

Research on the Application of Applied Mathematics in Modern Economic Management

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Abstract. With the rapid development of science and technology, economic management problems are becoming more and more complex, and the demand for accurate and efficient analysis tools is becoming more and more urgent. With its unique logical and quantitative analysis capabilities, applied mathematics provides strong support for economic management, whether it is market forecasting, cost control, resource allocation, and decision-making optimization, mathematical methods can play an important role. This paper summarizes the applied mathematics, then discusses the application value of applied mathematics in modern economic management, and points out the specific application of applied mathematics in modern economic management, in order to provide a useful reference for promoting the better development of modern economic management.

Keywords: Applied mathematics; modern economic management; mathematical theory; mathematical methods.

1. Introduction

With the advancement of globalization and informatization, the economic system is increasingly diversified and dynamic, which poses new challenges to economic management. Applied mathematics, as an effective tool for accurate analysis and processing of complex problems, is gradually playing an increasingly important role in modern economic management [1]. Applied mathematics covers statistics, probability theory, advanced linear programming, optimization theory, etc., providing strong theoretical support for economic management. By using these mathematical tools, we can more accurately grasp market trends, analyze economic phenomena, predict future trends, and then make scientific decisions and strategies.

2. Overview of Applied Mathematics

Applied mathematics is a general term for the application of purposeful mathematical theories and methods to the study of how mathematical knowledge can be applied to other fields, especially the sciences. It is the opposite of pure mathematics and covers many branches of mathematics such as differential equations, vector analysis, matrices, Fourier transforms, complex variable analysis, numerical methods, probability theory, mathematical statistics, operations research, control theory, combinatorics, information theory, etc., as well as the study of mathematical problems proposed from various fields of application.

Applied mathematics has a wide range of applications in several fields. In the field of natural sciences, applied mathematics plays an important role in fields such as physics, astronomy, and chemistry, providing accurate descriptions and predictions of natural phenomena. In the field of engineering, applied mathematics is widely used in structural design, computational mechanics models, electrical engineering optimization, and the design of communication systems to ensure structural strength and stability, and to solve circuit problems. In the field of finance and insurance, mathematical knowledge is not only used for data analysis, but also for the development and management of tools to ensure the safety and soundness of financial activities. In addition, applied mathematics also plays an important role in many fields such as computer science, Internet, big data, industry, biotechnology, scientific research data analysis, international economics and trade.

The core goal of applied mathematics is to connect abstract mathematical concepts to the real world and provide people with the tools to solve problems. Through mathematical models, algorithms, and techniques, applied mathematics is able to harness the power of the future and solve real-world problems in a variety of fields [2,3].

3. The Application Value of Applied Mathematics in Modern Economic Management

3.1. Adjust and control the relationship between the quantity of economic activities

In modern economic management, enterprises are faced with an increasingly complex market environment, which requires accurate data and models to analyze and predict market trends. Applying probability theory, mathematical statistics and other methods in mathematics can help enterprises establish mathematical models and quantitatively analyze key factors such as market demand, production costs, and sales revenues, so as to provide a scientific basis for enterprise decision-making. Through the establishment of mathematical models, the resource allocation of modern enterprise production, logistics and other aspects can be optimized, and the efficiency of resource utilization can be improved. For example, through the application of linear programming, network optimization and other mathematical methods can reasonably arrange production plans, optimize transportation routes, and reduce production costs.

3.2. Analyze and clarify quantitative relationships

By constructing mathematical models, applied mathematics provides a scientific analytical tool for economic management. These models can analyze economic phenomena, reveal their internal laws and quantitative relationships, and provide strong support for enterprise decision-making. For example, in marketing, enterprises can use mathematical models to accurately predict market demand, and flexibly adjust product strategies and pricing strategies according to the forecast results to respond to market changes and expand market share. In terms of financial management, it can help enterprises formulate scientific capital operation plans, ensure the safety and liquidity of funds, and escort the steady development of enterprises.

In addition, optimization methods in applied mathematics have also revolutionized economic management. In the face of limited resource conditions, enterprises need to seek the optimal resource allocation scheme under various constraints, and optimization methods can help enterprises achieve this goal. Whether it's linear programming in production planning or path optimization in logistics management, applied mathematics can help companies find optimal solutions and improve productivity and economic efficiency.

