Research on Digital Management of Whole Process of Science and Technology Planning Project in Shandong Province Based on Internet Technology

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ABSTRACT

To implement the party central committee stressed the "deepening the reform of science and technology system, enhance the vitality of science and technology innovation", "form the dynamic management and operational mechanism of science and technology", this study took 100 major science and technology innovation project of Shandong Province as the main research object. Combined with the method of project management and statistical calculation, the evaluation index system and model of the process management mode of science and technology planning projects were established. Based on the perspective of digital management, the data information processing model was established. The whole process management software platform was built with Internet technology. Countermeasures and suggestions to improve the management efficiency of science and technology projects in Shandong Province were put forward.

Keywords: *Science and technology project, Project management, Digital management, Internet technology*

1. INTRODUCTION

Science and technology planning projects are scientific research projects invested by national and local governments to achieve strategic goals, solve major science and technology problems in the process of economic and social development, and achieve high-quality development [1]. From the perspective of management content and key decision points, science and technology planning projects can be divided into four stages: project approval, implementation, final acceptance and achievement transformation.

Science and technology plan is a policy tool for organizing and implementing science and technology innovation [2]. It is an organizational form for realizing effective allocation of science and technology resources and carrying out major scientific research activities through financial fund support and guarantee. The whole process management of science and technology planning projects is very helpful in improving the achievement of science and technology planning goals and fund efficiency, especially in the management innovation of the transformation of scientific and technological achievements [3].

The management of science and technology planning projects in developed countries has undergone decades of development and evolution, forming a mature management model [4]. For example, the United States has adopted the model of full life cycle to carry out process management of science and technology planning projects, which could reduce risks and better achieve planning objectives [5]. In terms of process optimization for project management, Stadnicka has tried to establish a new operational model and study the role of optimization process and optimization method in actual business process optimization [6].

The management of science and technology programs in China is still in the exploratory stage, and the problems of "emphasizing project approval, neglecting management, and weak transformation" are more prominent [7,8]. In order to improve the effect of project management, the domestic science and technology management departments have explored a variety of science and technology plan management modes. Therefore, the construction of the whole process efficiency management system of science and technology planning projects is of great significance to promote the construction of a high-level innovative and strong science and technology province in Shandong Province.

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2. WHOLE PROCESS MANAGEMENT

The operating system of scientific research projects in foreign countries is quite different from that in China. Foreign management experience is difficult to be directly applied to Shandong science and technology project management practice.

Domestic research focuses on the management of scientific research projects at the national and university levels. Less attention is paid to the management of local government scientific research projects, so there is a lack of in-depth research on the whole process management of scientific research projects.

Therefore, in order to further improve the effectiveness of science and technology planning project management in our province, this paper will deeply analyze the characteristics and influencing factors of science and technology planning project management.

The optimization path of the whole process efficiency management is proposed by constructing the theoretical model of the whole process efficiency evaluation of science and technology planning projects. This can promote the construction of a high-level innovative province in Shandong Province.

2.1 Theoretical Model

This study aims to further improve the whole process management level of science and technology planning projects in Shandong Province.

By innovating the process management of science and technology planning project, optimizing the allocation of science and technology resources and improving the performance of science and technology planning project management, a scientific and efficient management mode of science and technology planning project has been established.

According to the relevant regulations of the state, the project shall be evaluated by experts before it is approved. Some projects also need expert evaluation in process management and acceptance. In order to do a good job in the evaluation of the project, the Shandong Province science and technology expert database system is constructed. It can dynamically collect the information of science and technology experts from the whole province or even the whole country, and automatically match the appropriate expert candidates according to the requirements of the project evaluation of each business of the system.

2.2 Construction Process

The research is carried out in the context of "Dilemma analysis -- Pattern design -- Theoretical reference -- Mechanism countermeasures".

2.2.1 Dilemma Analysis

The policy documents related to science and technology plan project management of 16 cities in Shandong province are systematically sorted out. The main research objects are the undertaking units and science and technology management departments of some provincial science and technology planning projects. We carried out field research and in-depth discussions as planned.

