THE CONSTRUCTION AND APPLICATION OF DATA-DRIVEN EVALUATION SYSTEM OF SCIENTIFIC RESEARCH ACHIEVEMENTS IN REGIONAL PRIVATE UNIVERSITIES - A CASE STUDY OF NANNING UNIVERSITY

CHEN YUNSHENG
6617195714

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION
GRADUATE SCHOOL OF BUSINESS
SIAM UNIVERSITY
2025

THE CONSTRUCTION AND APPLICATION OF DATA-DRIVEN EVALUATION SYSTEM OF SCIENTIFIC RESEARCH ACHIEVEMENTS IN REGIONAL PRIVATE UNIVERSITIES - A CASE STUDY OF NANNING UNIVERSITY

CHEN YUNSHENG

This Independent Study Has Been Approved as a Partial Fulfillment of the Requirements for the Degree of Master of Business Administration

Advisor..... Jidapa C.
(Dr. Jidapa Chollathanratanapong)

Date: ....20..../.... Aug .../... 2025

……..……..
(Associate Professor Dr. Jomphong Mongkhonvanit)
Dean, Graduate School of Business

Date……..……/……/……

Title: The Construction and Application of Data-driven Evaluation System of Scientific Research Achievements in Regional Private Universities - A Case Study of Nanning University

Researcher: Chen Yunsheng

Degree: Master of Business Administration

Major: Educational Management

Advisor: .....Jidapa C.....

(Dr. Jidapa Chollathanratanapong)

.....20 / Aug / 2025.....

ABSTRACT

With the rapid development of higher education in China, private universities have become an important part of the higher education system. However, there are many problems with their scientific research performance evaluation system, such as insufficient scientific research input, inadequate incentive policies, and an imperfect evaluation system, making the evaluation of scientific research performance face many challenges.

The objective of this study were: 1) to explore the current situation of the scientific research input, output, and impact at Nanning University, and the inherent laws of its own scientific research development; 2) to provide recommendations for the scientific research input, output, and impact of Nanning University.

This study adopted quantitative research methodology, and a questionnaire survey was conducted to verify the rationality of the current scientific research evaluation system, the fairness of the evaluation process, and the application effect of the evaluation results.

The study found that the number of master's and doctoral personnel has increased by 105% over the past five years, and the total amount of research funding has increased by 325.66%. The continuous input in scientific research has promoted the vigorous development of output and brought about a continuous rise in the scientific research impact. For every 1 unit increase in input, the output increases by 0.85 units and the impact increases by 0.92 units. 95.92% of the respondents believe that the research evaluation system of Nanning University is in line with its positioning as a "private applied university", and its evaluation criteria are consistent with the university's development goals.

This study proposes three suggestions based on this analysis. Firstly, increase input in scientific research, optimize fund allocation, and attach importance to talent cultivation. Secondly, reform the evaluation system, focus on quality and influence, and introduce dynamic and international evaluations. Thirdly, promote the enhancement of scientific research impact, strengthen academic exchanges, achievement transformation, and student participation in scientific research. This study provides new insight for evaluating the research performance of private universities and helps to promote regional education development and enhance innovation capabilities.

Keywords: data-driven evaluation, scientific research input, scientific research output, scientific research impact, private universities.

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my advisor for her invaluable guidance, support, and encouragement throughout my Independent Study. Her insightful comments and constructive criticism have significantly improved the quality of my work.

Additionally, I am grateful to Associate Professor Dr. Jomphong Mongkhonvanit, Dean, Graduate university of Business, for his support and encouragement throughout my studies. His dedication to the graduate program and commitment to excellence have inspired me to strive for academic excellence.

Finally, I would like to extend my appreciation to all the faculty members and staff of Siam University who have contributed to my growth and development as a student. Their unwavering support and encouragement have been a source of inspiration and motivation to me.

CHEN YUNSHENG

DECLARATION

I, *CHEN YUNSHENG*, hereby declare that this Independent Study entitled "*THE CONSTRUCTION AND APPLICATION OF DATA-DRIVEN EVALUATION SYSTEM OF SCIENTIFIC RESEARCH ACHIEVEMENTS IN REGIONAL PRIVATE UNIVERSITIES - A CASE STUDY OF NANNING UNIVERSITY*" is an original work and has never been submitted to any academic institution for a degree.

CHEN YUNSHENG

(CHEN YUNSHENG)

Jun. 16, 2025

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1 Introduction

1.1 Background of the Study

In the context of increasingly fierce global competition in science and technology, universities, as important bases for knowledge innovation and technology transformation, have become particularly important for evaluating and optimizing their scientific research performance. Taking China as an example, since 2014, the Ministry of Education of China has issued five consecutive documents, providing detailed regulations on the specific indicator system and evaluation points for the evaluation reform of scientific research achievements in universities, and putting forward a series of principled guiding, and normative opinions. These documents aim to stimulate the vitality of scientific research innovation in universities, provide institutional guarantees for scientific research innovation, and solve the problems of equivalent evaluation of scientific research performance classification, scientific research evaluation environment, and scientific research integrity. Local governments at all levels in China have also introduced a series of related policies. In 2021, the Guangxi Autonomous Region issued the *14th Five-Year Plan for Scientific and Technological Innovation in Guangxi*, which clearly stated the need to optimize the allocation of innovation resources, enhance the innovation capabilities of universities and research institutions, and promote the transformation of scientific and technological achievements into practical productive forces.

However, despite policy support and the increasing input in scientific research, how to scientifically and objectively evaluate the scientific research performance of universities is still an urgent problem to be solved. Van Raan (1993) proposed that traditional research performance evaluation often focuses on the quantity of scientific research achievements, such as the number of published papers, patent applications, etc., while neglecting the quality, transformation efficiency, and actual contribution to economic and social development of scientific research achievements. Such an approach not only leads to the waste of scientific research resources but also inhibits the innovation enthusiasm of scientific researchers. Therefore, it is particularly important to establish a comprehensive, scientific, and objective evaluation system for the scientific research performance of public universities.

According to the basic situation of national education development released by the Chinese Ministry of Education in June 2025, as of 2024, there are a total of 803 private universities in China, accounting for 25.75% of the country's universities. Liu (2025) argued these universities produce a large amount of scientific research output every

year, but the conversion rate is relatively low. This reflects the serious problems in the current performance evaluation system for scientific research in private universities, which has failed to effectively stimulate the enthusiasm of researchers in private universities to transform their achievements, accurately reflect the scientific research performance of private universities, and effectively reflect their educational positioning.

Currently, data-driven methods have been widely applied in various fields, which can achieve accurate evaluation and prediction of complex problems through techniques such as big data analysis and data mining (Guan et al., 2020; Papadopoulos & Hossain, 2023; Dol & Jawandhiya, 2023). In the field of higher education, data-driven methods also have enormous potential for application (Rabelo et al., 2024; Shafiq et al., 2022). By collecting and analyzing relevant data on scientific research activities in private universities, their research performance can be evaluated more objectively and comprehensively, providing a scientific basis for research management and promoting the sustainable development of research work in private universities (Boztaş et al., 2024). The United Nations Educational, Scientific and Cultural Organization (UNESCO) has repeatedly emphasized the importance of data-driven decision-making in promoting global higher education and scientific research development. Especially in its released *Paris Action Agenda* and *Recommendation on Higher Education Reform and Development*, UNESCO explicitly states that universities should utilize data analysis and information technology to optimize scientific research management and evaluation systems, promote scientific innovation and academic progress (Hazelkorn, 2009). These documents provide important guidance for the reform of the scientific research performance evaluation system of regional private universities.

1.2 Problems of the Study

Compared with public universities, private universities generally face many challenges in building a scientific research performance evaluation system, which is due to complex and profound reasons. There are mainly three problems:

Firstly, the insufficient input in scientific research by private universities hinders their scientific research development. From a financial perspective, the funding sources of private universities are relatively single, mainly relying on tuition income, making it difficult for them to obtain a large amount of government funding for scientific research like public universities (Tang et al., 2024). This makes the university struggle in terms of purchasing research equipment and funding research projects. Some scholars believed that research input is the cornerstone of scientific research activities, and

without sufficient financial support, scientific research work is like water without a source or a tree without roots (Weinberg et al., 2014). Gerhardt and Karsan (2022) believed some private universities do not attach enough importance to scientific research, have inadequate incentive policies for scientific research, and do not provide sufficient support for scientific research, which in turn affects the choice of scientific research talents to choose private universities. Boran (2018) argued that teachers lack sufficient motivation and guarantees to engage in scientific research work, resulting in low enthusiasm for scientific research and difficulty in forming stable research teams.

Secondly, the quality of scientific research output in private universities is not high. In the evaluation of scientific research achievements, private universities often prioritize quantity over quality. Wang (2021) argued that some teachers, in pursuit of the quantity of scientific research results, neglect the depth and innovation of research, resulting in most scientific research results remaining at a low level and lacking significant academic achievements with significant influence. Some scholars believe that the quality of scientific research is the core manifestation of the level of scientific research in universities (Towne & Shavelson, 2002). Feist (1997) proposed that simply pursuing quantity without emphasizing quality will only lead to a vicious cycle of low-level repetition in scientific research work.

Finally, the scientific research impact of private universities is not significant. Due to resource constraints, private universities lack motivation in academic exchanges and the transformation of scientific and technological achievements. Academic exchange opportunities are limited, making it difficult to engage in in-depth cooperation and communication with top international research institutions and scholars, resulting in a narrow academic perspective and difficulty in accessing cutting-edge research concepts and methods (Sharif et al., 2023). Pan (2021) considered the channels for transforming scientific and technological achievements are not smooth, and scientific research results are difficult to transform into actual productivity. Othman and Othman (2014) claimed that the effectiveness of social services is not prominent enough, and the scientific research impact at the university and social levels is not significant.

Therefore, how to scientifically and effectively evaluate the scientific research performance of private universities and construct a research performance evaluation system that is in line with their characteristics has become an important issue that urgently needs to be addressed.

1.3 Objectives of the Study

This study, based on data-driven analysis, examines how scientific research input, output, and impact are implemented at Nanning University, which is a regional private university. The main purposes are:

1. To explore the current situation of the scientific research input, output, and impact at Nanning University, and the inherent laws of its own scientific research development.

2. To provide recommendations for the scientific research input, output, and impact of Nanning University.

1.4 Scope of the Study

This study focused on the evaluation system of scientific research performance of Nanning University, a typical representative of regional private universities, as the specific research object for in-depth analysis. The time span of this study was from 2020 to 2024, covering all scientific research activities and achievements of Nanning University comprehensively. It not only involved the researchers and managers of Nanning University, but also their roles in scientific research output and impact. The study further explored the situation of scientific research input, including the scale and structure of input in funds, equipment, manpower, and other aspects. At the same time, this study conducted a detailed analysis of the incentive policies and research evaluation system implemented, and evaluated their rationality and effectiveness. Ultimately, by comprehensively considering the scientific research achievements and evaluation effects generated by these factors, strong support is provided for the construction of a scientific and reasonable evaluation system for the scientific research performance of regional private universities.

