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Construction of Evaluation Indicator System for Acceptance of Soft Science and Technology Projects in Tobacco Industry based on OKR

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Abstract

Soft science and technology projects are one of the basic organizational forms of scientific and technological activities, being the process of generating, accumulating, and applying new knowledge.The evaluation of science and technology project is a key stage in the process of science and technology project management. In the new development stage, it is urgent to speed up the formation of a comprehensive innovative management system. Constructing an acceptance evaluation indicator system of soft science and technology projects is an important link to deepen the management of science and technology projects. Based on the OKR (Objectives and Key Results) method and combined with the characteristics of soft science projects, the acceptance evaluation objectives such as schedule, quality, cost, and team management are proposed. The evaluation objectives are transformed into quantifiable key outcome indicators, and a system of evaluation indicators for soft science and technology project acceptance in tobacco industry is constructed. Field research is carried out in the tobacco industry, using the entropy value method to assign weights to the evaluation indicators, with a view to providing a decision-making basis for the acceptance evaluation of the scientific and technological project management departments, and accelerating the formation of new quality productivity in the tobacco industry.

Keywords

Objectives and Key Results; Acceptance Evaluation Indicator; Soft Science and Technology Project; Entropy Method; Tobacco Industry.

1. Introduction and Literature Review

The core of new quality productive forces is scientific and technological innovation. Science and technology is the primary productive force and innovation is the primary driving force. Science and technology projects are the starting point of scientific and technological innovation, scientific and technological innovation cannot be separated from the implementation of science and technology projects. Science and technology projects in tobacco industry to scientific research and technological development as the content of a separate project, which is carried out to solve the scientific and technological problems arising in the process of industry management. Science and technology project evaluation is a necessary tool to grasp the progress of the project, and plays a key role in improving the efficiency and benefit of scientific and technological innovation activities. In 2022, state market regulatory administration

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approved releasing a series of standards, such as the General Rules of Science and Technology Research Project Evaluation, which provide the basis and guidelines for scientific research project evaluation activities. In 2024, the government work report pointed out that it should accelerate the promotion of a high level of scientific and technological self-reliance, to strengthen the status of enterprises as the main body of scientific and technological innovation, deepen the scientific and technological evaluation, science and technology projects, and budget management system reform. Soft science and technology project evaluation is an important means and guarantee to promote the sustainable development of scientific and technological innovation in the tobacco industry and to improve the management level of the tobacco industry. Soft science and technology project evaluation is an important means and guarantee of promoting the sustainable development of scientific and technological innovation in the tobacco industry and improving its management level. Acceptance evaluation is a necessary part of the management process of soft science and technology projects, and the establishment of a scientific acceptance evaluation system is of great significance to the establishment and development of the tobacco industry's innovation system.

At present, academics have formed relevant results of science and technology project evaluation, which mainly include two aspects. On the one hand, research on the theory of science and technology project evaluation. Scholars have explored the division of the whole life cycle of science and technology projects, the construction of the whole life cycle evaluation indicator system and other issues. Donglin Song et al. proposed the evaluation indicator system for process management of science and technology program projects based on the whole life cycle perspective and proved the scientific and rationality after evaluating and analyzing the evaluation indicator system [1]. Zhibo Wang et al. believed that the whole process management of science and technology projects can be optimized from a macro perspective, eliminating redundant activities to improve the efficiency of the management, and establishing a system for tobacco enterprises' evaluation indicator system in terms of the establishment of the project, the process of implementation, the funding, the acceptance and the application management [2]. Liquan Niu et al. proposed post-evaluation indicatores and contents according to the four states of the evaluated enterprise science and technology projects after acceptance [3]. Linna Guo et al. explored the application of the "horse racing system" in the organization of science and technology projects, analyzed the key success factors and management points of each stage of the "horse racing system" project, and constructed a whole-process evaluation framework system that meets the characteristics of the "horse racing system" from the stages of topic selection, project establishment, implementation, achievement transformation, and exit [4].

On the other hand, research on the evaluation of different types of science and technology projects. Aihua Zhang et al. combined the discipline theory and method of soft science to construct a performance evaluation indicator system for soft science and technology projects and conducted an empirical analysis [5]. Haijiang Geng et al. constructed a performance evaluation indicator system for enterprise science and technology projects from the quantitative and qualitative dimensions for the significant scientific and technological projects of state-owned enterprises, based on the prerequisite of cultivating the enterprise's innovation ability and realizing the development of the enterprise [6]. Chao Li et al. analyzed the meaning of performance evaluation of agricultural science and technology program projects, and then constructed the performance evaluation indicator system of agricultural science and technology program projects from output quantity, benefit situation, and satisfaction [7].

