Design of University Asset Procurement Optimization Scheme Considering Multi-Objective Optimization

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Keywords: Multi-Objective Decision Theory, Taking into Account Multi-Objective Optimization, Procurement Optimization Scheme, Universities, Assets.

Abstract: The procurement optimization scheme plays an important role in the asset procurement of universities, but there is the problem of inaccurate optimization positioning. The traditional genetic algorithm cannot solve the problem of procurement optimization in the asset procurement of universities, and the effect is not satisfactory. In the management of modern educational resources, the procurement of university assets is a crucial link. It is not only related to the teaching and research ability of the school, but also directly affects the economic benefits and development sustainability of the school. Therefore, developing an efficient, cost-effective and future-proof procurement plan is an important topic for every university administrator. This article will discuss how to achieve multi-objective optimization of university asset procurement, and propose an innovative and practical solution.

1 INTRODUCTION

First, we need to clarify the core concept of multi-objective optimization (Ma and Sun, et al. 2023). There are many goals involved in the process of university asset procurement, including cost minimization, quality maximization, supplier stability, procurement efficiency, etc. To achieve the optimal combination of these goals, scientific methods and tools must be adopted (Liu and Wu, 2022). This usually requires the establishment of a comprehensive evaluation model to quantify the indicators, and then the use of multi-objective decision theory to make trade-offs and choices (Li and Qin, 2022).

2 RELATED CONCEPTS

2.1 Mathematical Description Taking Into Account Multi-Objective Optimization

For example, when considering the balance between cost and quality, we can build a cost-benefit analysis model that uses budget constraints and performance requirements as constraints to find the best sourcing point (Zheng, 2023). This requires not only a deep understanding of asset prices in the market, but also the ability to accurately assess the impact of asset performance on future teaching and research.

$$\lim_{x\to\infty}(y_i \cdot t_{ij}) = y_{ij} \geq \max(t_{ij} \div 2) \tag{1}$$

Among them, the judgment of outliers is $tol(y_i \cdot t_{ij})$ shown in Equation (2).

$$\max(t_{ij}) = \Gamma(t_{ij}^{\ 2} + 2 \cdot t_{ij}) \succ mean(\sum t_{ij} + 4)\mathrm{M} \tag{2}$$

Next, in order to ensure the stability of suppliers and procurement efficiency, we can use the principles of supply chain management to establish long-term cooperative relations, and improve the transparency and responsiveness of the procurement process through information technology (Huang, 2021). For example, the implementation of an e-procurement system can greatly shorten the procurement cycle (Liu, 2021), reduce the processing time of paper documents, and also facilitate the tracking of order status and timely adjustment of procurement strategies.

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$$F(d_i) = \sqrt{b^2 - 4ac} \sum t_i \bigcap \xi \cdot \sqrt{2} \to \iint y_i \cdot 7 \quad (3)$$

2.2 Selection of Procurement Optimization Scheme

In addition, in order to meet the challenges of future technological change, universities should consider the flexibility and scalability of procurement (Liu Yuanyuan, 2021). This means that when developing a procurement plan, it is important not only to meet current needs, but also to anticipate possible changes in the future (Xu Yezhou, 2021). For example, it is wise to purchase lab equipment that can be upgraded and maintained, or to choose a computer system that offers software update services.

$$g(t_i) = \ddot{x} \cdot z_i \prod F(d_i) \frac{dy}{dx} - w_i \quad (4)$$

In summary, through scientific methods, advanced technology and close cooperation, the multi-objective optimization of university asset procurement solutions can effectively improve the overall performance of procurement, and achieve the multiple goals of cost savings, quality improvement, supply stability and future adaptability (Li, 2021).

$$\lim_{x \to \infty} g(t_i) + \lim_{x \to \infty} F(d_i) \le \bigcap \max(t_{ij}) \quad (5)$$

This not only brings significant economic benefits to universities, but also provides a better learning and research environment for students and teachers, thus promoting the progress of the entire educational industry.

$$\overline{g(t_i)} + F(d_i) \leftrightarrow mean(\sum t_{ij} + 4) \quad (6)$$

2.3 Analysis of Procurement Optimization Scheme

Against the backdrop of tight budgets, universities need to make smart asset purchases while ensuring the quality of education and meeting the needs of teaching and research. This involves multiple considerations, such as the quality of the asset, price, supplier selection, maintenance costs, and the useful life of the asset (Yu, 2021). In addition, the transparency of the procurement process, compliance and timeliness need to be considered. These factors intertwine to make procurement a complex decision-making issue.