1.5 Significance of the Study

With the globalization of higher education and technological innovation, the environment in which scientific research performance operates has changed, and its evaluation system and measurement indicators are also facing enormous challenges (Bititci et al., 2012). Gott and Duggan (2002) argue that existing evaluation methods lack sufficient reliability in performance assessment in scientific practice, and there is a disconnect between theory and practice. Cao (2023) believes that there are many factors and complex situations in the evaluation of scientific research in universities, and the indicators are not perfect enough, and the efficiency needs to be improved.

From an academic perspective, this study takes the research performance evaluation system of Nanning University as an example and conducts quantitative research using various methods such as literature review, field research, and survey questionnaires. This research achievement will help enrich and improve the theoretical system of scientific research performance evaluation, and fill the gap in existing research in the field of scientific research performance evaluation in private universities. By deeply analyzing the current situation of scientific research performance evaluation at Nanning University, this study reveals the problems and shortcomings in the current scientific research performance evaluation, provides new perspectives and ideas for subsequent related research, and promotes the continuous development of scientific research performance evaluation theory.

From a practical perspective, the comprehensive, scientific, and objective research performance evaluation system constructed in this study can provide practical and feasible improvement directions and paths for Nanning University and other private universities. By analyzing the relationship between scientific research input, output, and impact, it is possible to effectively enhance the scientific research capabilities and achievement transformation efficiency of private universities, and promote the vigorous development of scientific research in private universities. At the same time, this research result can also provide useful reference and guidance for the evaluation of scientific research performance of other types of universities, promote the balanced development of regional education, enhance regional innovation capabilities, and inject strong impetus into the comprehensive development of China's higher education industry.

1.6 Definition of Key Terms

Scientific research input refers to the total amount of resources invested in conducting scientific research and technological development activities, including manpower, financial, material, and time factors. Specifically, scientific research input covers the formation of team members (such as researchers, teachers, and graduate students in universities), input in research funds (including government funds, corporate input, self-raised funds by universities and research institutions, international cooperation funds, etc., used for research project funding, research institution funding, establishment of laboratories and research facilities, purchase of research equipment, etc.), input in research venues and equipment (such as providing venues, large mechanical equipment, instruments, and valuable experimental consumables for

scientific research activities), which are the foundation and guarantee for the development of scientific research activities.

Scientific research output refers to the scientific products produced during the scientific research process, including theoretical research output, applied research output, and project output. Theoretical research output is more representative of academic papers, journal articles, conference papers, and book publications. The typical representatives of applied scientific research output are technology patents, new technologies, new processes, new products, improved process flows, and cultivated new products. The typical representative of project output is the number of approved vertical scientific research projects.

Scientific research impact refers to the proven benefits that scientific achievements generate outside the academic community, that is, the visible changes that occur in society, economy, and environment caused or promoted by scientific research. Scientific research impact is specifically divided into two aspects: academic impact and economic and social impact. The former refers to the outstanding contributions of excellent research within or across disciplines in promoting people's understanding and enhancing scientific knowledge, methods, theories, and research applications, while the latter refers to the outstanding contributions of excellent research to society and the economy, as well as the benefits it brings to individuals, organizations, and countries.

Data-driven method refers to a methodology that uses data as its core element to drive decision-making, optimize processes, or innovate models through the collection, storage, analysis, and application of data. The core of data-driven methods lies in using data as key input to replace or assist traditional experience, intuition, or subjective judgment, in order to achieve more accurate, efficient, and quantifiable goals. Data-driven method emphasizes automation and intelligence, achieving data processing and insights through algorithms, models, or tools, and continuously optimizing strategies and dynamically iterating based on real-time data feedback.

Chapter 2 Literature Review

2.1 Scientific Research Performance Evaluation System and Its Research Progress

In 1662, some scientists interested in natural philosophy established the Royal Society in Britain and engaged in a review of each other's research work, promoting the overall development of the scientific community and society (Thomson, 2011). After centuries of development, this type of evaluation activity has gradually evolved into today's peer appraisal, becoming an important means of scientific research evaluation. Tang (2006) believed that scientific research evaluation was a process of assessing the value of scientific research activities and their input-output situations through a series of scientific and systematic evaluation criteria and methods, in order to determine their quality, effectiveness, and contribution. Scientific research evaluation is not only a quantitative analysis of scientific research output, but also a comprehensive consideration of the innovation, scientific nature, applicability, and social value contained in scientific research activities from multiple dimensions. Gingras (2016) proposed that research evaluation is a way for governments and research managers to use diversified and quantitative indicators to evaluate teachers, professors, training programs, and universities. Hamann (2016) claimed that research performance assessment had a significant impact on disciplinary stratification and standardization in higher education institutions, which in turn affects the allocation of resources and funding. The ultimate goal of scientific research evaluation is to provide a decision-making basis for scientific research management, promote the rational allocation of scientific research resources, and promote the improvement of scientific research quality and the development of innovation capabilities.

Based on the diversification of scientific research evaluation, scholars have constructed targeted performance evaluation systems for university scientific research using different tools. Through the implementation of the balanced scorecard, the performance indicators of scientific research innovation in Latin American universities had been strongly developed (Peris-Ortiz et al., 2019). However, this method required the evaluated objects to be of the same nature, such as basic research type or applied technology type, and needed to be customized according to their characteristics and strategic objectives when implementing the balanced scorecard (Chen et al., 2006). Scholars such as Johnes and Li (2008) and Sharma and Thomas (2008) conducted in-depth evaluations and analyses of the scientific research performance of higher education institutions in China by using the DEA method and obtained corresponding

efficiency scores and rankings. However, the DEA method could not directly reflect the difference in scientific research quality and could only evaluate it based on the quantity of input and output. Van Raan (2014) used the bibliometric analysis method to evaluate scientific research performance, believing that it could effectively reflect the quality, impact, and academic contribution of research results and provide a decision-making basis for scientific research institutions, scholars, and policymakers. However, this method also had some limitations, such as data quality, indicator selection, and disciplinary differences. Sun (2010) put forward the evaluation models of fuzzy analytic hierarchy process and fuzzy approximation ideal method. On the basis of comprehensive consideration of multiple evaluation criteria, fuzziness and subjectivity were processed through triangular fuzzy number parameterization language values, and quantitative and non-quantitative factors were uniformly measured, thereby improving the accuracy and effectiveness of evaluation. The method of performance evaluation of scientific research institutions has shifted from quantitative analysis to "quantitative + non-quantitative" analysis, which better reflected the benefits of scientific and technological activities and achievements.

2.2 Development of the Application of Data-driven Concepts

Kostakis and Kargas (2021) claimed that the formation and development of the data-driven concept is a dual product of technological progress and human cognitive innovation. Its core lies in transforming data into the core driving force for decision-making and action through data collection, analysis, and application. This concept has undergone a leapfrog development from basic statistics to intelligent decision-making, and has spawned revolutionary changes in multiple fields (Brunner et al., 2024).

The embryonic form of data-driven can be traced back to the development of statistics in the early 20th century. Scholars such as Karl Pearson laid the theoretical foundation for data analysis through probability theory and statistical models (Pearson, 1938). In the 1930s, the first commercial electronic computer, the IBM 601, was introduced, marking the first step in data processing from manual computation to automation (Ceruzzi, 2003). Although the data-driven approach has not yet formed a complete methodology, the combination of statistics and computational techniques provides tools and theoretical support for future development.

In the 1960s, the introduction of database management systems (DBMS) greatly improved the efficiency of data storage and retrieval (Silberschatz et al., 1991). In the late 1970s, the popularity of personal computers (PCs) further lowered the threshold for data processing, and companies began to attempt to use data to optimize internal

processes (Cooper et al., 2000). For example, the manufacturing industry reduces downtime by monitoring equipment status through production data. However, the application of data in this stage is still limited to local optimization, lacking systematic analysis and cross-domain collaboration.

The birth of the World Wide Web (WWW) in 1990 accelerated data sharing and circulation (Gillies & Cailliau, 2000). In 1995, the popularity of data warehousing and online analytical processing (OLAP) technology enabled enterprises to integrate multiple sources of data to support strategic decision-making (Chaudhuri & Dayal, 1997). The popularity of business intelligence tools such as SAP BI and Oracle BI marks the shift from data-driven technology tools to enterprise management paradigms (Eboigbe et al., 2023). For example, retail companies optimize inventory management by analyzing sales data, while financial institutions use customer data to improve risk assessment models.

The launch of the Hadoop project in 2005 solved the problem of distributed storage and processing of massive amounts of data (O'Driscoll et al., 2013). The launch of Amazon Web Services (AWS) in 2006 provided elastic computing resources for data-driven applications (Ravindranathan et al., 2013). Hristova (2024) claimed that the release of Google BigQuery in 2009 further propelled real-time data analysis capabilities. At this stage, data-driven application scenarios have expanded from enterprise decision-making to areas such as social governance and healthcare. For example, the transportation department optimizes signal timing by analyzing real-time road condition data, while medical institutions use patient data to improve diagnosis and treatment plans.

The breakthrough of the deep learning algorithm AlexNet in the ImageNet competition in 2012 marked the beginning of deep integration between data-driven and artificial intelligence (Yuksel & Metin, 2025). Qureshi (2025) claimed that machine learning, natural language processing, and other technologies have shifted data-driven from "descriptive analysis" to "predictive decision-making". For example, CATL has shortened the research and development cycle of battery materials by 30% by combining material mechanisms, big data analysis, and AI algorithms; Baowu Echeng Iron and Steel constructed a converter process model based on "data + mechanism", which improved refining efficiency by 23%. At this stage, the core features of a data-driven approach are real-time performance, automation, and cross-domain collaboration. Chourasia (2025) believed that data-driven can achieve millisecond-level response through streaming data processing technology, and AI algorithms can replace manual completion of complex decisions. Data-driven can also break down data silos

and achieve multi-source data fusion. Griliches (1979) emphasized that research input needs to be combined with data-driven approaches in order to achieve a dual improvement in technological breakthroughs and economic benefits.

2.3 Particularity of Scientific Research Evaluation in Private Universities

As an important component of China's higher education system, private universities have significant differences in their research evaluation mechanisms in terms of goal orientation, resource endowment, and development path compared to public universities. This uniqueness stems from the combined effects of the "application-oriented" positioning, resource constraints, and social service functions of private universities, which require breakthroughs through strategies such as classification evaluation, dynamic adjustment, and resource collaboration.

