Research on Optimal Allocation of Enterprise Resources Based on Operational Research Method

Yaozhong Hu*
New York University, Tandon School of Engineering, Department of Business and Technology Management (Operations Research), New York NY 11201, USA
*Corresponding email: yaozhongh04@163.com

Abstract

This paper discusses the key role of operational research methods in the optimal allocation of enterprise resources. This paper summarizes the basic theory of operational research methods and their common application in enterprises in detail and explains how to allocate resources effectively through scientific analysis methods. In particular, the classification and characteristics of enterprise resources and the objectives and principles of optimal allocation of resources are deeply studied. The effective allocation of enterprise resources is influenced by market demand, utilization efficiency and risk management. Based on this, this paper puts forward a resource allocation strategy based on market demand, puts forward action suggestions to improve resource utilization efficiency, and emphasizes the importance of strengthening risk management in resource allocation. The goal of this study is to help enterprises realize the scientific allocation of resources under the guidance of operational research methods, to maintain their competitive advantage in the fierce commercial competition and enhance their economic and social benefits.

Keywords

Operational research methods, Resource allocation, Risk management

Introduction

In the management of enterprise resources, precise and accurate resource allocation has become an important cornerstone to determine the long-term development of enterprises. Therefore, it is particularly important to use professional operational research methods to study the optimal allocation of enterprise resources.

Operations research, as a comprehensive subject based on mathematics, aims to systematically analyze complex problems through scientific methods and means to seek the optimal decision-making scheme [1].

Operational research methods include linear programming, dynamic programming, graph theory and other methods and models. These methods and models can provide mathematical description and model establishment of resource allocation according to the specific situation of enterprises, making the decision-making process more accurate and effective [2].

In the fierce market competition, the survival and development of enterprises often depend on the optimal allocation of resources. Specific paper, from the perspective of combining theory with practice, the optimal allocation of enterprise resources will be studied in depth, and the strategies and suggestions of resource allocation based on operational research methods will be analyzed in detail, and relevant strategies and specific measures will be put forward from the perspective of market demand, improvement of resource utilization efficiency and risk management [3].

Theoretical overview

Overview of operational research methods

Operational research is an applied science, which uses mathematical models, statistical analysis, and algorithms to solve optimization and decision-making problems in various practical problems. It aims at rational distribution and utilization of limited resources through scientific methods and technologies to achieve the best results [4-7].

The development of operational research methods can be traced back to the last century. After years of development, a complete set of theoretical and methodological systems has been formed. It covers many fields, such as linear programming, nonlinear programming, integer programming, dynamic programming, graph theory, queuing theory and so on [8]. These methods can help people make wise decisions in complex situations and improve the efficiency of resource utilization and economic benefits. Therefore, the operational research method is a powerful tool, which can help enterprises and organizations make more scientific and reasonable decisions when facing various challenges and realize the optimal allocation of resources and the maximization of benefits [9].

Common operational research methods

Common operational research methods include linear programming, integer programming, nonlinear programming, dynamic programming, and queuing theory. Linear programming is a method to study how to optimize a linear objective function under a set of linear constraints.

It is widely used in production planning and resource allocation. Integer programming is based on linear programming, which requires decision variables to take integer values.

This method is often used to solve problems such as personnel arrangement and equipment allocation [10,11]. Nonlinear programming is used to deal with the optimization problem of objective function or constraint condition containing nonlinear function; Dynamic programming is a mathematical method to solve the optimization of multi-stage decision-making process, which can find the optimal solution in complex problems; Queuing theory mainly studies the performance indexes of various queuing systems to optimize the design and operation of service systems.

The queuing theory model is shown in the following Figure 1.

