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Research Article

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Big data analysis technology in regional economic market planning and enterprise market value prediction

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Abstract: Market planning for regional economic development is a crucial task connected to stability and systematicness and influences the unique outcomes of regional economic growth. As a result, market planning for regional economic development must be given more weight. There are several issues with regional economies currently developing in many parts of our country. Lack of focus on market planning for regional economic growth results in several flaws in market planning, making it challenging to support sustainable development. The accurate analysis of diverse massive economic datasets has significant research value. The aim of this study is to provide an overview of market planning and regional economic and industrial development, analyze the effects of market planning on regional economic and industrial development, identify issues with market planning and regional economic and industrial development, and suggest solutions. This article employs big data analysis technology to forecast corporate market value and develop regional economic markets. The system is employed to conduct experimental big data analysis within a specific field for an extended period. According to test analysis results, the system's data analysis accuracy can reach up to 95.8%, which has a promising future for use.

Keywords: big data, market planning, enterprise market value, forecasting model

1 Introduction

Planning the long-term, significant, and essential aspects of regional economic and social development from a strategic height is referred to as regional economic development market planning. Simply put, to enhance the scientific nature of regional economic development over an extended period, based on the evaluation of regional economic and social development, and to examine the objectives and guiding ideology. The comprehensive process of making decisions and planning essential countermeasures, including their stages and key components.

Planning for the regional economy should adhere to specific guidelines. Think about the overarching principle first. Since improving the scientific nature and efficacy of regional economic development is the primary goal of regional economic market planning, we must consider all relevant factors and concentrate on the broader context. Only in doing so will we be able to unite all facets of development, encourage collaboration between development strategies and plans, and more effectively accomplish strategic objectives. Second, emphasize the advantage principle. The relatively big size of my country means that different regions have various topographical and climatic features, natural resources, environmental circumstances, cultural customs, etc. As a result, while creating regional economic plans and market strategies, regional characteristics

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must be considered appropriately to maximize benefits. The third is the benefit principle. Regional economic development market planning aims to maximize benefits while minimizing costs. Regional economic development should be planned and distributed equitably to achieve this goal. In order to ensure that the regional economy engages in sustainable development for a considerable amount of time, we must make effective use of the benefit principle when developing market planning and insist on the unity of ecological and social benefits. Decision-making emphasizes a process-oriented, co-evolutionary approach. Criteria include efficiency, often derived from potential Pareto improvements. Considerations extend to environmental and social systems' equity, stability, and resilience. The production process theory guides the allocation of fixed resources.

Even though different parts of our nation have been giving regional economic development market planning more and more thought and taking numerous steps to advance the science of market planning, issues nevertheless inevitably arise. As a result, we can provide focused solutions and offer sound advice for the continued growth of the local economy [1]. However, at the moment, many regions in our nation cannot consider the actual circumstances of regional economic development while establishing market plans for regional economic development. Due to analysis and other factors, the market planning does not adequately account for the area context. Creating regional economic market planning is a methodical process that requires attention to numerous details. Several regions in my country are developing market strategies at the moment. A marketing plan serves as a roadmap for gaining new clients, fostering more robust bonds with existing ones, boosting sales, enhancing client retention, and raising brand awareness. It has not always been precise and thorough, and market planning science has to be improved.

Internet has emerged as the fastest-growing, most inventive, and fiercely competitive industry in human civilization due to the advancement and reform of communication technology. In 1994, China made a connection to the internet. As a result of industrial strategies like the "Internet + Action Plan" and the transformation of my country's economic structure, internet has grown swiftly and permeated every part of daily life [2].

My nation successively built the Growth Enterprise Market and the Science and Technology Innovation Market to encourage the growth of high-tech businesses. These markets offer more extensive funding options for high-tech startups, and the businesses have proliferated. Many businesses have imitated the early enterprises, which raised enormous capital by going public. Corporate capital operations are shared in order to grow bigger and stronger. The A-share market in my country had 296 internet-listed companies as of the end of 2019, with a market value of about 3385.6 billion yuan [3]. In the 5 years from 2015 to 2019, as seen in Figure 1,

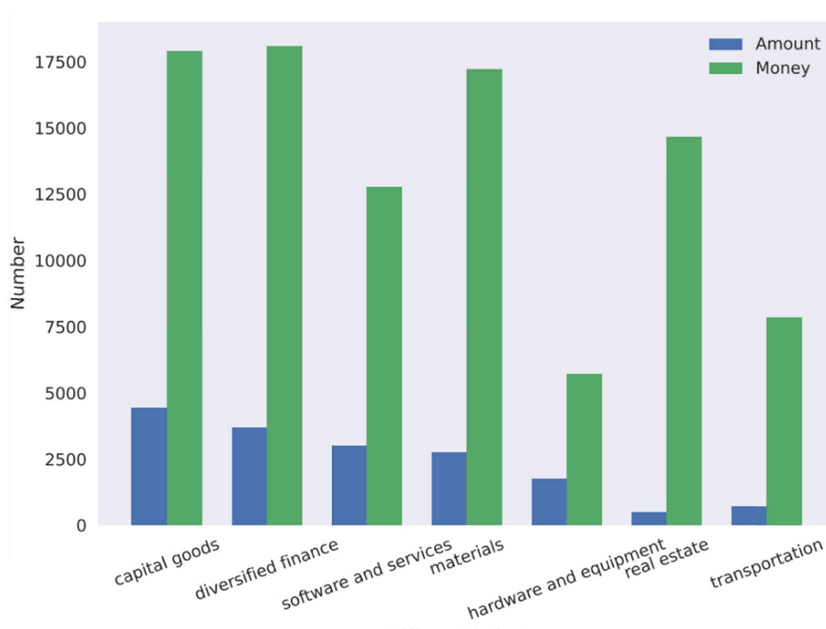

Figure 1: Statistics by industry of the number and amount of mergers and acquisitions from 2015 to 2019.

there were 3,006 mergers and acquisitions in the internet software and service sector, totaling 1274.5 billion yuan [4]. However, due to incidents like Baidu's high-priced acquisition of 91 Wireless, blind mergers and acquisitions are becoming increasingly common, detrimental to the growth of the internet industry, investor interests, and even the orderly development of the capital market. Therefore, it is crucial to understand how to fairly and effectively assess an enterprise's value.