On this basis, comprehensive analysis and empirical research are carried out on the present situation and system of science and technology project management in Shandong Province.

Through the efficiency management mechanism of science and technology plan project, the current predicament and the key to break the situation can be solved.

2.2.2 Pattern Design

Based on the design mode of "Project approval stage -- Implementation stage -- Acceptance stage -- Achievement transformation stage -- Later management stage", this study constructed the whole process efficiency evaluation index.

The scientificity and effectiveness of management mode and evaluation index are demonstrated on provincial key science and technology major innovation projects.

Based on the "PDCA model", this study constructed a theoretical model of efficiency evaluation for the whole process of science and technology planning projects. It can strengthen the process control and risk management. (Figure 1)

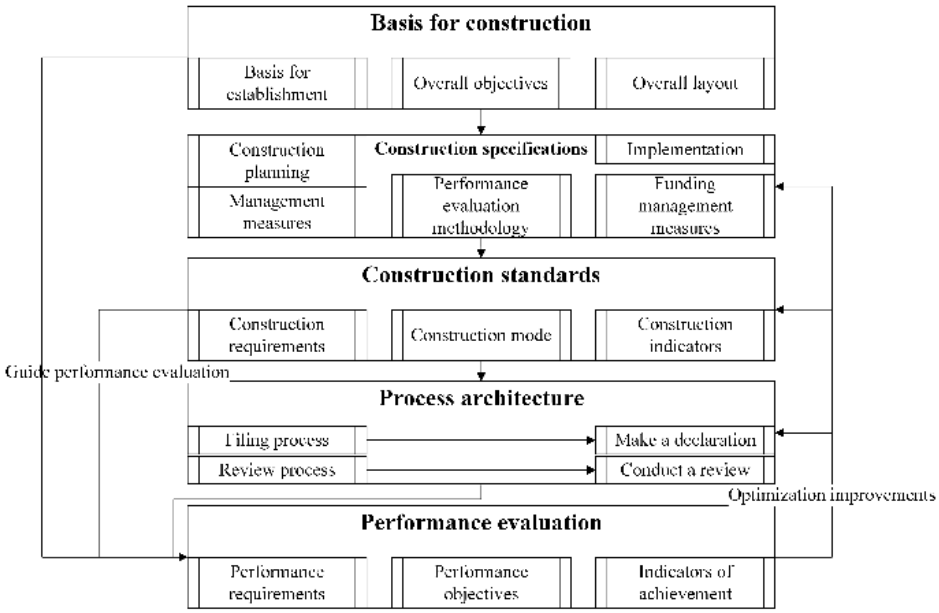

Figure 1 Theoretical model of efficiency evaluation for whole process of science and technology planning project.

2.2.3 Theoretical Reference

The management mode of science and technology projects in advanced countries, domestic advanced regions and large enterprises is fully sorted out.

Based on the theory of "Life Cycle Theory", this paper summarized the development process and driving factors of Science and technology project management in China, and analyzed its development trend.

2.2.4 Mechanism Countermeasures

On the basis of detailed field research data and full demonstration, this study reasonably and effectively constructed the operation mechanism of full efficiency management of science and technology plan, and put forward feasible countermeasures and suggestions based on the reality of Shandong Province.

2.3 Research Methods

This research used logical reasoning, game theory, in-depth investigation, multi-party demonstration, case analysis, empirical research and other methods.

2.3.1 Logical Reasoning and Game Theory

Through combing the classical literature, the intrinsic significance of improving the efficiency management efficiency of the whole process of science and technology planning projects is clarified. Clarify policy orientation and development direction by sorting out relevant policies issued at the national level and Shandong Provincial level.

Inductive and deductive mechanism of efficiency management in the whole process of science and technology planning projects. Based on the basic principles of information economics and game theory, this paper analyzes the moral hazard and adverse choice caused by information asymmetry in existing science and technology planning projects. Through the game analysis between government science and technology management department and project undertaer, the influence of project monitoring and incentive mechanism on project output is revealed.