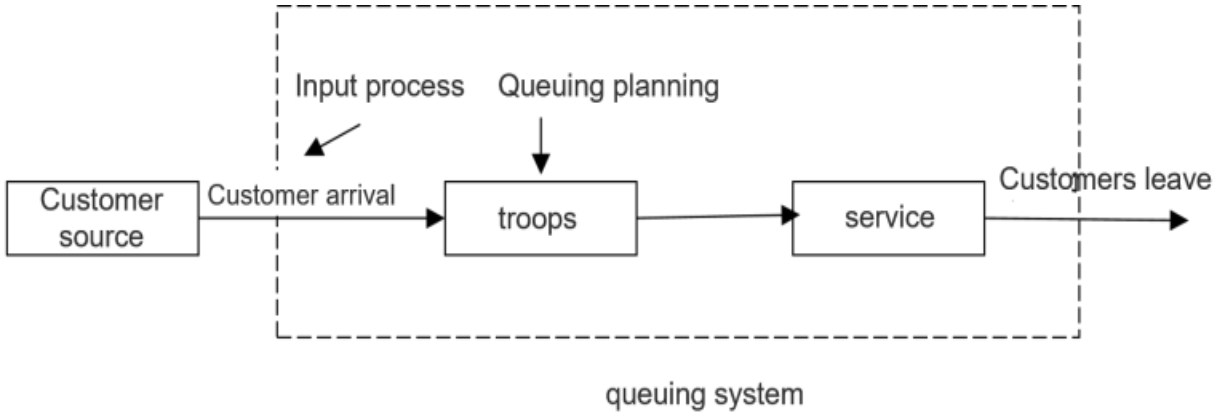


Figure 1. Queuing theory model.

These operational research methods have their own characteristics and scope of application, and enterprises can choose appropriate methods to optimize the allocation of resources according to their own actual conditions.

The role of operational research methods in the optimal allocation of enterprise resources

Operational research methods play a significant role in the optimal allocation of enterprise resources. This method can not only help enterprises to use limited resources more effectively. Through the establishment of mathematical models, production, sales, inventory, and other links of enterprises are analyzed and optimized, so that resources can be reasonably allocated, and the utilization rate of resources can be improved [12]. The method of operational research aims to solve the problem of resource allocation and optimization through mathematical models and algorithms, and the resource planning matrix can provide an intuitive and structured way to describe and analyze the relationship between resource requirements and tasks. The resource planning matrix table is shown in the following Tobal 1.

Key factor		Weight	Alternative strategy			
			Set up in Europe joint venture		Establish in Asia joint venture	
			AS	TAS	AS	TAS
Chance	The unification of Europe	0.01	4	0.40	2	0.02
	Consumers pay more attention to health factors when purchasing goods	0.15	4	0.60	3	0.45
	The rise of free market economy in Asia	0.10	2	0.20	4	0.40
	The demand for soup is increasing by 10% every year	0.15	3	0.45	4	0.60
	North American Free Trade Agreement	0.05	—	—	—	—
Threaten	The demand for food only increases by 1% every year	0.10	3	0.30	4	0.40
	ConAgra's Banquet TV food leads with 27.4% market share	0.05	—	—	—	—
	Unstable Asian economy	0.10	4	0.40	1	0.10
	Canned boxes cannot be biodegradable	0.05	—	—	—	—
	The depreciation of the dollar	0.15	4	0.60	2	0.30
Superiority	Profits increased by 30%	0.10	4	0.40	2	0.20
	The new North American branch	0.10	—	—	—	—
	Successful new healthy soup	0.10	4	0.40	2	0.20
	The market share of Swanson TV food has increased to 25.1%	0.05	4	0.20	3	0.15
	One-fifth of all managers' bonuses are based on the overall performance of the company	0.05	—	—	—	—
	The utilization rate of production capacity increased from 60% to 80%	0.15	3	0.45	4	0.60
Weakness	Sales at Pepperidge Farm dropped by 7%	0.05	—	—	—	—
	Corporate restructuring costs $302 million	0.05	—	—	—	—
	The company's operations in Europe are losing money	0.15	2	0.30	3	0.45
Weakness	The company's international operation is progressing slowly	0.15	4	0.60	3	0.45
	The profit rate before tax is 8.4%, which is only half of the industry average	0.05	—	—	—	—
Amount to		1.00		5.30		4.32

The theoretical basis of optimal allocation of enterprise resources

Classification and characteristics of enterprise resources

Enterprise resources are the foundation of enterprise development, which can be divided into human resources, financial resources, material resources and information resources.