3.3. Promote further deepening reforms of economic entities

By providing quantitative analysis tools, applied mathematics makes economic decision-making more scientific and accurate. Whether it is in macroeconomic regulation, market forecasting or risk assessment, the application of mathematical methods has improved the efficiency of economic management. Applied mathematics has also become an important tool to promote the deepening of economic reform, through mathematical modeling and simulation analysis, economic agents can predict the effect of reform plans, assess potential risks, and formulate more reasonable and effective reform strategies. In addition, applied mathematics is also helpful to optimize the economic structure and industrial layout, reveal the internal relationship and mutual influence between industries, provide a scientific basis for economic agents, promote the rational allocation and efficient use of resources, and achieve sustainable development [4].

4. Analysis of the Specific Application of Applied Mathematics in Modern Economic Management

4.1. Application of Applied Mathematics in Modern Enterprises

In modern economic management, the importance of applied mathematics is becoming more and more prominent, which not only provides managers with a scientific basis for decision-making, but also promotes the efficiency and accuracy of enterprise operations. Especially in modern business operations, the application of applied mathematics has become the key to enhance competitiveness. Taking tea enterprises as an example, with the acceleration of the internationalization of the tea industry, standardized management has become the development trend of tea production enterprises, and it is necessary to sort out various data related to the tea industry through mathematical modeling, so as to obtain the supply and demand situation and price change trend of the tea market. This data-based decision-making method makes the decision-making of enterprises more scientific and accurate, and helps enterprises occupy a favorable position in the fierce market competition. By building a mathematical model, enterprises can conduct quantitative analysis of production, sales and other links, find out the optimal resource allocation scheme, and maximize the use of resources. The use of different mathematical modeling can also help tea companies deal with market risks, through the analysis of historical data and the prediction of future trends, potential market risks can be discovered in time and corresponding countermeasures can be formulated.

Firstly, mathematical modeling was used to analyze and optimize the tea production process. Through mathematical modeling, various complex factors in the tea production process can be quantitatively analyzed, so as to more accurately grasp the influence mechanism of each factor on tea yield and quality. Specifically, mathematical modeling can measure the environmental conditions required for tea growth, such as temperature, humidity and light, as well as the impact of different planting techniques and management strategies on tea growth. Through model simulation and prediction, the most suitable production conditions can be found, so that the environment for tea growth is more suitable to maximize the yield of tea.

Secondly, the mathematical model is used to promote the marketing of tea products. The product marketing activities of tea production enterprises are inseparable from the strong support of data, and data analysis can help enterprises understand the purchasing habits, preferences and market demand of consumers, so as to guide the packaging design of tea products. Through mathematical models, the impact of different packaging styles on consumers' purchase intentions can be predicted, and then the packaging design can be optimized to improve the attractiveness of products. At the same time, brand image design is also an indispensable part of the marketing activities of tea production enterprises, through the establishment of a mathematical model of brand image, enterprises can quantitatively analyze the impact of different brand elements on consumer cognition, and then optimize brand strategy, enhance brand awareness and reputation [5].

4.2. The Role of Calculus Ideas in Economics

As an important part of the research process of advanced mathematical functions, calculus includes the fields of limits, integration, differentiation and its specific applications, and the research and study in this field can directly affect the production, distribution and flow of value in economics. An in-depth study of calculus can help optimize the allocation of scarce resources, thereby further promoting economic activity and economic progress [6].

4.2.1 The specific application of differential thinking in economics

The main differential thought used in economics is the limit theory in differential thought, which is one of the most widely used and most concerned theories in the field of economics. Among them, the most frequently used are the limit value and the optimal quantity, which are calculated to help analyze, judge and estimate various economic problems in the process of economic management, so as to help enterprises make optimal decisions on resource allocation. The limit theory in calculus can

not only simulate the price fluctuation range of a certain commodity in a certain period, but then enterprises can rationalize and adjust their marketing decisions according to the situation reflected in the simulation results to maximize corporate profits.

4.2.2 The specific application of the idea of integral in economics

The theory of integral thought mainly includes two aspects: definite integral and indefinite integral. Integration is the inverse of differentiation. The main application of the integration idea is to calculate the original function value through the known function, and the use of the integration idea can greatly simplify the calculation process of the function, which not only greatly reduces the workload and difficulty of function calculation, but also effectively improves the speed of solving the function problem. The idea of integral is also widely used to solve problems such as financial interest rates, medical insurance, loans and deposits.