Even though the company is still in the early stages of development, substantial R&D spending is one of its distinguishing features, which increases its prospective value. There are numerous options for development methods when operating startup businesses. Managers decide to expand investment when a project has potential for development in order to boost corporate income; when investment encounters severe competition or risks, managers can decide to cut or give up. Investment is a versatile and adaptable management tactic.

Currently, three classic evaluation methods and other methodologies can be used to determine the market worth of domestic and international businesses. However, the conventional evaluation methods have certain drawbacks since locating comparable businesses is challenging, and future business development is highly unknown. In navigating unpredictable conditions influenced by dynamic external factors, market volatility, and technological progress, relying solely on historical data and linear projections is unreliable. To enhance decision-making resilience, adopting a flexible, scenario-based approach that considers unforeseen variables is crucial. The economic value-added approach and the natural option method are further evaluation techniques. The latter simply takes into account financial indicators and does not take into account non-financial aspects like the corporate management model.

In contrast, the former necessitates several subjective reclassification adjustments to report items. The key financial metrics for assessing a company's profitability are net profit and return on assets. The primary performance indicators include profitability, leverage, valuation, liquidity, and efficiency KPIs. Additionally, a metric for measuring customer acquisition cost is essential. In recent years, the natural option approach has become a prominent option for determining the market value of businesses. It analyses the present option characteristics of the firm to determine the possible option value; however, it is simple to overlook the current asset value.

2 Related works

2.1 Development status abroad

Along with the growth of regional economic market planning, the regional economic market planning approach also evolves continuously. Planning for foreign regional economic markets has a lengthy history [5]. The lengthy study procedure has consistently improved and enhanced the planning method, which is currently quite sophisticated.

The design of the Custer coal mine in England from 1922 to 1923 and the urban regional planning of New York in the United States in 1929 are two examples of how foreign regional economic market planning is based on urban planning and industrial and mining location planning [6]. The planning scope, however, is modest and straightforward for this time frame. Most regional economic market planning techniques until the 1940s were relatively straightforward, primarily utilizing industrial location and geography methods [7]. The importance of cities' function and position in the local economy grew by the 1940s due to the growth of capitalism, increased industrialization, and urbanization. The planning process meets numerous challenges [8]. Greater London Regional Plan was first created by the United Kingdom in 1944, after which industrialized nations, the former Soviet Union, and Eastern European nations generally implemented a large-scale regional economic market plan [9]. The input-output method and linear programming have become quite popular, and the regional economic market planning method has advanced rapidly. The input-output method application offers a potent tool for interregional trade and research of regional industrial structure; linear programming offers convenience for resource allocation and sensible use.

Regional economic market planning has advanced to a new level since the 1960s, with the study of people, society, environment, and resources caused by capitalist industrialization and urbanization [10]. A simple economy gives way to a complete planning of five factors in the regional economy: the economy, people, society, environment, and resources. During this time, the regional economic market planning approach has advanced to a new stage of development to respond to the complexity of regional economic comprehensive planning. Regional economic market planning techniques have gradually evolved in the West away from conventional techniques like qualitative description, zoning, and analysis and toward techniques like systems engineering, grey control system, AHP method, system dynamics model, and multi-objective decision planning [11]. Another significant turning point in the innovation of planning methods and tools occurred around 1990 when several regions began using decision support system technology in their regional economic market planning efforts [12]. With these new technologies, planners and decision-makers can more effectively address various planning-related issues, increase job productivity, lessen the subjective influence of human variables, and focus on planning's quantitative issues [13]. Regional economic market planning is now a multi-disciplinary, all-encompassing process rather than a straightforward approach, including a few disciplines. For instance, countries use computers as the primary tool for regional planning and fully utilize remote sensing, geographic information systems (GIS), global positioning system, and other high-tech and mathematical modeling technologies.

On the one hand, this makes it convenient for the public to quickly and easily participate in planning and understand the planning results, but on the other hand, it alters the planning process. In the past, the planning process was primarily based on qualitative research, and the area was the subject of quantitative study. Fuzzy science techniques for uncertain factor analysis and mathematical models and model systems are frequently employed in mathematical applications. Western regional economic market planning techniques are progressing towards an all-encompassing model of quantification and modeling.

2.2 Domestic development status

The application research for the regional economy planning approach is still in its infancy in my country. My nation once used regional planning based on joint processing plants from 1953 to 1957 to assist with developing new industrial zones and cities. Only straightforward geographic, mathematical, and locational techniques were applied [14]. The central government decided to develop land planning as we entered the 1980s. Most provinces, cities, and districts have planned land in succession and obtained specific results [15]. Input-output tables were first collected by Shanxi Province in 1982. Subsequently, many other provinces, municipalities, and districts followed Shanxi's lead. Since then, Xinjiang has created strategies for its social and economic development [16]. In order to create development market plans in the Simo area of Yunnan and Jining County of Kunming City, Sun et al. [17] established a complete set of basic index model systems and a dynamic rolling model system of induced indexes in 1990. As a result, the designated strategic goals and plans have a comparatively high level of performance, high adaptability, and precision. In 1997, Wang et al. [18] proposed a Pareto optimum algorithm for identifying answers by fusing the positive eigenvector approach with network technology, providing a regional economic network model. The theory, guiding principles, scope, and regional economic market planning techniques were studied and elaborated upon by Lin et al. [19] in 2020. They talked about the concepts, modeling procedures, and principles of applying multi-objective optimization techniques to challenges in regional economic market planning and incorporated some of their ideas into examples of specific applications that were examined. In 2020, Hung et al. [20] reviewed the use of GIS in county urban system planning and discussed how it might be used in regional planning research to manage data, analyze data, support decision-making, and articulate planning conclusions. In the study by You and Wu [21], it is suggested that the use of remote sensing and GIS technology be made more common in regional planning in the new era, resulting in the digitization of the entire regional planning process, from field research, data collection, processing, and computational simulation to planning and mapping, implementation, and supervision. In 2007, Radwan et al. [22] developed a comprehensive index evaluation method appropriate for the western region using fuzzy comprehensive evaluation for the region's planning. The same year, regional economic market planning used a hybrid analytical hierarchy process and grey relational decision-making.