Human resources are the most dynamic and creative resources in enterprises, including employees' knowledge, skills, experience, and creativity. Its characteristics are subjective initiative and creativity, which can bring innovation and development impetus to enterprises. Financial resources are the material basis for enterprises to conduct production and business activities, including funds and assets.

Financial resources are characterized by liquidity and risk, which need reasonable planning and management to ensure the stability of enterprise's capital chain [13,14]. Material resources are the material carriers of enterprises' production and operation activities, including raw materials, equipment, workshops, etc. Material resources are substantive and consumptive and need to be purchased and used to reduce costs and improve efficiency. Information resources are all kinds of information generated and collected by enterprises in their production and business activities, including market information, technical information, and management information. Information resources are characterized by timeliness and value and need to be collected and processed in time to support the decision-making and management of enterprises [15].

Objectives and principles of optimal allocation of resources

The goal of optimal allocation of resources is to realize the rational allocation and effective utilization of enterprise resources, to improve the economic benefits and competitiveness of enterprises. Specific objectives include improving resource utilization, reducing costs, improving production efficiency and meeting market demand. The principle of optimal allocation of resources includes the following aspects.

(1) The principle of integrity: the various resources of the enterprise are regarded as a whole, and comprehensive consideration and optimal allocation are conducted to maximize the overall benefits.

(2) Benefit principle: Based on improving the economic benefits of enterprises, through optimizing resource allocation, reducing costs and improving output, the optimal utilization of resources can be achieved.

(3) The principle of coordination: pay attention to the coordination between resources, so that all kinds of resources can match each other in quantity, quality, time, and space, and avoid the waste and idleness of resources.

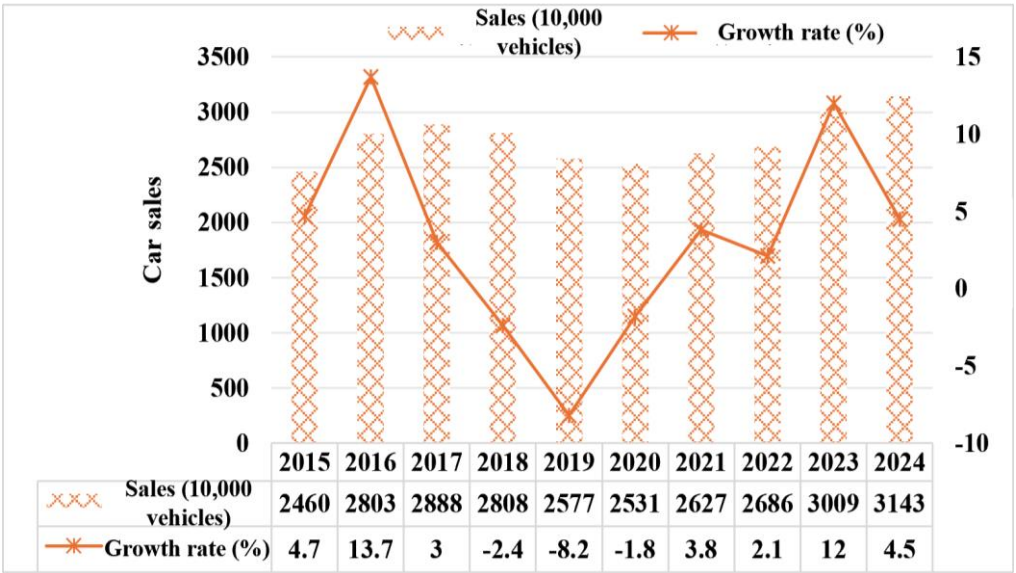
(4) Dynamic principle: according to the changes in the internal and external environment of the enterprise, adjust the resource allocation scheme in time to adapt to the changes in market demand and competitive situation.

(5) The principle of sustainability: In the process of optimizing the allocation of resources, the sustainable utilization of resources should be fully considered to realize the long-term development of enterprises.

Factors affecting the optimal allocation of enterprise resources

There are many factors that affect the optimal allocation of enterprise resources, including the following aspects.

