1yn_t - 1yn_0) \tag{4}$$

Among them, $\alpha + \beta = 1$. It can be seen that because of the approximate calculation process, the result of the Diesel factorization method also contains "surplus", namely:

$$\Delta z = \Delta z_m + \Delta z_n + r \tag{5}$$

When the changes of m and n are small, the "surplus" is also small; on the contrary, if the changes of m and n are large, the "surplus" will be relatively large.

Other decomposition methods include sequential substitution, average distribution of interaction effects, and proportional distribution of interaction effects. These methods differ in how they handle the "surplus" from the Laplace method. Sequential substitution attributes all interaction effects to one factor, while average distribution spreads the interaction effects evenly across all factors.

The interactive influence proportional distribution method, as the name suggests, is in the Laplace decomposition method, the interactive influence is distributed to the influence of each factor according to a certain proportion, such as:

$$\Delta z = \Delta z_m + \Delta z_n = \left[(m_t - m_0)n_0 + \frac{\Delta m/m_0}{\Delta m/m_0 + \Delta n/n_0}\Delta m\Delta n\right] + \left[(m_t n_0 - m_0 n_0) + \frac{\Delta n/n_0}{\Delta m/m_0 + \Delta n/n_0}\Delta m\Delta n\right] \tag{6}$$

Obviously, if both m and n vary by very small values, their interaction is also small, and the results calculated by the above method will not be very different. However, if the interaction effect is large, the above decomposition methods may have a certain residual error. At this time, a more reasonable decomposition method needs to be found.

3.2 Methods of Deconstruction of Enterprise Marketing Economy

Domestic research focuses on how dynamic marketing capabilities form and impact corporate performance. These capabilities are vital for competitiveness and adapting to environmental changes. Scholars have studied them from cognitive, process, and combination perspectives.

Perception-based capabilities involve integrating social capital, human capital, and management knowledge, often requiring decisions by middle and senior managers. Process-based capabilities emphasize responsiveness in business processes to adapt quickly to market changes. Portfolio planning includes market segmentation, target market selection, and positioning, which depend on consumer characteristics, corporate resources, and product competitiveness.

Marketing risk management involves monitoring, evaluating, and addressing risks through information collection, forecasting, analysis, and decision-support. The system includes early warning, information processing, indicator evaluation, and management control, using methods like

brainstorming and Delphi for indicator selection. The signal diagram of marketing risk early warning management is shown in Figure 2:

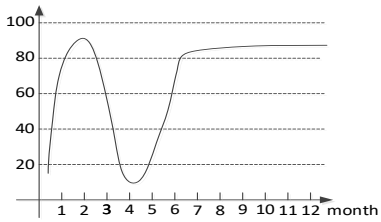

Figure 2. Signal diagram of marketing risk early warning management

Early warning classification management system: 1. The main task of the early warning classification system is to divide the marketing risks into different levels according to the priority of the risk occurrence, so as to provide a basis for risk prevention. 2. The early warning and pre-control system is mainly composed of the risk prevention countermeasure library and the prevention measures update system. The schematic diagram of the marketing risk early warning classification process is shown in Figure 3:

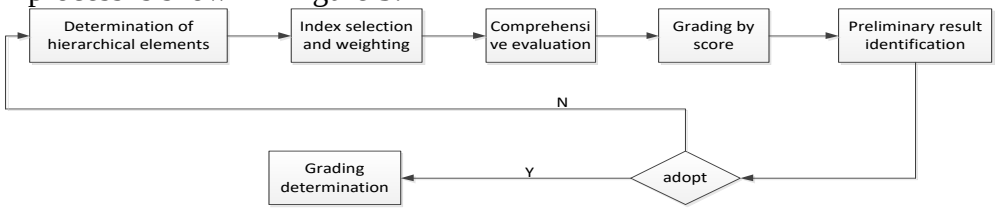

Figure 3. Schematic diagram of the marketing risk early warning classification process

The early warning management system includes early warning management, synchronous warning management, and feedback warning management. Pre-check identifies potential issues, synchronous control ensures smooth signal acquisition, and feedback control evaluates warning results against planned standards.

Economic analysis quantifies project benefits using dynamic (considering time value) and static methods. It supports decision-making through single-scheme evaluation, multi-scheme comparison, and project prioritization. The present value method converts project cash flows to present values for analysis, comparing costs or benefits as needed, typically using net present value.

Single-plan analysis: If NPV is zero, the plan meets the benchmark return rate and is barely feasible or needs improvement.

