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# Research on Contract Risk Management of Hospital Construction Project based on Fuzzy Analytic Hierarchy Process

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**Abstract:** With Covid-2019 outbreak in December 2019, the number of medical infrastructure projects in infrastructure projects has increased. Although contract management is an important link of medical infrastructure project management but there is little quantitative research on the risk analysis. in this paper, firstly, three first-level risk indicators of contract risk management evaluation system are extracted by combing literature: contract drafting, contract signing and contract performance. Then, taking the contract management of a 3A hospital in Chengdu as an example, 12 second-level risk indicators are determined by fault tree method. Then, by experts scoring and statistically analyzing the risk points of 100 construction project contracts signed by the hospital from 2016 to 2020, the weight of secondary risk indicators is determined and the risk matrix is established. Then, the evaluation matrix of contract risk management evaluation system is established by 10 experts. Finally, the evaluation index system of contract risk management is obtained by combining the risk matrix with the evaluation matrix through fuzzy analytic hierarchy process, and the maximum membership degree method is adopted to complete the risk assessment. The research results show that there are high risks in the contract drafting stage and medium risks in the contract signing and contract performance stages in the contract management of a Grade A hospital in Chengdu. The author puts forward reasonable suggestions to improve the contract management level of hospital construction projects.

**Keywords:** Construction Project Contract Risk; Risk Management System; Fuzzy Analytic Hierarchy Process; The Fault Tree Method.

## 1. Introduction

In China's traditional infrastructure investment, Not much in health infrastructure, According to the Guotai Junan Securities company report in March 2020, Among the stock PPP (Public-Private Partnership) projects with a total investment scale of 17.6 trillion yuan in 29 provinces in China, The top two are the iron and highway bases (railways, roads, ports, docks, airports, tunnels, etc.), Real estate, soil storage, The proportion of both is about 41% and 20%, respectively, Under the epidemic, which has attracted the attention of the people, With only about $300 billion in projects, Accounting for 1.7% [1]. However, with the outbreak of COVID-19 in December 2019, the improvement of the urgent medical rescue system and the supplement of the medical and health infrastructure sector have been highlighted again, and the implementation of medical and health infrastructure projects is imperative. In his important speech, Present Xi stressed that to take a long-term view, sum up experience, draw lessons, and improve the national public health emergency management system, it is necessary to further improve the prevention and treatment system of major epidemics, and strive to solve the deficiencies in the existing system. Xi general secretary once mentioned: "in view of the outbreak exposed the short board and the insufficiency, to short board, plug up the loopholes, strong or weak, the persistence of the perfect, the establishment of the establishment, the establishment of the implementation of the implementation, perfect major epidemic prevention and control system mechanism, improve the national public health emergency management system", thus, to promote medical infrastructure project is of vital significance, will directly affect the residents' healthy life.

In contrast to traditional infrastructure projects, Medical infrastructure projects have many features: for example, In the design stage, attention should be paid to minimize the risk of hospital perception, It refers to the layout of operating rooms, changing rooms, dirt channels and other areas, the direction of the flow of people and logistics, Must follow the relevant specification design, When medical radiation equipment is used in some rooms is involved, At the design stage, the radiation prevention design should be made in accordance with the Law on the Prevention and Treatment of Occupational Diseases, the Management Regulations on Radiological Diagnosis and Treatment and other relevant specifications, And obtain the approval of the pre-evaluation of radioactive occupational disease hazards; During the construction phase, When involving the construction of special medical-related facilities and equipment such as medical gas facilities, Special attention must be paid to the construction process and construction safety; During the acceptance phase, If the special medical construction is involved, It shall be accepted after passing special tests including cleanliness test, indoor air quality safety test and evaluation of radioactive occupational disease hazard control effect. Contract management is an important link in the project "three control three tube coordination", the contract can for the basic stages of the project proposal, feasibility study, design, construction preparation, construction, completion acceptance, the construction project evaluation stage) to provide necessary guarantee, therefore, in view of the characteristics of the construction projects, accurate terms of the contract, timely contract performance will better guarantee for project construction, research contract, strengthen the contract management of medical infrastructure

project management plays an important role.

