A four-stage management mode of safe production affairs

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Abstract—Safety production management system is widely used at present. The current safety production management system only improves some aspects of production safety, but it is not suitable for all engineering management, and there is no good solution in the engineering management mode. In this paper, a four-stage management mode based on safety production affairs is proposed, which plays a good role in the engineering management of safety production. The intelligent safety assessment system has a good effect.

1. INTRODUCTION
With the rapid development of society, there are more and more enterprises. The hidden danger of production safety is related to people's life and property safety, so safety production has become the top priority of enterprise development. Wang Y et al. combined with the safety production status of coal enterprises, it is proposed to improve the safety production management level of enterprises and realize the intensive management mode [1]. Hou Q et al. studied the transformation of enterprise safety production management mode and established a preventive management mode, which played a good role in early warning of safety risks [2]. Yan t et al. applied the Internet of things technology to the safety production of enterprises to realize intelligent monitoring and early warning of hidden dangers in time [3]. Lizhong Tong et al. studied the hidden dangers of safety production in chemical enterprises and proposed a method for selecting and evaluating equipment maintenance suppliers, which can select the best equipment suppliers and improve production safety [4]. The above research shows the importance of enterprise safety production. This paper will also be based on safety production research.

Intelligent systems are used in various types of safety production affairs at present. The term "affairs" has a wide range of concepts. "Public affairs" put forward by Huiyong Wang refers to the social activities directly engaged by a small number of professionals with public affairs as the object and participated by everyone [5]. Guochun Cai mentioned in the definition of the concept of college student affairs management that Chinese scholar Fang Wei thinks "student affairs" refer to all non-academic activities of students [6]. The transaction mentioned by Xiaofeng Lei et al. in the safety production transaction management oriented to the principle of security domain maintenance involves database transactions[7]. To avoid confusion, we will explain the meaning of the word "transaction" in this paper, which refers to a series of related production activities in enterprise safety production.

At present, the hierarchical management model has made great help to the production safety of enterprises, and many researchers have also proposed many hierarchical management models. Xiang m
et al. set up a control group to study the hierarchical management mode of nurses. The experiment shows that hierarchical management can improve the quality of nursing management very well [8]. Grözinger G et al. studied the current problems of university hospital information processing and proposed a three-level model, which can well evaluate the quality of hospital information management [9]. Guangwei He studied the application effect of hierarchical management mode in standardized management of outpatients with tuberculosis and verified the effectiveness of the application of hierarchical management mode by setting a control group [10]. Caibi Zhao proposed that three-level control should be applied in mine operation to ensure its safety [11]. Guoliang Xu proposed the hierarchical management mode of multi-department cooperation, which was applied to enterprise safety production, and strengthened the enterprise safety production responsibility system [12]. Then an excellent hierarchical management mode applied to the safety production management system can make the operation of the system more efficient. The above research shows that the hierarchical model plays an excellent role in management.

However, the above model is not well reflected in the responsibility allocation and the interaction between responsibilities, and the angles involved are relatively limited, which does not apply to all project management. Given the above problems, this paper proposes a four-stage management mode of safety production affairs, which can effectively improve the management of enterprise safety production engineering.

2. RELATIVE CONCEPTS
This section introduces the related concepts in the four-stage management mode. It includes mode objects and mode roles.

The four-stage management mode proposed in this paper is "contract-project-work-construction". This mode makes the division of responsibility in the process of project implementation clear and solves the problems of unclear division of responsibility and poor interoperability in the process of project implementation. It is a general project management mode.

The management mode is defined as an interaction of four roles and four objects. The role is the object of operating the system, which is divided into contract manager, project manager, work manager, and construction personnel. The object is the main object of system work access, which is triggered by role, including contract, project, work, and construction.

2.1. Mode objects
The contract is a statement of specific matters agreed by many parties, which generally includes cooperation contents, responsibilities of all parties, economic relations, ownership of achievements, acceptance methods, and indicators. Here the contract object is the first stage.