The constraint of resource endowment. Levy (2011) claimed that scientific research funding of private universities mainly relies on tuition income, and the government's support is relatively weak. It is relatively lacking in scientific research resources such as funding, equipment, and talent compared to public universities. Taking Nanning University as an example, the proportion of government projects in its research funding is less than 50%, far lower than that of public universities. Shortage of funds has led to delayed equipment updates and serious talent loss, making it difficult for scientific research teams to achieve economies of scale. Blalark (2012) argued that private universities are subject to certain limitations in the selection and implementation of scientific research projects, and need to pay more attention to the rational allocation and efficient utilization of resources. Zhang (2014) proposed that private universities need to achieve maximum efficiency under limited resources. Given the limited resources, the evaluation of scientific research in private universities places greater emphasis on the efficiency of input and output (Casani et al., 2014). In the evaluation index system, consideration will be given to research input, such as the efficiency of research funding utilization, the utilization rate of research equipment, and the conversion rate of achievements, rather than the number of papers.

The applicability of target positioning. Luo (2022) claimed that private universities focus on cultivating applied talents as their core, and scientific research needs to serve regional economic and industrial development. Scientific research work is more inclined towards applied research, focusing on solving practical problems and closely integrating with local industries. Its scientific research achievements are mostly reflected in the form of patents, technology transfer, etc., and have a significant direct

contribution to the local economy. For example, Xijing University focuses on the field of intelligent manufacturing and directly applies scientific research results to production lines through co-building laboratories with local enterprises. This integrated model of "industry university research application" requires scientific research evaluation to highlight "technical practicality" rather than the theoretical depth of basic research. Jiang (2015) believed that the evaluation of scientific research in private universities should be guided by applied technology and avoid homogeneous competition with public universities.

The diversity of evaluation subjects. Private universities emphasize the combination of on-campus evaluation and off-campus evaluation. Teixeira and Amaral (2001) proposed that the scientific research evaluation of private universities not only include self-evaluation within the university but also introduce external evaluation mechanisms, such as government, enterprises, industry associations, etc., participating in the evaluation. This diversified evaluation subject can more comprehensively reflect the actual value of scientific research achievements. In recent years, third-party evaluation agencies have played an increasingly important role in the scientific research evaluation of private universities. Its independence and professionalism can provide objective and impartial reference for scientific research evaluation (Yan et al., 2023). For example, the research results of the tourism management major at Sanya University need to be verified for their value through market feedback from hotel industry partners. This multi-party participation evaluation mechanism requires private universities to establish a composite evaluation system of "market-oriented + academic recognition".

The dynamism of development stages. Tang (2013) proposed that private universities are mostly in the "connotation construction period", and their scientific research capabilities show an unbalanced development trend. Abramo and D'Angelo (2015) believed that their scientific research evaluation indicators would be dynamically adjusted according to the development stage of private universities and regional economic and social factors. For example, after Jilin International Studies University was granted the authority to confer master's degrees, its research evaluation shifted from a "quantity-oriented" to a "quality-oriented" approach, emphasizing international cooperation and interdisciplinary collaboration. In addition to traditional research evaluation indicators such as papers and patents, private universities will also add indicators such as the fit between research projects and local industries and the contribution of research results to the local economy. With the upgrading of local industries, Nanning University has adjusted the weight of high-tech achievement

transformation in scientific research evaluation accordingly. This stage characteristic requires the evaluation mechanism to have the ability to dynamically adjust.

2.4 Application of Data-driven Concept in the Scientific Research Evaluation System of Private Universities

The data-driven concept is applied to the management of scientific research input in private universities. The data-driven concept provides precise and dynamic decision support for the management of scientific research input in private universities. Wright (1980) argued that traditional research input allocation relies on empirical judgment, which can easily lead to resource misallocation. Private universities are limited by resource constraints and need to optimize resource allocation efficiency through data empowerment to achieve “maximum output of limited resources”. The European Commission's 2023 report shows that its “Open Science” data platform assisted funding decisions, combined with AI-based analysis of project proposals and historical data, have increased the expected outcome matching of research funding by approximately 15-20% (Moradi & Abdi, 2023). Altuntas and Dereli (2015) pointed out that, based on literature and patent citation network analysis, it is possible to effectively identify bottleneck areas in technology transformation and guide targeted input. In China, Xi’an Peihua University integrates historical data such as teacher research output and project conversion rate through a data platform, dynamically adjusts input weights based on subject development priorities, and improves the return on input in scientific research. Tan and Geng (2024) pointed out that data-driven budget allocation requires the construction of a three-dimensional model of “historical data + disciplinary planning + market demand” to avoid aimless input. The management of scientific research input is shifting from experience-driven to scientific decision-making, providing a critical path for enhancing innovation efficiency.

The data-driven concept is applied to the management of scientific research output in private universities. The data-driven concept provides a scientific and refined solution for the management of scientific research output in private universities (Zharova et al., 2023). Zhengzhou Sias College has achieved digital transformation of scientific research management through big data-driven innovation in scientific research governance. Scholars such as Chen and Huang (2023) have proposed to construct a diversified evaluation system through data-driven approaches, incorporating applied technological achievements, scientific and technological transformation, and other aspects into the evaluation scope. This will shift the focus of scientific research evaluation from a single quantitative approach to a combination of qualitative and

quantitative evaluations, resulting in an effective improvement in scientific research output. Zhejiang Shuren University utilizes a data platform to integrate research data such as projects, awards, and papers, and uses knowledge graph technology to explore the correlation between research directions of research teams, assisting in the development of differentiated incentive policies and achieving growth in high-impact output. Huanghe University of Science and Technology has established a digital portrait system for researchers, integrating 18 types of data, including paper citations, project participation, and social services, to customize personalized development paths for 326 teachers. This has increased the proportion of young teachers who have obtained national-level research projects from 12% to 31%. And through real-time tracking of output indicators such as citation volume and patent conversion rate of scientific research results through data platforms, private universities can timely grasp the dissemination and application of scientific research results, providing a strong basis for subsequent adjustments in scientific research direction and optimization of scientific research policies, and promoting the continuous advancement of scientific research output management in private universities to new heights (Jakovljevic et al., 2024).

The data-driven concept has a driving effect on the impact of private scientific research. The practice of Zhejiang Shuren University in 2023 shows that by establishing a "research efficiency dashboard" integrating 12 types of data such as project cycle, funding consumption, and enterprise feedback, the accuracy of project funding that meets regional industrial needs can be improved by 40%, and the annual growth rate of horizontal research funding can reach 25%. Not only that, Zhejiang Shuren University relies on a data platform to integrate data from more than 2300 scientific research projects in the past five years and uses knowledge graph technology to discover potential cooperation opportunities in the interdisciplinary field of "artificial intelligence + biomedicine". This has led to the output of 17 SCI highly cited papers by interdisciplinary teams, resulting in a 23-place increase in the university's international ranking in related fields. Xi'an Eurasia University has constructed an evaluation system that includes 12 indicators, such as technological maturity, market demand, and industry adaptability. Through dynamic evaluation of 138 patents, 27 achievements with high conversion potential have been selected, of which 6 have been industrialized and have driven a 65% increase in university enterprise cooperation projects. With the improvement of data governance capabilities, private universities are gradually breaking through resource barriers and forming research clusters with international visibility in specific fields.

2.5 Scientific Research Status of Nanning University

As one of the first pilot universities for applied technology universities in China and a newly established master's degree-granting unit in Guangxi, Nanning University fully implements the discipline construction model led by professors and supported by backbone. It revised its scientific research evaluation system twice, in 2021 and 2023, focusing on evaluating teachers' research abilities from multiple aspects, such as research projects, paper publications, patent applications, and research awards. The university encourages teachers to carry out scientific research projects with practical application value, emphasizing the practicality and innovation of scientific research results and paying special attention to the transformation and application effects of scientific research results in order to promote the industrialization process of scientific research results. In the past five years, the university has jointly built 22 scientific research platforms at or above the municipal level, with a cumulative input of 137.5 million yuan in scientific research funds. It has obtained 507 vertical projects at all levels, commissioned 606 horizontal scientific research projects by enterprises and institutions, published 2155 papers, and authorized 731 patents, as shown in Table 1. In the 2024 Soft Science China University Rankings, Nanning University ranks 24th among private universities in China and is the only Guangxi private university to enter the top 50 in the country.

Table 1. Scientific Research Data of Nanning University (2020-2024)

Primary indicator	Secondary indicator	Tertiary indicator	2020	2021	2022	2023	2024
Input	Manpower	Number of researchers	874	867	942	916	1,038
		Master's and doctoral personnel	331	374	471	519	679
		Senior professional title personnel	228	266	317	306	334
	Financial	Scientific research funding	11,227,500	30,550,200	39,091,100	46,335,000	47,791,030
		Vertical project funding	5,708,000	7,691,300	1,134,500	5,326,400	6,702,300
	Infrastructure	Value of scientific research equipment	164,394,700	191,771,400	226,273,200	235,542,300	270,401,900

Primary indicator	Secondary indicator	Tertiary indicator	2020	2021	2022	2023	2024
		Scientific research platforms at or above the municipal level	6	7	9	15	22
Output	Papers	Paper published	465	440	285	437	528
		High-level papers	82	84	119	155	177
		SCI	6	16	34	31	34
		SSCI	0	0	0	0	1
		EI	20	39	49	81	99
		Chinese core paper	56	29	36	43	43
	Patents	Authorized invention patents	50	66	24	13	19
		Authorized utility model patents	273	67	29	18	16
		Authorized design patents	122	8	22	4	0
	Vertical projects	National-level projects	0	0	0	0	3
		Provincial & ministerial-level projects	3	8	17	17	45
		City-level projects	42	62	87	73	138
		County-level project	1	3	2	1	5
Impact	Academic exchange	Academic lectures at all levels	34	35	21	58	71
		Number of teachers attending academic lectures	1,925	2,041	2,135	3,756	3,921
	Social services	Translation volume of patents	2	24	107	81	108
		Total amount of patent transformation	34,980	376,000	668,000	322,220	779,900
		Horizontal scientific research projects	2	66	189	169	180
		Funding of horizontal scientific research projects	263,800	7,318,200	24,607,300	28,474,800	29,069,900
	Science and technology awards	Number of provincial and ministerial level science and technology awards	1	0	0	1	5

Primary indicator	Secondary indicator	Tertiary indicator	2020	2021	2022	2023	2024
	Students' participation	Students' participation in scientific research projects	97	17	117	301	164
		Awards in subject competitions	330	511	685	851	961

2.6 Conceptual Framework

The conceptual framework of this study is based on the concept of data-driven approach, specifically exploring the interrelationships between three variables: scientific research input, output, and impact, in order to construct a more scientific and reasonable dynamic research performance evaluation system that is suitable for the characteristics of private universities.