Based on this, this paper adopts the method of hierarchical analysis and fuzzy mathematics to establish hospital construction project contract risk management evaluation system, expected to establish and improve the hospital construction project contract management mechanism, establish a reference contract risk management evaluation system, improve the purpose of management level of contract hospital construction project, a class-A hospital of Chengdu construction project contract management as an example, to verify its feasibility.

# 2. Research Status of Contract Risk Management

## 2.1. Contract Management

### 2.1.1. Research Focus of Contract Management

(1) Risk management research

Risk management mainly studies various risks in the process of contract management, and puts forward reasonable measures to identify and deal with the risks. Generally, based on the different subject behaviors of the contract, the contract risk can be divided into two categories, namely, subjective and objective risk. Under different management modes, the distribution of contract risks is different. Of course, some risks also exist in all contract management modes, mainly including legal risk, environmental risk, price floating risk, etc[2]. Risk management will be used in all stages of contract performance and formation: in the contract formation stage, the subject terms, price terms, payment clause, insurance clause and other risks are easy to occur; in the contract performance stage, there are production risks, foreign exchange risks and management risks[3], The Employer shall seek the best transfer of the risk to the Contractor [4].

(2) Contract text research

The research of the contract text mainly focuses on the interpretation of the model contract text, followed by the case analysis of the contract text and contract terms. In the study of the contract clause, the default clause[5]Terms of progress payment[6]And security guarantee provisions[7]Is the focus of the object of researchers. Chen Yongqiang et al[8]Comparing the old and new FIDIC contracts, we found that the new version of FIDIC contract is more operable, Liu Pan[9]And Zhang Ling[10]The progress and changes of the new FIDIC contract were also studied.

(3) Claims management research

Most of the claim management starts from the direction of the contractor. Huang Zhengbiao[11]Analyzed the labor claim, Chen Guozheng[12]Taking the owner as the starting point, the author deeply studies the duties that the owner should perform, points out that the owner needs to improve the awareness of counter-claim management, and explains how to take correct measures to improve the efficiency of claim. Huang Heng et al[13]A contract status model was developed to identify claims opportunities and reduce the adverse impact of engineering claims on project costs.

(4) Method and theoretical research

Since the project management theory, it has gradually played an important role in the field of construction contract management. For the last decade, workflow technology[14], modularization management[15], framework agreement[16] And centralized management[17]Both belong to the emerging management methods in the field of contract management, and effectively improve the efficiency of contract management through the use of these principles and technologies.

(5) Referring to the relevant literature of "contract management problems", it is found that in the past ten years, the contract management problems mainly include the loopholes in the legal environment, the disconnection between bidding documents and engineering practice, the shortage of contract management system optimization, claims and contract difficulties.

### 2.1.2. Research methods of contract risk management

At present, China has done a lot of research on contract risk management, and adopted diversified research methods, among which the research methods of contract risk management are mainly reflected in the identification and evaluation of risks, as follows.

(1) Risk identification

With the deepening of research in the field of contract risk identification, many types of methods have been formed, including Delphi method, fault tree analysis method, brainstorming method and so on.

(2) Risk assessment

Contract risk assessment method includes: survey scoring method, hierarchical analysis method, Monte Carlo probability simulation, sensitivity analysis, fuzzy mathematics method, etc.

