Artificial Intelligence, Medical Engineering and Education
Z.B. Hu et al. (Eds.)

doi:10.3233/ATDE231314

Analysis of Risk Prevention and Control Paths for Government Procurement in Universities in the Information Age

Wenzhe ZHAO, Qin SU[1], Qiang CHEN
Procurement and Tendering Office of Wuhan University of Technology, Wuhan, China

Abstract. Government procurement is an important link in promoting the operation and development of universities, which contains a series of risks. In the era of information technology, new types of risk vulnerabilities require advanced means and prevention. This article analyzes the risks of university government procurement from key aspects such as procurement document preparation, review process, and performance acceptance, forms a risk list, and establishes a process optimization matrix. It proposes response and prevention measures for university government procurement risks in the information age, in order to provide reference and reference for university government procurement work.

Keywords: Information age; Universities; Government procurement; Risk prevention and control

1. Introduction

Higher education institutions are places for cultivating high-level talents, which to some extent directly determine the development of a region or even a country [1-3]. The operation of higher education institutions requires the procurement of materials. In order to ensure the stable and orderly operation of school work, government procurement in universities provides strong material support for the development of universities, supporting various units of universities to assist in the smooth implementation of education, teaching, scientific research, management services, and other work, laying the foundation for achieving the connotation oriented development of universities [4, 5]. The scale of government procurement in universities is huge, involving complex and diverse funds and projects, and facing various risks. Conducting risk analysis and taking corresponding prevention and control measures is conducive to ensuring the fairness, impartiality, and transparency of government procurement in universities [6]. The above measures are of great significance for achieving the connotative development of universities and improving their educational level [7-9].

Domestic and foreign scholars have conducted relevant research on the risks in bidding procurement from different perspectives. Rusk S. believes that reducing risk is important for all projects. By means of adapting strategies to address economic, technical, environmental and social risks - and their increasing impact, if these risks are carried forward - risks can be reduced and project feasibility protected [10]. Hallikas analyzed the probability and possible outcomes of risk occurrence, and evaluated the risk [11].

[1] Corresponding Author: Qin SU, Email: 565791435@qq.com

Neu D. Everett J. proposed that Preventing corruption within government procurement: Constructing the specified and ethical subject is very important [12]. Liu Lihua and others analyzed the problems in actual bidding procurement in universities and proposed corresponding countermeasures and suggestions [13]. Zhou Xingyu and others analyzed the problems in internal control of university procurement business and proposed relatively comprehensive suggestions [14]. Li Huan, Wu Yang, and others have proposed in multiple papers the management mechanism and improvement measures of procurement organizations in the purchase of university equipment [15,16]. Strengthening security assessment and reducing procurement risks are also topics of common concern to the public [17,18].

The rapid development of technology in the information age has accelerated the pace of digital, networked, and intelligent transformation of traditional procurement [19, 20, 21]. It is of great significance to effectively avoid various potential risks and strive to achieve the goal of high-quality and cost-effective procurement [22-25].

2. Risk Analysis of Government Procurement in Universities

2.1. Current Situation of Government Procurement Work in Universities

In recent years, with the reform of institutional mechanisms and the improvement of governance capabilities in universities, most universities have established specialized procurement and bidding management agencies to uniformly manage various procurement and bidding work in the school. The names of these agencies include the Procurement and Bidding Center, the Bidding and Equipment Procurement Center, and the Procurement and Bidding Management Office. Unlike ordinary enterprises, the tasks in university procurement appear in a bottom-up manner, driven by the scientific agenda of university researchers. However, the actual situation varies among universities, and there are still differences in the specific responsibilities of their procurement and bidding management agencies. Government procurement in universities requires the collaboration of many departments and personnel, which involves huge amounts of funds, complex procedures, diverse interests, and other characteristics during organization and implementation. Therefore, they face various risks, which may lead to problems such as waste of funds and unfair competition.

2.2. Government Procurement Risks in Universities

The government procurement of universities is a complex and complete organizational process, among which the most important key links are three: the preparation of procurement documents, the process of bid opening and evaluation, and the contract and performance (see Figure 1).