The project is consistent with the general concept of the project. As the second stage object of the mode, it can be divided into several subprojects, which are the same kind of objects.

The work is a task that needs to be implemented by the construction team and can not be further decomposed into works. In general, a project or subproject can be divided into multiple jobs.

The construction is the construction task with the smallest granularity which requires the construction workers to operate on-site. Each construction task is assigned a constructor. Each construction team is divided into several construction tasks and assigned several constructors or evaluation experts.

2.2. Mode roles
The contract manager carries out contract creation, project creation, project release, record status, project completion audit, contract completion data archiving.

The project manager carries out project acceptance, work division, assignment release, project status reporting, project completion data submission, work completion audit.

The work manager can accept the work, establish the construction team, issue the construction, report the work status, submit the work completion data, and review the construction completion.
The constructors carry out construction task acceptance, formal construction, construction status report, construction completion submission.

3. **FOUR-STAGE MANAGEMENT MODE**

This section introduces the four-stage management mode. Including the visual definition of the four stages, as well as the implementation process description.

3.1. **Visual definition**

This section defines the visualization of the four-stage management mode. Visualization is a macro concept. According to the research situation, the definition method can be described, and various types of aspects can be defined. Let's make a few introductions. Visualization proposed by Meiklejohn D et al. Is a data association method, which can well identify objects with certain characteristics [13]. Hernández I f et al. Proposed visualization, which refers to the use of visual methods to identify crop maturity, is an intelligent visualization [14]. Yisheng Luo analyzed the concept and characteristics of visualization and proposed that visualization is an effective method to enhance cognition and improve work efficiency [15]. In the research and implementation of the workflow visualization definition tool, Yongxing Zhang mentioned that using graphical representation to define workflow has the advantages of simple and intuitive [16]. Jiuhu Cao mentioned that visualization of thinking is an intuitive way to express ideas by using symbols such as pictures [17]. Based on the description of visualization in the above research, we will explain the definition of visualization involved in this paper. The definition of visualization is displayed in the form of graphics or interface so that the user can get an intuitive perception of things.

The following describes the visualization definition of the four-stage management mode, the visualization definition of the proposed mode is realized by the combination of graphic elements. The visualization definition is shown in Figure 1. The details of the visualization are as follows.

The contract belongs to the top-stage object of the system, which is created by the contract manager. After the contract is approved, both parties sign the contract and determine the effective date. After the contract takes effect, the contract manager creates the subordinate project of the contract and releases the project to the project manager. After the project completion data is submitted, the audit is carried out, and the status during the contract execution is recorded.

The project belongs to the subordinate object of the contract, which is created and issued to the project manager by the contract manager. After receiving the project information, the project manager will check and process the project information, divide multiple subordinate jobs, and send them to the work manager. After the complete data of the project is submitted, the project status should be reported to the contract stage and receive work status reported by the work stage.

The work belongs to the subordinate object of the project, which is created by the project manager and issued to the work manager. After receiving the work information, the work manager needs to check and process it, set up a construction team, and issue it to each construction worker. After the construction completion data is submitted, it is necessary to timely report the work status to the project stage and receive the construction execution reported by the construction status.

The construction belongs to the subordinate object of the work, that is, the bottom object of the mode. After the construction team is established by the work manager, the evaluation experts or constructors are assigned. After receiving the construction information, the constructors check and process the construction information and start the construction after confirming the construction task. After the completion of the construction, the completion data shall be submitted to the work stage for review, and the construction shall be completed after the approval. During the construction, the construction execution status should be reported to the work stage in time.
3.2. Implementation process

This section will introduce the specific implementation process of the four-stage management mode. The pattern implementation process is shown in Figure 2.

The whole process is from top to bottom, the roles at all stages create and distribute the subordinate objects to the subordinate roles, and then from the bottom up, the roles at all stages report and submit the execution results of objects at all stages to the superior roles. Generally speaking, it is a recursive and regression implementation process. The process is described as follows.