This paper focused on the analysis and design of science and technology project management system from the perspective of project monitoring and incentive by government science and technology management departments.

2.3.2 In-depth Investigation and Case Analysis

100 major innovation projects in Shandong province were selected as the main research objects. This study selected typical representatives to carry out field research and in-depth discussion and exchange.

We have accurately grasped the status quo, pain points and difficulties of the whole process management of science and technology planning projects in Shandong Province.

The typical phenomena and cases of major innovation projects in Shandong province are systematically studied. Grounded theory can provide a basis for the construction of new theories and the proposal of effective and feasible policy suggestions.

2.3.3 Multi-party Demonstration

The construction of performance evaluation indicators has widely solicited the opinions and

suggestions of project management units, competent units, experts and project undertaking units.

On the basis of constructing the model, multi-party verification is carried out. This can effectively solve real problems. Collecting microscopic data and materials is not only the source of model validation data, but also the basis of case analysis.

2.3.4 Empirical Research

This paper carried out normative research and empirical tests on specific research topics.

The normative research aims to summarize the management mode of science and technology planning projects in Shandong Province, form a clear theoretical context, and clarify the theoretical basis and constraints of the operation mechanism of science and technology planning project management in Shandong Province.

The empirical test aims to test and verify the stability and reliability of the whole process project management model.

2.4 Operation Mechanism

The operation mechanism of full efficiency management is divided into four processes.

2.4.1 Condense the Question

By means of expert discussion, data analysis and other methods, the realistic difficulties faced by the management of science and technology planning projects in Shandong province are clarified and the key scientific problems are condensed.

2.4.2 Construction of Index System

Centering on the whole process of science and technology planning project management, including project approval, implementation, acceptance, achievement transformation and post-management, this paper extracted the key factors and constructed an evaluation index system to strengthen process control and risk management through evaluation.

2.4.3 Validation Index System

This study fully combed the experience and practice of advanced countries and provinces in the whole process management of science and technology planning projects, and verified the evaluation index system.

2.4.4 Countermeasures and Suggestions

Based on the actual management of science and technology planning projects in Shandong Province and the existing policies and systems, this paper put forward some countermeasures and suggestions for the problems of "attaching importance to project establishment, light management and weak transformation". This study constructed the optimization path of the whole process management of science and technology planning projects. (Figure 2)

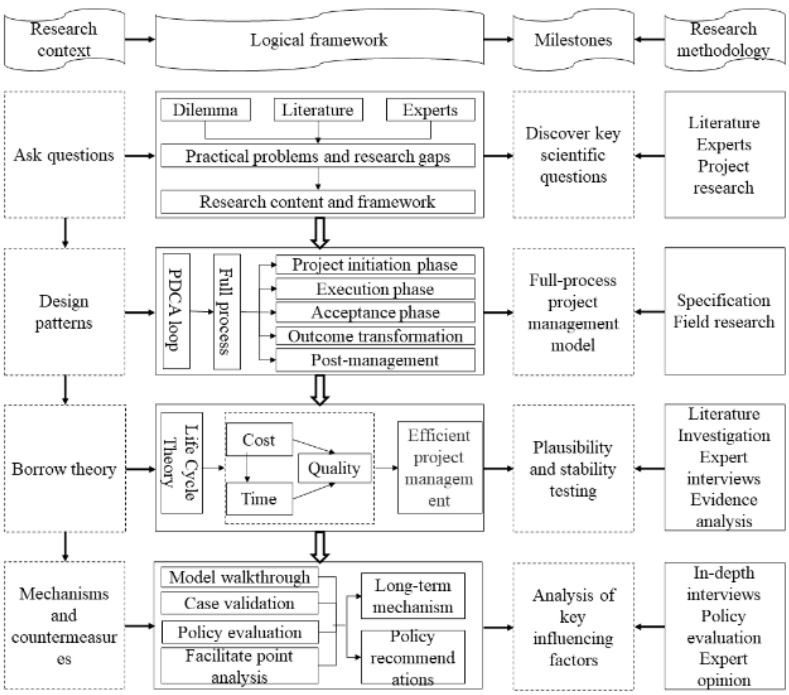

Figure 2 Optimization path of whole process management of science and technology planning project.