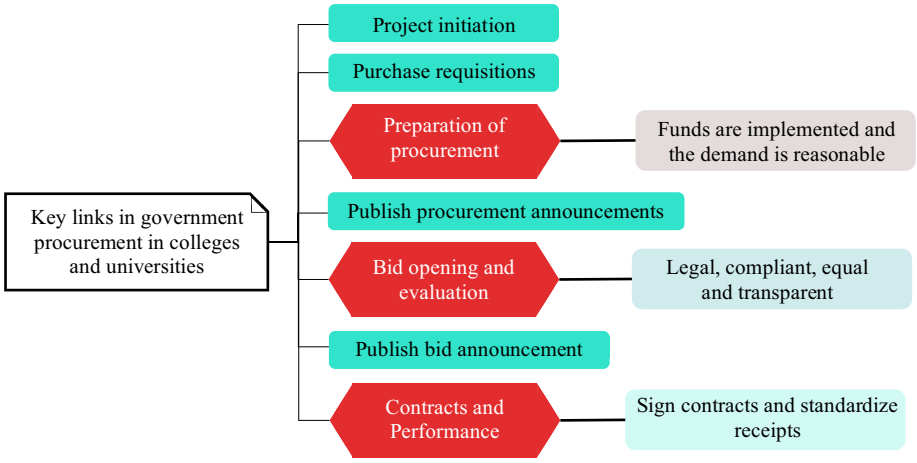

Figure 1. Key links of government procurement in universities

2.2.1. Risk of Procurement Document Preparation

The complete and accurate preparation of procurement documents is of great significance for achieving project objectives. When preparing procurement documents, the purchaser should implement the requirements of national government procurement regulations. At the same time, it is necessary to ensure the implementation of funds and reasonable demand.

The main contents of this type of risk include: technical parameter risk; Financial and competitive risks.

2.2.2 Review Process Risks

The most concise expression of the evaluation process is bid opening and evaluation. The evaluation of government procurement projects in universities should follow the principles of fairness, impartiality, and openness, ensuring that all potential suppliers can participate in competition on an equal footing. To comprehensively consider the capabilities, performance, and product performance of suppliers, select suitable suppliers to ensure the quality and effectiveness of the project.

It mainly includes three aspects, namely organizational risk, expert review risk, and corruption risk.

2.2.3 Contract and Performance Risks

The purchaser and supplier bind the rights and obligations of both parties by signing contracts, and performance acceptance is of great significance for quality control, risk management, project progress control, and cooperation relationship maintenance in contract performance. Performance acceptance is the last hurdle in the government procurement work of universities, and it is a key link to ensure that the government budget meets the originally set performance goals. Doing a good job in supervising performance acceptance can effectively reduce procurement risks.

The specific categories include contract risk, supplier risk, supervision risk, and policy risk.

3. Risk Assessment and Process Optimization

3.1. Procurement Risk Assessment

Identify the degree of risk in the form of a list for the purpose of proposing prevention and control measures. The risk score and impact degree are divided into three levels, with values assigned as 3 points, 2 points, and 1 point. The higher the score, the higher the importance. Risk comprehensive score=risk score × The score of impact degree indicates that a result greater than or equal to 6 is an important risk, a result less than 3 is a minor risk, and the rest is a general risk.

The setting of risk score and impact degree score is directly related to the success or failure of risk identification. In an effort to accurately reflect the risk scores and impact levels of each risk point, this article uses the Delphi method to select 10 experts and scholars with years of experience in government bidding and procurement work in universities. They anonymously express their opinions and assign risk scores and impact levels to experts through three rounds of investigation. The arithmetic mean method is used as the result.

$$M_j = \frac{1}{n}\sum_{i=1}^{n} m_{ij} \quad (1)$$

Among them, M_j is the arithmetic mean of the indicator $j(j=1,2)$, $j=1,2$, representing the risk score and impact degree score, n is the number of experts, and m_{ij} is the score of the second expert on the indicator j. And the degree of coordination of expert opinions is reflected through the coefficient of variation:

$$CV_j = \frac{\sigma_j}{M_j}\sum_{i=1}^{n} m_{ij} \quad (2)$$

Among them, σ_j is the standard deviation of all experts' evaluation of indicators j.

$$\sigma_j = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(m_{ij} - M_j)^2}\sum_{i=1}^{n} m_{ij} \quad (3)$$

The smaller the CV value, the higher the degree of coordination and convergence of expert opinions. After repeated consultation, induction, and modification, it was finally summarized into a consensus among experts, and the risk level was identified in the form of a list. The risk list of government procurement in universities is shown in Table 1.

In the table, the risk score and its coefficient of variation are denoted as *M1* and *CV1*, respectively; The impact degree score and its coefficient of variation are represented by *M2* and *CV2*; *M1* × *M2* is the comprehensive score. The last column is

the determined risk level, where * * represents important risks, and * represents general risks.