3 Methods

To some extent, the local economy reflects the standard of living of the populace. A critical measure of the standard of living that reflects the financial health of the neighborhood is the local economy. It includes things like work prospects, income levels, and general economic activity, all of which greatly influence the standard of living for locals. Electronic maps, transportation data, census data, and other sources are all combined in a multidimensional analysis based on massive data, standard selection, and feature modeling. Electronic maps enhance the representation of economic data, facilitating the recognition of patterns and distinctions in regional economic activities. Integrated visuals simplify intricate data, assisting decision-makers in comprehending regional trends. It can act as the foundation for regional economic decision-making. A specific approach framework is shown in Figure 2. The process consists of data cleaning, particular time and place selection in the determination criteria, accurate space-time range narrowing, and space-time correlation and analysis. The data analysis comprises five essential stages: defining business queries, gathering and storing data, cleaning and preparing data, conducting analysis, and visualizing findings. It aims to reveal patterns, explore temporal trends, and evaluate relationships among spatial and temporal variables to derive actionable insights. Analyzing the socioeconomic life, economic development, and geographical characteristics of the population can be done with accurate data support from the visualization of results, graphical representation and analysis of data, and evaluation of data using econometric models. Visualizations enhance comprehension of data trends, patterns, and relationships, making complex economic information more accessible. Line charts, bar graphs, and scatter plots are standard tools that effectively convey insights to policymakers, researchers, and the public. This section establishes a specific space-time region to create a framework for regional economic research using the night market as an example.

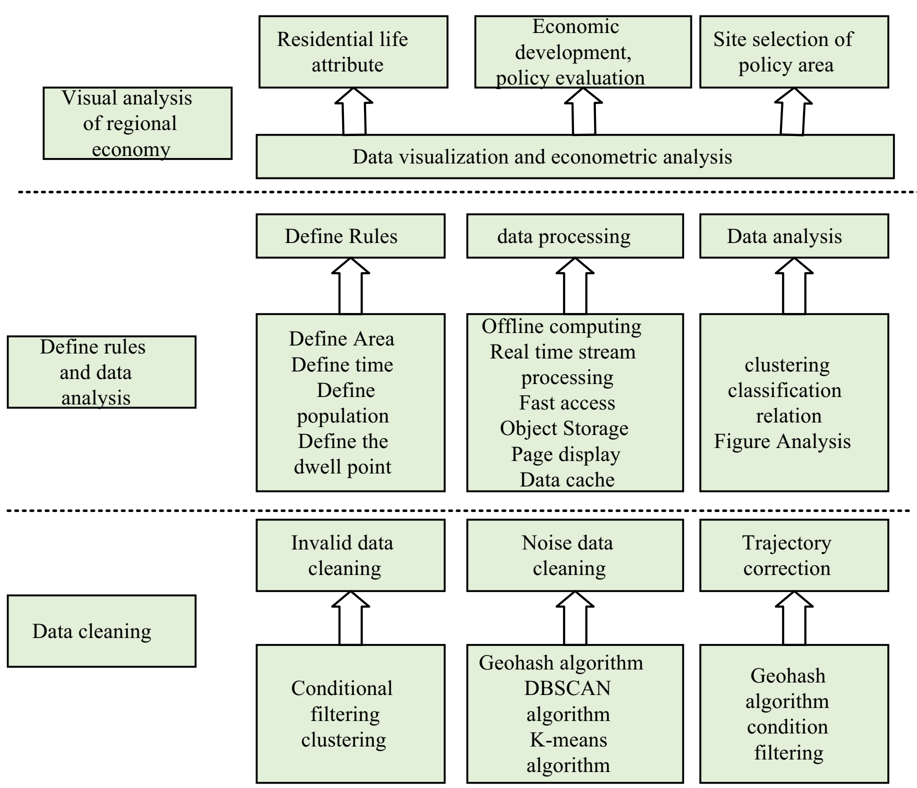

Figure 2: Framework of regional economic analysis method of big data.

3.1 Analysis of regional economic market planning

The recursive convolutional neural network (RCNN) model is chosen in this study to analyze the direction of market planning in regional economic time series (RETS-RCNN). It is introduced as economic news articles and technical indicators.