In summary, it can be seen that the existing literature on the evaluation of science and technology projects mainly focuses on the construction of the evaluation system of the whole life cycle of science and technology projects, the construction of the evaluation system of specific types of science and technology projects, which can provide a reference for the construction of the evaluation indicator system of soft science and technology project

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acceptance. However, there are the following shortcomings: (1) most of the existing literature is based on life cycle theory, only considering the evaluation of important factors in each stage of the project and lacking in the establishment of an operational evaluation indicator system based on other related theories. (2) the existing literature focuses more on the evaluation of science and technology plan projects, enterprise technology development projects, and the construction of soft science and technology project performance evaluation indicator system, and lacks the research results on the evaluation indicator system of soft science and technology project acceptance. Objectives and Key Results (OKR) is an advanced management method. This paper is based on the characteristics of soft science and technology projects and the OKR method to explore constructing a set of applicable soft science and technology project acceptance evaluation indicator system, and using the entropy value method to evaluate. In order to stimulate the innovation potential of scientific and technological personnel, create an innovative environment, and provide a scientific decision-making basis for the acceptance evaluation work of the management department of industrial science and technology projects.

2. The Basis for Constructing the Acceptance Evaluation Indicator System of Soft Science and Technology Projects in the Tobacco Industry

2.1. The Connotation of the OKR Method

The OKR method is developed based on management objectives by drawing on the organizational management idea of the balanced scorecard. Andy Grove first proposed it and implemented it in Intel Corporation, which has achieved outstanding results [8]. The method tracks the achievement of performance goals based on the objectives set and the key results expected. It is a tool and method for the performance evaluation of projects. The "O" in the OKR method is Objectives, which reflect the direction and vision of the team's efforts and are primarily qualitative descriptions. The "KR" refers to Key Results, which measure whether or not the goal is realized. It breaks down the goal into specific, measurable indicators, mainly quantitative descriptions. When the Key Results are completed, the corresponding objectives are also completed. This is conducive to the project members focusing on completing the project assessment requirements. Based on the OKR method to construct the acceptance evaluation indicator system of soft science and technology projects in the tobacco industry, which has strong applicability.

2.2. Characteristics of Soft Science and Technology Projects in the Tobacco Industry

2.2.1. Timeliness

Science and technology projects are the primary carriers of scientific and technological innovation in the tobacco industry. And the soft science and technology projects are carried out around the industry's scientific and technological development trends. Soft science and technology projects are easily affected by changes in the internal and external environmen. Its research methods and theoretical foundations are time-sensitive and require completion within a certain period of time.

2.2.2. Specificity

The science and technology projects and technology development projects are different from the basic theory. Research objectives of soft science and technology projects mainly include accelerating the scientific and technological progress of the industry, upgrading the level of organization and management, enhancing the capability of independent innovation. The research results are mostly presented as intangible knowledge or produce specific macro guidance, focusing on the effectiveness of talent cultivation.

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2.2.3. Wide Research Scope

Tobacco industry soft science and technology projects involve management innovation, institutional innovation, marketing innovation, cultural innovation, technological innovation, strategy, planning, policy and strategy, and many other areas. The research content is highly targeted.

3. Construction of Acceptance Evaluation Indicator System for Soft Science and Technology Projects in the Tobacco Industry

3.1. Objectives of Acceptance Evaluation of Soft Science and Technology Projects in the Tobacco Industry

The acceptance evaluation objectives of soft science and technology projects mainly focus on systematically analyzing the project implementation process, completion, and team management, checking and determining whether the research content of the science and technology project meets the acceptance standards, whether the research results of the project are of scientific value, and evaluating the quality of the science and technology project research. Applying on the OKR method and combining with the characteristics of soft science and technology projects in the tobacco industry, four objectives are proposed for the acceptance evaluation of soft science and technology projects, including progress evaluation objective, quality evaluation objective, cost evaluation objective, and team management evaluation objective. Based on the OKR method, the above four evaluation objectives are transformed into quantifiable key result indicators, according to which the acceptance evaluation indicator system of soft science and technology projects in the tobacco industry is constructed to effectively improve the scientific management level of soft science and technology projects in the industry.

3.1.1. Progress Evaluation Objectives

Since soft science and technology projects must be finalized within a specified period, the objectives of progress evaluation are to carry out project acceptance on time and to implement the project according to the planned schedule.

3.1.2. Quality Evaluation Objectives

There are expected requirements on the quantity and quality of scientific and technological project results at the time of project establishment. Therefore, the quality evaluation goal of soft science and technology projects in the tobacco industry is to meet the acceptance standards for project research results and the effectiveness of talent training.

