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Analysis of Optimization Measures of Project Performance Management under the Perspective of Digital Transformation

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Abstract: With the in-depth advancement of digital transformation, enterprises are in urgent need of optimizing their methods in project performance management. This paper analyzes the current status and problems of performance management in airport construction projects against the backdrop of digital transformation, and identifies key obstacles such as an imperfect performance indicator system, unsmooth management processes, and insufficient data management capabilities. To address these issues, it proposes optimization strategies including building a digital performance indicator system, optimizing management processes, and enhancing data management and application capabilities. By implementing dynamic adjustment mechanisms and intelligent tools, enterprises can effectively improve performance management, achieve in-depth integration with digital strategies, and lay the foundation for the continuous optimization of enterprise performance.

In today's era of rapid development of the digital economy, enterprises are facing an ever-changing market environment. Digital transformation has become an important path for enterprises to pursue long-term development and competitive advantages. However, in this process, how to effectively manage and evaluate project performance has always been a focus of enterprises. Traditional project performance management methods are facing many challenges, especially when dealing with rapidly changing technological and market demands, they appear particularly weak. This paper will, from the perspective of digital transformation, explore the problems existing in the performance management of airport construction projects and propose corresponding optimization measures to help enterprises better adapt to the development needs of the digital era.

1. Current Status and Problems of Project Performance Management in Airport Construction from the Perspective of Digital Transformation

1.1 Analysis of Current Status

1) Current Status of Enterprise Digital Transformation

Driven by global digital development, the digital transformation of enterprises in the field of

airport construction has become a trend. A large number of airport construction projects have increased investment and accelerated the pace of transformation to enhance competitiveness and adapt to market changes. According to research reports, global corporate investment in digital technologies reached $4.5 trillion in 2024, with much of the funds flowing into infrastructure and transportation industries. In China, the scale of the digital economy reached 45.5 trillion yuan in 2023, accounting for 39.8% of GDP, reflecting the extensive penetration of digital transformation in various industries such as airport construction[1] . From the perspective of technological application, emerging technologies such as big data, cloud computing, artificial intelligence, and the Internet of Things have been widely applied, supporting decision-making in airport construction and improving engineering operation efficiency.

2) Application of Digitalization in Project Performance Management

With the advancement of enterprise digital transformation, digital tools are increasingly widely used in project performance management of airport construction projects, covering links such as performance goal setting and evaluation. In the stage of setting performance goals for airport construction, enterprises use digital platforms and big data analysis technologies to more scientifically formulate project performance goals closely aligned with corporate strategies and track the progress of goal completion in real-time. In the performance evaluation stage, digital systems can automatically collect data such as project progress, cost, and quality, improving evaluation efficiency. A 360-degree performance evaluation system is used to comprehensively assess the performance of project members, ensuring that airport construction can be completed on time and with high quality[2].

1.2 Existing Problems

1.2.1 Imperfect Performance Indicator System

In the context of digital transformation, the performance indicator systems of many airport construction enterprises have the problem of insufficient pertinence. When setting performance indicators for airport construction projects, some enterprises do not fully consider the uniqueness of the project and the new demands brought by digital transformation, and continue to use traditional general indicators, leading to a disconnect between indicators and actual situations.

1.2.2 Unsmooth Performance Management Processes

Currently, many enterprises have cumbersome performance management processes in airport construction, involving multiple links, resulting in low efficiency. In the process of setting and evaluating performance goals, complex approval and communication procedures are required, which consume a lot of time and often lead to delays in project initiation. In addition, the lack of effective collaboration and communication between departments leads to poor data collection and feedback, affecting the overall progress of airport construction.

1.2.3 Weak Data Management and Application Capabilities

In terms of data management and application, many airport construction enterprises face problems of low data quality and insufficient analysis capabilities. Poor data accuracy and consistency affect performance evaluation, leading to decision-making errors. At the same time, enterprises usually lack professional data analysts and advanced tools, unable to deeply analyze the value in data, which limits the formulation of decisions. These problems seriously affect the management efficiency and effectiveness of airport construction projects.

2. Optimization Strategies for Airport Construction Project Performance Management from the Perspective of Digital Transformation

2.1 Building a Digital Performance Indicator System

2.1.1 Designing Indicators Based on Strategic Goals and Digital Characteristics

In airport construction projects, the strategic goals of enterprises are also the core guiding principles for implementation. Digital transformation requires that the design of performance indicators be closely aligned with the airport construction strategy to ensure that the project direction is consistent with overall development. In this context, it is necessary to consider the digital characteristics of airport construction and design diversified indicators to reflect the effect of technology application and digitalization of construction processes.

For example, in airport construction projects, indicators such as the proportion of new technology application can be set to measure the degree of use of emerging technologies such as smart airports and drone monitoring. In addition, indicators related to construction quality, such as project progress compliance and safety hazard indicators, are introduced to ensure the stability and safety of airport construction in the digital environment.

2.1.2 Determining Indicator Weights Using Data Analysis

In the performance evaluation of airport construction projects, the scientific and reasonable determination of indicator weights is crucial. Using data analysis tools and methods can more objectively define the importance of each indicator. Common methods include Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Factor Analysis, which provide a structured approach to manage and compare performance indicators.

Through AHP, performance can be stratified, such as financial performance and customer satisfaction, and their relative importance can be determined through pairwise comparison. On the other hand, PCA and Factor Analysis can reduce multiple related indicators to a few key factors, thereby extracting indicators that significantly contribute to the overall performance of airport construction, making the determination of indicator weights more scientific.