2.5 Data Information Processing Model

The demand subject of science and technology plan project management system is composed of solving the problems in practice and solving the frontier needs and predictions of future development. In order to meet the needs of the whole process management, the system takes safe and stable operation as the main standard.

However, in order to meet the needs of constantly changing administrative management mode and continuously improving the convenience service ability, the system also requires the characteristics of dynamic management. It is required to be able to adjust according to the change requirements of management and service.

2.5.1 System Design Architecture

In general, the safety and stability of the science and technology plan project management system is the major premise. Safety technology, emergency response and safety management guarantee must be established under the guidance of unified safety regulations.

On this basis, according to the science and technology plan, the number of projects is large and the management process is dynamic. From the perspective of business feasibility, certain processes, process element relationships and various forms can be easily modified or added as needed. Make the system have the greatest "flexibility" and realize flexible management. At the same time, components are connected with standard based technical interfaces to enhance system functions. Facilitate the integration or compatibility with other systems, and effectively ensure the scalability of the system and the extensibility of service functions.

2.5.2 Function Module of the whole Process Management Platform

System management platform is a platform for administrators to use and conduct business configuration and security management of the whole system, including user management, process management, permission management, form management, report management and other functions.

Management process sorting requires multi-object and multi-level communication, analysis of the relationship between basic processes and process elements, and analysis of the relationship between business functions and data. Integrate the relevant or decentralized management into a unified management mode, and establish the logical function of system development by the relevance of system development requirements, management function structure, workflow combination, and project object attributes.

All aspects involved in the management of science and technology planning projects and the concept of user-friendly service can be fully considered and coordinated, and effectively strengthen the whole process management and control of science and technology planning projects.

2.5.3 Structured Design and Framework

The system adopts modular and standardized design structure. According to the characteristics of science and technology plan project management, the system is designed into three parts: Science and technology plan project data submission platform, science and technology plan project data processing platform and system management platform. The businesses of various platforms are interconnected and work together.

The science and technology plan project data submission platform is mainly used by applicants. It has the functions of registration and login, online submission and processing of various project materials, tracking and online viewing of the approval status of application data, and receiving announcements sent by science and technology management departments. Taking user query as an example, the logic architecture diagram is shown. (Figure 3)

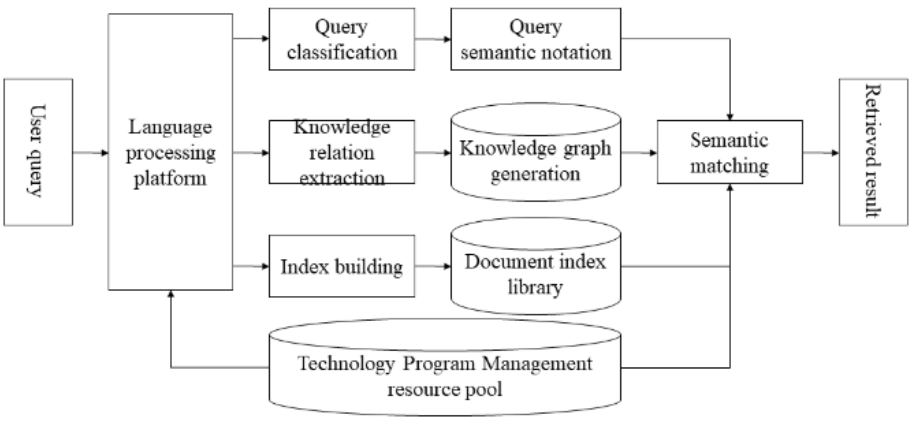

Figure 3 Logical architecture diagram.

The data processing platform of science and technology plan project is mainly used by managers, including dozens of science and technology plan project management system function modules, such as planning preparation, project guide release, online application, project pre review, project evaluation and review, project review, project approval, contract management, fund management, implementation management, project acceptance, acceptance and review, whole process browsing, comprehensive statements, online announcements, document management, system management, historical data query. By subdividing and defining the parameters of each function module, the system meets the business processing and decision support of the whole process. The platform system can manage basic information such as circulation, storage, reminder, notification, summary and result import according to the organizational structure management process.