3.1.3. Cost Evaluation Objectives

The effect of cost management is one of the important objectives of the acceptance and evaluation of soft science and technology projects in the tobacco industry. The cost evaluation objective is mainly concerned with the reasonableness of the management of scientific and technological project funds.

3.1.4. Team Management Evaluation Objectives

Project manager coordinates and implements soft technology projects, and project work reports are submitted regularly. The project managers are responsible for the orderliness and rationality of the organization and management process of the science and technology project, to ensure the smooth implementation of the project. This objective evaluates whether the objectives of the teamwork of soft technology projects in the tobacco industry are practical and successful.

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3.2. Construct the Acceptance Evaluation Indicator System of Soft Science and Technology Projects in the Tobacco Industry

Based on the OKR method, combined with the General Rules of Science and Technology Research Project Evaluation and Guidelines in 2022, and considering the characteristics of soft science and technology projects. The objectives (O) and the key results (KR) of the acceptance evaluation of the soft science and technology projects are determined from the aspects of progress, quality, cost, and team management evaluation. The existing research results were sorted out, and finally construct the acceptance evaluation indicator system of soft science and technology projects, see Table 1.

Table 1. Acceptance Evaluation Indicator System for Soft Science and Technology Projects in Tobacco Industry

Evaluation objective (O)	Evaluation indicators (KR)	Explanation of evaluation indicators	Grading criteria
Progress evaluation	Achievement of research objectives	Whether the science and technology projects achieves the goal on time	Milestone measurement
	Research on task completion	Whether the research tasks are completed as required and meet acceptance criteria	Milestone measurement
	Adjustment and completion on research content	Whether the adjustments during the implementation of science and technology projects are allowed and the status of completion of the adjusted elements	Milestone measurement
	Completion of assessment indicators	Whether the various assessment indicators of science and technology projects meet the acceptance criteria	Milestone measurement
Quality evaluation	Innovation of the research content	Quality and quantity of papers published in the research process of science and technology projects	Milestone measurement
	Quality of texts	Whether the submitted science and technology projects acceptance materials are complete and standardized	Scoring by percentage of completion
	Effectiveness of Talent Cultivation	Whether to improve the quality and level of scientific and technological talents	Scoring by percentage of completion
Cost evaluation	Management and utilization of funds	Whether the science and technology projects funds are used for scientific planning and compliance	Scoring by percentage of completion
Team management evaluation	Organizational management level	Whether the organizational management and platform conditions of science and technology projects undertakings can support projects implementation	Scoring by percentage of completion
	Management of documents and information	Whether the documents submitted by each research stage of science and technology projects are complete	Scoring by percentage of completion

3.2.1. Progress Evaluation Indicators

The progress evaluation of soft science and technology projects is the overall control of the efficiency of science and technology projects and the evaluation and supervision of the degree of completion of science and technology projects within a certain period. Since the soft science projects in the tobacco industry have time-sensitive requirements, the progress evaluation

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mainly focuses on whether the project can be accepted on schedule, which is mainly reflected in whether the progress of project implementation is in line with the planned progress, to effectively avoid project delays and improve the acceptance rate of the project. The following four representative key result evaluation indicators (KR) were selected: First, Achievement of research objectives. It is mainly used to evaluate whether the science and technology projects have achieved the planned research objectives in the project declaration or project proposal on schedule. Second, Research on task completion. It is mainly used to evaluate whether the research tasks are completed according to the declaration or project proposal requirements and meet the acceptance criteria. Third, Adjustment and completion on research content. Since the soft science and technology projects of the tobacco industry will be adjusted in the process of implementation due to the deviation between the actual and the plan, it is necessary to evaluate whether the adjusted contents of the science and technology project are allowed, and the completion of the adjusted contents. Fourth, Completion of the assessment indicators. This indicator is mainly used to evaluate whether the assessment indicators in the project declaration or project proposal have been completed as planned and meet the acceptance criteria.