As shown in Figure 3,

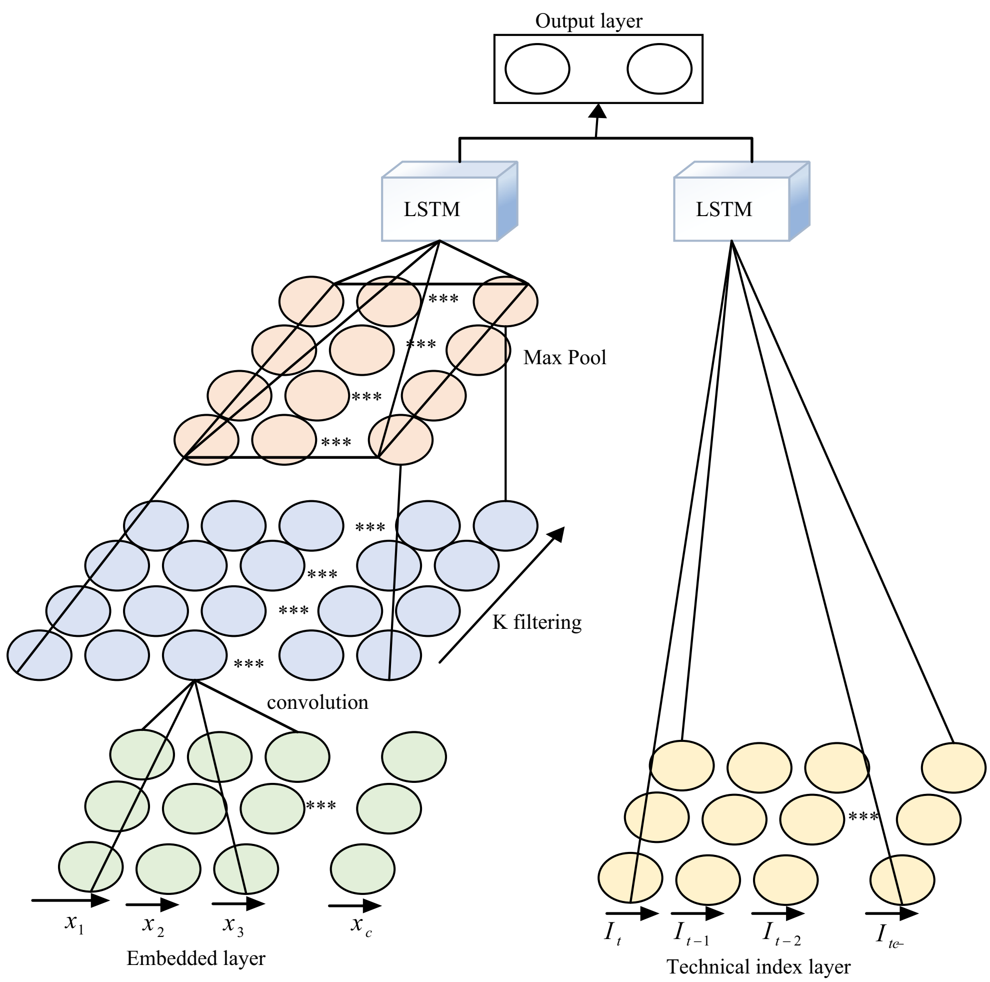

Figure 3: TS-RNN.

$$q_j = W \cdot \vec{x}_{j:j+R-1} + \vec{b}, \tag{1}$$

where $\vec{b} \in R^R$ is the bias term. Equation (1) is applied to the sentence window to generate the feature map Q,

$$Q = [q_1, \cdots, q_j, \cdots, q_{L-R+1}]. \tag{2}$$

To introduce nonlinearity into the model, the rectifier linear unit is used as the activation function,

$$h(q_j) = \max\{0, q_j\}. \tag{3}$$

Since this layer involves many parameters, the model is prone to overfitting, so a Dropout regularization technique with probability $p = 0.5$ is used.

3.2 Setting and estimation of a regional econometric model

The spatial dependency of economic growth between regions must serve as the foundation for measuring diffusion backflow and market area effect between regions. Spatial economics studies commonly utilize binary matrices consisting of zeros and ones to examine spatial effects. A weight matrix is employed to gauge the spatial interdependence or connectivity among countries, indicating proximity and influencing the extent of spatial spillovers between them. To evaluate whether there is spatial correlation across regions and to establish the properties of spatial correlation, we first build a spatial econometric model. At the same time, we thoroughly chose the model using the fixed-effect LR test. The spatial lag model is used in this study for the test results, to examine the geographic relationship between the economics of a province and a county. The comparison model used in this study is

$$Y_{it} = \alpha + \rho WY_{it} + \beta X_{it} + \delta_{it} + u_{it} + \varepsilon_{it}. \tag{4}$$

where α is the constant term, ρ and β are the coefficients to be estimated, W is the spatial weight matrix, δ is the individual fixed, u is the time fixed, and ε is the random error term, which obeys a normal distribution.

Through the spatial weight matrix, the spatial correlation between areas primarily affects each region. Unique patterns, clusters, and the influence of adjacent regions can be identified by breaking down spatial relationships into discrete elements. This method improves understanding of how spatial factors lead to differences between various places. As a result, the spatial weight matrix is primarily decomposed for the spatial decomposition. Because a given province's regional economic development has created a center-secondary-periphery, the interaction of the same level area, the diffusion and return of the central area to the secondary area, the diffusion and return of the central area to the peripheral area, the diffusion and return of the secondary area to the peripheral area, and the secondary area are the primary divisions of the spatial effect between the center and the periphery. Encouraging regional development can foster economic growth in surrounding areas. However, it may also result in a return of economic activities to the central area, impacting the overall regional economic landscape. The dynamic interplay between diffusion and return shapes regional economic development. Primary and peripheral regions on central regions and peripheral regions on secondary regions are the effects of market area. Therefore, this study divides three different levels of regions into L, M, and S, and the economic output of the corresponding region is Y^{L}, Y^{M}, Y^{S} on average. Therefore, the decomposition of the spatial weight matrix can be in the form of a block matrix,

$$W = W_{\mathrm{LL}} + W_{\mathrm{LM}} + W_{\mathrm{LS}} + W_{\mathrm{ML}} + W_{\mathrm{MM}} + W_{\mathrm{MS}} + W_{\mathrm{SL}} + W_{\mathrm{SM}} + W_{\mathrm{SS}}. \tag{5}$$

Then, the total effect of spatial spillover between regions of different levels can be expressed as

$$Y = W_{\mathrm{LL}}Y^{\mathrm{L}} + W_{\mathrm{MM}}Y^{\mathrm{M}} + W_{\mathrm{SS}}Y^{\mathrm{S}} + W_{\mathrm{LM}}Y^{\mathrm{M}} + W_{\mathrm{LS}}Y^{\mathrm{S}} + W_{\mathrm{MS}}Y^{\mathrm{S}} + W_{\mathrm{ML}}Y^{\mathrm{L}} + W_{\mathrm{SL}}Y^{\mathrm{L}} + W_{\mathrm{SM}}Y^{\mathrm{M}}. \tag{6}$$

At the same time, the dummy variables representing the three types of areas affected by the spillover effect are multiplied by the above formula to determine the measure of the source and receiver of the spillover effect. If the L-type region is the receptor, it should be $W_{\mathrm{ML}}Y^{\mathrm{L}}I$, and so on, when estimated in the model; if the i set observation of the sample is the L-type region, then $W_{\mathrm{LL}}Y^{\mathrm{L}}L \neq 0$, $W_{\mathrm{ML}}Y^{\mathrm{L}}L \neq 0W_{\mathrm{SL}}Y^{\mathrm{L}}L \neq 0$ other spatial autocorrelations. The variables are all 0, and so on. Therefore, the Spatial Autoregressive (SAR) model based on spatial decomposition to measure the directional spatial correlation between regions of different levels can be determined as

$$\begin{aligned} Y_{iu} = \alpha &+ \rho_{\mathrm{LL}}W_{\mathrm{L}}Y^{\mathrm{L}}L + \rho_{\mathrm{MM}}W_{\mathrm{MM}}Y^{\mathrm{M}}M + \rho_{\mathrm{SS}}W_{\mathrm{SS}}Y^{\mathrm{S}}S + \rho_{\mathrm{LM}}W_{\mathrm{LM}}Y^{\mathrm{M}}M + \rho_{\mathrm{LS}}W_{\mathrm{LS}}Y^{\mathrm{S}}S + \rho_{\mathrm{MS}}W_{\mathrm{MS}}Y^{\mathrm{S}}S \\ &+ \rho_{\mathrm{ML}}W_{\mathrm{ML}}Y^{\mathrm{L}}L + \rho_{\mathrm{SL}}W_{\mathrm{SL}}Y^{\mathrm{L}}L + \rho_{\mathrm{SM}}W_{\mathrm{SM}}Y^{\mathrm{M}}M + \beta X_{it} + \delta_{it} + u_{it} + \varepsilon_{it}. \end{aligned} \tag{7}$$

Including dummy variables in the model makes it easier to identify and quantify spillover effects and distinguish various groups or areas. This method improves the assessment of the interactions between adjacent units and considers the data's heterogeneity, which makes the SAR framework better.