Market demand: the change in market demand directly affects the production and sales plan of enterprises, thus affecting the allocation of resources. Take the automobile consumption market as an example: the automobile sales volume and growth rate in China from 2015 to 2024 are shown in the following Figure 2.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Sales (10,000 vehicles)	2460	2803	2888	2808	2577	2531	2627	2686	3009	3143
Growth rate (%)	4.7	13.7	3	-2.4	-8.2	-1.8	3.8	2.1	12	4.5

Figure 2. China automobile sales and growth rate from 2015 to 2024.

Enterprises need to adjust the resource allocation scheme in time according to the changes in market demand to meet the market demand. Technical level: the technical level of an enterprise determines its production efficiency and product quality and then affects the utilization efficiency of resources. Advanced technology can improve production efficiency and reduce costs, thus optimizing resource allocation. Competitive environment: The fierce competitive environment requires enterprises to continuously improve their competitiveness and optimize resource allocation to improve product quality and reduce costs. The strategies and actions of competitors will also have an impact on the resource allocation of enterprises. Enterprise strategy: the strategic goal and development direction of an enterprise determine the investment and allocation focus of resources. Different strategic choices need different resource allocation schemes to support them. Management level: the management level of an enterprise directly affects the utilization efficiency and allocation effect of resources. Scientific management methods and processes can improve the integration ability and synergistic effect of resources and realize the optimal allocation of resources. Policies and regulations: national policies and regulations have an important impact on the production and business activities of enterprises, such as environmental protection policies and tax policies.

Strategies and suggestions for optimal allocation of enterprise resources

Resource allocation strategy based on market demand

The optimal allocation of enterprise resources should closely focus on market demand. Enterprises need to deeply understand the market trends and customer needs and accurately grasp the changes in market trends and consumer preferences through market research, data analysis and other means. On this basis, according to the scale and characteristics of market demand, the input of production resources should be adjusted to ensure that the supply of products or services matches the market demand. For example, for products with rapid market demand growth, enterprises should increase investment in production resources, including increasing raw material procurement, expanding production scale, and increasing labor force, to meet the growth of market demand.

At the same time, enterprises should adjust the product structure and product line in time according to the changes in market demand, eliminate products with shrinking market demand, and concentrate resources on developing products with broad market prospects.

Suggestions on improving the efficiency of resource utilization

To realize the optimal allocation of enterprise resources, improving the efficiency of resource utilization is the key. Enterprises can improve the efficiency of resource utilization in many ways.

On the one hand, enterprises should strengthen internal management, optimize business processes, and reduce waste and idleness of resources. Through the process of optimization of production, sales, coordination and other links, operating costs are reduced, and work efficiency is improved.

For example, lean production is adopted to reduce inventory backlog and waste in the production process and improve production efficiency.

Optimize the coordination distribution process, reduce transportation costs, and improve efficiency.

On the other hand, enterprises should strengthen technological innovation, introduce advanced production technology and equipment, improve the level of production automation, and thus improve the utilization efficiency of resources. At the same time, enterprises should also strengthen the training and education of employees, improve their skills and work enthusiasm, give full play to their potential, and improve the utilization efficiency of human resources.

Resource allocation strategy to strengthen risk management

Risk management is especially important in the process of optimizing the allocation of enterprise resources. Enterprises need to identify and evaluate various potential risks, such as market risks, technical risks, and financial risks, and adopt corresponding risk management strategies.

For market risk, enterprises can reduce the risk through diversified market strategies. For example, open new market areas and reduce dependence on a single market;

At the same time, enterprises can also respond to market price fluctuations and competitive pressures through flexible pricing strategies and marketing strategies. For technological risks, enterprises should increase R&D investment, improve their independent innovation ability, and reduce their dependence on external technology.

At the same time, enterprises should also strengthen the research and prediction of technology development trends and adjust the direction of technology research and development in time to cope with the risks brought by technological changes. For financial risks, enterprises should rationally arrange capital structure, optimize financial budget, strengthen capital management, and ensure the stability of enterprise capital chain. At the same time, enterprises should also establish a risk early warning mechanism to find and deal with potential financial risks in time.

