Higher Education Management Based on Intelligent Decision Support System

Ya Li[1] , Zhe Gao[2] ,Xiuping Xu[3*]

[1]30511977@qq.com, [2]2920050720.qq.com, Corresponding author e-mail:[3]254050075@qq.com

Changshu Institute of Technology, Changshu ,Jiangsu,China

Abstract: In today's society, higher education management is facing increasingly complex challenges and changes. Driven by globalization and technological advancement, higher education institutions need to adapt to the changing environment and provide high-quality educational services. To meet these challenges, policymakers need accurate data and information to guide their decisions. Therefore, data collection for decision-making projects and objectives in higher education management becomes crucial. In higher education administration, decision-making projects cover aspects such as enrollment management, student assessment, and financial management. These programs require policy makers to make informed decisions based on the facts to improve the quality of education and student satisfaction. Through the analysis of students' learning situation and needs, this paper finds that intelligent decision support system decision makers can understand students' needs and trends, so as to make more accurate enrollment management decisions. Intelligent decision support system helps decision makers make more informed decisions and improve education quality and student satisfaction through functions such as data analysis, real-time feedback, resource optimization and accurate decision-making.

Keywords: Intelligent Decision Support System; Higher Education Management; Educational Technology; Data Analysis

1. Introduction

With the continuous intensification of global higher education competition and the rapid development of educational technology, higher education management has become a field of great concern [1]. Higher education management involves a series of management activities that organize, plan, coordinate and supervise higher education institutions to improve the quality of education, enhance the student experience and meet the needs of society. In this ever-changing environment, higher education management is developing towards a more scientific, data-driven and focus on education quality and student experience [2-3].

Abroad, many scholars have conducted in-depth research on higher education management. They have employed various research methods, including qualitative research and quantitative research, to explore and address issues and challenges in higher education management [4]. Based on the cloud-based knowledge management framework for decision-making in higher education institutions, Younas M has drawn some valuable conclusions by using methods such as case studies, questionnaires, and interviews in higher education institutions [5]. Camilleri M A used the balanced scorecard as a performance management tool in higher education and found

ITEI 2023, November 24-26, Zhengzhou, People's Republic of China

DOI 10.4108/eai.24-11-2023.2343592

that higher education institutions should take market demand and competitive environment into account when formulating strategic planning. At the same time, he also found that the application of educational technology can improve teaching effectiveness and student participation [6].

The purpose of this article is to explore the latest trends and challenges in higher education management and propose corresponding solutions. By summarizing and analyzing the research results of domestic and foreign scholars, this paper aims to provide useful reference and guidance for higher education administrators and decision makers, and help them better deal with problems and changes in higher education management. At the same time, this paper also looks forward to the future development direction of higher education management in order to promote the sustainable development of higher education institutions and improve the quality of education.

2. Higher Education Management

2.1 The Concept and Status Quo of Higher Education Management

Higher education management refers to the process of planning, organizing, leading, and controlling higher education institutions, with the aim of providing high-quality educational services, promoting school development, and achieving educational goals [7]. Higher education management includes various management activities such as strategic planning, financial management, human resource management, student recruitment and management, teaching quality evaluation, etc. In modern society, higher education management is facing some challenges and changes [8]. The following are some of the current status and trends in higher education management:

Internationalization: With the development of globalization, higher education institutions are facing the pressure of international competition and cooperation. Many schools have begun to focus on international development, recruiting international students, offering international courses, and launching cooperative projects with foreign universities [9].

Quality Assurance: Higher education institutions pay more and more attention to the improvement and guarantee of teaching quality [10]. Many countries have established quality assurance mechanisms for teaching evaluation and accreditation to ensure the quality and level of higher education.

Technology application: The rapid development of information technology has had a profound impact on higher education management [11]. Schools have begun to adopt various technological tools and platforms, such as learning management systems, online courses, virtual laboratories, etc., to provide a more flexible and convenient learning environment.

Data-driven decision-making: Higher education institutions are increasingly emphasizing the application and analysis of data. By collecting and analyzing various data, schools can better understand student needs, adjust curriculum, optimize resource allocation, etc., to support decision-making and improve management.