Therefore, ρ_{LL}, ρ_{MM}, ρ_{SS} represent the spatial spillover effect between cities at the same level, ρ_{LM}, ρ_{LS}, ρ_{MS} represent the diffusion and reflux effect of the central area on the secondary area, the central area on the peripheral area, and the secondary area on the peripheral area, and ρ_{ML}, ρ_{SL}, ρ_{SM} represent the secondary area, respectively. The impacts of market areas on central regions, central regions on peripheral regions, and peripheral regions on secondary regions.

3.3 Enterprise market value forecast

According to the above study, an enterprise's market value comprises its current and potential value. Enterprise value represents a company's overall value, similar to a balance sheet, while market value reflects its stock value. Both are used in business valuation, with enterprise value indicating current worth and market value showing both current and potential future value. As a result, this essay will also assess the two components of value independently. The potential value V2 is evaluated using actual options, whereas the current value V1 is evaluated using the conventional income technique. The assessment approach is displayed in Figure 4.

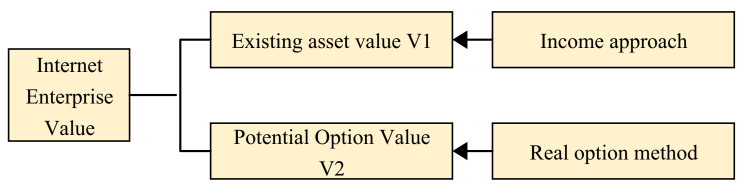

Figure 4: Composition of the basic model for enterprise market value assessment.

(1) Building a discounted cash flow model investment in project R&D, acquisition, reorganization, and scale-up activities, as well as a fast increase in operating income. The company's growth potential will stabilize at a mostly fixed level, and at this point, the company will enter a stable period due to the internet industry's "first dominance" and the Matthew effect.

The binary tree model is based on a discrete process, and it uses dynamic programming to handle the interaction between options, underlying assets, and decision-making. The binary tree model, a discrete option valuation method, breaks time into intervals to simulate asset price changes. Unlike continuous models such as Black–Scholes, it is adept at handling complexities like American-style options and variable volatility. Its flexibility suits various option types and market conditions. This method more accurately simulates the calculation of option value. Although the binary tree model simplifies the B-S pricing model, it is more appropriate for evaluating and pricing particular investment projects since its calculation involves a substantial number of information sets, such as the projected value of options at each time node. It supports discrete time intervals and adapts well to diverse asset price changes, making it ideal for intricate investment projects like American-style options or those with irregular cash flows. This flexibility enables accurate valuation by considering various scenarios at each step. Although the B-S model's derivation procedure is rather complex, acquiring its fundamental parameters does not necessitate a significant amount of data collecting and processing,

$$C_0 = S_0 \times [N(d_1)] - Xe^{-r_c \times t} \times [N(d_2)] \text{ or } C_0 = S_0 \times [N(d_1)] - PV(X) \times [N(d_2)]. \quad (8)$$

where C_0 is the current option value; S_0 is the existing value of the underlying asset; X is the strike price; e is the natural logarithmic base; r_c is the continuously compounded risk-free rate of return (years); t is the maturity time (years); and σ is the underlying asset return volatility.

In calculating an enterprise's potential value, the most crucial step is to determine the value of each parameter, such as S_0, $XtS_0\sigma$, etc. Currently, the underlying asset of the real option is an enterprise, and the specific meanings of the above parameters are as follows:

(1) C_0 is the potential option value of the company. The overall value of the enterprise includes the existing asset value and the potential value, and the potential value is evaluated through the option pricing formula.
(2) X is the execution price, which can usually be regarded as the investment cost in the evaluation of enterprise market value.
(3) t is the exercise period of the natural option. The evaluation of the market value of the enterprise refers to the period from the evaluation base date to the expiration date of the natural option.
(4) r_c is the risk-free interest rate under continuous compounding, which can be replaced by the treasury bond maturity yield that is the same or similar to the option expiration date.
(5) σ is the volatility of the underlying asset return. For companies, it usually refers to the volatility of the stock price.

Since it has been established that the big data analysis portfolio evaluation model is used to assess the market value of businesses, the fundamental model needs to be upgraded. As a result, the improved grey prediction approach forms the foundation for further model optimization. This method is appropriate for predicting "poor information, few samples" systems because it can distinguish differences in the development trends of different system components through correlation analysis, system law mining, and the establishment of differential equations. On the one hand, the macro environment that businesses operate in is unstable, and the future revenue of businesses has a high level of uncertainty. On the other hand, the grey forecasting approach may use known data to anticipate the future revenue of businesses with a high level of uncertainty. We enhance prediction accuracy by integrating sophisticated algorithms, utilizing historical data with a focus on recent trends, and adjusting dynamically to evolving conditions.

On the other hand, most businesses are still in the startup or development phase, and there is a need for more publicly available data, making it challenging to use techniques like time series forecasting. However, the grey forecasting method has fewer requirements for historical data, which can help businesses overcome their lack of historical data; prepare for the future by analyzing market trends, customer preferences, and competitor actions; seek advice from industry experts, stay updated on emerging trends, and gather customer feedback; and monitor competitors for strategic insights, address risks, and use internal data for performance evaluation and predictive modeling.

In terms of volatility forecasting, this study uses forecasted volatility to replace actual volatility, and the grey forecasting method also applies to forecasting corporate volatility.