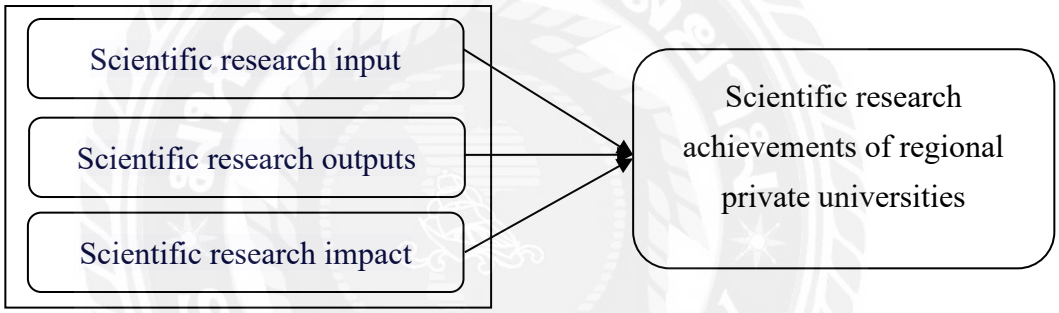

Figure 1. Conceptual Framework

Chapter 3 Research Methodology

3.1 Research Design

This study adopted a quantitative research approach, collecting the scientific research data of Nanning University over the past five years through the *Annual Report on Science and Technology Statistics of National Ordinary Higher Education Institutions* issued by the Chinese Ministry of Education and the scientific research management system of Nanning University. The data includes scientific research input (such as research funding, number and structure of research personnel, etc.), output (such as the quantity and quality of published papers, research project approval, etc.), and impact (such as academic exchanges, achievement transformation and application, etc.). The researcher imported these data into SPSS software for statistical analysis, used correlation and significance analysis to reveal the relationship between various indicators of scientific research performance evaluation, evaluated the rationality and effectiveness of the existing evaluation system, and explored the potential of data-driven application in scientific research evaluation. At the same time, by designing a survey questionnaire for researchers and research managers at Nanning University, an evaluation of the current research evaluation system was conducted to assess the rationality of evaluation indicators, the fairness of the evaluation process, and the application effect of evaluation results, providing supplementary information for subsequent analysis.

3.2 Population and Sample

The population in this study specifically referred to all scientific research activities and outputs of Nanning University from 2020 to 2024, as well as some experts and scholars in the field of scientific research evaluation. All scientific research activities and outputs include their researchers and research managers, as well as the achievements they produce in scientific research, technological development, social services, etc., such as scientific research projects, research funding, academic papers, patent applications and authorizations, academic lectures, etc.

The personnel sample mainly came from all scientific research personnel and research management personnel of Nanning University, among whom 418 are front-line research personnel (accounting for 89.7%), 36 scientific research management personnel (accounting for 7.73%), 10 experts and scholars in the field of scientific research evaluation (accounting for 2.15%), and 2 other management personnel (accounting for 0.42%).

3.3 Research Instrument

This study used a questionnaire as the main data collection tool.

The questionnaire design is based on the theoretical framework of scientific research performance evaluation, , as shown in Table 2, covering key dimensions including scientific research input (such as research funding, number and structure of research personnel), scientific research output (such as quantity and quality of paper publications, research project approval), and scientific research impact (such as academic exchange, achievement transformation and application). It focuses on the rationality of the evaluation system, the fairness of the evaluation process, and the application effect of the evaluation results. The questionnaire uses the Likert five-point rating scale (1 means strongly disagree, 5 means strongly agree) to record respondents' opinions and evaluations on various evaluation indicators, aiming to obtain subjective evaluations and opinions from researchers and research managers, ensuring the quantifiability and comparability of measurement results.

Table 2. Evaluation Items on the Current Scientific Research Evaluation System

Item	
Evaluation on the scientific research input	
1	I believe that Nanning University has sufficient input in research funding to meet the needs of scientific research.
2	I believe that the number and structure of researchers at Nanning University can meet the research needs.
3	I believe that Nanning University's input and maintenance of research equipment are sufficient and in place.
4	I believe that the research time of the researchers at Nanning University is fully guaranteed.
5	I think the research incentive mechanism at Nanning University is positive and motivating.
Evaluation on the scientific research output	
1	I believe that the number of papers published by researchers at Nanning University is in line with their actual research abilities.
2	I believe the quality of papers published by researchers at Nanning University is high.
3	I believe that Nanning University has achieved significant results in the establishment of scientific research projects.

4	I believe the number and level of research awards received by Nanning University are satisfactory.
5	I believe that the process of evaluating the output of scientific research projects at Nanning University (such as project initiation, paper publishing, etc.) is open and transparent.
Evaluation on the scientific research impact	
1	I believe Nanning University is active in academic exchanges.
2	I believe the transformation and application effect of scientific research achievements at Nanning University is significant.
3	I believe that the social impact of the scientific research achievements of Nanning University is significant.
4	I believe that the scientific research work of Nanning University has made significant contributions to regional economic development.
Comprehensive evaluation of scientific research evaluation system	
1	I believe that the current research evaluation system at Nanning University is reasonable and can comprehensively reflect the value of scientific research.
2	I believe that the current research evaluation system at Nanning University is fair and avoids administrative intervention.
3	I believe that the current research evaluation system of Nanning University has been effectively applied.
4	I believe that the current research evaluation system at Nanning University can help enhance the enthusiasm of researchers.
5	I believe that the evaluation results of Nanning University can be effectively used for resource allocation and professional title promotion.
6	I believe that the existing system of Nanning University is in line with its positioning as an applied research institution for private universities.

3.4 Reliability and Validity Analysis of the Scale

To ensure the reliability and effectiveness of the research tool, this study conducted reliability and validity analysis on the questionnaire.

This study used Cronbach's alpha coefficient to test the internal consistency reliability of the questionnaire, ensuring a high correlation between each dimension and

item, thereby ensuring the stability and reliability of the measurement results. The reliability analysis shows that the questionnaire as a whole and all dimensions have high internal consistency, as shown in Table 3.

Table 3. Reliability of Dimensions in the Questionnaire

Dimension	Cronbach's α	Reliability
Scientific research input	0.928	High internal consistency
Scientific research output	0.912	High internal consistency
Scientific research impact	0.935	High internal consistency
Evaluation system	0.946	High internal consistency

Validity analysis includes content validity and construct validity. In terms of content validity, the questionnaire design of this study was based on the theoretical framework of scientific research performance evaluation, covering key dimensions such as scientific research input, scientific research output, and scientific research impact. The questionnaire was reviewed by 10 experts and scholars in the field of scientific research evaluation, and 94% of the items were considered "highly relevant" by all experts, covering the research topic. The average score of the relevance of each item is 0.98 (>0.9 standard), as shown in Table 4.

Table 4. Expert Questionnaire Review Opinions

Dimension	Expert recognition rate	S-CVI/UA	S-CVI/Ave
Scientific research input	100%	1.00	1.00
Scientific research output	95%	0.95	0.98
Scientific research impact	100%	1.00	1.00
Evaluation system	90%	0.90	0.97
Overall questionnaire	96.25%	0.94	0.98

Structural validity was tested through factor analysis to assess the differentiation and aggregation between various dimensions of the questionnaire, ensuring that the questionnaire accurately reflects the key dimensions of scientific research performance evaluation. Through principal component analysis, three common factors were extracted, corresponding to scientific research input, output, and impact. It was found that the cumulative variance explained rate reached 82.5%, which is higher than the acceptance standard of 60%. The loadings of each item on the corresponding factor are

all greater than 0.7, and there is no cross-factor loading greater than 0.4, indicating that the questionnaire has good construct validity, as shown in Table 5 and Table 6.

Table 5. Factor Loading Matrix

Question		Scientific research input	Scientific research output	Scientific research impact	Commonality
Scientific research input	Q1	**0.832**	0.112	0.103	0.87
	Q2	**0.865**	0.078	0.095	0.89
	Q3	**0.791**	0.158	0.121	0.84
	Q4	**0.809**	0.132	0.089	0.86
	Q5	**0.847**	0.101	0.116	0.88
Scientific research output	Q1	0.105	**0.853**	0.092	0.82
	Q2	0.092	**0.891**	0.075	0.88
	Q3	0.121	**0.826**	0.143	0.85
	Q4	0.088	**0.802**	0.162	0.83
	Q5	0.103	**0.845**	0.116	0.86
Scientific research impact	Q1	0.095	0.092	**0.871**	0.88
	Q2	0.131	0.105	**0.827**	0.84
	Q3	0.078	0.143	**0.862**	0.87
	Q4	0.116	0.089	**0.891**	0.90
Evaluation system	Q1	0.102	0.118	**0.851**	0.87
	Q2	0.091	0.095	**0.892**	0.90
	Q3	0.088	0.103	**0.867**	0.88
	Q4	0.113	0.121	**0.839**	0.86
	Q5	0.105	0.097	**0.874**	0.89
	Q6	0.099	0.112	**0.828**	0.85
Eigenvalue		6.28	5.94	5.63	-
Variance explained rate		29.02%	27.45%	26.03%	**Total: 82.5%**

Table 6. Aggregate Validity Indicators

Dimension	Cronbach's α	Composite reliability	Average Variance Extraction
Scientific research input	0.928	0.931	**0.723**
Scientific research output	0.912	0.918	**0.705**
Scientific research impact	0.935	0.939	**0.739**
Evaluation system	0.946	0.949	**0.758**
Overall scale	0.968	-	-

3.5 Data Collection

The relevant data of scientific research output were obtained through the *Annual Report on Science and Technology Statistics of National Higher Education Institutions* by the Chinese Ministry of Education and the research management system of Nanning University.

The personnel sample mainly came from all scientific research personnel and research management personnel of Nanning University. The research population and management personnel of Nanning University were classified according to their educational background, degree, and professional title, and then a certain number of participants was selected from each stratum for questionnaire distribution to ensure sample coverage and validity of research results. This study distributed 550 survey questionnaires in a hierarchical manner through Questionnaire Star. Participants had two weeks to complete and return the questionnaire. As of the survey deadline, a total of 493 questionnaires were collected, of which 27 were excluded due to invalidity or incompleteness. Finally, 466 valid questionnaires were obtained, with a response rate of 89.64% and a valid questionnaire rate of 94.52%, indicating that participants actively participated in the relevant survey and provided a solid data foundation for the study, as shown in Table 7.

Table 7. Questionnaire Collection and Statistics

Category	Count	Percentage
Questionnaires distributed	550	——
Questionnaires returned	493	89.64%
Invalid/incomplete questionnaires	27	5.48%
Valid questionnaires	466	94.52%

3.6 Data Analysis

This study focused on data analysis from three aspects: descriptive statistics, inferential statistics, and qualitative data analysis.

This study conducted descriptive statistical analysis on the collected quantitative data to demonstrate the basic situation and distribution characteristics of Nanning University in terms of research input, output, and impact.

At the same time, this study used inferential statistical methods including correlation, significance, and analysis of variance (ANOVA) to analyze the relationships and differences between different variables, revealing the inherent connections and influencing mechanisms between various indicators of scientific research performance evaluation.

Finally, a content analysis was conducted on the survey data to extract the opinions and suggestions of researchers and research management personnel on the current research evaluation system, providing a subjective basis and in-depth insights for constructing a dynamic evaluation system. At the same time, combined with quantitative analysis results, the comprehensive revelation of the role path of research input-output impact in Nanning University provides strong support for proposing targeted policy optimization plans.