$$No(t_i) = \frac{\overline{g(t_i)} + F(d_i)}{mean(\sum t_{ij} + 4)} \sqrt{a^2 + b^2} \quad (7)$$

$$\frac{\overline{g(t_i)} + F(d_i)}{mean(\sum t_{ij} + 4)} \le 1$$

Among them, it is stated that the scheme needs to be proposed, otherwise the scheme integration is $Zh(t_i)$ required, and the result is shown in Equation (8).

$$Zh(t_i) = \bigcap \ [\sum \overline{g(t_i)} + F(d_i)] \quad (8)$$

In practice, multi-objective optimization also requires an interdisciplinary teamwork. Procurement departments work closely with the finance department, academic affairs department, research teams, and external suppliers to analyze data and make the best decisions. This collaborative work model helps to integrate information and resources from all sides, making procurement activities more efficient and rational.

$$accur(t_i) = \frac{\min[\sum \overline{g(t_i)} + F(d_i)]}{\sum \overline{g(t_i)} + F(d_i)} \Lambda \quad (9)$$

Finally, it's important to recognize that no optimization is set in stone. With the changes in the external environment and the development of internal needs, the strategy of asset procurement of universities should also be adjusted in a timely manner. This requires regular evaluation of the procurement effect, timely collection of feedback information, and adjustment of optimization models and decision-making parameters based on the evaluation results.

$$accur(t_i) = \frac{\min[\sum \overline{g(t_i)} + F(d_i)]}{\sqrt{b^2 - 4ac} \sum \overline{g(t_i)} + F(d_i)} + randon(t_i) \quad (10)$$

Multi-objective optimization is a mathematical approach to finding the best trade-off solution between multiple conflicting targets. In the asset

procurement of universities, multiple goals such as cost minimization, efficiency maximization, and supply risk minimization can be set, and algorithms can be used to analyze and deal with the interrelationship between these objectives, so as to obtain a series of feasible procurement solutions.

3 OPTIMIZATION STRATEGY OF PROCUREMENT OPTIMIZATION PLAN

Second, the introduction of multi-objective optimization theory. Multi-objective optimization is a mathematical approach to finding the best trade-off solution between multiple conflicting targets. In the asset procurement of universities, multiple goals such as cost minimization, efficiency maximization, and supply risk minimization can be set, and algorithms can be used to analyze and deal with the interrelationship between these objectives, so as to obtain a series of feasible procurement solutions.

3.1 Introduction of Procurement Optimization Plan

In order to effectively execute a multi-objective optimization strategy, it is first necessary to establish clear procurement goals and standards. This includes the establishment of a comprehensive evaluation system covering asset performance, price, maintenance services, supplier reputation and other aspects. Next, the quantitative model was used to score and rank different procurement options, and sensitivity analysis was used to investigate the impact of changes in each factor on the final result.

Table 1: Procurement optimization requirements

Scope of application	Grade	Accuracy	Procurement optimization
Electronic	I	85.00	78.86
Equipment	II	81.97	78.45
Experimental	I	83.81	81.31
equipment	II	83.34	78.19
Supplier and	I	79.56	81.99
product	II	79.10	80.11
selection			

The procurement optimization process in Table I. is shown in Figure 1.

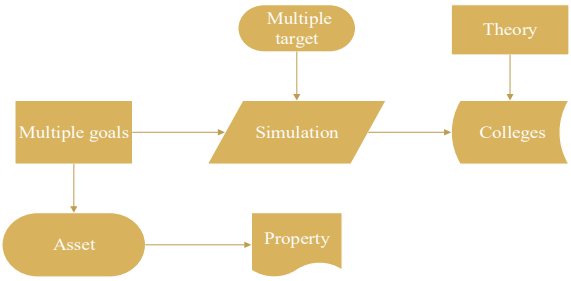

Figure 1: The process of analyzing procurement optimization scenarios

This paper can show the application effect of multi-objective optimization in university asset procurement through specific cases. For example, a university has successfully balanced short-term expenses and long-term benefits by building a comprehensive scoring system that includes teaching quality, scientific research support, cost control and other goals, and has realized the upgrading of equipment while ensuring the stability of teaching and scientific research.

3.2 Procurement Optimization Plan

With the advancement of science and technology and the development of data analysis tools, the future of university asset procurement will be more intelligent and refined. The introduction of machine learning, artificial intelligence and other technologies will provide more powerful data support for purchasing decisions. At the same time, universities need to develop procurement teams with interdisciplinary knowledge to adapt to this trend.