(2) The following takes the GM(1,1) model to predict the operating income as an example to illustrate the steps of using the model.

3.3.1 Original data inspection

Before using the model, it is necessary to test whether the original data suit the model, so the level test is carried out. If the calculation result is within the range of $(e^{-2/(n+1)}, e^{2/(n+1)})$, the test is passed, and the GM(1,1) model can be used for modeling. Otherwise, the data need to be transformed to meet the test conditions.

The operating income of a technology company from 2008 to 2018 is the original sequence data used to anticipate the operating income data. The established original sequence is given in Table 1,

$$X^{(0)} = \{3,535.54, 8,372.07 \ldots 198,486.26\}. \tag{9}$$

Table 1: Operating revenue of Company A from 2008 to 2018

Particular year	Operating income (10,000 yuan)
2008	3535.55
2009	8372.08
2010	14080.25
2011	17269.10
2012	27380.32
2013	34692.68
2014	64902.99
2015	102214.74
2016	170173.42
2019	181580.94
2018	198486.27

3.4 Model accuracy evaluation

(1) The residual error test calculates the relative and absolute errors and observes whether the error changes are stable by calculating the residual error.

(2) The correlation degree test is calculated, and the test is passed when the value is more significant than 0.5. The metric assesses the model's ability to capture data patterns, with a strong correlation indicating accurate predictions. This efficient test reliably evaluates the model's performance by quantifying the strength and direction of the relationship.

Then, calculate the small error probability as

$$P = p\{|e^{(0)}(k) - \overline{e^{(0)}}| < 0.6475S1\}. \tag{10}$$

According to the above research, the conventional GM(1,1) model can forecast businesses' cash flow and volatility, but it also has several drawbacks. The model, for instance, works well with data series that exhibits traits of mild volatility and exponential change. However, as indicated in Table 2, most businesses are in the startup or growth stages, with multiple development and investment stages.

Table 2: Evaluation classification of prediction results

P	C	Accuracy class	
More than 0.96	Less than 0.36	Level 1	Good
More than 0.9	Less than 0.6	Level 2	Qualified
More than 0.8	Less than 0.66	Level 3	Barely qualified
Up to 0.8	0.66 or more	Level 4	Unqualified

This study will correct the nonlinear residual generated by the original model. Polynomial regression analysis is a critical regression analysis method. Since polynomials can approximate any function, it can solve related problems in nonlinear regression. When revising the GM(1,1) model, polynomial regression can be introduced to perform polynomial regression on the residual between the predicted sequence $\widehat{X}^{(0)}(K)$ and the initial sequence $X^{(0)}(K)$ (i.e., $e(0)(k)$), and the original residual sequence $e(0)(k)$ performs fitting prediction, and then uses the obtained prediction residual value $\hat{e}(0)(k)$ to correct the prediction sequence $\hat{X}(0)(k)$. The polynomial model enhances prediction accuracy by capturing curvature in the data, unlike the linear GM(1,1) model. It provides a flexible representation of underlying patterns, improving the model's ability to approximate nonlinear trends and make accurate predictions. At this time, the prediction error due to the characteristics of the original sequence can be corrected to improve the prediction accuracy further.

The revised GM(1,1) model can increase forecasting accuracy by rewriting the nonlinear residual and is more suited for enterprise data forecasting. The grey forecasting theory can handle the forecasting problem of the system with uncertainty. Its ability to thrive with limited data, adeptness in handling uncertainty, and incorporation of historical and expert insights make it well-suited for unpredictable economic environments. Its flexibility and efficacy in addressing uncertain aspects make it a valuable tool for predicting revenue in turbulent business conditions. The enterprise fluctuation is comparatively severe, and the new model can partially correct the prediction inaccuracy brought on by this nonlinear fluctuation through adaptive simulation. The enhanced grey forecasting model has significant implications for business valuation when taken as a whole. Figure 5 below illustrates how the enterprise market value evaluation model was improved. The market value of an enterprise is determined using methods like discounted cash flow analysis, comparable company analysis, and precedent transactions. Factors influencing market value include revenue and profit growth, market share, competitive position, industry trends, management quality, and economic conditions.

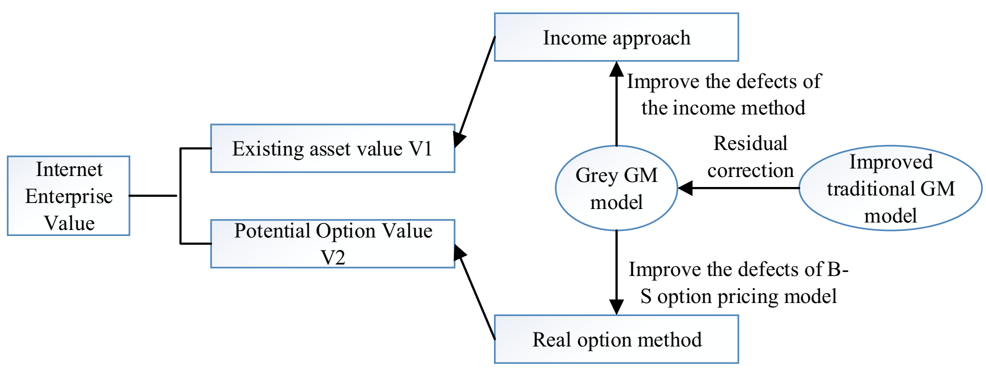

Figure 5: Improvement roadmap for the basic model of enterprise market value evaluation.

4 Experiments

The analysis of regional economic growth and the formation of spatial patterns have changed in recent years from qualitative regional analysis to quantitative analysis. Objective data-driven analyses enhance the efficiency of economic studies, replacing subjective interpretations with quantifiable insights. This shift results in more robust analyses, enabling researchers and policymakers to make well-informed decisions. The expression of economic and geographical elements is more intricate and logical due to the ongoing refinement of regions, provinces, prefecture-level cities, and counties and the constant refinement of spatial units. Advancements in spatial unit refinement have elevated the precision of economic and geographical analysis. Enhanced data granularity enables a more detailed comprehension of relationships, patterns, and trends, facilitating informed decision-making in both economic and geographical realms. Along with market areas, diffusion returns, and the regional economic structure are centered on the center. The spatial mutual spillover link between the core metropolitan and periphery areas and the spatial correlation between the peripheral and central areas serve as crucial performance mechanisms for the effect. The center between the regions can be more clearly displayed from the standpoint of geographical units; more precisely, the regional spatial scale is divided. Marginal connections, economic growth hinges on spatial interdependencies, with positive connections fostering regional clusters and negative links leading to concentrated decline. To ensure balanced growth, prioritize policies that enhance regional connectivity, invest in infrastructure, and implement targeted interventions across geographical areas. Therefore, this study further refines each region of X Province from a geographical point of view and divides it into administrative districts, county-level cities and districts, and counties of urban municipal districts based on the spatial scale division of the existing literature and the actual economic situation of X Province. It may clearly indicate how the various regions of X Province are faring economically.