Chapter 4 Findings and Discussion

4.1 Findings

4.1.1 Basic Data Analysis

Scientific research input continues to grow. In terms of manpower input, the scale of scientific research personnel has steadily increased, and the growth rate of highly educated talents is significant. From Table 8, it can be seen that by 2024, the number of scientific researchers in the university will increase to 1038, an increase of 18.76%; the number of master's and doctoral personnel has increased by 105.14%, accounting for 65.4% by 2024. The number of senior professional title personnel also fluctuated and increased, indicating that human resources input has been continuously optimized. In terms of funding, there has been an explosive growth in research funding. By 2024, the total scientific research funding of the university will increase by 325.66%. The total amount of horizontal project funding increased from 263,800 yuan in 2020 to 29.4 million yuan in 2024, accounting for 61.5% of the total funding in 2024, becoming the dominant source of funding and a structural shift in funding input. In terms of facility input, the total value of scientific research equipment increased from 164 million yuan to 270 million yuan, an increase of 64.48%. The number of scientific research platforms increased by 13 between 2023 and 2024, achieving a leapfrog development in scientific research facility input.

Table 8. Scientific Research Input of Nanning University (2020 to 2024)

Secondary indicator	Tertiary indicator	2020	2024	Growth rate
Manpower	Number of researchers	874	1,038	18.76%
	Master's and doctoral personnel	331	679	105.14%
	Senior professional title personnel	228	334	46.49%
Financial	Scientific research funding	11,227,500	47,791,030	325.66%
	Vertical project funding	5,708,000	6,702,300	17.42%
Infrastructure	Value of scientific research equipment	164,394,700	270,401,900	64.48%
	Scientific research platforms at or above the municipal level	6	22	266.67%

Scientific research output levels are optimized. The quality of the paper has significantly improved. Although the total number of papers fluctuates in a "V" shape, high-quality papers continue to grow. High-level papers increased by 115.85%, SCI papers increased by 466.67%, and EI papers increased by 395%. Patent structure is also strategically adjusted. Due to the implementation plan of the Patent Quality Improvement Project in China, which clearly aims to improve the quality of patent examination and cultivate high-value core patents, the focus has shifted from quantity to quality. As a result, the number of patent applications significantly decreased, leading to a corresponding decrease in the number of patent authorizations. Moreover, the proportion of patent applications and authorizations focused more on invention patents increased significantly, from 11.35% to 54.29% of the total number of patents, and the patent structure has been optimized. Significant breakthroughs were made in scientific research projects, and the quantity and quality of vertical projects were improved. In 2024, national-level projects achieved zero breakthroughs, provincial- and ministerial-level projects surged 14 times, and municipal-level projects also increased by 228.57%, as shown in Table 9.

Table 9. Scientific Research Output of Nanning University (2020 to 2024)

Secondary indicator	Tertiary indicator	2020	2024	Growth rate
Papers	Paper published	465	528	13.55%
	High-level papers	82	177	115.85%
	SCI	6	34	466.67%
	SSCI	0	1	100%
	EI	20	99	395%
	Chinese core paper	56	43	↓
Patents	Authorized invention patents	50	19	↓
	Authorized utility model patents	273	16	↓
	Authorized design patents	122	0	↓
Vertical projects	National-level projects	0	3	300%
	Provincial & ministerial-level projects	3	45	1400.00%
	City-level projects	42	138	228.57%
	County-level project	1	5	400.00%

The impact of scientific research continues to soar. Academic exchange activity has increased. The number of academic lectures doubled from 34 per year to 71 per

year, with a 103.69% increase in teacher participation. The university will also begin hosting international academic conferences in 2024. The ability to provide social services has increased significantly. The number of patent conversions increased from only 2 in 2020 to 108 in 2024. The number of horizontal project items increased by 89 times (2 → 180 items), and the contract amount increased by 109 times (26.38 → 29.0699 million yuan). Student participation exhibits polarized characteristics. The number of awards in subject competitions continued to increase by 191.21% (330 → 961). The participation of students in scientific research fluctuated greatly, with a sharp drop to 17 in 2021 and a surge to 301 in 2023, as shown in Table 10.

Table 10. Scientific Research Impact of Nanning University (2020 to 2024)

Secondary indicator	Tertiary indicator	2020	2024	Growth rate
Academic exchange	Academic lectures at all levels	34	71	108.82%
	Number of teachers attending academic lectures	1,925	3,921	103.69%
Social services	Translation volume of patents	2	108	5300%
	Total amount of patent transformation	34,980	779,900	2129.56%
	Horizontal scientific research projects	2	180	8900%
	Funding of horizontal scientific research projects	263,800	29,069,900	10919.67%
Science and technology awards	Number of provincial and ministerial level science and technology awards	1	5	400%
Students' participation	Students' participation in scientific research projects	97	164	69.07%
	Awards in subject competitions	330	961	191.21%

The above data shows that the indicators of applied scientific research at Nanning University (horizontal funding/patent conversion/horizontal projects) have shown exponential growth, with horizontal projects increasing by 8900%, horizontal funding increasing by 10919.67%, and patent conversion increasing by 2129.56%. High-quality achievements (high-level papers/provincial and ministerial-level projects) and talent

input show synchronous and steady growth (average annual growth rate > 20%). The distribution of these data clearly reflects the development trajectory of scientific research at Nanning University: from accumulating basic research capabilities (2020-2021) to transforming into applied scientific research (2022-2024), forming a characteristic development path of “talent-driven application transformation social services”.

4.1.2 Correlation Analysis

Firstly, a correlation analysis of primary indicators was conducted. The primary indicators were paired pairwise to form three indicator pairs, and obtain the correlation coefficient r and P values (*P<0.05, ** P<0.01). According to the comparison in Table 11, for every 1 unit increase in scientific research input, scientific research output increases by 0.85 units and scientific research impact increases by 0.92 units, verifying the positive driving effect of scientific research input on output and impact. For every 1 unit increase in scientific research output, the scientific research impact increases by 0.9 units, verifying the positive driving effect of output on impact.

Table 11. Correlation Analysis of Primary Indicators

Indicators pairwise	Correlation coefficient r	P value	Correlation strength
Input VS output	0.85*	0.032	Highly positively correlated
Input VS impact	0.92**	0.009	Extremely strong positive correlation
Output VS impact	0.90**	0.015	Extremely strong positive correlation

Next, this study conducted a correlation analysis of key tertiary indicators. As shown in Table 12, the correlation coefficient of the number of master’s and doctoral personnel to the number of high-level papers in terms of talent input and paper quality is r=0.965**, p=0.008. The correlation coefficient between the coefficient of senior professional titles and the number of SCI papers published is r=0.985**, p=0.002. The above data indicates that the number of high-level talents directly determines the quality of papers, and an increase in the number of master's and doctoral personnel leads to a 96% variation in high-level papers (R^2=0.96). In terms of funding input and achievement transformation, the correlation coefficient between the total amount of scientific research funding and the total amount of patent transformation is r=0.886*, p=0.046. The correlation coefficient of horizontal project funding to patent technology conversion is r=0.934*, p=0.02. The study found that for every 1 million yuan increase

in horizontal project funding, the average number of patent conversions increased by 8.7 (β=0.087). In terms of facility input and project approval, the correlation coefficient of the total value of scientific research equipment to the number of provincial and ministerial-level projects is r=0.924*, p=0.025, and the correlation coefficient of the number of scientific research platforms to the number of academic lectures hosted is r=0.899*, p=0.016. Research has found that applied scientific research indicators such as horizontal funding and achievement transformation in Nanning University have achieved explosive growth, and are strongly linked to input in talent and scientific research platforms, reflecting the success of the university's "application-oriented" scientific research performance evaluation model, which strongly supports Nanning University's title as one of the first pilot universities for applied technology in China.

Table 12. Correlation Analysis of Key Tertiary Indicators

Indicators	5-year growth rate	Core Associated indicators	Correlation coefficient r / p value
Master's and doctoral personnel	105%↑	High-level papers	0.965** / 0.008
Senior professional title personnel	46.49%↑	SCI	0.985** / 0.002
Scientific research funding	325.66%↑	Total amount of patent transformation	0.886* / 0.046
Funding of horizontal projects	10919.67%↑	Total amount of patent transformation	0.934* / 0.02
Value of scientific research equipment	64.48%↑	Provincial & ministerial-level projects	0.924* / 0.025
Scientific research platforms	267%↑	Academic lectures at all levels	0.899* /0.016

Finally, this study conducted elasticity coefficient analysis of input, output, and impact. Nanning University has revised and implemented research incentive policies twice, in 2021 and 2024, increasing research input, optimizing research allocation, and emphasizing the quality of research results. Data shows that between 2020 and 2024, the elasticity coefficient of research input and output continued to increase, reaching 0.92 in 2024, indicating that the efficiency of resource allocation has been optimized.

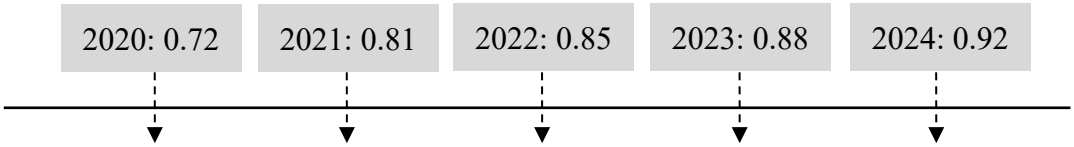

Figure 2 Changes in Research Input-output Elasticity Coefficient (2020-2024)

4.1.3 Descriptive Statistical Analysis

This study conducted surveys with frontline teachers (89.7%), senior researchers (45.28% with over 5 years of experience), doctors (56.65%), and masters (36.7%) as the main population, and a total of 466 valid questionnaires were collected.