3.2.2. Quality Evaluation Indicators

Soft science and technology project acceptance evaluation of the tobacco industry pays attention to the progress and quality of science and technology project completion. Progress management and quality management complement each other to ensure the project is accepted on schedule. The quality of scientific and technological projects is mainly reflected by the number and level of scientific and technological achievements. The evaluation focuses on the status of the science and technology projects in the discipline and the impact on the future of the discipline. The following three indicators were selected as key results (KR) evaluation indicators: First, Innovation of the research content. This indicator is the core indicator of acceptance evaluation. It is mainly used to evaluate the degree of innovation of the research results of the science and technology projects, including the quality and quantity of the papers published by the project team at each stage; whether the research results put forward new point of view, new system, new methodology and new theory; and whether the research can help to promote the previous research and inspire other scholars in their relevant research. Second, Quality of text. This indicator is an important reflection of the quality of soft science and technology projects. It mainly evaluates whether the materials submitted for project acceptance are complete and whether the text expression is standardized. Third, Effectiveness of talent cultivation. It is mainly used to evaluate the degree of influence on scientific and technological talents during the implementation of soft science and technology projects, whether it can improve the quality and level of scientific and technological talents, and whether it has the role of cultivating scientific and technological talents.

3.2.3. Cost Evaluation Indicators

The cost evaluation of soft science and technology projects in the tobacco industry is mainly reflected in the supervision and evaluation of project funding use. Setting the indicator of Management and utilization of funds is mainly used to evaluate whether the funding of soft science and technology projects has been scientifically planned, the proportion of various types of costs is reasonable, the project funds are in compliance with the use process, and the income and expenditure situation is accurate, and so on.

3.2.4. Team Management Evaluation Indicators

Tobacco industry soft science and technology projects research team personnel mostly from different departments. The team management evaluation is critical. It evaluates not only the implementation of the project specifics but also the management of scientific and technological talents in the process of project implementation. Combining the research results of Donglin

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Song et al. [1] and other scholars and based on the relevant indicators of the General Principles for Evaluation of Scientific and Technological Research Projects, two indicators are selected as key result (KR) evaluation indicators. First, the indicator of organization management level is mainly used to evaluate whether the organizational management and platform conditions of the tobacco industry soft science, and technology project undertaking unit can support the implementation of the project and effectively promote the smooth development of the research project. Second, the indicator of management of documents and information is mainly used to evaluate whether the documents and other supporting materials submitted at each stage of the research of soft science and technology projects in the tobacco industry are complete, orderly, and scientifically managed.

In addition, the scoring rules adopted by the OKR method can be categorized into two types: "Milestone measurement" and "Scoring by percentage of completion". For "Milestone measurement", It is necessary to judge whether the soft science and technology projects have completed the research tasks before the deadline. The score is "1" if the research tasks have been completed, and "0" if they have not. Adopting "Scoring by percentage of completion", the scoring interval is 0~1.0. In the acceptance evaluation of soft science and technology projects in the tobacco industry, the progress evaluation indicator and the "Innovation of research content" indicator in the quality evaluation are the key points of whether the project can pass the acceptance assessment. If the progress of the science and technology project is not completed according to the requirements and the research content is not innovative, the project will not pass acceptance. Therefore, milestones measure the four progress evaluation indicators and the "Innovativeness of the research content" indicator. If the progress of a soft science project is not completed due to force majeure, the deadline for acceptance of the project may be extended as appropriate. Other evaluation indicators can be collectively agreed upon by the acceptance experts based on previous evaluation experience and rated between 0 and 1.0.

4. Empowerment on Tobacco Industry Soft Science and Technology Project Acceptance Evaluation Indicator

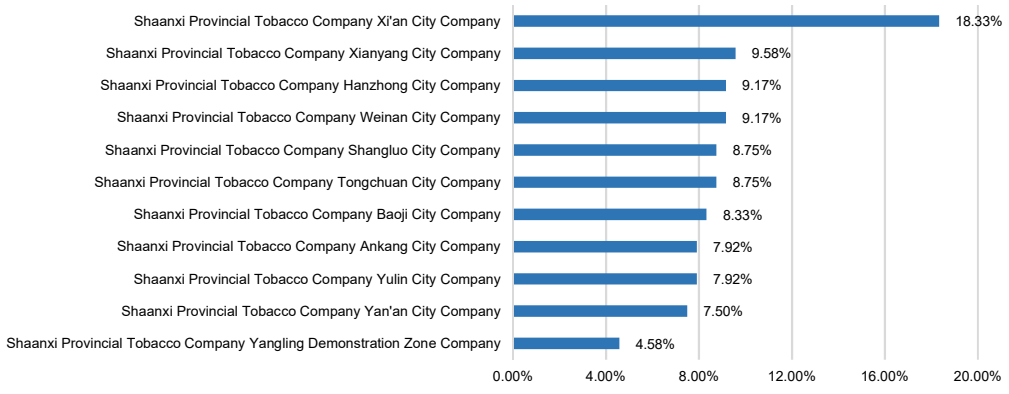

Figure 1. Status of questionnaires

The research group conducted field research in 11 prefectural and municipal tobacco companies under the jurisdiction of Shaanxi Provincial Company of China National Tobacco Corporation. In order to obtain the relevant data of respondents' evaluation indicators on the acceptance of the industry's soft science and technology projects questionnaires are distributed to relevant managers, employees with experience in scientific research projects, and so on. The questionnaire is divided into two parts: first, the basic information of the respondents in

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Shaanxi Tobacco Company, mainly including gender, age, working years, education, and the city where they work. Second, the respondents select the importance of the evaluation indicators of the acceptance on the soft science and technology projects. The questionnaire survey is based on field research. A total of 240 questionnaires were issued, and 240 valid questionnaires were retrieved, see Figure 1.