4.3. Practical application of applied mathematics in economic management

4.3.1 Risk analysis and control

With the continuous evolution of the market environment, the characteristics of randomness are becoming more and more prominent, which brings more challenges to enterprises and also exacerbates the risks of enterprises. If companies fail to effectively assess these risks, they may suffer more serious economic losses in the course of their operations. Therefore, for enterprises, risks should be accurately identified and assessed through mathematical and statistical methods to formulate reasonable risk response strategies. For example, a company plans to invest in multiple projects, and the estimated investment amount of each project is about 5 million yuan, of which the expected rate of return of the first project reaches 8%, which is slightly lower than other projects. In order to improve the efficiency of the overall investment, enterprises can adopt a portfolio investment strategy to reduce risk and improve overall returns by diversifying investments. When assessing portfolio investment risk, enterprises can make full use of mathematical statistical methods to comprehensively consider the known standard deviation and the expected rate of return of the portfolio to achieve a scientific assessment of investment risk. Through the use of advanced mathematical and statistical calculation technology, enterprises can accurately quantify the value of risk; When making investment decisions on a single asset, companies can calculate the dispersion ratio and make a detailed comparison analysis with the acceptable risk ceiling, so as to develop a more risk-conscious investment plan [7].

4.3.2 Quality management

Mathematical statistics is based on a large number of real data, and provides strong decision-making support for enterprises through the internal laws of data. In the process of economic management, enterprises can use mathematical statistical methods to understand the quality of products and services, find potential quality problems, and formulate corresponding improvement measures. In the practice of quality management, mathematical statistical methods can be used to calculate the number of errors per million quality inspections (usually measured by DPMO) to achieve accurate assessment of product quality level. Conversely, it means that the quality situation needs to be improved. The application of this mathematical statistical method not only helps enterprises to achieve more specific and accurate quality management, but also improves the management effect, makes the management process more standardized and efficient, so as to effectively improve the product quality level and enhance market competitiveness.

4.3.3 Marketing Management

Marketing management is the key link for enterprises to achieve market goals and enhance competitiveness. The application of applied mathematics in marketing management is mainly reflected in market forecasting, consumer behavior analysis, product positioning and pricing strategy.

Market forecasting is the basis for a business to develop a marketing strategy. Mathematical models such as time series analysis and regression analysis are widely used in market forecasting,

and time series analysis can predict market demand trends in the future through the analysis of historical sales data. Regression analysis, on the other hand, can study the relationship between market demand and other factors (such as price, promotions, etc.), so as to predict changes in market demand under different marketing strategies.

Consumer behavior analysis is an important means of understanding market demand and consumer preferences. Algorithms such as cluster analysis and decision trees can help companies identify the characteristics and needs of different consumer groups, and then formulate targeted marketing strategies. Cluster analysis can divide consumers into different groups based on their purchase records, browsing behaviors and other data, and each group has similar consumption habits and preferences. Enterprises can design different products and services according to the characteristics of these groups to meet the needs of different consumers.

Product positioning and pricing strategy are key aspects of a company's efforts to achieve its market goals. Methods such as multi-dimensional scale analysis and joint analysis in applied mathematics can help enterprises determine the positioning of products in the market and formulate appropriate pricing strategies. Multi-dimensional scale analysis can reveal the relative position of products in multiple dimensions through consumers' evaluation of different product attributes, so as to help enterprises determine the competitive advantages and disadvantages of products. The joint analysis can study the degree of consumer preference for different attributes and levels of products, as well as the impact of these preferences on purchase decisions, and provide a basis for enterprises to formulate pricing strategies.

The marketing optimization model aims to maximize the use of marketing resources. For example, in advertising, enterprises can use linear programming or optimization algorithms to determine the proportion of advertising in different channels and different time periods to maximize advertising effectiveness. In addition, companies can also use algorithms such as dynamic programming to develop long-term marketing plans to ensure that they can achieve their market goals at different stages [8].

5. Summary

In summary, the theories and methods of applied mathematics can be effectively applied to the field of modern economic management, and provide strong support for key links such as data processing, model construction and decision optimization. It improves the efficiency and accuracy of economic management, and provides a scientific basis for coping with the complex and changeable economic environment. With the continuous progress of science and technology and the continuous development of the economy, the application prospect of applied mathematics in the field of economic management will be broader, and it will make important contributions to the prosperity and stability of the economy and society.

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