The contract manager manages all the contracts in the system independently, reviews the rationality and legality of the contracts after they are created, and starts to execute the contracts after they are approved. At the beginning of implementation, the subordinate project is created and its rationality and legitimacy are reviewed, and the project stage is released after the approval. After that, the project manager will receive the above project and accept it. After acceptance, the project will be executed. When executing, first create subordinate jobs and review their rationality and legitimacy, and then release them to the work stage after passing the audit. After that, the work manager will receive the above work and accept it. After acceptance, the work will start. During the implementation, the subordinate construction group should be created first and its rationality and legitimacy should be checked. After the approval, the construction team should be assigned and the construction personnel should be assigned. The constructors receive and accept the tasks of the above construction team, and complete the tasks within the time limit according to the details of the construction tasks. Record the construction status during the construction and report to the work stage, and submit the relevant data after the construction is completed. After receiving the complete construction data, the work manager will review it. If the review fails, it will be returned to the constructor for improvement. After the review, the construction status will be checked and the construction data will be accepted. After that, the work manager needs to record and report the work status to the project stage, and submit the completion data after the completion of the work. The project manager shall review the complete data after receiving it. If it fails to pass the review, it shall be returned to the work manager for improvement. After the review is passed, the project manager shall check the work status and accept the work data. After that, the project manager needs to record and report the project implementation status to the contract stage, and submit the completion data after the project is completed. The contract manager will review the project completion data after receiving the project complete data. If the review fails, the
contract manager will return it to the project manager for improvement. After the review, the project implementation status will be checked and the project data will be accepted. After that, the contract manager needs to record the execution status of the contract during the execution of the contract, and archive all recursive data after the contract execution.

4. EXPERIMENT AND ANALYSIS
In this section, the four-stage management mode is verified by experiments. We apply the proposed model to the production safety evaluation occasions of an intelligent safety assessment system and discuss the functionality of the four-stage management mode based on the experiment.

4.1. Experiment introduction
This section will introduce the experimental system. The experimental system is an intelligent safety evaluation system, which is based on the four-stage management mode proposed in this paper to carry out the safety evaluation of enterprise production. The experimental system will be introduced below.
Figure 2. Implementation flow of mode
The intelligent safety assessment system aims to use advanced information technology, based on the safety evaluation standards of various industries, to evaluate and manage the safety of production and manufacturing service facilities and processes of various units, so as to ensure safe production. Based on the four-stage management mode, the system completes the process of evaluation contract to on-site.
evaluation. Since the experimental system is the Chinese version, the functional structure is used to reflect the implementation of the system, as shown in Figure 3.

Based on the four-stage management mode of contract project work construction, the smart safety assessment mainly realizes the main workflow of safety evaluation. Besides, the design of the evaluation test paper and evaluation report template, as well as the input and maintenance function of evaluation standards, it generates statistical reports for all the data generated by evaluation work, which is used for the message center of multi-party communication of the system, as well as for users, permissions, and other technical aspects Audit and other basic system functions.

4.2. Experimental analysis

Through the implementation of the intelligent safety evaluation experimental system, the four-stage management mode in this paper is verified. In the system, from the evaluation contract to the site construction, the internal workflow of each object module is independent. After each module role accepts the evaluation object, the internal evaluation work of the module is fixed, and the process is not interfered with, which reflects the clarity of the division of responsibility chain. Only when the on-site evaluation is completed and the evaluation results are submitted to the superior, the interaction with the evaluation module will be involved. The location of interaction between modules is consistent with the implementation of the project. All stages independently complete the tasks assigned by the superior, and then interact with the superior and submit the task results for acceptance. The model is easy to use, easy to operate, easy to apply to various types of engineering management, and has strong universality.

5. Conclusion

In this paper, the safety production management system is studied, and it is found that there are great deficiencies in the engineering management mode. A four-stage management mode based on safety production affairs is proposed, which solves the problems of unclear safety production management responsibility and poor interaction between objects. The proposed model is applied to the intelligent safety production evaluation management system, and the experimental results are good, which shows that the proposed model is effective.

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