Cost present value method: Convert all costs of each option to present value and select the option with the lowest present value.

Annual cost method: Convert cash flows of each option to equivalent annual values using a discount rate, then analyze based on these values. Typical measures include annual NAV and annual cost value.

Annual NAV method: Convert all cash inflows and outflows of the investment plan to annual values. The difference between these values is the annual NAV of the plan. The net present value is converted to the equivalent annuity value, which is the annual net present value, which is:

$$NAV = NPV\left(A/P, i_0, y\right) \tag{7}$$

$$NAV = \sum_{i=0}^{y}\left(B_t - C_t\right)\left(P/F, i_0, t\right)\left(A/P, i_0, y\right) \tag{8}$$

$$NAV = \sum_{i=0}^{y} \frac{B_t - C_t}{(1+i_0)^t} \cdot \frac{i_0(1+i_0)^y}{(1+i_0)^y - 1} \tag{9}$$

The annual cost method is used to analyze the options that can meet the same needs or provide the same benefits but have different lifespans. The option with the lowest annual cost is the best option. The calculation method is as follows:

$$EAC = \sum_{i=0}^{y} C_i (P/F, i_0, t)(A/P, i_0, y) \tag{10}$$

$$EAC = \sum_{i=0}^{y} \frac{C_t}{(1+i_0)^t} \cdot \frac{i_0(1+i_0)^y}{(1+i_0)^y - 1} \tag{11}$$

The benefit-cost approach reflects the economic relationship between total benefits and total costs. It has two analytical metrics: benefit-cost ratio and net benefit. Benefit costing can be based on the current flow characteristics of the project, using present and annual values as appropriate. For multi-scenario analysis, use the present value calculation when the lifespan of the plans are equal, and use the annual value calculation when the lifespan of the plans are not equal.

3.3 Methods of Mathematical Model Construction

The development of society and technology are inseparable, and the development of technology and mathematics are inseparable. In the real world, it is often difficult to find quantitative relationships, regularities or spatial forms. Quantitative laws and spatial forms are often hidden behind various colorful phenomena. When abstracting mathematical problems in the real world, some small factors must be put aside, the largest factors must be grasped, and some necessary simplifications must be made in order to accurately solve abstract mathematical problems with appropriate mathematical methods.

The conceptual model of the mathematical model is relative to the prototype. Archetypes are real objects that people are interested in in social practice. In the field of science and technology, discovered archetypes are often replaced by terms such as "system" or "system of things". A systems perspective enables people to understand and comprehend things better. There are always contradictions in the things and systems that people are interested in and study about, and contradictions are problems. A thing or system is always in motion and change, and understanding the regularity of its motion and change is a core issue in the study of a thing or system.

A mathematical model should reflect reality, that is, the quantitative aspects of real problems. Because it is a model, it is not an accurate representation of the real problem and does not take into account many non-quantitative aspects of the real problem. Some minor quantitative factors are usually omitted, and necessary simplifications are made to reflect the quantitative laws of practical problems.

Mathematical modeling is the process of establishing a mathematical model for a specific objective thing. It is a mathematical model that objectively analyzes a specific phenomenon or reality with mathematical symbols. Using this scientific method, modeling must start with practical problems, follow the cognitive laws of dialectical materialism "practice". Accurately determine the modeling goals, use observation, imagination and logical thinking, summarize and simplify practical problems, and continue to learn and improve until a mathematical model is established for analysis. Research solves real problems. Mathematical modeling is a scientific method to quantitatively solve practical problems, and it is also a bottom-up innovation process.

4. Experiment of Deconstruction of Enterprise Marketing Economy under the Condition of Low Carbon Economy

4.1 Deconstruction of Enterprise Marketing Experiments under Low-Carbon Economy

China's efforts to promote the development of a green and LCE in recent years are obvious to all. Energy conservation, emission reduction and low-carbon transformation are not only out of international responsibility, but also out of China's own development needs. This part is based on the experimental research on enterprise marketing of LCE development in Inner Mongolia.

Overview of Inner Mongolia: 1. Geographical location, the Inner Mongolia Autonomous Region is located on the northern border of China, extending diagonally from northeast to southwest, forming a long and narrow shape. Its total area is 1.183 million square kilometers, accounting for 12.3% of the country's land area, ranking third in China. 2. Population situation, Inner Mongolia Autonomous Region is composed of 49 ethnic groups including Mongolian, Han, Manchu and Hui, among which Han population accounts for 78.38% of the total population and Mongolian population accounts for 17.65%. 3. The climate characteristics belong to the typical mid-temperate monsoon climate.