2.1.3 Establishing a Dynamic Adjustment Mechanism

In the rapidly changing digital era, airport construction enterprises need to establish a dynamic adjustment mechanism to adapt to changes in the external environment and internal strategies. Project performance indicators should be updated in a timely manner according to adjustments in enterprise strategies. For example, when enterprises increase investment in smart airport construction, the weight of relevant innovation indicators should be increased to maintain competitiveness.

Enterprises also need to monitor market changes, such as the dynamics of competitors and the improvement of industry standards. Original performance indicators may no longer be applicable, so new indicators must be continuously introduced to measure the effect of improvements, such as construction data analysis speed and project progress accuracy. This ensures that enterprises can respond to technological progress at any time and utilize digital advantages.

The dynamic adjustment mechanism also needs to clarify the trigger conditions, processes, and responsible subjects for adjustments. Scientific and standardized processes should be formulated, including data collection, formulation and implementation of indicator adjustment plans, and collaboration between departments, to ensure that performance indicators are always in line with enterprise strategies and market environments.

2.2 Optimizing Digital Performance Management Processes

2.2.1 Design of Automated and Intelligent Processes

In the digital transformation of airport construction, automated tools and intelligent algorithms are key to optimizing performance management processes. These tools improve the efficiency of construction data collection and reduce human errors, making performance management more scientific and accurate. Through technologies such as IoT sensors and Building Information Modeling (BIM) systems, real-time automatic collection of construction data can be achieved, ensuring efficient and accurate data.

Intelligent algorithms have demonstrated strong analytical capabilities in performance evaluation. By analyzing historical data through machine learning, they can predict employees' future performance, identify potential problems, and provide suggestions for construction improvement. This in-depth analysis not only enhances the scientific nature of performance management but also provides real-time monitoring for project cost management, ensuring timely early warnings and the adoption of measures to control costs.

2.2.2 Strengthening Collaboration among All Links of Performance Management

The performance management of airport construction projects involves multiple links such as goal setting, execution, evaluation, and feedback, and all links need to collaborate closely. In the goal-setting stage, various departments and team members participate together to ensure that the goals are in line with the strategic direction and operable. The use of digital platforms makes goal decomposition and visual display clearer, enhancing the team's sense of identity and responsibility for the goals.

In the execution process, construction management units use digital project management systems to monitor progress and coordinate resources and tasks in a timely manner. The system automatically updates and issues early warnings, helping team members understand the project status, thereby adapting to changes, strengthening collaboration, and improving execution efficiency.

In the performance evaluation stage, a multi-data integration method is adopted to ensure objective and fair evaluation. The introduction of a 360-degree feedback mechanism can obtain evaluation opinions from all parties. Through the online evaluation platform, the standardized process improves evaluation efficiency, helping construction management units make data-driven decisions and ensuring continuous improvement of the performance of airport construction projects[3] .

2.2.3 Implementing Dynamic Performance Management

In the rapidly changing market environment, traditional periodic performance management is not flexible enough. Dynamic performance management can track airport construction project data in real-time, discover problems in a timely manner, and take measures to ensure that the project moves towards the predetermined goal. Through the application of sensors and project management software, enterprises can obtain real-time information such as project progress, cost, and quality.

Once abnormal data is found, the dynamic performance management system will issue an early warning immediately and conduct data analysis to find the root cause of the problem. Through in-depth analysis, the reasons for overspending in construction costs can be identified, and corresponding solutions can be provided to help construction management units quickly adjust project strategies. In addition, timely data feedback enables construction management units to respond decisively to changes in market demand.

2.3 Enhancing Data Management and Application Capabilities

2.3.1 Improvement of Data Quality

Data is the core of the digital transformation of airport construction, and its quality directly affects the effect of project performance management. High-quality data provides reliable support for decision-making, while low-quality data may lead to wrong judgments and bring adverse effects to the project. Therefore, improving data quality is an important foundation for optimizing performance management.

In the process of data collection, problems such as duplicate records, inconsistent formats, and incorrect entry often occur. Using tools such as OpenRefine and Trifacta, format specifications and verification rules can be set to remove duplicate records, correct wrong data, and fill in missing information. This process ensures the accuracy and completeness of the data, laying a good foundation for subsequent analysis.

Data verification is also an important link to ensure data quality. By establishing verification rules, when checking project progress, comparison can be made according to the project plan and milestones to find inconsistent data in a timely manner and issue warnings. In addition, establishing a data quality monitoring mechanism, through regular sampling and feedback channels, encourages relevant personnel to report problems, thereby continuously promoting the improvement of data quality.

2.3.2 Data Analysis

Abundant data resources provide huge potential for performance management of airport construction projects, and data analysis and mining technologies are the key to realizing this potential. Advanced methods such as statistical analysis and machine learning can be used to extract valuable information from large amounts of data.

Statistical analysis is the basis of data analysis, including descriptive statistics, correlation analysis, and hypothesis testing. By calculating indicators such as the average and standard deviation of the project, the overall data trend can be understood and potential problems can be found.

The application of machine learning algorithms is also very critical. Through supervised learning, airport construction performance prediction models can be established to identify risks in advance and formulate response strategies. At the same time, using unsupervised learning, such as cluster analysis, potential patterns in the data can be found, providing references for project management. Combined with data visualization tools, the analysis results are displayed in an intuitive form, enabling construction management units to quickly understand project performance.

3. Conclusion

In summary, digital transformation brings opportunities and challenges to the performance management of airport construction projects. Only by building a scientific digital performance indicator system, optimizing management processes, and enhancing data management and application capabilities can enterprises remain invincible in the airport construction market. In the future, enterprises need to attach importance to the application of digital tools and establish flexible performance management mechanisms to more efficiently respond to market changes in the field of airport construction.

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