A study of Digital Econometrics in the Planning Stage of a Project from the Perspective of DuPont Analysis

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Abstract. In recent years, China's housing and urban-rural construction has entered the stage of connotative and high-quality development, which puts forward higher requirements for the economic balance ability of engineering projects, and the economic measurement and analysis of the programme at the pre-planning stage is of great significance for the smooth landing and sustainable development of the project. With the advantages of DuPont analysis method, such as simple calculation logic and clear index level, the article reconstructs the DuPont analysis index system according to the needs of project economic evaluation, takes it as the underlying logic of economic calculation of the project pre-planning programme, and empowers it with digital technology to construct the 'programme quantity calculation' and 'economic index accounting' in the pre-planning stage. The study also empowers digital technology to construct an economic measurement method that is real-time related and mutually adjustable between 'planning programme calculation' and 'economic index calculation' in the pre-planning stage. It is found that the DuPont analysis theory has good applicability in the field of economic measurement of engineering projects, and with digital technology, it can achieve the direct traceability of abnormal economic indicators to the planning scheme through the real-time feedback between the spatial scheme and economic indicators to guide the optimization of the pre-planning scheme, which has the advantages of rapid response, accurate measurement and support for the efficient comparison of multiple schemes.

Keywords: DuPont Analysis, Digital Intelligence, Planning Solutions, Economic Measurement

1 Introduction

In recent years, China's urban construction and development is experiencing unprecedented changes, with the whole gradually shifting from the previous incremental focus to equal emphasis on both increment and stock, and from the development of external expansion to the scientific development of connotation. The traditional high-leverage, high-debt, high-turnover development model has been unsustainable, both from the macroeconomic, or micro-project development point of view, shows a new,

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more demanding development logic is being formed, and this situation puts forward a more delicate and comprehensive requirements for the development of projects in the field of housing and urban-rural construction, especially for the excavation of the project's economic benefits, which need to be considered in the pre-planning stage. The comprehensive economic balance of the project, front project industrial layout, operation planning and other work. Taking urban renewal projects in Chongqing as examples, projects such as the "Ziwei Road Commercial Street" and "Shancheng Lane" have successfully tapped into significant economic potential through asset revitalization and industrial operation. In contrast, projects like "Jiujie Youge Danwei" and "Shi ba ti" are confronting substantial financial losses due to deficiencies in industrial planning and miscalculations in economic feasibility assessments. At this stage, China's pre-planning stage of the project's economic measurement of the importance of the project is not high, there is not a systematic, standardised measurement methods and tools. In particular, the application of information technology tools is mainly based on BIM model design and cost analysis, which is mainly reflected in the lack of coordination mechanism between cost analysis and planning scheme, as well as the obvious interface segmentation between various work links. This systematic disconnection directly leads to a significant deviation between the economic calculation model and the actual implementation effect of the project, which is specifically reflected in the deviation between the preliminary planning scheme and the final implementation results exceeding the reasonable threshold. Currently, there have been more innovative practices and application explorations in the field of corporate financial analysis at home and abroad, but the overall economic measurement research at the project level in the pre-planning stage is still relatively small.

In this paper, on the basis of many years of pre-planning practice, according to the demand for project economic evaluation, the DuPont analysis index system is reconstructed, and with the advantages of DuPont analysis, such as concise calculation logic and clear index hierarchy, the DuPont analysis method is used as the underlying logic of economic calculation for the pre-planning programme of the project, and empowered by the digital technology, the digital economy platform is constructed, which combines the functions of planning programme design, economic calculation, optimization of the programme and comparison, and tries to construct a platform for economic calculation at the pre-planning stage. With the empowerment of digital technology, we build a digital economic calculation platform integrating the functions of planning programme design, economic calculation, programme optimization and comparison, and try to construct an economic calculation method in which the ‘calculation of planning programme quantity’ and the ‘calculation of economic indicators’ in the pre-planning stage are related in real time and adjusted to each other, so as to enrich and improve the theories and methods of economic calculation in the pre-planning stage of China's engineering projects.

2 Literature Review and Research Framework

2.1 Research Progress on the Expansion of the Application of DuPont Analysis

DuPont analysis theory is a method of corporate financial analysis, and there have been more research explorations to improve and optimise its theoretical system, including the optimisation of cash flow, sustainability, and profitability analysis [1][2].