### 2.1.3. Division of Contract Risk Management Stages

Today, there are no public recognized standards in some stages of contract management, Chen Shengrong [18] It also expounds the scope of the contract management agency and the division of various responsibilities from many aspects, mainly including the contract conclusion, implementation, file management, etc., and each stage must be strictly controlled in strict accordance with the relevant regulations to ensure the expected results. Dai class[19]In the process of contract management, two stages are contract formation stage and contract termination stage; Liu et al[20]On this basis, the contract management is further divided into the following four stages, namely, contract planning, signing, performance and termination. No matter which way, there are some similarities in the classification method, generally including the following main contract management activities: bidding, bidding, bid evaluation, contract signing, preparation before contract implementation, contract implementation, defect liability period and management after contract implementation.

## 2.2. Contract Risk Management Evaluation

As is known to all, in the process of contract management, the risk management system is related to the performance evaluation index, in which the contract risk management can take the negative performance evaluation index as an index. Zhao Jinyi[21]A new performance evaluation method of contract management is proposed, which specifically includes two necessary components, one is behavioral performance evaluation and the other is result performance evaluation. The behavior performance evaluation is performed in two aspects: information and technology, mainly whether the contract information is consistent with the bidding documents and the results in the bidding process, whether the contract terms have been comprehensively reviewed, whether there are errors and omissions, whether the important terms are clearly defined; the result performance is mainly manifested in economy and harmony, mainly whether the contract management results effectively control the funds, whether the contract

performance results meet the contract subject, which can be used as the indicators of contract risk management evaluation.

### 2.3. Main Risks of Contract Management of Hospital Construction Projects

In view of the problems existing in the hospital construction contract, Tang Qiaodi[22], Zhang Ying[23]And Wang Huizhen[24]This paper respectively expounds the imperfect contract management system, the imperfect contract terms (such as construction period, quality standard, material procurement plan, change rules, construction responsibility, etc.), including the weak legal awareness of contract management personnel, the incomplete preservation of contract technical data, etc. Yi-min Chen[25]Analyze the contract management risks faced by public hospitals, and summarize the existing problems, which are mainly reflected in: insufficient feasibility study before the signing of the contract, incomplete and unfair contract terms, and lack of follow-up evaluation of the contract execution process. Wang Xian[26]It is emphasized that the contract terms of the key management links shall clearly stipulate the liability for breach of contract. For example, if the quality of the project is affected by factors such as leakage and corners, the liability for breach of contract shall be clearly defined in the contract terms, and the corresponding legal liability shall be investigated. Wu Mengqiang[27]Taking Zhanjiang Central People's Hospital as an example, the paper analyzes the contract management and risk control of construction projects, and divides the contract management risk into internal risk and external risk: internal risk including insufficient understanding of contract, imperfect management system and low quality; external risk including unilateral breach of contract due to low reputation of contract unit, natural environment and other factors.

Through the above research and analysis of the research focus of contract management in the past ten years, contract risk management, contract risk management evaluation, and the main risks of contract management in hospital construction projects, the author believes that contract management has the characteristics of wide research scope, diverse research methods, and qualitative research far more than quantitative research. At home and abroad, the contract management of risk, and taking it as the contract risk management evaluation system, and establishing the secondary index research of hospital construction project contract risk management, in order to further establish the contract risk management evaluation system quantitative study of hospital construction project contract management.

## 3. Theoretical Basis

The theoretical basis of this paper mainly has two, one is the fuzzy hierarchy analysis method, the other is the contract risk management.

Fuzzy hierarchical analysis method (Fuzzy Analytic Hierarchy Process, FAHP) is a combination of hierarchical analysis method and fuzzy evaluation method. Hierarchical analysis refers to the decision method that decomposes the elements always related to decision making into goals, criteria, programs and other levels and conducts qualitative and quantitative analysis on this basis; fuzzy comprehensive evaluation method is a comprehensive evaluation method based on fuzzy mathematics, which transforms the qualitative evaluation into quantitative evaluation according to the membership theory of fuzzy mathematics to make a general evaluation of things or objects restricted by various factors. The biggest problem of hierarchical analysis method is that when there are many evaluation indicators at a certain level, it is difficult to guarantee its thinking consistency. In this case, the fuzzy hierarchical analysis method formed by combining the advantages of fuzzy method and hierarchical analysis method will be able to solve this problem well.