Student Services and Support: Student services and support are important aspects of higher education administration. The school is committed to providing comprehensive student support, including services in academic counseling, career planning, mental health, etc., to enhance students' learning experience and success rate [12].

Continuous development and innovation: Higher education management needs to constantly adapt to social changes and changes in demand, and carry out continuous development and innovation. Schools need to pay attention to the educational needs of emerging fields, and flexibly adjust curriculum and teaching models to cultivate talents who can meet the needs of future society [13].

To sum up, higher education management is facing the status quo and trend of constant change and development in terms of internationalization, quality assurance, technology application, data-driven decision-making, student services and support, and continuous development and innovation.

2.2 Overview of Intelligent Decision Support System

Intelligent decision-making system is a system that uses artificial intelligence and data analysis technology to assist the decision-making process [14]. It collects, organizes and analyzes a large amount of data and information, and uses algorithms and models to make inferences and predictions to help users make more accurate and effective decisions [15].

Intelligent decision-making systems usually consist of multiple components, including data collection and processing modules, analysis and modeling modules, decision support modules, etc. [16]. The data collection and processing module is responsible for acquiring data from different data sources, and cleaning, sorting and storing [17]. The Analysis and Modeling module uses a variety of data analysis techniques, such as statistical analysis, machine learning and data mining, to discover patterns and trends in data and build corresponding models. The decision support module uses these models and algorithms to provide users with decision-making suggestions and prediction results [18].

Intelligent decision-making system has a wide range of applications in higher education management. It can help school administrators analyze students' learning situations and behavior patterns, predict students' academic performance and retention risks, and develop individualized teaching plans and support measures [19]. At the same time, the intelligent decision-making system can also assist school managers in resource allocation and budget management, and optimize the school's operational efficiency and quality [20].

In short, intelligent decision-making systems help users make more informed decisions by integrating and analyzing big data, providing decision support and predictive capabilities. It has great potential in higher education management and can improve the management level and teaching quality of schools.

2.3 Basic Principles of Intelligent Decision Support System

The basic principle of intelligent decision support system is to combine the concept of artificial intelligence technology and decision support system to provide intelligent support and assistance in the decision-making process. The basic principle of intelligent decision support system is shown in Figure 1:

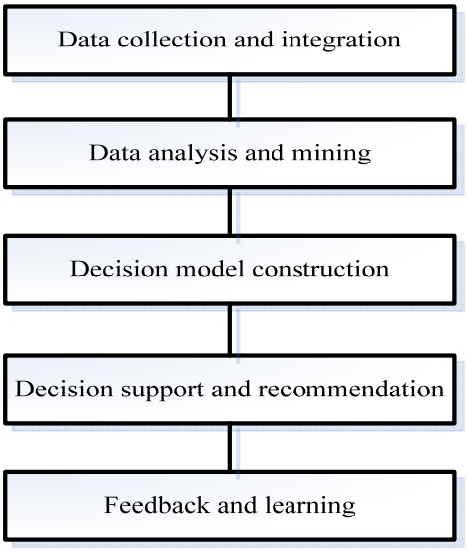

Figure 1. Basic principle of intelligent decision support system

Data collection and integration: Intelligent decision support systems work by collecting and integrating information from various data sources, including structured and unstructured data.

Data analysis and mining: The system uses data analysis and mining techniques to process and analyze the collected data to discover patterns, trends and correlations in the data.

Decision-making model construction: The system constructs a model applicable to specific decision-making problems based on the analysis results and domain knowledge. These models can be statistical models, machine learning models, optimization models, etc.

Decision support and recommendation: The system provides decision support and recommendation based on the constructed decision model. It can generate various decision-making schemes and recommendation results according to user needs and goals.

Feedback and learning: The system can learn and optimize based on user feedback and the subsequent impact of decision-making results. This can be achieved by updating model parameters, adjusting decision-making strategies, etc.

In general, intelligent decision support systems provide users with intelligent support and assistance in the decision-making process through data analysis and model construction, helping them make more accurate and effective decisions.