Zhang Yingwei and Hu Mingying start from the classification of enterprise activities, reclassify assets, liabilities and profits, and reconstruct the DuPont analysis system. The financial data samples of listed companies in China's manufacturing industry from 2013 to 2018 are used for empirical testing, and it is found that the reconstructed DuPont analysis system has stronger explanatory power compared with the traditional DuPont analysis system [3]. Xu Ming improved the DuPont analysis system based on analysing the importance of the DuPont analysis system, and found that by distinguishing between operating activities and financial activities, it is more reflective of the benefits brought by the enterprise's operating activities [4]. Yang Huifeng for the evaluation of the operating performance of listed companies, DuPont analysis theory and the application of the analysis system to carry out improved analysis, the introduction of management financial statement data, through a variety of financial statement data collection systematic analysis of the company's operating problems, in order to provide objective performance evaluation results [5]. Ahmed and other scholars use factors related to the prediction of the product and revenue output components of the corporate value creation cross-sectoral linkages in drivers, and other closely related economic indicators to incorporate the continuous flow of accounting data into a dynamic factor model and to advocate the use of interdisciplinary ideas in macro-accounting analyses [6].Yan Jin added sustainable growth rate financial indicators to the DuPont analytical system to measure a company's ability to develop in the long term, predicted the company's development by judging the size of the sustainable growth rate level and observing the stability of return on net assets, and predicting the return on net assets of the company in the second year, which was found to have good practicality [7].Pablo Jose Arana Barbier proposed to add financial return on equity to DuPont analysis to form a new and improved DuPont analysis method, which expands the financial criterion more with the aim of not only increasing profitability, but also to increase net cash flow [8].Joseli W et al. concluded that there is a need to improve the traditional DuPont analysis system by adding indicators related to sustainability to help firms understand their overall performance and improve their operational capabilities [9].

At present, the improvement and application research of DuPont analysis theory mainly focuses on the analysis of the company's financial capability, and the economic measurement indexes involve a wide range of indicators, including cost analysis, sustainable operation, return on equity, etc., which are somewhat similar to the economic evaluation of engineering projects.

2.2 Research Progress on Digital Economic Measurement of Engineering Projects

With the development of artificial intelligence and information technology, enterprise financial information management has been developed and matured, but the research in the field of engineering project economic measurement empowered by digital tools is still relatively small. Existing research mainly focuses on the field of engineering project cost analysis, especially in the area of BIM model empowering engineering project cost analysis.

James Heaton et al. describe a methodology that allows BIM-related data to be extracted directly from the model into relational data for integration into existing asset management systems [10].Andrey Pilyay and Liubov Shilova used cost estimation through the combination of a BIM model and cost data applied to the design phase and found that the data used for the cost evaluation of the data into the existing BIM data model for cost estimation is more effective [11]. Shen Zixin and Guo Yuyao proposed that the measurement of industrial integration has undergone a great transformation with the optimisation and upgrading of information technology, and in the process of development, natural science algorithms are continuously absorbed and combined with artificial intelligence technology, which can be greatly improved in terms of text mining, data analysis and processing capacity, and measurement standardisation [12]. Xu Xiaolei, Yang Yang, relying on the independently developed 'financial intelligent operation analysis system', the complex and cumbersome wholesale electricity price measurement process, through the automatic acquisition of data, form a key to summarise the functions, clear and concise in the measurement interface to be reflected, accurate and efficient to assist the entire wholesale electricity price measurement process [13].

It can be seen that digital technology can be efficiently applied with all kinds of data acquisition, calculation, in the field of engineering projects can read three-dimensional models and other design solutions of economic and technical indicators, and according to the requirements of a more rapid and accurate calculation, analysis, which for the project programme based on the complete economic calculations to provide empirical evidence for reference, but also for the selection of this paper lays a solid, feasible practice and research basis. However, the application of digital tools in current project management exhibits significant limitations. Cost analysis and planning schemes demonstrate insufficient integration, while operational interfaces remain severely fragmented. Furthermore, the planning and design phases lack a comprehensive economic assessment system, resulting in substantial uncertainties in the implementation of investment, financing, and economic equilibrium schemes.