The research method of the contract risk management is the contract management method based on the risk management theory. Risk management (Risk Management) refers to the management process of how to minimize the risk in a project or enterprise environment where there are certain risks. The contract risk management adopted in this paper mainly applies the specific methods of risk identification and risk assessment. The risk identification methods include Delphi, brainstorming, fault tree analysis, work-risk decomposition (WBS-RBS), scene analysis, data, inquiry, field investigation, etc. The risk assessment methods include survey scoring, hierarchical analysis, Monte Carlo probability simulation, sensitivity analysis, fuzzy mathematics, etc.

Fuzzy hierarchy analysis theory has been widely applied, but because the medical infrastructure projects is different from the traditional infrastructure projects, in the construction stage are unique, such as medical facilities design specification, occupational disease hazards radiation hygiene, cleanliness requirements, hazardous waste and medical waste disposal specification for medical infrastructure projects have its specific applicability, so medical infrastructure projects in contract management also has its uniqueness, and in infrastructure project contract management, few special research for medical infrastructure project contract management, quantitative research is relatively less. Therefore, this paper uses the fuzzy level analysis method to establish the contract risk management evaluation system of hospital construction project, which can provide ideas for improving the research in this aspect to some extent.

Based on this, this paper adopts the fuzzy hierarchy analysis method to quantitatively analyze the contract risk management of hospital construction projects, which is mainly divided into three steps:

(1) On the basis of literature review, three contract risk first-level indicators are extracted: contract drafting, contract signing and contract performance. The weight of the first-level indicators of each risk factor is determined through hierarchical analysis, so as to establish the contract risk management index set of hospital construction projects $U = \{U_1, U_2, U_3\}$.

(2) According to the fault tree method and statistical analysis method, further determine the secondary index weights of each risk factor $U_{11}$, $U_{12}$... $U_{mn}$, standardize the survey results, obtain the evaluation matrix V1 and $V_2$... $V_n$, and then synthesize the fuzzy comprehensive evaluation matrix G (multiply the secondary index and the evaluation matrix) with the second level index of risk factors.

(3) The maximum membership method is used to evaluate the risk of each index, and the results are analyzed for evaluation.

## 4. Contract Risk Management of the Construction Project of a Third-class a Hospital in Chengdu

The contract management of the construction project of a

Grade A hospital in Chengdu is a complex and huge system, involving many contents. Firstly, the contract management is divided into three stages, namely, contract drafting, signing and performance stage, which are the primary risk management index; secondly, the secondary risk management index is determined by fault tree method, as shown in Figure 1.