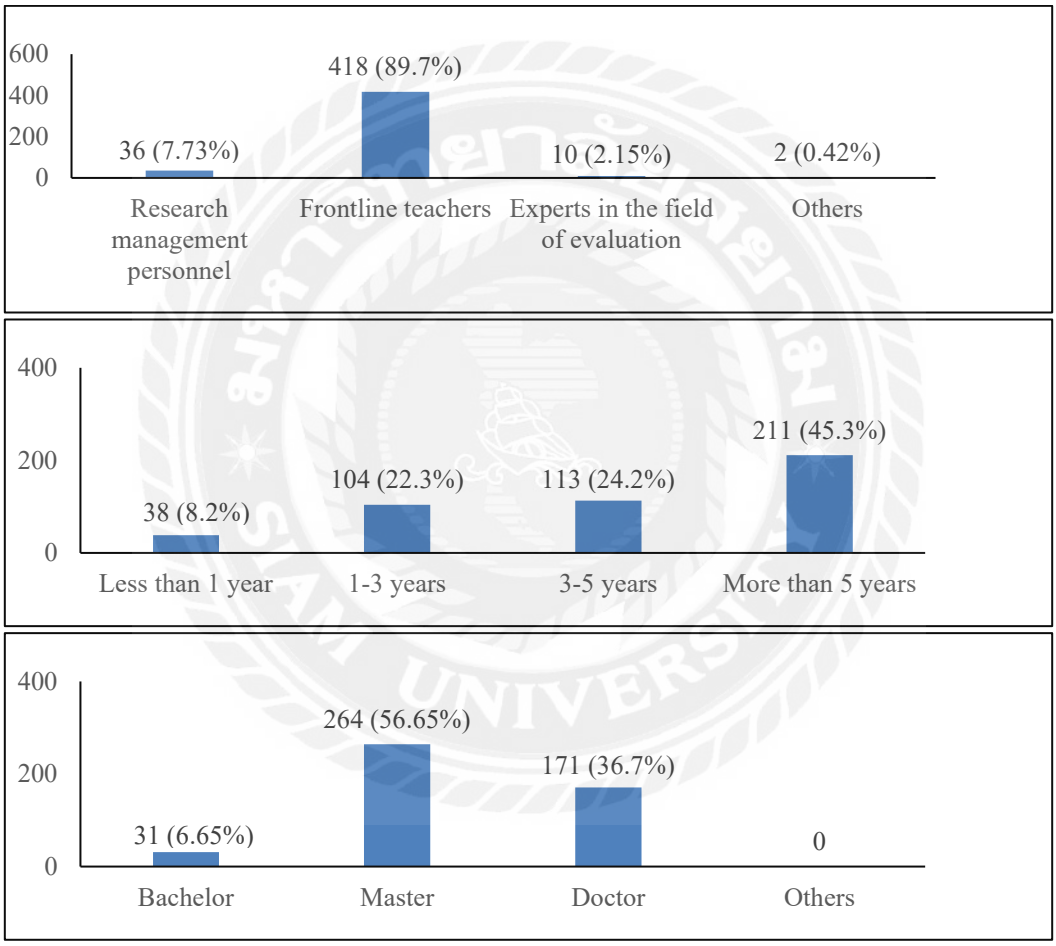

Figure 3 Distribution of Basic Characteristics of Samples

In terms of scientific research input, the survey results in Table 13 show that respondents generally believe that Nanning University's input in research funding and the number and structure of research personnel are sufficient and reasonable. Specifically, the average score for research funding input reached 4.42, indicating that the majority of respondents (95.28% agree or strongly agree) believe that Nanning University's input in research funding can meet research needs. The average score of

the number and structure of scientific researchers is the highest within the evaluation content, at 4.5, indicating the satisfaction of respondents with the scientific research team (95.7% agree or strongly agree). The average score for the research equipment input and maintenance adequacy is 4.37 (the lowest within the evaluation content), but the positive evaluation rate is as high as 98.50%, with only 1.07% holding a negative attitude, indicating that the vast majority of respondents recognize the adequacy of equipment investment and maintenance, and some engineering disciplines have raised demands for high-end instruments and equipment. The average score for the adequate guarantee of research time is 4.48, with a positive evaluation rate of 96.36%, reflecting the reasonable arrangement of research time by university teachers. The average score for the research incentive mechanism mobilization is 4.43, with a positive evaluation rate of 96.35% and no negative evaluations, indicating that the incentive mechanism is recognized by all staff for its positivity. It is the only indicator in the evaluation content with no objections. These data reflect the effectiveness of Nanning University in allocating scientific research resources, providing a solid foundation for the smooth implementation of scientific research activities.

Table 13. Descriptive Statistical Analysis of Scientific Research Input

Evaluation content	**Average score**	**Agree or strongly agree**	**Neutrality rate**	**Disagree or strongly disagree**
Adequacy of research funding input	4.42	95.28%	3.65%	1.07%
The rationality of the number and structure of scientific researchers	4.50	95.70%	3.00%	1.28%
Research equipment input and maintenance adequacy	4.37	98.50%	0.43%	1.07%
Adequate guarantee of research time	4.48	96.36%	2.79%	0.85%
Research incentive mechanism mobilization	4.43	96.35%	3.65%	0%

Comprehensive dimension	**4.44**	**96.44%**	**2.70%**	**0.85%**

In terms of scientific research output, the survey results also show a high level of recognition from respondents towards Nanning University. In Table 14, the average scores for the quantity and quality of published papers are 4.47 and 4.41, respectively, indicating that respondents generally believe that the papers published by researchers at Nanning University are in line with their actual research abilities and are developing towards high quality. The average score for scientific research project approval is 4.7, highlighting the outstanding achievements of the university in project cultivation and application support (98.71% agree or strongly agree). In addition, the average score of the number and level of scientific research awards has reached 4.55, further verifying the excellent performance of Nanning University in scientific research output (95.71% agree and strongly agree).

Table 14. Descriptive Statistical Analysis of Scientific Research Output

Evaluation Content	Average score	Agree or strongly agree	Neutrality rate	Disagree or strongly disagree
The number of published papers meets the research capability	4.47	95.71%	4.08%	0.21%
Quality of paper	4.41	95.71%	3.22%	1.07%
Evaluation of research project achievements	4.70	98.71%	1.07%	0.21%
Satisfaction with the scientific research awards	4.55	95.71%	3.86%	0.43%
Comprehensive dimension	**4.53**	**96.31%**	**3.06%**	**0.48%**

In terms of scientific research impact, the survey results show that Nanning University has also achieved significant results in academic exchanges, achievement transformation, and application. In Table 15, the average score for academic exchanges is 4.45, indicating that respondents believe that Nanning University is active in

academic exchanges (96.36% agree or strongly agree). The average scores for the application effect and social impact of achievement transformation are 4.46 and 4.48, respectively. The average score for the contribution of scientific research work to regional economic development has also reached 4.57, indicating that the scientific research work of Nanning University has a significant promoting effect on regional economic development (98.71% agree or strongly agree), reflecting the positioning and implementation of "applied scientific research" at Nanning University and providing empirical cases for private universities to serve local development. 5.15% of respondents hold a neutral attitude towards the social impact of universities and believe that universities need to strengthen the promotion of their achievements.

Table 15. Descriptive Statistical Analysis of Scientific Research Impact

Evaluation Content	**Average score**	**Agree or strongly agree**	**Neutrality rate**	**Disagree or strongly disagree**
Academic exchange activity	4.45	96.36%	3.43%	0.21%
Application effect of achievement transformation	4.46	96.78%	2.36%	0.86%
Social impact of scientific research achievements	4.48	94.85%	5.15%	0%
Contribution of scientific research to regional economy	4.57	98.71%	1.29%	0%
Comprehensive dimension	**4.49**	**96.68%**	**3.06%**	**0.27%**

In terms of the scientific research evaluation system, the survey results show that respondents generally believe that the current scientific research evaluation system of Nanning University is reasonable and fair, and the results have been effectively applied. In Table 16, the rationality of the evaluation system received 95.07% support, the fairness of the process reached 98.5% (with no "disagree"), and the mechanism to avoid

administrative intervention was trusted. In addition, 95.50% believe that the evaluation results have been effectively applied, 96.14% believe that the system enhances research enthusiasm, and 95.49% believe that the evaluation system is conducive to resource allocation and professional title promotion, which also confirms the effective connection between “data-driven” and “result application”. 95.92% of the recognition system conforms to the positioning of “private application-oriented universities”, and the comprehensive effectiveness of the scientific research evaluation system has a support rate of 96.1%, highlighting the consistency between the evaluation criteria and the school's development goals.

Table 16. Descriptive Statistical Analysis of Scientific Research Evaluation System

Evaluation Content	**Average score**	**Agree or strongly agree**	**Neutrality rate**	**Disagree or strongly disagree**
Reasonability of evaluation system	4.39	95.07%	4.51%	0.43%
Fairness of evaluation process	4.48	98.50%	1.50%	0%
Evaluate the effectiveness of the application results	4.40	95.50%	4.51%	0%
The role of the system in enhancing research enthusiasm	4.54	96.14%	3.65%	0.21%
The results applied to resource allocation and professional title promotion	4.42	95.49%	4.29%	0.21%
The system conforms to the university’s position	4.43	95.92%	4.08%	0%
Comprehensive dimension	4.44	96.10%	3.76%	0.14%

In summary, Nanning University has achieved significant results in scientific research input, output, impact, and scientific research evaluation system, and has been

widely recognized by the respondents. These data provide strong empirical support for the construction of a data-driven evaluation system for scientific research performance of regional private universities, and also provide important references for further optimizing the research management system and improving scientific research performance of Nanning University.

4.1.4 Volatility Indicators Analysis

The total number of published papers dropped sharply to 285 in 2022, forming a clear valley. The total number of authorized invention patents also has abnormally declined after 2022, from 67 in 2021 to 16 in 2024, indicating a cliff-like decline in invention activities. The number of students participating in projects has also fluctuated sharply in 2021 and 2023, revealing an extremely unstable state of scientific research participation. Although the P-values of these three indicators are less than 0.05, their dispersion is high, as shown in Table 17.

Table 17. Volatility Index (P<0.05 but high dispersion)

Indicator	ANOVA（F）	P value	Volatility
Paper published	6.87	0.022*	65 articles in 2021 → 285 articles in 2022
Authorized invention patents	7.25	0.018*	67 in 2021 →29 in 2022 →18 in 2023 →16 in 2024
Students' participation in scientific research projects	5.92	0.031*	97 in 2020 → 17 in 2021 →117 in 2022 →301 in 2023 →164 in 2024 Severe fluctuations in 2021/2023

In addition, there have been abnormal fluctuations in the vertical project funding indicators, Chinese core paper indicators, and design patent authorization indicators, as shown in Table 18.

Table 18. Non-significant Indicators (P>0.05 but high dispersion)

Indicator	ANOVA（F）	P value	Volatility
Vertical project funding	2.15	0.178	Cliff Descent in 2022
Chinese core paper	1.83	0.236	Valley value in 2021
Authorized design patents	0.97	0.482	Unauthorized in 2024

4.2 Discussion

Nanning University revised its scientific research performance evaluation system in 2021, shifting from emphasizing the quantity of published papers to emphasizing the quality of published papers, which directly led to a decline in the total number of published papers for that year. Moreover, the university's performance evaluation system has shifted its scientific resource input and placed more emphasis on the publication of high-level research papers in foreign languages. Teachers have also invested more in the publication of SCI and EI papers, which directly affects the publication volume of the Chinese core journals by Peking University.

In addition, Nanning University strengthens patent standardization examination and quality control, shifting the focus of applications from utility model patents and design patents to invention patents, and emphasizing the cultivation of high-value patents. Although patent authorization and funding have shown negative growth, the amount of achievement conversion has increased by 50 times, which to some extent reflects the improvement of patent quality.

The sharp decline in funding for longitudinal research projects in 2022 is mainly due to policy adjustments made by the university, shifting the focus of scientific research from basic research to applied research.

The fluctuation in the number of students participating in projects is due to the university's encouragement and promotion of students' active participation in subject competitions, which affects their research time.