Based on the above research, this paper combines the applicability of DuPont analysis system in the economic measurement of engineering projects and the ability of digital tools to be applied in the pre-planning programme, and researches the construction of a digital measurement platform for the planning programme based on DuPont analysis system. The main research contents include: reconstruction of DuPont analysis index system applicable to economic measurement of engineering projects, construction of platform for designing and economic measurement of pre-

planning programmes, and logical progression of economic measurement and programme comparison of planning programmes.

3 Theoretical Implications of DuPont Analysis and Optimisation of its Application

3.1 Connotation of DuPont Analytical Theory System

DuPont analysis is the analysis method used by the employees of DuPont in the United States when evaluating the financial reports of the Company, which is an industry-recognised method of comprehensive financial analysis, and is widely used in the analysis of the financial reports of the Company in China [14] [15]. DuPont analysis method shows the intrinsic connection of each financial indicator, and its indicators and calculation system model is shown in Figure 1.

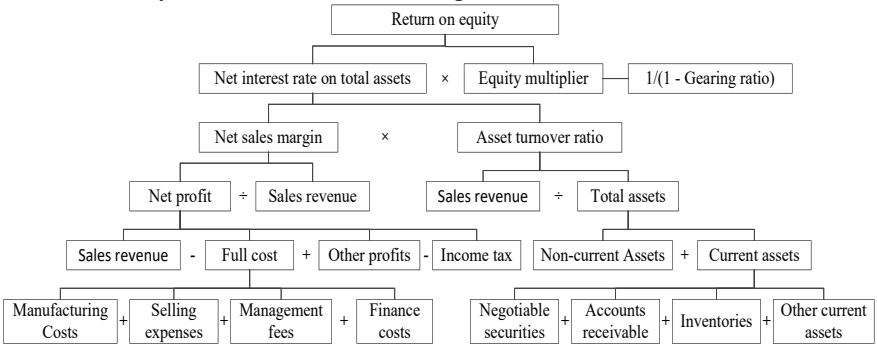

Fig. 1. DuPont Analytical System Model

DuPont analysis calculates cause and effect logic, clear hierarchical relationships, can explain the reasons for changes in indicators and trends [16], can effectively find the key factors affecting the profitability of enterprises [17], helps to deeply analyse the business performance of enterprises, comprehensively reflect the level of business profitability, asset operating ability and capital structure [18], and provides a concise and effective method for managers to improve the operating performance of the company, and for investors to better determine the value and changes of the company. It provides a concise and effective method for company managers to improve operating performance and investors to better judge the value and changes of the company [19]. All these advantages make DuPont analysis method has the conditions of application in the measurement of project economic indicators, especially in the planning stage of the economic measurement of the programme, has the advantages of clear and concise calculation logic, traceability of the results, etc., which is conducive to the economic optimization of the planning programme and the comparison of multiple options.

3.2 Optimisation of the Application of DuPont's Analytical Theory in Digital Econometrics

In order to improve the application effect of DuPont analysis theoretical system in the field of economic measurement in the pre-project planning stage, it is necessary to introduce digital tools to empower and optimise and upgrade the DuPont analysis system in various aspects, including the reconstruction of the index system, the construction of the platform and database for programme measurement, and so on. The specific improvement measures are as follows.

(1) Reconstruction of indicator system. According to the characteristics of projects in the field of engineering and construction and the needs of the implementation body, the financial and economic indicators are enriched and optimised to build an indicator system that can meet the needs of urban renewal, transformation of villages in cities, development of areas, construction of industrial parks, real estate development and other types of projects, so as to meet the needs of the project's economic benefit assessment in a more targeted manner. As shown in Figure 2, the reconstruction of the DuPont analysis system model is illustrated with the net profit margin of the project as an example.

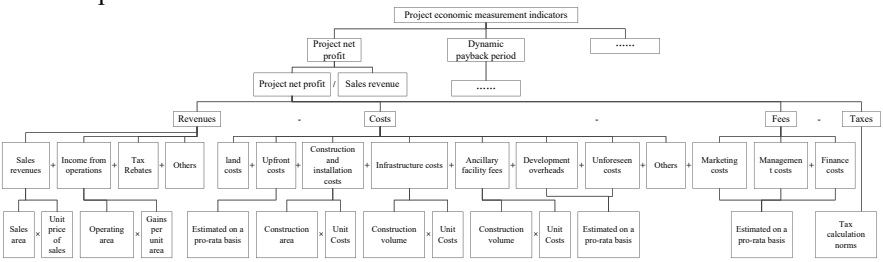

Fig. 2. Schematic diagram of the reconstruction of the DuPont Analytical System model

(2) Construction of a digital measurement platform. In order to output the calculation results more quickly and efficiently, it is necessary to accelerate the calculation speed and accuracy with the help of digital technology. The reconstructed DuPont analysis system model is used as the underlying basis of the digital economic calculation platform, and the logical connection between the economic and technical indicators of the planning programme and the DuPont analysis calculation system is established in the digital platform, so as to realize the intelligent output of the economic calculation results of the planning programme in the platform.