2.4 Advantages of Intelligent Decision Support System in Higher Education Management

Intelligent decision support system has the following advantages in higher education management:

Data-driven decision-making: Intelligent decision-making support systems can collect, organize and analyze a large amount of data, including student information, course data, teacher

evaluation, etc., so as to provide reliable data support for decision-making. This helps managers make decisions based on objective data, improving the accuracy and reliability of decisions.

Real-time monitoring and forecasting: The intelligent decision support system can monitor and analyze various indicators and data in real time, helping managers to keep abreast of the operating status of higher education institutions. The system can also make predictions based on historical data and models, provide future development trends and possible problems, and help managers make timely adjustments and decisions.

Multi-dimensional analysis: The intelligent decision support system can conduct multi-dimensional data analysis to help managers understand all aspects of higher education institutions. By analyzing data of different dimensions, managers can discover potential problems, development opportunities and optimization plans to improve the performance and competitiveness of higher education institutions.

Automation and efficiency improvement: Intelligent decision support systems can automate the process of data collection, collation and analysis, reducing tedious manual operations and the risk of human error. The system can quickly process a large amount of data, and generate visual reports and charts, provide intuitive information display and decision support, and improve management efficiency and decision-making speed.

Personalized decision support: The intelligent decision support system can provide personalized decision support according to the needs and roles of different users. The system can filter and present relevant data and information according to the user's permissions and preferences, helping users better understand and apply the results of the decision support system.

The advantages of intelligent decision support systems in higher education management include data-driven decision-making, real-time monitoring and prediction, multi-dimensional analysis, automation and efficiency improvement, and personalized decision support. These advantages can help managers better understand and manage higher education institutions, and promote scientific and effective decision-making.

2.5 Application of Intelligent Decision Support System in Higher Education Management

Enrollment and recruitment management: intelligent decision support systems can help colleges and universities conduct enrollment and recruitment management, including formulating enrollment plans, optimizing enrollment channels, and evaluating the effectiveness of enrollment policies. The system can analyze historical data, market trends and student needs, and provide reasonable suggestions and forecasts for decision makers.

Student management: The system can help colleges and universities manage students, including student course selection, academic progress monitoring, student counseling and support, etc. By analyzing students' academic performance, personal interests and needs, the system can provide students with personalized academic planning and tutoring advice.

Curriculum and teaching management: The intelligent decision support system can assist colleges and universities in curriculum and teaching management, including curriculum arrangement, teaching quality evaluation, teacher assignment, etc. The system can provide the best course arrangement and teaching resource allocation suggestions according to the learning needs of students and the professional background of teachers.

Financial and resource management: The system can help colleges and universities to manage financial and resource, including budget planning, resource allocation, project evaluation, etc. By analyzing the university's financial status, resource utilization and future needs, the system can provide decision makers with reasonable financial and resource management strategies.

Performance evaluation and quality assurance: The intelligent decision support system can help colleges and universities to conduct performance evaluation and quality assurance, including teaching quality evaluation, scientific research results evaluation, school ranking, etc. The system can provide data analysis and model prediction to help universities evaluate performance and improve quality assurance mechanisms.

3. System Data and Experiments

According to the process of higher education management, this paper decides to make decisions on the following items and take them as the goal of data collection. Achieving desired goals through data collection and systematic testing of enrollment management decisions, course placement decisions, student assessment decisions, and financial management decisions.

Enrollment management decision-making: intelligent decision support system can help colleges and universities make enrollment management decisions, such as predicting enrollment needs, formulating enrollment plans, etc.

Student assessment decision-making: intelligent decision support systems can be used for student assessment decision-making, such as formulating assessment indicators, analyzing student performance, providing personalized learning suggestions, etc., to promote students' academic development and improve teaching quality.

Financial management decision-making: intelligent decision-making support system can assist colleges and universities to make financial management decisions, such as forecasting financial income and expenditure, formulating budget plans, and conducting financial analysis, so as to achieve sustainable financial development.