Chapter 5 Conclusion and Recommendation

5.1 Conclusion

This study reveals the close relationship between scientific research input, output, and impact through in-depth analysis of the scientific research performance of Nanning University. The correlation analysis of primary indicators shows that scientific research input has a significant positive driving effect on both research output and impact. For every 1 unit increase in scientific research input, research output increases by 0.85 units and research impact increases by 0.92 units, highlighting the importance of increasing research input in improving overall research performance. In the analysis of key tertiary indicators, the study found that the number of high-level talents directly determines the quality of papers, and the increase in the number of master's and doctoral personnel significantly drives the output of high-level papers. There is a significant positive correlation between funding input and achievement transformation, and the increase in horizontal project funding effectively promotes the amount and value of patent technology transformation. In addition, the strong correlation between the total value of scientific research equipment and the number of provincial and ministerial-level projects, as well as the number of scientific research platforms and national-level projects, further emphasizes the key role of facility input in the establishment of scientific research projects. It is particularly worth mentioning that the increase in the number of student participation projects has a significant moderating effect on the promotion of research input and influence, indicating that strengthening student research participation is of great significance for enhancing overall research impact. This study validated the positive driving effect of research input on research output and impact through data analysis and revealed the intrinsic connections between various key indicators.

Meanwhile, through research and interviews with frontline teachers and senior researchers, this study found that Nanning University has achieved significant results in scientific research input, research output, research impact, and scientific research evaluation system and has been widely recognized by the respondents. The scientific research evaluation system of Nanning University is in line with its positioning as a "private application-oriented university", and its evaluation criteria are consistent with the university's development goals.

5.2 Recommendation

This study proposes the following suggestions from three aspects: scientific research input, scientific research output, and scientific research impact, in order to better improve the level and quality of research performance and achievements of private universities.

Increase input in scientific research in private universities. This study suggests that the government and private universities further increase their input in scientific research, especially in basic research, to provide stable financial support for scientific research activities. Basic research is the source of scientific innovation, and providing stable funding support for scientific research activities is the key to promoting scientific progress. At the same time, private universities should optimize their funding allocation mechanism, encourage researchers to apply for research projects, strive for more funding support for research projects, and then promote the scientific research output. In addition, private universities should strengthen the introduction and training of master's, doctoral, or senior professional title personnel, providing them with research start-up funds and broad career development platforms. Private universities should also focus on cultivating future research leaders and injecting new vitality into their scientific research endeavors.

Reform the evaluation system for scientific research achievements. The reform of the evaluation system is crucial for improving the research performance of regional private universities. This study suggests establishing an evaluation system with scientific research quality and innovation capability as the core orientation, reducing excessive reliance on quantitative indicators, paying more attention to the academic value and social influence of research results, and motivating researchers to pursue higher-level research achievements. At the same time, a dynamic evaluation mechanism should be introduced to encourage long-term and in-depth research work, avoid short-term achievement-oriented scientific research behavior, and ensure the continuity and depth of scientific research work. In addition, it is recommended to introduce international peer review to improve the objectivity and internationalization of evaluation, promote the scientific research level of private universities to be in line with international standards, and further enhance their scientific research strength and international influence.

Promote the improvement of scientific research impact through policies. This study suggests that private universities should increase their efforts in hosting and participating in international and domestic academic conferences, regularly invite

renowned scholars to give academic lectures, and encourage teachers to actively participate in high-level academic conferences at home and abroad in order to broaden their academic horizons and improve the quality and frequency of academic exchanges. At the same time, private universities should strengthen the transformation and application of patented technological achievements, and establish a closer mechanism for university-enterprise cooperation. Private universities should expand the scope of undertaking horizontal projects commissioned by enterprises and institutions, increase project contract amounts, enhance social service capabilities, and then realize the economic and social value of scientific research achievements. Finally, a more comprehensive student research participation system should be established to increase opportunities for students to participate in teacher research projects. By setting up student research assistant positions, research scholarships, and other means, students should be encouraged to actively participate in research activities and subject competitions, improve the quantity and quality of awards in student subject competitions, and further demonstrate students' research strength and the university's research impact.

5.3 Further Study

More studies can further deepen the application of data-driven scientific research performance evaluation in regional private universities. Specifically, future research may expand the research sample range to include more similar private universities in central and western China, in order to verify the universality and effectiveness of the evaluation system constructed in my study. At the same time, more advanced machine learning algorithms (such as the random forests) are introduced to process multi-source heterogeneous scientific research data, dynamically adjust the weights of evaluation indicators, improve the sensitivity and explanatory power of the system to abnormal fluctuations (such as sudden drops in patent authorization), and optimize the prediction accuracy of the evaluation model. In addition, research should further explore the differences in scientific research performance evaluation in different disciplinary fields, providing a basis for developing more targeted evaluation strategies. Ultimately, through continuous tracking and evaluation, the evaluation system will be continuously improved and optimized to achieve overall improvement in the scientific research performance of regional private universities.

References

Abramo, G., & D'Angelo, C. A. (2015). Evaluating university research: Same performance indicator, different rankings. *Journal of Informetrics*, *9*(3), 514-525.

Altuntas, S., & Dereli, T. (2015). A novel approach based on DEMATEL method and patent citation analysis for prioritizing a portfolio of investment projects. *Expert systems with Applications*, *42*(3), 1003-1012.

Bititci, U., Garengo, P., Dörfler, V., & Nudurupati, S. (2012). Performance measurement: challenges for tomorrow. *International Journal of Management Reviews*, *14*(3), 305-327.

Brunner, D., Legat, C., & Seebacher, U. (2024). Towards next generation data-driven management. *Collective Intelligence: The Rise of Swarm Systems and their Impact on Society*, 152.

Boran, G. S. (2018). Effect of research engagement on EFL teachers' motivation for and efficacy in teacher-research. *Education & Science/Egitim ve Bilim*, *43*(195).

Boztaş, G. D., Berigel, M., & Altınay, F. (2024). A bibliometric analysis of educational data mining studies in global perspective. *Education and Information Technologies*, *29*(7), 8961-8985.

Blalark, F. J. (2012). *Utilizing principal-agent theory and data envelopment analysis to examine efficiency of resource utilization in undergraduate education for public and private non-profit four-year research universities*. University of Minnesota.

Casani, F., De Filippo, D., García-Zorita, C., & Sanz-Casado, E. (2014). Public versus private universities: Assessment of research performance; case study of the Spanish university system. *Research Evaluation*, *23*(1), 48-61.

Ceruzzi, P. E. (2003). *A history of modern computing*. MIT press.

Cao, P. (2023). Research on the optimization of performance oriented university research management model under the background of "Breaking the Five Only". *Heilongjiang Education (Research and Evaluation of Higher Education)*, (03), 35-37.

Chaudhuri, S., & Dayal, U. (1997). An overview of data warehousing and OLAP technology. *ACM Sigmod Record*, *26*(1), 65-74.

Chen, S. H., Yang, C. C., & Shiau, J. Y. (2006). The application of balanced scorecard in the performance evaluation of higher education. *The TQM Magazine*,

18(2), 190-205.

Chen, Y. S., & Huang, Y. T. (2023). Visualization research of scientific research achievements evaluation in private colleges and universities by data. *Advances in Social Sciences, 12*(3), 1229-1237.

Chourasia, R. (2025). RTASM: An AI-driven real-time adaptive streaming model for zero-latency big data processing. *International Journal of Advanced Research in Science, Communication and Technology*, *5*(1), 39-48.

Cooper, B. L., Watson, H. J., Wixom, B. H., & Goodhue, D. L. (2000). Data warehousing supports corporate strategy at First American Corporation. *MIS Quarterly*, 547-567.

Dol, S. M., & Jawandhiya, P. M. (2023). Classification technique and its combination with clustering and association rule mining in educational data mining—A survey. *Engineering Applications of Artificial Intelligence*, *122*, 106071.

Eboigbe, E. O., Farayola, O. A., Olatoye, F. O., Nnabugwu, O. C., & Daraojimba, C. (2023). Business intelligence transformation through AI and data analytics. *Engineering Science & Technology Journal*, *4*(5), 285-307.

Feist, G. J. (1997). Quantity, quality, and depth of research as influences on scientific eminence: Is quantity most important? *Creativity Research Journal*, *10*(4), 325-335.

Gerhardt, T., & Karsan, S. (2022). Talent management in private universities: The case of a private university in the United Kingdom. *International Journal of Educational Management*, *36*(4), 552-575.

Gillies, J., & Cailliau, R. (2000). *How the web was born: The story of the world wide web*. Oxford University Press, USA.

Gingras, Y. (2016). Bibliometrics and research evaluation: Uses and *abuses*. Mit Press.

Gott, R., & Duggan, S. (2002). Problems with the assessment of performance in practical science: which way now? *Cambridge Journal of Education*, *32*(2), 183-201.

Griliches, Z. (1979). Issues in assessing the contribution of research and development to productivity growth. *The Bell Journal of Economics*, 92-116.

Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, *4*(4), 134-147.

Hamann, J. (2016). The visible hand of research performance assessment. *Higher Education, 72*, 761-779.

Hazelkorn, E. (2009). *Impact of global rankings on higher education research and the production of knowledge*. N.P.

Hristova, I. (2024). Optimizing cloud data management with Ai-driven solutions. In *Conferences of the department Informatics* (No. 1, pp. 162-168). Publishing house Science and Economics Varna.

Jakovljevic, M., Deceuninck, P., Pistollato, F., Daskalopoulos, E., Bernasconi, C., Carausu, F., ... & Krstic, K. (2024). Return on investment in science: Twenty years of European Commission funded research in Alzheimer's dementia, breast cancer and prostate cancer. *Cost Effectiveness and Resource Allocation*, *22*(1), 51.

Jiang, X. J. (2015). Jianqiao University: Exploration of the "Transformation and Development, Leading Breakthrough" of private universities. *Shanghai Education,* (01), 34-37.

Johnes, J., & Li, Y. U. (2008). Measuring the research performance of Chinese higher education institutions using data envelopment analysis. *China economic review*, *19*(4), 679-696.

Kostakis, P., & Kargas, A. (2021). Big-data management: A driver for digital transformation? *Information*, *12*(10), 411.

Levy, D. C. (2011). Public policy for private higher education: A global analysis. *Journal of Comparative Policy Analysis: Research and Practice*, *13*(4), 383-396.

Liu, M. Z. (2025). Research on the capacity of Guangxi Private Universities to serve local economic and social development under the background of education digital transformation. *Origins,* (08), 110-113.

Luo, Z. (2022). The role of the scientific research platform of private undergraduate universities in improving the quality of talent cultivation. *Advances in Education, Humanities and Social Science Research*, *1*(2), 371-371.

Moradi, S., & Abdi, S. (2023). Open science–related policies in Europe. *Science and Public Policy*, *50*(3), 521-530.

O'Driscoll, A., Daugelaite, J., & Sleator, R. D. (2013). 'Big data', Hadoop and cloud computing in genomics. *Journal of biomedical informatics*, *46*(5), 774-781.

Othman, R., & Othman, R. (2014). Higher education institutions and social performance: Evidence from public and private universities. *International Journal of Business & Society*, *15*(1).