4.1 Data sources

Logarithmic standardization is applied to the data in this research, taken from the statistical yearbooks of prefecture-level cities in X Province from 2001 to 2019. This section analyses data from 2001 to 2019 as a whole.

4.2 Measurement of regional development difference indicators

Theil entropy, which measures the degree of regional development imbalance and distributes the share of regional imbalance across and within groups, can also be used to scale the Theil index. Based on the assumption that the entire economy, represented by individuals, will be divided into groups, the loss index used to measure regional imbalances is calculated.

By decomposing the Theil index, it can be divided into inter-group gap and intra-group gap.

$$T_b = \sum_{k=1}^{k} y_k \log \frac{y_k}{n_k/n}, \tag{11}$$

$$T_w = \sum_{k=1}^{k} y_k \left(\sum_{i \in g_k} \frac{y_i}{y_k} \log \frac{y_i/y_k}{1/n_k} \right). \tag{12}$$

The Gini coefficient (G) is an indicator used to measure and judge regional income or wealth distribution inequality. It is constructed according to the Lorenz curve, and the international warning value of the Gini coefficient is 0.4.

$$G = \frac{1}{2n^2 u} \sum_{j=1}^{n} \sum_{i=1}^{n} |Y_j - Y_i|. \tag{13}$$

By studying the Theil index decomposition and the calculation of the Gini coefficient, this study finds that the current regional economic pattern in X Province presents some new phenomena as follows.

In X Province, the ongoing increase of the regional development disparity has been somewhat curbed. Since 2008, the X region has lagged behind the X region regarding GDP growth rate (Figure 6). We measure the imbalanced trend of economic development in X Province using the widely used Theil index, Gini coefficient, and Atkinson index. The change trend is essentially the same for all three, despite some variances in numerical measurement. Before 2006, the regional economic difference in X Province showed a rising tendency. After 2006, the regional disparity steadily declined and became more petite yearly (Figure 7). However, it cannot be denied that the enormous absolute level disparity between the X Province's east, west, and north regions and the A region continues to be a significant issue for the province's economic development. The spatial lag model studies spatial patterns in economic factors, incorporating the impact of neighboring areas through weighted relationships. It assesses how economic conditions in one location affect nearby areas, revealing and quantifying spatial trends and interactions in economic data across provinces and counties.

There is a clear gap between the central cities of Guangzhou and Shenzhen and other regions, and the internal development of the X region is differentiated.

The gap between the core area of the A and the non-A area is the primary manifestation of the regional gap in X Province. The decrease in disparities across groups primarily reflected the decline in regional differences. While intra-group differences were broadly steady, changes in group differences and the overall index followed the same pattern. Further, we looked at the gap within the group and discovered that the faster

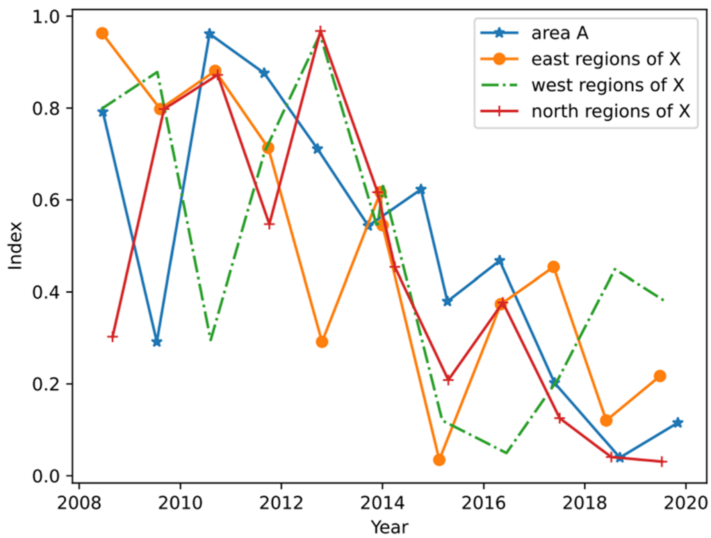

Figure 6: Comparison of GDP growth rates in the A and X's east, west, and north.

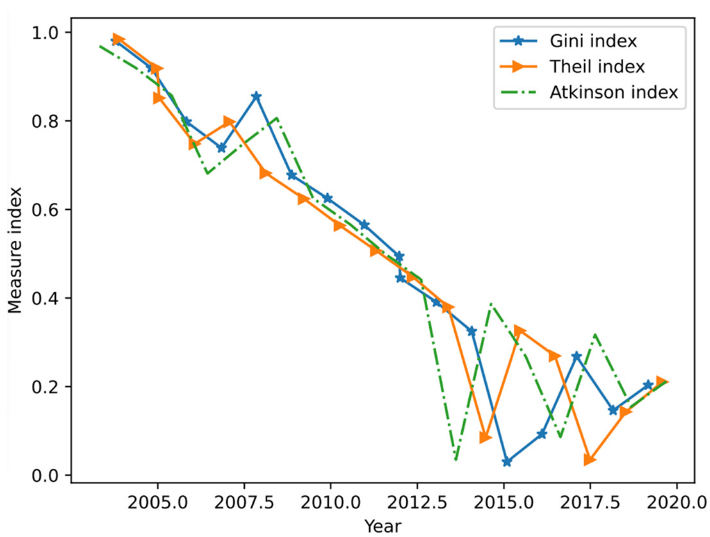

Figure 7: The overall difference measure index of X Province.

the region developed, the bigger the distance within the group was, as shown in Figures 8 and 9. The rate of economic development is relatively rapid. However, because of the increased regional competition, it has also led to differences in economic development rates within the group. The distinctions within groups grew as a result of this. The non-A region has always had a shaky base for economic growth, and there has never been much industrial advancement [19,23]. The per capita GDP distribution is relatively uniform, and the development disparity between X's east, west, and north sections is insignificant. As X's internal divisions between its east, west, and north sections strengthen, so do they.