(3) Platform database construction. After reading the economic and technical indicators such as the project volume and development time sequence of the planning programme, the digital platform still needs a highly standardized and matching measurement basis, such as the cost quota specification, the housing selling price database, and the industrial rent database. Therefore, it is necessary to build a measurement database according to the type of measurement projects, local norms, and internal control standards of enterprises, etc., and to enrich and accumulate the database and iteratively optimise it according to platform applications, market fluctuations, and policy changes.

(4) Planning programme intelligent design. In the digital platform, configure the programme design function and establish the project planning programme design model as the data source of various economic and technical indicators. At the same time, all kinds of economic and technical indicators are associated with the design scheme model, which can be adjusted with the dynamic optimisation of the scheme model, and then output real-time measurement results.

Under the DuPont analysis system, the operation framework of the digital platform for the economic calculation of the pre-project planning programme is shown in Figure 3.

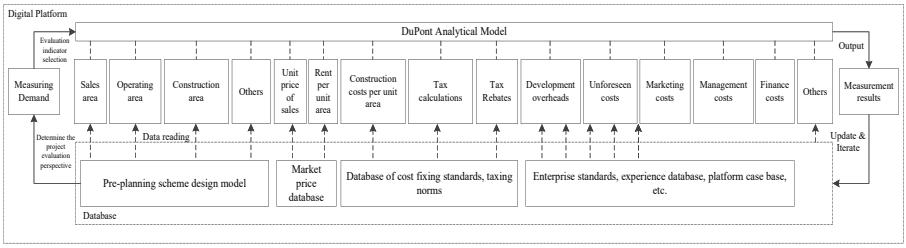

Fig. 3. Schematic diagram of the digital platform enabling DuPont's analytical measurement system

4 Digital Measurement of Project Planning Solutions under the DuPont Analysis System

According to the optimisation of the DuPont analysis model and the construction of the digital measurement platform mentioned above, the economic measurement of the planning scheme can be carried out according to the following path,as shown in Figure 4.

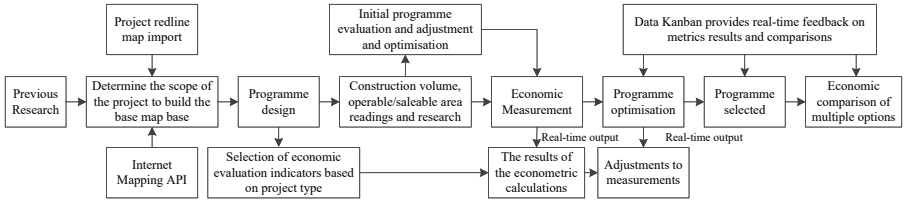

Fig. 4. Flowchart of economic calculation and option comparison for pre-planning programme

(1) Preliminary study. At this stage, it is necessary to clarify the project positioning and the main development framework, including clarifying the project positioning, confirming the scope of the project, sorting out the project assets and construction objects, and clarifying the requirements for the design of the programme such as the floor area ratio, building height limit, building density and green space rate according to the construction planning conditions.

(2) Create project base map. Adopt red line map import and Internet map API on the digital platform to generate the base map for project visualisation, which is used

as the blueprint of the construction programme for pre-project planning, so as to facilitate the visual design, modification and preservation of the programme.

(3) Programme design. Programme design is carried out on the project blueprint, identifying the attributes of the development programmes involved, specifying the types of buildings such as residential, commercial and educational buildings, and the development modes of 'retaining, altering, dismantling and constructing', so as to facilitate the confirmation of technical and economic indicators such as the construction area of the project, the saleable area, and the saleable area and the business area, as well as the economic evaluation indicators. Design forms include, but are not limited to, two-dimensional image design, three-dimensional model design, database programme retrieval and optimisation.