Pan, H. R. (2021). The current situation and countermeasures of technology achievement transformation in private universities: A case study of

Guangzhou Xinhua University. *Ability and Wisdom,* (16),166-168.

Papadopoulos, D., & Hossain, M. M. (2023). Education in the age of analytics: maximizing student success through big data-driven personalized learning. *Emerging Trends in Machine Intelligence and Big Data*, *15*(9), 20-36.

Rabelo, A., Rodrigues, M. W., Nobre, C., Isotani, S., & Zárate, L. (2024). Educational data mining and learning analytics: A review of educational management in e-learning. *Information Discovery and Delivery*, *52*(2), 149-163.

Pearson, E. S. (1938). *Karl Pearson: An appreciation of some aspects of his life and work*. Cambridge University Press.

Peris-Ortiz, M., García-Hurtado, D., & Devece, C. (2019). Influence of the balanced scorecard on the science and innovation performance of Latin American universities. *Knowledge Management Research & Practice*, *17*(4), 373-383.

Qureshi, H. (2025). AI for predictive analytics: Transforming business strategies with intelligent systems. *Journal of AI Range*, *2*(1), 23-33.

Ravindranathan, M. K., Vadivu, D. S., & Rajagopalan, N. (2024). Cloud-driven machine learning with AWS: A comprehensive review of services. In *2024 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE)* (pp. 1-8). IEEE.

Silberschatz, A., Stonebraker, M., & Ullman, J. (Eds.). (1991). Database systems: Achievements and opportunities. *Communications of the ACM*, *34*(10), 110-120.

Shafiq, D. A., Marjani, M., Habeeb, R. A. A., & Asirvatham, D. (2022). Student retention using educational data mining and predictive analytics: A systematic literature review. *IEEE Access*, *10*, 72480-72503.

Sharif, S., Braimah, M., & Dogbey, A. E. (2023). Academic supports, motivation to learn, motivation to transfer and transfer of training: A comparative analysis of public and private universities. *European Journal of Training and Development*, *47*(5/6), 507-532.

Sun, C. C. (2010). A performance evaluation model by integrating fuzzy AHP and fuzzy TOPSIS methods. *Expert Systems with Applications*, *37*(12), 7745-7754.

Tan, H. B & Geng, Z. C. (2024). Data driven new quality productivity: Theoretical logic, practical challenges, and promotion path. *Price: Theory & Practice,* (05), 39-44.

Tang, J. H. (2006). *Study on the science research evaluation system and application of university* (Master's thesis, Hunan University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD0506&filename=2006131171.nh

Tang, T. L. P., Tang, D. S. H., & Tang, C. S. Y. (2004). College tuition and perceptions of private university quality. *International Journal of Educational Management*, *18*(5), 304-316.

Tang, Y. (2013). *Research on the demand of private higher education in Zhejiang Province* (Master's thesis, Zhejiang University of Technology**).** https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201401&filename=1013364910.nh

Teixeira, P., & Amaral, A. (2001). Private higher education and diversity: An exploratory survey. *Higher Education Quarterly*, *55*(4), 359-395.

Thomson, T. (2011). *History of the royal society: From its institution to the end of the Eighteenth Century*. Cambridge University Press.

Towne, L., & Shavelson, R. J. (Eds.). (2002). *Scientific research in education*. National Academies Press.

Van Raan, A. F. (1993). Advanced bibliometric methods to assess research performance and scientific development: basic principles and recent practical applications. *Research Evaluation*, *3*(3), 151-166.

Van Raan, A. F. (2014). Advances in bibliometric analysis: Research performance assessment and science mapping. *Bibliometrics Use and Abuse in the Review of Research Performance*, *87*(4), 17-28.

Wang, Y. Q. (2021). *Research on the regional equilibrium of the allocation of higher education financial resources in China* (Doctoral dissertations, Central University of Finance and Economics). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2023&filename=1021644020.nh

Weinberg, B. A., Owen-Smith, J., Rosen, R. F., Schwarz, L., Allen, B. M., Weiss, R. E., & Lane, J. (2014). Science funding and short-term economic activity. *Science*, *344*(6179), 41-43.

Wright, B. D. (1980). *The resource allocation problem in research and development (Center Discussion Paper No. 353)*. Yale University Economic Growth Center.

Yan, Q., Xu, X. Y., Hu, Y. D., Ma, M. & Hu, X. (2023). *Research on the Evaluation Index System and Operating Mechanism of Research Integrity in Anhui Province*. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=SNAD&filename=SNAD000002041218.

Yuksel, B. B., & Metin, A. Y. (2025, May 22). *Data-driven breakthroughs and future directions in AI infrastructure: A comprehensive review* [Preprint]. arXiv. https://doi.org/10.48550/arXiv.2505.16771

Zhang, Y. (2014). *Research on the education resource integration of private higher education institutions in Guangxi* (Master's thesis, Guangxi University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201501&filename=1014379603.nh

Zharova, A., Härdle, W. K., & Lessmann, S. (2023). Data-driven support for policy and decision-making in university research management: A case study from Germany. *European Journal of Operational Research*, *308*(1), 353-368.

Appendix

Survey Questionnaire: Evaluation on the current scientific research evaluation system of Nanning University

Part 1 Basic information

1. Your identity is_____.

a) University scientific research management personnel

b) Frontline teachers in Nanning University (including research positions)

c) Experts and scholars in the field of scientific research evaluation

2. The time you have been engaged in scientific research management or scientific research work is_____.

a) Less than 1 year

b) 1-3 years

c) 3-5 years

d) More than 5 years

3. Your educational background and degree is_____.

a) Undergraduate

b) Master

c) Doctor

4. Your professional title is_____.

a) Professor/Researcher/Other Senior Professional Titles

b) Associate Professor/Associate Researcher/Other Associate Senior Titles

c) Lecturer/Assistant Researcher/Other Intermediate Professional Titles

d) Teaching assistant/research intern/other junior professional titles

e) No professional title

5. Your subject is_____.

a) Engineering

b) Science and Technology

c) Humanities and Social Sciences

d) Management

The following questionnaire used Likert scale, ranging from 1 to 5, in which 1=Strongly disagree, 3=neutral, 5=Strongly agree.

Part 2 Evaluation on the current scientific research evaluation system

Items		Alternative Answer				
Evaluation on the scientific research input		1	2	3	4	5
1	I believe that Nanning University has sufficient input in research funding to meet the needs of scientific research.					
2	I believe that the number and structure of researchers at Nanning University can meet the research needs.					
3	I believe that Nanning University's input and maintenance of research equipment are sufficient and in place.					
4	I believe that the research time of the researchers at Nanning University is fully guaranteed.					
5	I think the research incentive mechanism at Nanning University is positive and motivating.					
Evaluation on the scientific research output						
1	I believe that the number of papers published by researchers at Nanning University is in line with their actual research abilities.					
2	I believe the quality of papers published by researchers at Nanning University is high.					
3	I believe that Nanning University has achieved significant results in the establishment of scientific research projects.					
4	I believe the number and level of research awards received by Nanning University are satisfactory.					
5	I believe that the process of evaluating the output of scientific research projects at Nanning University (such as project initiation, paper publishing, etc.) is open and transparent.					
Evaluation on the scientific research impact						

1	I believe Nanning University is active in academic exchanges.					
2	I believe the transformation and application effect of scientific research achievements at Nanning University is significant.					
3	I believe that the social impact of the scientific research achievements of Nanning University is significant.					
4	I believe that the scientific research work of Nanning University has made significant contributions to regional economic development.					
Comprehensive evaluation of scientific research evaluation system						
1	I believe that the current research evaluation system at Nanning University is reasonable and can comprehensively reflect the value of scientific research.					
2	I believe that the current research evaluation system at Nanning University is fair and avoids administrative intervention.					
3	I believe that the current research evaluation system of Nanning University has been effectively applied.					
4	I believe that the current research evaluation system at Nanning University can help enhance the enthusiasm of researchers.					
5	I believe that the evaluation results of Nanning University can be effectively used for resource allocation and professional title promotion.					
6	I believe that the existing system of Nanning University is in line with its positioning as an applied research institution for private universities.					

บันทึกข้อความ

ส่วนงาน บัณฑิตวิทยาลัย สาขาบริหารธุรกิจ **โทร.ภายใน** 5336

ที่ มส 0210.01 / 0248 **วันที่** 9 กันยายน 2568

เรื่อง ขออนุมัติสำเร็จการศึกษาประจำปีการศึกษา 2567

เรียน ท่านอธิการบดี

เรื่องเดิม นักศึกษาหลักสูตรบริหารธุรกิจมหาบัณฑิต MRS. CHEN YUNSHENG รหัสนักศึกษา 6617195714 ได้ศึกษารายวิชาครบถ้วนสมบูรณ์ และได้ปฏิบัติตามเกณฑ์สำเร็จการศึกษาตามที่มหาวิทยาลัยสยามกำหนดเรียบร้อยแล้ว ทั้งนี้พร้อมยื่นเรื่องขออนุมัติสำเร็จการศึกษา โดยมีรายละเอียดดังต่อไปนี้

1. ผ่านการตรวจสอบความซ้ำซ้อนด้วยโปรแกรม Grammarly เมื่อวันที่ 12 มิถุนายน 2568
2. ผ่านการสอบประมวลความรู้ข้อเขียน เมื่อวันที่ 26 กรกฎาคม 2568
3. ผ่านการสอบปากเปล่าขั้นสุดท้ายวิชาการค้นคว้าอิสระ เมื่อวันที่ 18 กรกฎาคม 2568
4. ผ่านเกณฑ์มาตรฐานความรู้ภาษาอังกฤษ Oxford Placement Test score 96 CEFR C1 เมื่อวันที่ 24 ตุลาคม 2567
5. ผ่านการประชุมวิชาการระดับนานาชาติ at the 1st Thailand –Sino International Conference and 17th National and International Academic Conference on "Innovation and Management for Sustainability" Subject : The Construction and Application of Data-Driven Evaluation System of Scientific Research Achievements in Regional Private Universities –A Case Study of Nanning University on 14-16 November at Siam University, 2024, Bangkok Thailand

เรื่องพิจารณา เพื่อพิจารณาเข้าประชุมสภามหาวิทยาลัย และอนุมัตินักศึกษาสำเร็จการศึกษา ประจำปีการศึกษา 2567 ดังรายละเอียดเอกสารประกอบการสำเร็จการศึกษาตามที่แนบมา

จึงเรียนมาเพื่อพิจารณาอนุมัติ และให้ดำเนินการต่อไป

(รศ.ดร.จอมพงศ์ มงคลวนิช)
คณบดีบัณฑิตวิทยาลัย สาขาบริหารธุรกิจ

ตรวจทานเรียบร้อยแล้ว ถูกต้องครบถ้วน
17 ก.ย. 68

สำนักงานอธิการบดี
เอกสารฉบับนี้สามารถอัปโหลดเข้าฐานข้อมูลได้
ลงชื่อ
วันที่ 17/9/68