Using internet businesses as an example, those defined narrowly are more indicative of the sector. The essential details regarding specifically categorized internet companies listed in my country. A total of 187 unicorn companies, with a combined market value of 11.2 trillion yuan, were among the 296 domestically listed companies with a market size of more than 3.39 trillion yuan as of the end of December 2019 (excluding the first category of companies). Internet-listed businesses increased from 2008 to 2019, and their market shares also increased.

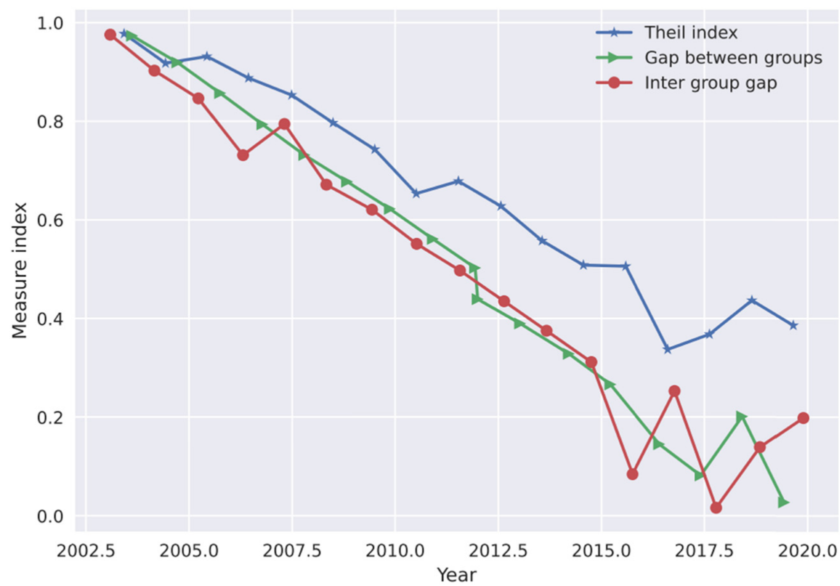

Figure 8: Theil index decomposition of regional differences in X Province.

Figure 9: Intra-group difference index by region.

4.2.1 Test of prediction model

Sun Wang's operational income data are used to forecast the traditional GM model(1,1) and the enhanced GM model(1,1), respectively, and the horizontal comparison and analysis models are produced. This is done to illustrate better the impact of the improved GM model(1,1) on the prediction accuracy. The data for 2019 using the enterprise income data of X Company from 2008 to 2018 are forecasted as an example, and compared the relative error and prediction error in 2019 as shown in Table 3.

The system experiment is run under the cloud security terminal network using the new RCNN economic analysis model. To analyze and compile statistics on the relationship and influence between enterprise development and economic development, the big data of enterprise development in a particular region

Table 3: Comparison of prediction accuracy between the original GM 1,1) model and improved GM(1,1) model

Serial no.	Actual value (10,000 yuan)	GM(1,1)			Improve GM(1,1)		
		Fitted value	Residual	Relative error (%)	Fitted value	Residual	Relative error (%)
1	3535.55	3535.55	−0.00	0.00	3646.34	−110.80	3.14
2	8372.08	32987.57	−24615.50	294.03	5637.44	2734.65	32.67
3	14080.25	40858.36	−26778.13	190.18	9960.37	4119.89	29.27
4	1,726,910	50607.14	−33338.05	193.05	17160.35	108.76	0.64
5	27380.32	62681.96	−35301.65	128.94	28550.60	−1170.29	4.28
6	34692.98	77637.82	−42944.85	123.80	45769.29	−11076.32	31.94
7	64902.99	96162.14	−31259.16	48.17	70572.26	−5669.28	8.74
8	102214.74	119106.34	−16891.61	16.54	104162.47	−1947.74	1.92
9	170173.42	147524.98	22648.42	13.32	145488.59	24684.84	14.52
10	181580.94	182724.34	−1143.41	0.64	187353.70	−5772.77	3.19
11	198486.27	226322.20	−27835.94	14.03	208007.80	−9521.54	4.81
			Average error	92.97		Average error	12.28
12	157233.29	280322.48	123089.20	43.92	153612.72	3620.58	2.31

over a year are used [24,25]. In the primary sector, exports to foreign nations make up nearly all of the total, or 99.33%, a far more significant percentage than exports to domestic markets. The tertiary sector exports a higher percentage of its output to other regions of China due to the region's significant contribution to the country's high-tech industry. It is compared to the National Bureau of Statistics' economic analysis findings, as indicated in Table 4.

Table 4: Demand category statistics

Demand category	Proportion (%)
Consumption of fixed capital	11.90
Inventory increase consumption	1.04
Government consumption	11.36
Rural household consumption	2.74
Urban household consumption	20.47
Export from foreign regions	11.58
Domestic circulation	40.90

The accuracy rate of the data in Table 5 is low because of the unreliable source of industrial data and poor real-time performance. However, it can reach more than 99.5% when the system analyses secondary and tertiary sectors with a high level of information technology.

Table 5: Comparison of economic analysis results

Industry	Accuracy (%)	Rejection rate (%)
Primary industry	92.6	7.4
Secondary industry	99.3	0.7
The service sector, tertiary industry	99.7	0.3

5 Conclusion

For the steady and sustainable development of the regional economy against the backdrop of the new normal, it is crucial to strengthen the formulation of market planning for regional economic development. However, creating a regional economic growth market plan requires a systematic process that considers several factors. In addition to strengthening analysis and advancing the scientific nature of system planning, we must also train market planners to enhance their all-around abilities and traits. The article offers several suggestions for market planning for regional economic growth based on the actual scenario to serve as a resource and reference point for pertinent employees. The evaluation and forecasting of the market value of businesses also contribute significantly to the growth of the local economy. The strategy used in this study to make predictions can accurately and successfully forecast market value.

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