Conclusion

Through in-depth discussion on the application of operational research methods in the optimal allocation of enterprise resources, it can be found that in the current business environment, the application of operational research methods plays a vital role in the effective allocation and maximum utilization of resources for enterprises.

By using the method of operational research, enterprises can identify and evaluate the demand and supply of resources more accurately, to formulate more reasonable and effective resource allocation strategies. The resource allocation strategy based on market demand is the key to the optimal allocation of enterprise resources. In the ever-changing market environment, enterprises must flexibly adjust the allocation of resources to meet the needs of customers.

Therefore, operational research methods play a key role in the optimal allocation of enterprise resources. Through scientific and systematic analysis and decision support, enterprises can better realize the optimal allocation of resources and thus stand out in fierce market competition. In the future, with the progress of science and technology and the change of the market, operational research methods will play a more significant role in the field of enterprise resource management.

Funding

This work was not supported by any funds.

Acknowledgements

The authors would like to show sincere thanks to those techniques who have contributed to this research.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Ali, I., Kannan, D. (2022) Mapping research on healthcare operations and supply chain management: a topic modelling-based literature review. *Annals of Operations Research*, 315(1), 29-55.

[2] Dai, S., Kuosmanen, N., Kuosmanen, T. (2023) Variable selection in convex quantile regression: L1-norm or L0-norm regularization? *European Journal of Operational Research*, 267(2), 456-467.

[3] Kuosmanen, T., Zhou, Z. (2021) Non-crossing convex quantile regression. *Economics Letters*, 200, 1-6.

[4] Zeng, B., An, H. (2023) Foundations of operations research: From linear programming to DEA and their main derivatives. *European Journal of Operational Research*, 267(3), 789-801.

[5] Zhou, Z., Kuosmanen, T. (2020) Forward-looking assessment of the GHG abatement cost: Application to China. *Energy Economics*, 87, 1-10.

[6] Annarella, A., Battistella, C., Noni no, F. (2021) Literature review on digitalization capabilities: Co-citation analysis of antecedents, conceptualization, and consequences. *Technological Forecasting and Social Change*, 166, 120635.

[7] Jin, J. G., Nieto, H., Lu, L. (2021) Robust bike-sharing stations allocation and path network design: A two-stage stochastic programming model. *Transportation Letters*, 12(10), 682-691.

[8] Mao, Q. L., Wang, K. X. (2023) How does internet development optimize enterprise resource allocation: A perspective from enterprise inventory adjustments. *China Industrial Economics*, 1-18.

[9] Guo, F., Huang, Z., Huang, W. (2021) Integrated location and routing planning of electric

vehicle service stations based on users differentiated perception under a time-sharing leasing mode. *Journal of Cleaner Production*, 273, 123513.

[10] Liu, Q., Qu, X., Wang, D., Abbas, J., Mubeen, R. (2022) Product market competition and firm performance: business survival through innovation and entrepreneurial orientation amid COVID-19 fiscal crisis. *Frontiers in Psychology*, 12, 790923.

[11] Jastremski, O., Trifonov, O., Mantralike, O., Baronets, H. (2023) The impact of strategic decisions on the future development of organizations and economic dynamics. *Futurity Economics Law*, 3(4), 117-133.

[12] Hera, A., Al Rian, A., Faruque, M. O., Sisan, M. M. H., Khan, N. A., Rahaman, M. A., Ali, M. J. (2024) Leveraging information systems for strategic management: Enhancing decision-making and organizational performance. *American Journal of Industrial and Business Management*, 14(8), 1045-1061.

[13] Xiang, X., Li, Q., Khan, S., Khalaf, O. I. (2021) Urban water resource management for sustainable environment planning using artificial intelligence techniques. *Environmental impact assessment review*, 86, 106515.

[14] Yan, Z., Li, M., Li, Z. (2021) Efficient and Economical Allocation of Irrigation Water under a Changing Environment: A Stochastic Multi - Objective Nonlinear Programming Model. *Irrigation and Drainage*, 70(1), 103-116.

[15] Yu, X., Wang, P. (2021) Economic effects analysis of environmental regulation policy in the process of industrial structure upgrading: Evidence from Chinese provincial panel data. *Science of the Total Environment*, 753, 142004.