Table 2: The overall situation of the procurement optimization plan

Category	Random data	Reliability	Analysis rate
Electronic Equipment	85.32	85.90	83.95
Experimental equipment	86.36	82.51	84.29
Supplier and product selection	84.16	84.92	83.68
,ean	86.84	84.85	84.40
X6	83.04	86.03 P=1.249	84.32

3.3 Procurement Optimization Scheme and Stability

Conclusion: In summary, multi-objective optimization provides a scientific and systematic decision-making framework for university asset procurement. By setting targets, making accurate quantitative assessments, and employing advanced data processing techniques, we can not only improve the efficiency of resource use, but also enhance the strategic nature of asset procurement. In the future, with the development of technology and the accumulation of practical experience, multi-objective optimization will play a greater role in the asset procurement of universities.

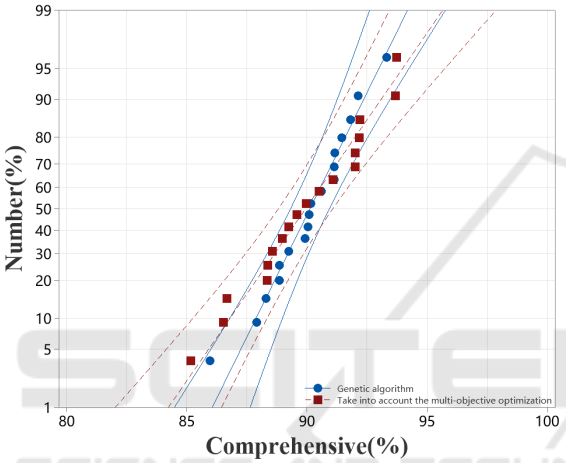

Figure 2: Procurement optimization scheme with different algorithms

In the era of knowledge economy, as an important base for cultivating high-quality talents and scientific research, the quality of education and innovation ability is directly related to the quality of education and the improvement of innovation ability. Therefore, a forward-looking and reasonable university asset

Table 3: Comparison of the accuracy of procurement optimization solutions of different methods

Algorithm	Survey data	Procurement optimization	Magnitude of change	Error
Take into account multi-objective optimization	85.33	85.15	82.88	84.95
Genetic algorithm	85.20	83.41	86.01	85.75
P	87.17	87.62	84.48	86.97

procurement plan is very important to support the long-term development strategy of the university. The purpose of this paper is to put forward a set of systematic ideas and methods for university asset procurement, in order to achieve optimal allocation of resources and enhance the overall competitiveness of universities.

First and foremost, any effective asset procurement program must be based on an accurate asset requirements analysis. Colleges and universities should conduct regular asset inventory, clarify the current asset stock and use status, and scientifically predict the equipment renewal and new demand in a certain period in the future in combination with the school's development plan, professional setting and scientific research project needs. In addition, universities need to establish a dynamically adjusted asset management system to ensure that asset information is updated in real time and provide data support for procurement decisions.

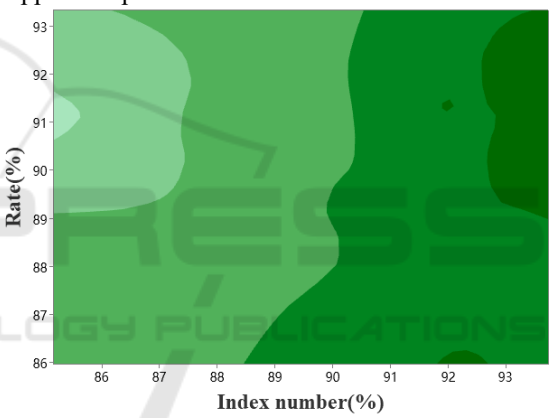

Figure 3: Procurement optimization with multi-objective optimization in mind

Next, the procurement programme should highlight the principle of cost-effectiveness. On the premise of ensuring quality, select cost-effective products through market competition mechanism.

3.4 Rationality of procurement optimization scheme

Furthermore, sustainability is a principle that cannot be ignored in modern university procurement. With the improvement of social requirements for environmental protection, green procurement has become a trend. Universities should not only pay attention to the energy-saving performance and environmental protection standards of products when purchasing, but also consider the environmental responsibility and social responsibility performance

of suppliers, and encourage and support those suppliers who practice the concept of sustainable development.