Resource Status: As a major energy production and consumption area in China, Inner Mongolia not only consumes part of its own energy, but also plays an important role in the "West-East Coal Transportation" and "West-East Gas Transmission" as an energy production base. The graph of total energy production and consumption in Inner Mongolia is shown in Figure 4:

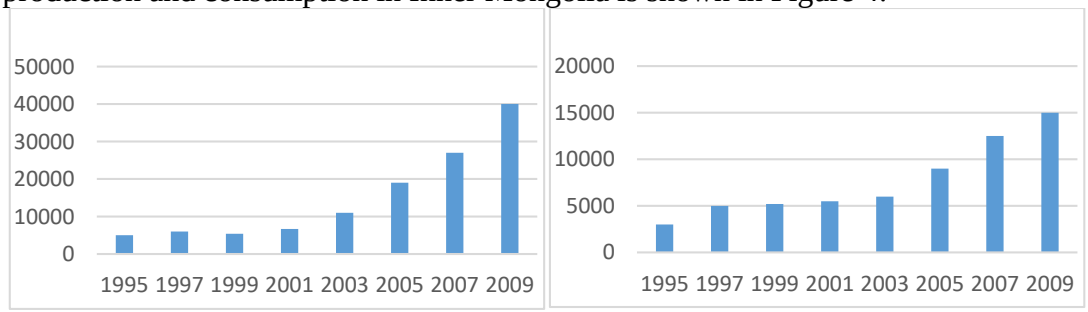

Figure 4. Total energy production and consumption in Inner Mongolia

Inner Mongolia's energy production and consumption grew significantly from 1995 to 2009. Energy production rose from 46.42 million tons to 401.85 million tons, an 8.66x increase, accounting for 14.63% of the national total in 2009. Energy consumption increased from 32.684 million tons to 153.43 million tons by 2015, a 4.69x rise, making up 5.01% of the national total. Since 2001, production growth has outpaced consumption growth, improving supply-demand balance.

The energy consumption elasticity coefficient, reflecting economic growth's dependence on energy consumption, is analyzed to understand short-term dynamics. A higher coefficient indicates lower energy efficiency for economic growth. This coefficient has generally declined due to technological advances, economic restructuring, and the development of energy-intensive industries. Figure 5 shows the change trend of the elastic coefficient of energy consumption in Inner Mongolia and China.

Inner Mongolia's energy consumption elasticity averaged 0.99 (1995–2009), above the national 0.62, highlighting significant energy-saving challenges.

Enterprises need diversified, low-cost marketing models amid product line expansion, shifting to mobile internet marketing.

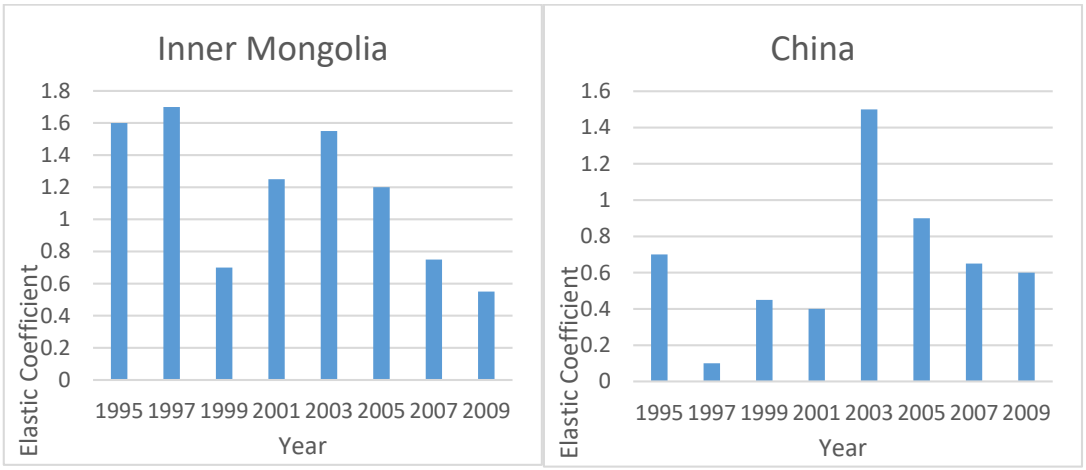

Figure 5. Trend of Energy Consumption Elasticity in Inner Mongolia and China

Low-carbon efforts in Inner Mongolia need improvement: only 20% new energy adoption, 14.19% focus on eco-certifications in procurement, and inconsistent low-carbon management. Most enterprises use environmentally friendly packaging and rail transportation, but the recycling rate is very low, as shown in Figure 6.