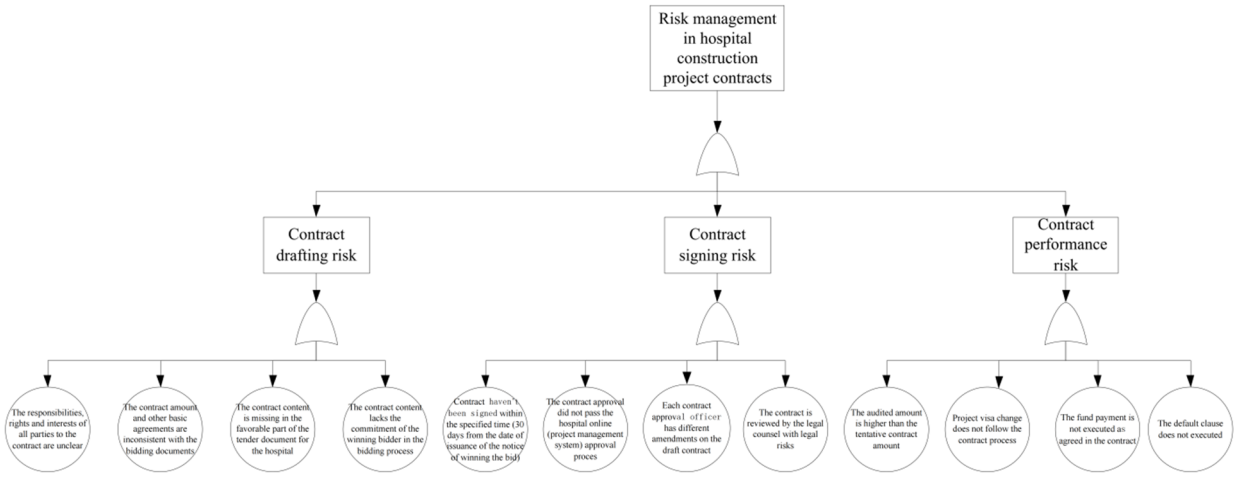


**Figure 1.** Risk fault tree of contract management of construction project of a Grade A hospital in Chengdu

Then, the contract risk management evaluation system for the construction project of a Grade A hospital in Chengdu is established as shown in Table 1 below.

**Table 1.** Contract risk management evaluation system for the construction project of a Grade A hospital in Chengdu

| Target layer | Level 1 indicators | Secondary indicators |
|---|---|---|
| Contract risk management evaluation system for the construction project of a third-class A hospital in Chengdu | Contract drafting risk U1 | The responsibilities, rights and interests of all parties to the contract are unclear U11 |
| | | The contract amount and other basic agreements are inconsistent with the bidding documents U12 |
| | | The contract content is missing in the favorable part of the tender document for the hospital U13 |
| | | The contract content lacks the commitment of the winning bidder in the bidding process, U14 |
| | Contract signing risk U2 | Contract haven't been signed within the specified time (30 days from the date of issuance of the notice of winning the bid) U21 |
| | | The contract approval did not pass the hospital online (project management system) approval process U22 |
| | | Each contract approval officer has different amendments on the draft contract U23 |
| | | The contract is reviewed by the legal counsel with legal risks U24 |
| | Contract performance risk U3 | The audited amount is higher than the tentative contract amount U31 |
| | | Project visa change does not follow the contract process U32 |
| | | The fund payment is not executed as agreed in the contract U33 |
| | | The default clause does not executed U34 |

**Table 2.** Weight of first-level index of contract risk of construction project of a Grade A hospital in Chengdu

| risk indicator | contract signing | Contract performance | Contract drafting | weight |
|---|---|---|---|---|
| contract signing | 1 | 1 | 1/3 | 0.1867 |
| Contract performance | 1 | 1 | 1/5 | 0.1577 |
| Contract drafting | 3 | 5 | 1 | 0.6535 |

The established evaluation index system will be sent to 10 contract management experts from the three third-class A units in Chengdu for consultation. The experts will determine the relative importance of each index according to the 1-9 scale method, and give the relative scale respectively. The hierarchical analysis method was used to determine the first-

level index judgment matrix and calculate the weight of each index (see Table 2).

Judgment of the consistency of the matrix [28] By formula:

$$AW = \lambda_{max} W$$

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(AW)_i}{\omega_i}$$

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (1)$$

$$CR = \frac{CI}{RI}$$

From Formula (1) - (4):

$$\lambda_{max} = 3.030$$

$$CI = 0.0150$$

$$CR = 0.02 < 1$$

While taking into account the consistency, the corresponding first-level index weight is formed (Table 2). The author extracted 2016-2020 in Chengdu a 3 class-A hospital construction project of 100 contracts, analyze the risk point, through the method of statistical analysis of the secondary index of contract statistics (keep a decimal), to get a class-A hospital of Chengdu construction project contract risk management secondary index weight (keep four decimal):