Table 1. List of risks in government procurement by universities

Risk Link	Type of risk	*M1*	*CV1*	*M2*	*CV2*	*M1*×*M2*	Grade
Documentation	Technic risk	3.00	0.00	3.00	0.00	9.00	**
	Financial risk	2.70	0.17	2.90	0.10	7.83	**
	competitive risk	2.00	0.00	2.10	0.14	4.20	*
Review process	Organizational risk	2.80	0.14	2.70	0.17	7.56	**
	Review expert risks	2.60	0.19	2.90	0.10	7.54	**
	Corruption risk	2.10	0.14	2.00	0.00	4.20	*
check and accept	Contract risk	2.00	0.00	1.90	0.15	3.80	*
	Supplier risk	2.70	0.17	2.80	0.14	7.56	**
	Supervision risk	1.90	0.15	2.00	0.00	3.80	*
	Policy risk	2.00	0.00	2.10	0.14	4.20	*

The results of the above risk analysis show that the coefficient of variation for each indicator score is less than 0.2, indicating a high degree of coordination and good convergence of expert opinions. According to the comprehensive score, there are 5 important risks and 5 general risks.

3.2. Key Process Optimization Matrix

Based on the key links identified in the procurement risk assessment, and in accordance with the principles of legal compliance, equal rights and responsibilities, hierarchical management, and classified exercise, a process optimization matrix for key links in government procurement is established (Table 2) to further strengthen the supervision of key links throughout the entire government procurement process (pre, during, and post), ensuring the smooth progress of government procurement work in universities.

Table 2. Optimization matrix for key processes in government procurement

Principle		Comply with the law, equal rights and responsibilities, hierarchical management, and classified exercise of power			
Beforehand	Key link	Separation of compilation and review of procurement documents			
	Process optimization	Centralized department	Technical experts	Agency Company	Countersign approval
During the process	Key link	Review process - compaction responsibility, fairness and impartiality			
	Process optimization	Party A's Representative	Collection of experts	expert training	Sound screen retention
Afterwards	Key link	Contract and performance - equal rights and responsibilities			
	Process optimization	Classification processing	Hierarchical implementation	Synchronous verification	Acceptance certificate

4. Risk Prevention and Control of University Procurement in the Information Age

4.1. Basic Measures for Preventing Procurement Risks in Universities

Universities can take the following basic measures to prevent procurement risks.

(1) Improve institutional construction

Universities should establish a sound procurement management system, establish standardized procurement processes, clarify procurement procedures and the responsibilities of relevant personnel, focus on strengthening the construction of supervision mechanisms for important positions and key links, and ensure the compliance and transparency of procurement activities.

(2) Strengthen demand management

Universities should recognize the importance of procurement demand management, expand the breadth and depth of procurement demand management, and in the stage of procurement demand preparation, combine practical issues such as demand investigation, demand review, and procurement plan implementation to do a good job in procurement demand management.

(3) Improve personnel quality

Adopting various methods such as education and training, exchange and discussion, and case analysis to enhance the business capabilities of university procurement staff. At the same time, establish a reasonable incentive mechanism and performance evaluation system to promote the enthusiasm and initiative of procurement staff in universities.

(4) Strengthen performance acceptance

Universities should organize multiple departments, including finance, procurement, auditing, and purchasing units, to conduct joint acceptance based on the technical and commercial terms stipulated in the procurement contract. The departments participating in the acceptance work should jointly issue proof materials of acceptance after passing the acceptance.

4.2. Digital Procurement Platform Architecture in the Information Age

In the era of informatization, procurement business is gradually moving towards digitization and intelligence. There is an advanced concept that believes that digital procurement can turn the procurement department into a value creation center for enterprises, rather than just ensuring supply when "buying things".

Figure 2 shows the architecture design of a digital procurement platform. The three main components are the one-stop expenditure management platform, online matchmaking and collaboration platform, and the integration and centralization of procurement business.

The one-stop expenditure management platform can be seen as a "cloud + end" resource sharing and collaboration platform. It is a one-stop procurement mall with multiple terminals in parallel and full process cloud operation, connecting the reimbursement process and improving the overall financial efficiency of the enterprise. Transform the traditional two-party game, either overt or covert, into a transparent and controllable tripartite collaboration, reduce management difficulty, and effectively implement supplier performance evaluation.

The online matchmaking and collaboration platform includes full supplier management, sourcing management, contract management, physical inventory management, supplier collaboration portal, etc. Support all procurement needs of the

enterprise through an integrated platform. The matchmaking platform is more valuable in the future and can effectively achieve credit warning work.

The integration and centralization of procurement business is also an important aspect. The middle platform refers to a comprehensive capability platform between the front and back ends, which can effectively connect the front and back ends, and has new rapid response capabilities. The deployment of a series of new technologies, such as in memory multidimensional databases, distributed computing, data visualization, intelligent data analysis, machine learning, etc., can be rapidly expanded and applied in procurement.