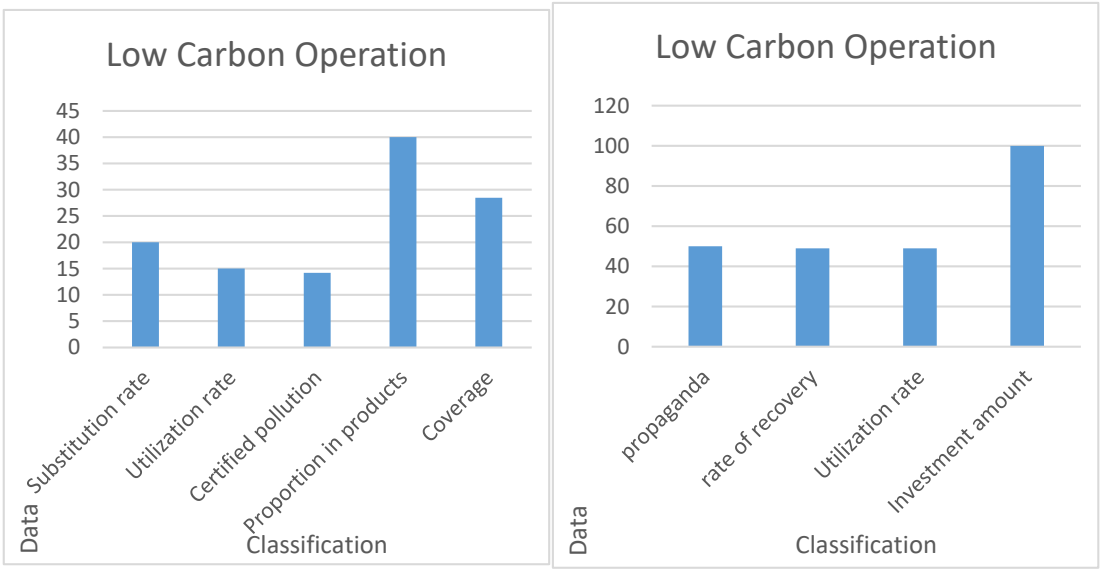

Figure 6. Low-carbon operation behavior of enterprises

4.2 Experiments in Economic Deconstruction

This section uses the literature review method to search the sample with the keywords "economics" and "analysis", so these two keywords account for the majority of this sample. While the results showed that the search tools could handle relevant searches reliably, they were of little value to this part of the analysis and were therefore excluded.

After removing the above keywords, among the 3145 articles collected, the top ten words in the titles of Chinese economic analysis literatures are shown in Table 1.

From Table 1 the following conclusions can be drawn: 1. China's economic analysis focuses on the situation, policies, development, growth and indicators. Due to specific historical, cultural, social and political reasons closely related to China's economic development and political context,

scholars analyze the status quo, policies, development, growth and indicators of China's economy to make judgments on the performance of the government.

Table 1. Top 10 ranking of Chinese economic analysis literature titles by terms

Title Words	frequency	probability
situation	535	0.1703
policy	528	0.1681
influence	433	0.1379
be based on	305	0.0972
demonstration	305	0.0972
development	255	0.0813
Regulation	254	0.0810
current	239	0.0762
increase	233	0.0743
function	226	0.0721

Based on the philosophical theory that material determines consciousness, China has established a development policy focusing on economic recovery, and economic growth has undoubtedly become the primary task. Table 2 shows the top ten headlines related to economic growth in Chinese economic analysis literature:

Table 2. Top 10 headline words of economic growth topic relevance

Title Words	frequency	probability
situation	51	0.2184
tax	40	0.1722
demonstration	38	0.1638
policy	27	0.1175
be based on	24	0.1049
Regulation	22	0.0965
stable	18	0.0797
forecast	17	0.0755
Model	13	0.0587
finance	11	0.0503

From the above ratios, it can be concluded that there are two most common types of articles on the topic of economic growth. One is a descriptive statistical analysis of key indicators based on the economic situation; the other is a set of economic indicators (based on data provided in fiscal and financial form) and economic growth.