$$U_1 = [0.1307, 0.1967, 0.1967, 0.1307]$$

$$U_2 = [0.0187, 0.0187, 0.0934, 0.0560]$$

$$U_3 = [0.0158, 0.0315, 0.0315, 0.0789]$$

**Table 3.** Weight of first-level index of contract risk of construction project of a Grade A hospital in Chengdu

| Target layer | Level 1 indicators | Level 1 index weight | Secondary indicators | The proportion of contract risk statistics | Secondary index weight |
|---|---|---|---|---|---|
| Contract risk management evaluation system for the construction project of a third-class A hospital in Chengdu | Contract drafting risk U1 | 0.6535 | The responsibilities, rights and interests of all parties to the contract are unclear U11 | 0.2 | 0.1307 |
| | | | The contract amount and other basic agreements are inconsistent with the bidding documents U12 | 0.3 | 0.1961 |
| | | | The contract content is missing in the favorable part of the tender document for the hospital, U13 | 0.3 | 0.1961 |
| | | | The contract content lacks the commitment U14 of the winning bidder in the bidding process | 0.2 | 0.1307 |
| | Contract signing risk U2 | 0.1867 | U21 contract within the specified time (30 days from the date of issuance of the notice of winning the bid) | 0.1 | 0.0187 |
| | | | The contract approval did not pass the hospital online (project management system) approval process U22 | 0.1 | 0.0187 |
| | | | Each contract approval officer has different amendments on the draft contract U23 | 0.5 | 0.0934 |
| | | | The contract is reviewed by the legal counsel with legal risks U24 | 0.3 | 0.0560 |
| | Contract performance risk U3 | 0.1577 | The audited amount is higher than the tentative contract amount U31 | 0.1 | 0.0158 |
| | | | Project visa change does not follow the contract process U32 | 0.2 | 0.0315 |
| | | | The fund payment is not executed at U33 as agreed in the contract | 0.2 | 0.0315 |
| | | | The default clause does not executed U34 | 0.5 | 0.0789 |

**Table 4.** Contract risk evaluation system for the construction project of a Grade-A hospital in Chengdu

| order number | Secondary indicators | High risk | Medium risk | low risk |
|---|---|---|---|---|
| 1 | The responsibilities, rights and interests of all parties to the contract are unclear U11 | 0.5 | 0.3 | 0.2 |
| 2 | The contract amount and other basic agreements are inconsistent with the bidding documents U12 | 0.8 | 0.1 | 0.1 |
| 3 | The contract content is missing in the favorable part of the tender document for the hospital, U13 | 0.5 | 0.3 | 0.2 |
| 4 | The contract content lacks the commitment U14 of the winning bidder in the bidding process | 0.3 | 0.2 | 0.5 |
| 5 | U21 contract within the specified time (30 days from the date of issuance of the notice of winning the bid) | 0.5 | 0.3 | 0.2 |
| 6 | The contract approval did not pass the hospital online (project management system) approval process U22 | 0.1 | 0.6 | 0.3 |
| 7 | Each contract approval officer has different amendments on the draft contract U23 | 0.5 | 0.5 | 0 |
| 8 | The contract is reviewed by the legal counsel with legal risks U24 | 0.3 | 0.4 | 0.3 |
| 9 | The audited amount is higher than the tentative contract amount U31 | 1 | 0 | 0 |
| 10 | Project visa change does not follow the contract process U32 | 1 | 0 | 0 |
| 11 | The fund payment is not executed at U33 as agreed in the contract | 0.8 | 0.1 | 0.1 |
| 12 | The default clause does not executed U34 | 0.5 | 0.3 | 0.2 |

Risk evaluation set V= (high risk, medium risk, low risk), find 10 project managers in similar grade A hospitals, and have rich experience in engineering contract management. After evaluating the 12 risk factors mentioned above, the contract risk evaluation system table is constructed, as shown in Table 4:

Thus, the evaluation matrices V1, V2, V3:

$$V_1 = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.8 & 0.1 & 0.1 \\ 0.5 & 0.3 & 0.2 \\ 0.3 & 0.2 & 0.5 \end{bmatrix}$$

$$V_2 = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.1 & 0.6 & 0.3 \\ 0.5 & 0.5 & 0 \\ 0.3 & 0.4 & 0.3 \end{bmatrix}$$

$$V_3 = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.8 & 0.1 & 0.1 \\ 0.5 & 0.3 & 0.2 \end{bmatrix}$$

The risk assessment set for each stage is:

$$G_1 = U_1 \times V_1 = [0.36027 \quad 0.14403 \quad 0.15050]$$

$$G_2 = U_2 \times V_2 = [0.07472 \quad 0.08593 \quad 0.02615]$$

$$G_3 = U_3 \times V_3 = [0.11195 \quad 0.02682 \quad 0.01893]$$

Based on the above results, the risk assessment set G of each stage can be evaluated$_1$、$G_2$、$G_3$Analysis, in the contract management of a third-class A hospital in Chengdu, the contract drafting stage ($G_1$), "0.36027" value is the largest, and the index in the contract drafting stage is "high" risk level according to the maximum membership principle; similarly, the index in the contract signing stage is "medium" risk level; the index in the contract performance stage is "medium" risk level.

# 5. Conclusion and Recommendations

## 5.1. Conclusion

The combination of fuzzy hierarchy analysis and the research method of contract risk management acts on the specific field of medical infrastructure, which can provide new ideas for quantitative research in this field. In addition, the combination of expert scoring and statistical analysis makes the weight more objective and the evaluation results are closer to the reality.

## 5.2. Suggestions

Based on the research of this paper, the following contract management suggestions for hospital construction projects:

First, hire professionals to manage, improve the efficiency of contract drafting, and achieve the accuracy of contract drafting.

Hospital in the process of contract management should pay attention to control the risk of each stage and especially pay attention to control the risk of the contract drafting stage, this also means that the hospital can hire the contract management personnel in the contract drafting stage review: the parties responsibility, right, is clear, the contract amount and other basic agreement is consistent with the bidding documents, the contents of the contract is missing good part of the hospital, lack of the contract content of the winning unit in the bidding process, at the beginning of the contract drafting do risk control.

Second, implement the fixed multi-person control under the long-term mechanism to improve the efficiency of contract management.

Based on the importance of contract drafting stage, the hospital can establish a long-term mechanism of contract examination and approval, by strengthening the examination and approval process, people review to reduce risk, such as establishing contract management approval, examination and approval, project management personnel, professional lawyer team approval, the main leadership of examination and approval mechanism, to fail to perfect part supplement in time, really improve the efficiency of the contract management.

Third, call experts to demonstrate, control the contract drafting chaos, will reduce the risk to a minimum.

When drafting the contract, experts can be convened to demonstrate, and the contract management risk points can be found and improved early through expert review, so as to "nip the contract management risk points in the cradle" and avoid the occurrence of subsequent contract management risks.

# References


[1] Tang Weike. Basic medical links to strengthen the shortcomings: the development of triage system has a long way to go [EB / OL]. http://epaper.21jingji.com/2020-04-24.

[2] Liu Charter Design and Procurement Construction (EPC) / Turkey Project Contract Conditions [J]. Construction Economy, 2013 (12): 60-65.

[3] Zhong Yihui "Going global" enterprise contract risk management research [J]. Journal of Central University of Finance and Economics, 2012 (2): 53-57.

[4] Wang Shouqing, Ke Yongjian. Franchise Project Financing (BOT, PFI, and PPP) [M]. Beijing: Tsinghua University Press, 2008.

[5] Dong Xiongyong. Party A's liability clause for breach of contract in the signing of the project contract [J]. Construction economy, 2013 (4): 42-44.

[6] Wen Jian'an. Research on the disputes over the payment terms of the construction project contract [J]. Construction Economy, 2014 (8): 83-86.

[7] Interpretation of safety protection clauses in construction Contract (Model text) [J]. Construction technology, 2011 (S2): 274-276.