3.1 Data Collection and Processing

In this study, we collected a large amount of data to support the application of Intelligent Decision Support System (IDSS) in higher education management. Data collection includes various information obtained from different colleges and universities and related institutions, such as student data, course data, teacher data, financial data, etc. These data are considered as input to IDSS to generate results for decision support and optimization of management processes. Data processing is one of the key steps to realize IDSS. We used techniques such as data cleaning, data transformation, and data integration to process the raw data. First, we cleaned the data to remove duplicate, incomplete and erroneous data. We then transformed the data to convert it into a common format and units for subsequent analysis and calculations. Finally, we integrated data from different sources to build a comprehensive dataset for use in IDSS. The structure of the decision-making system is shown in Figure 2.

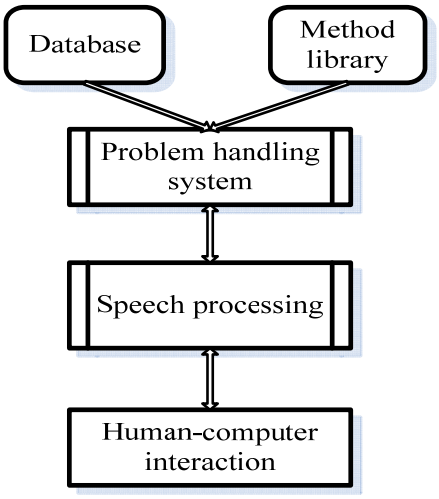

Figure 2. Decision system structure

3.2 Experiment Design and Implementation

In order to verify the effect and value of IDSS, we conduct a series of experiments. In the experiments, we use real higher education management scenarios and set different decision-making problems according to actual needs and goals. We apply IDSS to these problems and compare with traditional decision-making methods. By comparing the experimental results, we evaluate the performance of IDSS in improving efficiency, reducing cost and optimizing decision-making.

Through the collection and processing of systematic data, as well as the design and implementation of experiments, we can comprehensively evaluate the application effect of IDSS in higher education management. These data and experimental results provide us with strong support to demonstrate the value and potential of IDSS in providing decision support and optimizing management processes. At the same time, these results also reveal some issues and challenges, such as the impact of data quality and technical competence of managers. Therefore, we propose some improvement measures to further enhance the effect and application efficiency of IDSS.

3.3 Target Data Entry Situation

This article aims to make decisions about the various items of higher education management and use these items as the object of data collection. The target data entry situation of each project is shown in Table 1.

Table 1. Target data entry situation

Project	Input situation	
Enrollment management	Number of applicants	Acceptance rate
Student assessment	Examination performance	Academic performance
Financial management	Budget situation	Income and expenditure details

Through data collection and system testing, we will be able to better understand the situation of each project and make decisions based on data to improve the efficiency and quality of higher education management.

4. Data Analysis and Discussion

4.1 Data Analysis

When it comes to making decisions, determinant analysis is a common method used to identify the factors that have the most significant influence on the outcome. It helps decision-makers understand and evaluate the contribution of different factors to decision-making results, thus providing strong support for decision-making. The experimental comparison data in this paper are shown in Figure 3.