Scientific and technological innovation is the core driving force of future economic and social development. Science and technology plan is a policy measure to allocate science and technology resources around key science and technology fields, and an effective way to realize the strategic deployment of science and technology innovation. In the process of platform design, many key technologies are used, including project overall verification, document online synthesis, document server-side batch synthesis, form customization, intelligent report.

The efficiency management mode of the whole process of science and technology projects affects the progress and innovation of science and technology in China. This paper discusses document online synthesis in detail. The client word synthesis adopts "NTKO + XML + word template + word control technology". (Figure 4)

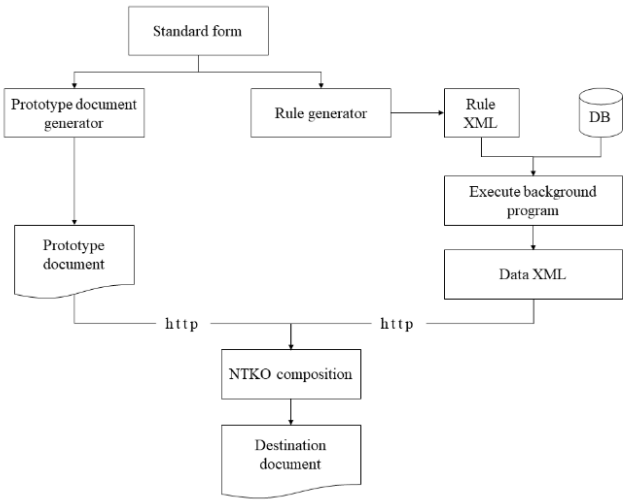

Figure 4 Client word composition schema.

The prototype word document is a word document with bookmarks, and the book signature corresponds to the book signature in the rule XML file one by one. The rule XML file defines the correspondence between the query logic of synthetic data and bookmarks, and the rule code is as follows:

```
<?xml version="1.0" encoding"UTF-8"?>
<root>
<ins type="docx">
<bookmark name="docx_1;docx_2;docx_3;d
ocx_4"value="select a,b,c,d from table"/>
</ins>
</root>
```

3. SUGGESTIONS

3.1 Fund Management

The person in charge of the project shall prepare the budget of various funds of the science and technology plan project to improve the utilization rate of funds. We recommend that a dedicated financial manager be involved in the technology program.

It is suggested to implement the supervision mechanism of financial management to ensure the special funds. This can improve the effective utilization rate of project funds.

3.2 Incentive System

Establishing the incentive system for scientific and technical personnel is an important means to improve the implementation level of science and technology projects.

The innovation achievements and work performance of researchers are assessed by scientific and reasonable evaluation indicators. It is helpful in getting good work done.

3.3 Management Process

It is suggested to improve the process of science and technology project management. Each link of project implementation needs to be managed to ensure that the project management process is fully adapted to the actual situation.

The management level of science and technology planning projects can be improved by implementing the management responsibilities in the process of science and technology planning projects.

4. CONCLUSIONS

Science and technology project management is easily affected by various factors. This study focuses on the current science and technology planning project management mechanism from the perspective of the whole process of project establishment, implementation, conclusion and achievement transformation.

Typical projects are selected for field research and in-depth discussion and exchange, and the evaluation index system and model of process management mode of science and technology planning projects are established.

Finally, based on the whole process management perspective, the countermeasures and suggestions to improve the management efficiency of science and technology planning projects in Shandong Province are put forward. It has greatly improved the management effect of science and technology projects in Shandong Province and strengthened the supporting role of scientific research in economic and social development.

AUTHORS' CONTRIBUTIONS

Zhengqian Feng contributed to the conception of the study;

Wang Li contributed significantly to analysis and manuscript preparation;

Zhongwei Chen wrote the manuscript;

Xikai Ding performed the data analyses;

Ning Dang helped perform the analysis with constructive discussions.

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