[8] Chen Yongqiang, Zhu Xingyu, Shi Hui, etc., a comparative analysis of the old and new versions of the Construction Contract Conditions [J]. International Economic Cooperation, 2018 (4): 57-62.

[9] Liu Pan, Chen Yongqiang, Zhao Shanshan. Progress management in the 2017 FIDIC Series contract Conditions [J]. International Economic Cooperation, 2018 (12): 66-70.

[10] Zhang Ling, Zhu Xingyu, and Chen Yongqiang. Analysis of changes in the new FIDIC series [J]. International Economic Cooperation, 2018 (6): 74-79.

[11] Huang Zhengbiao. On the claim management of hydropower projects [J]. Hydroelectric Power Generation, 2015 (5): 9-11.

[12] Chen guozheng. On the claim management of the owner unit in the hydropower project construction [J]. People Yangtze River, 2012 (14): 21-23.

[13] Huang Heng, Yuan Jianbo, Zhu Wenxi. Application of Contract Status Control Model in Highway Management of aim Management [J]. Highway Engineering, 2012 (4): 84-88.

[14] No Hongxia, Wang Shuhai, Qi Zhaohui, etc. Research on the application of workflow technology in engineering project contract approval [J]. Computer applications and software, 2013 (8): 155-15,177.

[15] Zhu Qingrong, Deng Yulu, Hu Jingjing. BHTPMS Application of the system contract management module in large-scale hydropower projects [J]. Water conservancy and Hydropower technology, 2015 (S2): 93-95.

[16] Li Xiangjun. Research on the application of framework contracts in the construction industry [J]. Construction Economy, 2014,35 (10): 99-103.

[17] Liu Yongming, Fang Buyun. Centralized management, planning and control of large-scale construction project contracts [J]. Highway, 2017 (12): 12-15.

[18] Chen Shengrong. Research on contract management and risk prevention of construction projects [J]. Engineering construction and Design, 2020 (06): 216-217.

[19] Dai P,Gan H,Gu Y.Contract Management for International EPC Projects[R].China:Southeast University,2009.

[20] Liu H, Sun W.Architecture study on the whole lifecycle management of construction contract in the large construction projects[J].Applied Mechanics and Materials, 2014, 662: 129-134.

[21] Zhao Jinyi. Research on the performance evaluation of construction contract management for large-scale engineering construction projects [J]. Theoretical Research on Urban Construction (electronic version), 2018 (36): 47.

[22] Tang Qiaodi. On the construction contract management of hospital construction projects [J]. Theoretical Research on Urban Construction (electronic version), 2018 (19): 47.

[23] Zhang Ying. Problems to be noted in the construction contract management of construction projects [J]. Green and environmental protection building materials, 2018 (04): 162.

[24] Hui-zhen wang. Problems and countermeasures existing in the construction contract management of construction projects [J]. Jiangxi Building Materials, 2016 (05): 299-300.

[25] Yi-min Chen. Strengthening economic contract risk control practices in public hospitals [J]. Chief accountant of China, 2018 (12): 72-74.

[26] Wang Xian. On the construction contract management of hospital construction projects [J]. Chinese Hospital Construction and Equipment, 2018,19 (07): 79-80.

[27] Wu Mengqiang, Ye Yuanwu, Chen Jiaolian, Yang Guande, He Mingxin. Contract management and risk control of agent construction hospital construction projects -- Take Zhanjiang Central People's Hospital as an example [J]. Project Management Technology, 2020,18 (02): 42-46.

[28] Jiang Yue qi, Yuan Yongbo, Zhang Mingyuan. Study on transmissibility of unsafe behavior among construction workers based on fuzzy comprehensive evaluation of AHP [J / OL]. Journal of Engineering Management: 1-6 [2021-05-04].https:// doi.org/10.13991/j.cnki.jem.2021.02.024.