Under the current conditions of increasing internationalization, economic development cannot always proceed smoothly. Structural imbalances in development, insufficient money supply, overheating or low price levels, overcapacity and external shocks can all lead to volatility in strong growth. However, since the Chinese government has set annual economic growth targets and delegated this task to local governments at all levels, how to deal with economic fluctuations and ensure stable growth has always been a hot topic in society. The top ten headlines in terms of the relevance of economic fluctuations are shown in Table 3:

Table 3. Top 10 headline words in relation to economic fluctuations

Title Words	frequency	probability
demonstration	39	0.2531
be based on	35	0.2277
Price	24	0.1581
cycle	21	0.1391
Model	16	0.1075
room	15	0.1012
factor	14	0.0948
relationship	14	0.0948
thigh	14	0.0948
market	10	0.0695

As can be seen from the correlations in Table 3, prices, housing and stocks are important correlations when studying economic fluctuations. The literature uses analytical methods to verify macroeconomic data and study the cyclical model of economic fluctuations and its causal relationship with other factors.

Rather than estimates of economic conditions, researchers in the field prefer to demonstrate econometric analysis. Through statistical reliability tests, the reasons for economic fluctuations are attributed to the research objects selected by the researchers.

To sum up, China's economic analysis literature mainly discusses the regulation and control of government policies from the perspective of traditional macroeconomic theory and international trade, but the amount of literature shows a downward trend. On the other hand, all decisions are based on empirical data and high-frequency models.

5. Conclusions

In the context of global warming and environmental degradation, the LCE also brings serious challenges to social and economic development. With the introduction and popularization of LCE, the marketing concept of enterprises has also brought about a low-carbon effect. In order to improve our own value, companies must not only pursue commercial interests, but more importantly, we must continue to coordinate efforts for social, economic and environmental development. Through the study of low-carbon economic conditions, this paper puts forward practical suggestions for constructing the mathematical model of Chinese enterprise marketing economic analysis, which has important theoretical and practical significance.

References

[1] Mohammed, Maks, Alam. New Capital Cost Table for Highway Investment Economic Analysis:[J]. Transportation Research Record, 2018, 1932(1):33-42.

[2] Pol T D, Ierland E C, Gabbert S. Economic analysis of adaptive strategies for flood risk management under climate change[J]. Mitigation & Adaptation Strategies for Global Change, 2017, 22(2):267-285.

[3] Kopp M, Coleman D, Stiller C. Energiepark Mainz: Technical and economic analysis of the worldwide largest Power-to-Gas plant with PEM electrolysis[J]. International Journal of Hydrogen Energy, 2017, 42(19):13311-13320.

[4] Ahmad J, Imran M, Khalid A. Techno economic analysis of a wind-photovoltaic-biomass hybrid renewable energy system for rural electrification: A case study of Kallar Kahar[J]. Energy, 2018, 148(APR.1):208-234.

[5] Zhang Q, Zhang L, Nie J. Techno-economic analysis of air source heat pump applied for space heating in northern China[J]. Applied Energy, 2017, 207(dec.1):533-542.

[6] Lou S, Zhang L, Wu Y. Coordination Operation of Electric Vehicles and Power System under Low-Carbon Economy[J]. Diangong Jishu Xuebao/Transactions of China Electrotechnical Society, 2017, 32(5):176-183.

[7] Serrano-Puente D. Are we moving toward an energy-efficient low-carbon economy? An input–output LMDI decomposition of CO $$_{2$$ 2 emissions for Spain and the EU28[J]. SERIEs, 2021, 12(2):151-229.

[8] Faerber L A, Balta-Ozkan N, Connor P M. Innovative network pricing to support the transition to a smart grid in a low-carbon economy[J]. Energy Policy, 2018, 116(MAY):210-219.

[9] Dou X. Low Carbon Technology Innovation, Carbon Emissions Trading and Relevant Policy Support for China's Low Carbon Economy Development[J]. International Journal of Energy Economics and Policy, 2017, 7(2):172-184.

[10] Winiewski P, Kistowski M. Agriculture and rural areas in the local planning of low carbon economy in light of the idea of sustainable development - Results from a case study in north-central Poland[J]. Fresenius Environmental Bulletin, 2017, 26(8):4927-4935.

[11] Holm T, Vennervirta P, Hmeenoja E. Identification of Skills Needed for Central Areas of Green and Low-Carbon Economy, for the Needs of Labor Market, in Finland[J]. European Journal of Sustainable Development Research, 2017, 1(1):1-8.