4.1. Selection of Empowerment Methodology

The entropy method is based on the amount of information provided by the evaluation indicators to judge the degree of dispersion of the indicators [9]. The entropy method is suitable for decision-making problems with multiple indicators, which can avoid the interference of subjective factors and make the evaluation results more objective. Therefore, the entropy value method is used to analyze the relevant data of this questionnaire survey, mainly using EXCEL software. According to the information contained in the evaluation indicators, the corresponding weight level is objectively determined to provide a basis for accepting the evaluation indicator weights. The valid questionnaires of this survey total 240, n=240. Scoring for 10 evaluation indicators, m=10. " x_{ij} " indicates the scoring value of the i_{th} respondent for the j_{th} indicator (i=1,2,...240; j=1,2,...10). In order to make the evaluation indicator data comparable, the original scoring value x_{ij} needs to be dimensionless and the eigenvalue is calculated. The entropy (e_j) and variability coefficients (d_j) of the j_{th} evaluation indicator are then calculated, where $0 \le e_j \le 1$, as shown in equations (1) and (2):

$$e_j = -\frac{1}{\ln(n)} \sum_{i=1}^{n} P_{ij} \ln(P_{ij}) \tag{1}$$

$$d_j = 1 - e_j \tag{2}$$

Finally, the weight (w_j) of each evaluation indicator is determined, as shown in formula (3):

$$w_j = \frac{d_j}{\sum_{j=1}^{m} d_j} \tag{3}$$

4.2. Empowerment Results and Analysis

According to the above steps, the use of EXCEL software to analyze the data related to questionnaire, and the weight of each acceptance evaluation indicator can be obtained, See Table 2.

Table 2. Empowerment results

Evaluation objective (O)	Weight	Evaluation indicators (KR)	Weight
Progress evaluation	0.381	Achievement of research objectives	0.062
		Research on task completion	0.074
		Adjustment and completion of the research content	0.127
		Completion of assessment indicators	0.118
Quality evaluation	0.334	Innovation of the research content	0.136
		Quality of texts	0.091
		Effectiveness of Talent Cultivation	0.107
Cost evaluation	0.052	Management and utilization of funds	0.052
Team management evaluation	0.233	Organizational management level	0.105
		Management of documents and information	0.128

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Based on OKR, a set of evaluation indicator system covering four evaluation objectives and ten key results was constructed. The entropy method was used to calculate the weight of each indicator. It can be seen from Table 2 that the weight of Progress evaluation is the highest, with a weight value of 0.381, while the weight of Cost evaluation is the lowest. This result shows that progress toward completion is the most important factor in the acceptance evaluation of soft technology projects in the tobacco industry. Among the key results (KR) evaluation indicators, the indicator with the highest weight is "Innovativeness of the research content", with a weight value of 0.136, and the indicator with the lowest weight is " Management and utilization of funds". This shows that the degree of innovation of the research content of the soft science and technology projects in the tobacco industry is very important, emphasizing that the research results should put forward new ideas, new theories. It is helpful to promote further research and development of the existing results, and the innovation of the project determines the success or failure of the project to a large extent.

5. Conclusion

The government report in 2024 points out that we should vigorously promote the construction of modernized industrial system and accelerate the development of new quality productivity. The core of the new quality productivity is scientific and technological innovation. Acceptance evaluation of science and technology projects is an important evaluation stage for tracking and managing the completion of science and technology projects in the tobacco industry. It successful completion helps to optimize the efficiency of science and technology project management and resource allocation, and enhance the overall effectiveness of scientific and technological innovation system. The construction of a soft science and technology project acceptance evaluation indicator system for the tobacco industry, screening out high-quality science and technology projects, enabling the industry to realize the optimal allocation of workforce, material, and financial resources, and then promote the enhancement of the scientific and technological innovation capacity, accelerate the transformation of scientific and technological achievements, and continue to cultivate the new quality productivity in the tobacco industry.

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