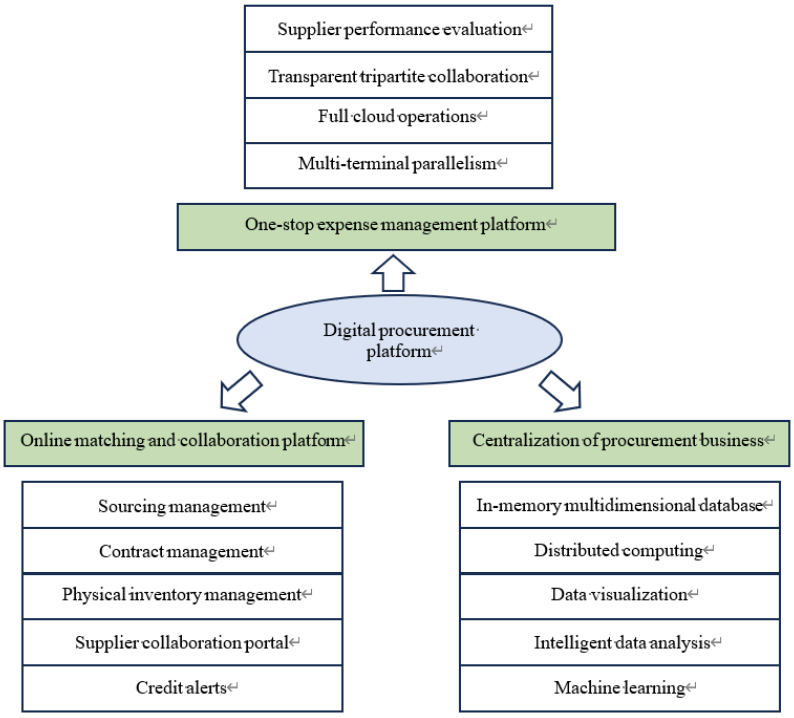

Figure 2. Architecture of a digital procurement platform

4.3. Procurement Risk Prevention Measures in the Information Age

The prevention of procurement risks in the information age requires building strong defenses from all aspects and leaving no loopholes. In addition to strengthening employee education and cultivating their sense of responsibility, it is also necessary to continuously enhance their ability to respond through technical means.

(1) Establish a digital procurement management platform

Procurement work should scientifically utilize information technology, establish a full process procurement management platform, and create a paperless, green, sustainable, and efficient procurement bidding model. By utilizing information technology, we ensure that the procurement process is traceable, data information can be queried, and improve procurement supervision capabilities and service levels.

(2) Building a standardized procurement document database

We should focus on procurement needs, establish a standardized procurement document database that includes various procurement categories and covers various procurement needs, provide demonstrations and templates for subsequent procurement projects, and accelerate the promotion of quality and efficiency improvement in university procurement work.

(3) Accelerate the digital development of procurement management

We should use information technology to comprehensively and systematically analyze data by capturing information such as demand, price, market, suppliers, and risks, in order to continuously optimize the government procurement workflow in universities and build an intelligent and flexible digital procurement system.

5. Conclusion

Government procurement in universities is an important task in their economic activities. It is directly related to the future development of the school. To conduct risk analysis of university procurement in the information age, it is necessary to conduct risk assessment and process optimization from a scientific perspective. Measures such as improving institutional construction and establishing a digital procurement management platform should also be taken to effectively reduce risks in the government procurement process of universities and promote high-quality development of government procurement work.

With the help of advanced technologies such as artificial intelligence and big data, the efficiency and reliability of procurement work will continue to improve, and the degree of intelligence will also become increasingly advanced. However, risk prevention is not a one-time solution, and the government procurement work in universities still needs to be continuously improved and improved. It is necessary to continuously improve personnel, systems, and technology, strengthen personnel training and technology promotion and implementation, in order to adapt to the development and changes of the new situation and achieve continuous improvement and innovation of government procurement work in universities.

References

[1] Li Jing, He Shengsheng. Spatial econometric analysis of factors influencing the development of higher education in China[J]. 2021, (6): 6-11 (in Chinese).

[2] Rae, John. Connecting for creativity in higher education[J]. Innovative Higher Education, 2022: 1-17.

[3] Jiang Fan, Li Yuqian. How to promote innovation in higher education and the construction of world-class universities-- Summary of the Summit Forum on "Innovative Development of Higher Education and the Construction of World Class Universities"[J]. 2021, (4): 83-88 (in Chinese).