In addition, the university asset procurement program should strengthen follow-up management and performance evaluation. Procurement is not a simple transaction, but a complete process that includes preliminary research, mid-term execution and post-management.

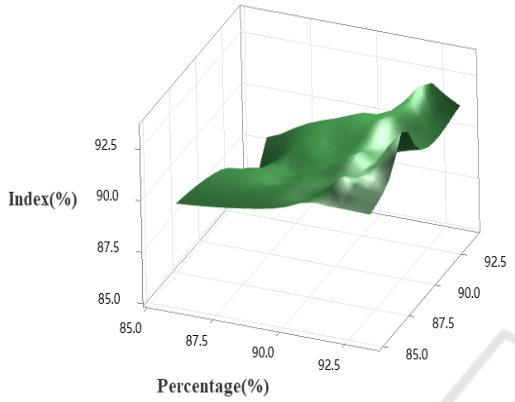

Figure 4: Procurement optimization scheme with different algorithms

3.5 The effectiveness of procurement optimization programs

Finally, innovation is the core driving force for the sustainable development of universities. Incorporating innovative thinking into asset procurement means moving beyond traditional sourcing models and product selections. Universities should actively explore opportunities for collaboration with emerging technology companies, such as using modern information technologies such as cloud computing and big data to optimize procurement processes, and even consider using blockchain technology to achieve transparency and traceability in the supply chain.

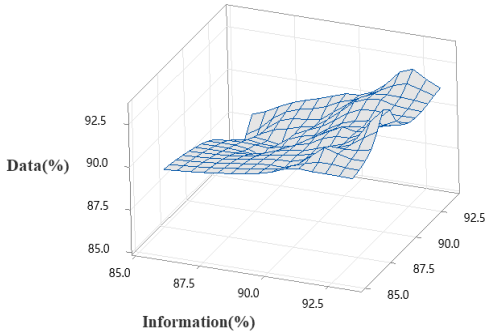

Figure 5: Procurement optimization scheme with different algorithms

This move not only helps to establish the social image of universities, but also conforms to the national policy guidance of promoting green consumption.

Table 4: Comparison of the effectiveness of procurement optimization solutions of different methods

Algorithm	Survey data	Procurement optimization	Magnitude of change	Error
Take into account multi-objective optimization	82.21	85.92	84.59	82.85
Genetic algorithm	83.73	84.23	84.41	83.55
P	84.20	87.39	84.76	83.90

In summary, an excellent university asset procurement plan should be based on accurate demand analysis, follow the principles of cost-effectiveness and sustainability, strengthen follow-up management and continuous innovation. Only in this way can colleges and universities maximize the value of every penny under the condition of limited resources, and lay a solid material foundation for cultivating talents and scientific research development in the future society.

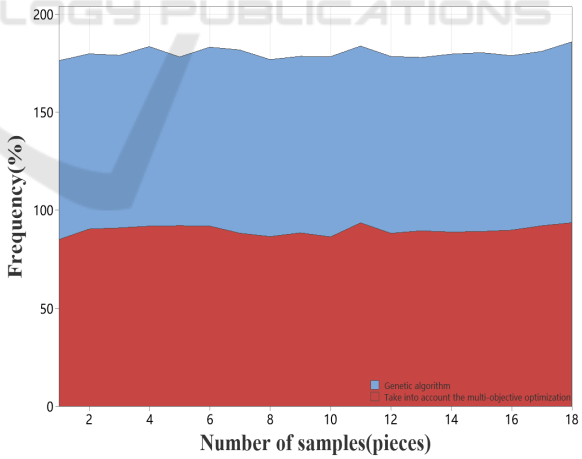

Figure 6: Optimize procurement optimization solutions with multiple objectives in mind

This is not only reflected in the selection of a single product, but also in the total cost of ownership of the asset from the perspective of the whole life cycle. For example, consider the energy consumption of the equipment, the cost of maintenance, and the cost of eventual end-of-life disposal. To this end,

universities can bring in professional third-party evaluation agencies to participate in the procurement process, and use financial analysis and risk assessment methods to assist decision-making.

4 CONCLUSIONS

Therefore, colleges and universities should establish a sound asset tracking and evaluation system to conduct a comprehensive performance evaluation of procurement results. This involves not only the efficiency of equipment and the statistics of failure rate, but also the survey of user satisfaction and the collection of improvement opinions. Continuously optimize asset procurement and management processes through a continuous feedback loop.

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