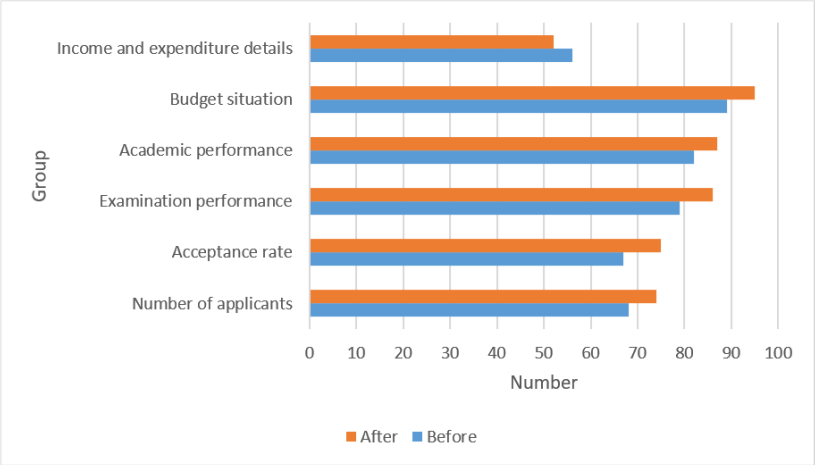

Figure 3. Target data comparison results

In higher education administration, this paper conducts an experiment to evaluate the advantages of an intelligent decision support system. The experiment collects the data of enrollment management, student evaluation, financial management, etc., and uses the intelligent decision support system for analysis and simulation. The data results show that intelligent decision support system has significant advantages in higher education management. First, the system can quickly and accurately collect, organize and analyze a large amount of educational data. Through data analysis, decision makers can obtain comprehensive information, including data on other aspects. This provides decision makers with a basis for gaining insight into individual projects. Second, intelligent decision support systems can provide real-time feedback and monitoring. Decision makers can keep abreast of the progress of each project and discover problems and challenges in a timely manner. The system will provide corresponding warnings and suggestions based on data changes, helping decision makers adjust strategies and take measures in a timely manner. This helps to improve the efficiency and effectiveness of education management. In addition, intelligent decision support systems can optimize the use of resources. Through data analysis, the system can discover areas where resources are underutilized or

wasted, and provide corresponding optimization solutions. Decision makers can allocate resources according to the system's suggestions, improve resource utilization efficiency, reduce costs, and achieve better education management. To sum up, the experimental results show that the intelligent decision support system has obvious advantages in higher education management. It can provide comprehensive, accurate and real-time information support to help decision makers make more informed decisions, improve education quality and student satisfaction. This provides higher education administrators with an effective tool to better address challenges and issues in education administration.

4.2 Limitations of the Research and Directions for Improvement

In this study, although the experimental results show that intelligent decision support systems have advantages in higher education management, there are still some limitations that need to be considered and improved. Here are some possible limitations and directions for improvement:

1. Data quality: The effectiveness and accuracy of an IDSS depends on the quality of the data used. If the data is incomplete, inaccurate or unreliable, it will affect the decision-making results of IDSS. Therefore, it is necessary to ensure the quality of data and take measures to correct and improve data quality problems.

2. Technical ability of managers: The use of IDSS requires managers to have certain technical capabilities, including the ability to analyze data, interpret models, and interpret results. If managers lack these skills, the full potential of IDSS may not be exploited. Therefore, it is necessary to train and support managers to improve their technical capabilities.

3. User acceptance: The successful application of IDSS also depends on user acceptance and adoption rate. If users are skeptical of IDSS or unwilling to accept new technologies, the effectiveness of IDSS will be limited. Therefore, user education and training are needed to improve their awareness and acceptance of IDSS.

4. Model accuracy: The accuracy of the models and algorithms used by IDSS is crucial to the accuracy of decision-making results. In the experiment, there may be limitations of some models or algorithms, resulting in inaccurate decision-making results. Therefore, further research and improvement of models and algorithms are needed to improve the accuracy and reliability of IDSS.

5. Feasibility and sustainability: Although the experimental results show that IDSS has potential in higher education management, its feasibility and sustainability need to be evaluated. This includes aspects such as cost benefit analysis, resource needs assessment and system maintenance. Only under the premise of being feasible and sustainable, IDSS can really play its role.

In summary, despite the potential of IDSS in higher education management, limitations in data quality, technical competence of managers, user acceptance, model accuracy, and feasibility and sustainability still need to be addressed. By solving these problems, the effect and value of IDSS in higher education management can be further enhanced.

5. Conclusion

Intelligent decision support systems have great potential in higher education management. By collecting and analyzing a large amount of data, the system can provide decision makers with comprehensive, accurate and real-time information support to help them make more informed decisions. Through the verification of the experimental results, we can see the advantages of intelligent decision support system in higher education management. It can provide accurate and real-time information support to help decision makers make informed decisions, improve education quality and student satisfaction. However, we should also be aware of the limitations of intelligent decision support systems. It relies on accurate data and reasonable algorithms, and requires the continuous development and improvement of artificial intelligence technology. Intelligent decision support system has great potential and advantages in higher education management. By leveraging data and technology, we are able to improve the quality of education and provide students with a better learning experience. However, we also need to use the system with care and keep improving and perfecting it to make sure it actually works.