[4] WU Guanyi. Whole Process Management of Government Procurement Suppliers in Colleges and Universities.[J]. Research & Exploration in Laboratory, 2019, .38(11): 282-300

[5] Yue Tongwen, Hou Yi. A study of university procurement performance based on big data on government procurement[J]. Academic Journal of Business & Management, 2023, .5(4): 77-86

[6] Zhu Bao. Analysis of strategies for improving the quality of university procurement work from the perspective of intensive development[J]. China Modern Equipment Education, 2022, (8): 41-42+46 (in Chinese)

[7] Schmidt A. T. Construction supply chain welcomes new report on government infrastructure procurement[J]. Highway Engineering in Australia: Transport Infrastructure·Traffic Management·Intelligent Transport Systems, 2022, (3): 53.

[8] Wirahadikusumah R, Abduh M, Messah Y. Framework for sustainable procurement - identifying elements for construction works[J]. Applied Mechanics and Materials, 2020, 897:245-249.

[9] Anstis, Siena. Government procurement law and hacking technology: The role of public contracting in regulating an invisible market[J]. Computer Law & Security Review 41(2021):105536.
[10] Rusk S. Front-end strategies to reduce project risks[J]. CIM Magazine, 2019, (2):14.
[11] J.Hallikas, V.Virolainen, M. Tuominen. Risk Analysis environments: a dyadic case study[J]. Journal and Assessment in Network of Production Economics, 2002, (07): 45-55.
[12] Neu D. Everett J., Rahaman A. S. Preventing corruption within government procurement: Constructing the disciplined and ethical subject[J]. Critical Perspectives on Accounting, 2015, 28: 49-61.
[13] Liu Lihua. Discussion on the problems and solutions of university bidding procurement[J]. Journal of Liaoning University of Technology (Social Sciences Edition), 2018, 20, (01): 51-53 (in Chinese).
[14] Zhou Xingyu. Research on internal control of procurement business in public universities in China[D]. Nanjing: Nanjing Audit University, 2017 (in Chinese).
[15] Li Huan, Liu Juan, Cui Yunpeng, et al. Problems and improvement measures in the sharing management mechanism of large-scale instruments and equipment in agricultural research institutions: Taking the Chinese academy of agricultural sciences as an example[J]. Agricultural Science and Technology Management, 2021,40(2): 48-52 (in Chinese).
[16] Wu Yang, Zhang Mingqing, Chen Jianxin. Exploration of procurement organizational structure and informationization procurementJ]. Experimental Technology and Management, 2017, 34(6): 9-13 (in Chinese).
[17] Zhang Jianfang. Improving internal control mechanisms to make procurement risks controllable[N]. Government Procurement Information Report, 2021-09-13 (8) (in Chinese).
[18] Ou Yang Y P. Shieh H M,Tzeng G H. A VIKOR technique based on DEMATEL and ANP for information security risk control assessment[J]. Information Sciences, 2013.232(Complete):482-500.
[19] Hashimova Kamala, "Intelligent Management of a Network of Smart Billboards on the IoT Platform in Industry 4.0", International Journal of Information Technology and Computer Science, Vol.14, No.6, pp.39-46, 2022.
[20] Muhammad Aqeel, Hammad Shahab, Muhammad Naeem, Muhammad Sikander Shahbaz, Faizan Qaisar, Muhammad Ali Shahzad, "Intelligent Smart Energy Meter Reading System Using Global System for Mobile Communication", International Journal of Intelligent Systems and Applications, Vol.15, No.1, pp.35-47, 2023.
[21] Bisrat Betru, Fekade Getahun, "Ontology-driven Intelligent IT Incident Management Model", International Journal of Information Technology and Computer Science, Vol.15, No.1, pp.30-41, 2023.
[22] Mustapha A. Mohammed, Seth Alornyo, Michael Asante, Bernard O. Essah, "Intelligent Detection Technique for Malicious Websites Based on Deep Neural Network Classifier", International Journal of Education and Management Engineering, Vol.12, No.6, pp. 45-54, 2022.
[23] Aya S. Noah, Naglaa E. Ghannam, Gaber A. Elsharawy, Abeer S. Desuky, "An Intelligent System for Detecting Fake Materials on the Internet", International Journal of Modern Education and Computer Science, Vol.15, No.5, pp. 42-59, 2023.
[24] Wang P Y, Zhang B. Information service of a government procurement cloud platform based on the value chain model[J]. Journal of digital information management, 2021(3):19.
[25] Domashova J, Kripak E. Application of machine learning methods for risk analysis of unfavorable outcome of government procurement procedure in building and grounds maintenance domain[J]. Procedia Computer Science, 2021, 190:171-177.