Reference

[1] Chernikova O, Heitzmann N, Stadler M, et al. Simulation-based learning in higher education: A meta-analysis[J]. Review of Educational Research, 2020, 90(4): 499-541.

[2] Latif S, XianWen F, Wang L. Intelligent decision support system approach for predicting the performance of students based on three-level machine learning technique[J]. Journal of Intelligent Systems, 2021, 30(1): 739-749.

[3] Nazir S, Khan H U, Shahzad S, et al. Editorial on decision support system for development of intelligent applications[J]. Soft Computing, 2022, 26(20): 10547-10551.

[4] Rezk H, El-Bakry H, El-Mikkawy M. Adaptive Intelligent Decision Support System for Enhancing Higher Education Quality Assurance[J]. International Journal of Electronics and Information Engineering, 2021, 13(4): 180-195.

[5] Younas M, Noor A S M, Arshad M. Cloud-based knowledge management framework for decision making in higher education institutions[J]. Intelligent Automation & Soft Computing, 2022, 31(1): 83-99.

[6] Camilleri M A. Using the balanced scorecard as a performance management tool in higher education[J]. Management in Education, 2021, 35(1): 10-21.

[7] Toshpulatov D, Nosirov B, Khalmatov T. Gradual implementation of smart management principles in the higher education system of Uzbekistan[J]. International Journal on Economics, Finance and Sustainable Development, 2021, 3(1): 22-29.

[8] Nodira T. Innovative management in the development of the higher education system[J]. Journal of Academic Research and Trends in Educational Sciences, 2022, 1(10): 346-351.

[9] Kaewsaiha P, Chanchalor S. Factors affecting the usage of learning management systems in higher education[J]. Education and Information Technologies, 2021, 26(1): 2919-2939.

[10] Sitanggang N. Relationship between total personal quality, service quality and student satisfaction on higher education system[J]. International Journal of Instruction, 2021, 14(4): 357-372.

[11] Cano M, Murray R, Kourouklis A. Can lean management change the managerial culture in higher education?[J]. Studies in Higher Education, 2022, 47(4): 915-927.

[12] Valentino V H, Setiawan H S, Saputra A, et al. Decision support system for thesis session pass

recommendation using AHP (analytic hierarchy process) method[J]. International Journal of Educational Research and Social Sciences (IJERSC), 2021, 2(1): 215-221.
[13] Cunningham J A, Menter M. Transformative change in higher education: Entrepreneurial universities and high-technology entrepreneurship[J]. Industry and Innovation, 2021, 28(3): 343-364.
[14] Valentino V H, Setiawan H S, Saputra A, et al. Decision support system for thesis session pass recommendation using AHP (analytic hierarchy process) method[J]. International Journal of Educational Research and Social Sciences (IJERSC), 2021, 2(1): 215-221.
[15] Yun Y, Ma D, Yang M. Human–computer interaction-based decision support system with applications in data mining[J]. Future Generation Computer Systems, 2021, 114(1): 285-289.
[16] Andi H K. Construction of business intelligence model for information technology sector with decision support system[J]. Journal of Information Technology and Digital World, 2022, 3(4): 259-268.
[17] Wohlfart O, Adam S, Hovemann G. Aligning competence-oriented qualifications in sport management higher education with industry requirements: An importance–performance analysis[J]. Industry and Higher Education, 2022, 36(2): 163-176.
[18] Morgan A, Sibson R, Jackson D. Digital demand and digital deficit: Conceptualising digital literacy and gauging proficiency among higher education students[J]. Journal of Higher Education Policy and Management, 2022, 44(3): 258-275.
[19] Chen P, Chang Y C. Enhancing Creative Problem Solving in Postgraduate Courses of Education Management Using Project-Based Learning[J]. International Journal of Higher Education, 2021, 10(6): 11-21.
[20] Asad M M, Hussain N, Wadho M, et al. Integration of e-learning technologies for interactive teaching and learning process: an empirical study on higher education institutes of Pakistan[J]. Journal of Applied Research in Higher Education, 2021, 13(3): 649-663.