(4) Data reading and judgement. Read the data of the designed scheme to ensure that the floor area ratio, total floor area, building density and other indicators of the design scheme meet the requirements, and optimize the scheme according to the data indicators associated with the design scheme and feedback in real time.

(5) Economic calculation and optimisation. Intelligent output of the results of various economic evaluation indexes, identification of key factors affecting the project's economic calculation based on the calculated project construction costs, sales revenue, industrial rental income, taxes, profit margins and other indicators, and further adjustments and optimisation of the planning scheme until the results of the calculations are within an acceptable range.

(6) Programme confirmation and comparison. Save the adjusted scheme and continue to optimize and adjust it on the basis of the existing scheme, and design multiple schemes based on the real-time feedback of the measurement results. Then, based on the platform's multi-programme data comparison, programme comparison is conducted to confirm the optimal programme.

In the digital platform constructed in this paper, DuPont analysis model further enriches the financial analysis index system according to the economic evaluation needs of engineering projects, and serves as the underlying measurement algorithm model of the digital platform. At the same time, the data of each measurement index is directly associated with the planning scheme in the digital platform, and corresponds to the changes with the adjustment of the scheme design, and outputs the measurement results in real time, which has the advantages of quickness, accuracy and efficiency. Under the conditions of construction planning, the digital platform can accurately identify the project volume, construction area, saleable area and other data of the planning scheme, and at the same time strictly output the calculation results in accordance with the tax law, the cost fixing standard and other pricing bases and the designed calculation formula. However, it is worth noting that there are still many calculation bases in the economic calculation of the project that need to be manually adjusted with the business co-operation terms, market conditions, project specificity and other factors. Therefore, in order to ensure the accuracy of the calculation results, it is necessary to attach great importance to the updating and maintenance of the database in the digital platform, and continuously accumulate and iterate the database in the daily calculation.

At present, for the economic calculation of the pre-planning stage of the project, the Office form tool is mainly used as the main tool, although BIM and other digital models are gradually widely used in the field of engineering and construction, but it is mainly concentrated in the cost calculation and analysis, and does not include the calculation of the project's revenues, taxes and fees and other areas, and there is still a lack of digital calculation tools for the overall economic evaluation of the project. The main reasons for this are the complexity of the calculation process, the uncertainty of the data source, and the high threshold of economic expertise. The lack of tax, legal and other related knowledge among pre-planners makes it difficult to complete a more complete economic measurement in the pre-planning stage. The difference of this study is that the financial perspective is introduced into the pre-planning programme, and the digital platform is used to construct a measurement tool that operates in tandem with the design of the programme by taking advantage of DuPont's theory of clear indicators and concise logic.

5 Conclusion

This paper reconstructs the indicator system of DuPont analysis method according to the characteristics of economic evaluation of engineering projects, and constructs the economic measurement tool of the planning programme with the help of digital platform, and draws the following conclusions.

(1) In addition to the application and improvement of DuPont analysis method in the financial analysis of the company, it can further take advantage of its simple calculation logic and clear indicator hierarchy relationship to reconstruct its indicator system in a targeted way, and apply it to the economic measurement of engineering projects such as urban renewal, old city renovation, and area development, with a high degree of adaptability and flexibility.

(2) The application of digital tools in the field of economic measurement of the preliminary planning scheme can achieve the direct traceability of abnormal indicators of economic measurement to the planning scheme through the real-time feedback between spatial scheme calculation and economic indicator calculation, in order to guide the optimization of the scheme design, which has the advantages of fast response speed, accurate calculation, and support for the comparison of multiple schemes.

(3) The accuracy of the economic calculation of the pre-planning programme is affected by many aspects, including market conditions, project specificities and the terms of business cooperation in the later stage of the project, etc. The improvement and maintenance of the database of the digital platform should be emphasized, so as to timely update the market data of the unilateral selling price of the construction area and the unilateral cost, and to continuously accumulate and iterate the database in the daily calculation.

The article provides a practical idea for the construction and application of digital economic measurement tools in the pre-planning stage of engineering projects, which is expected to supplement the vacancy of research in the field of digital measurement

of engineering projects. At the level of technical theoretical research, this study requires further in-depth exploration regarding the functional development and application of digital platforms, the integration of economic evaluation with investment and financing schemes, and the generation of cash flow statements. Additionally, to ensure sustainable development in the application of digital technologies in project management, a crucial research focus lies in how to implement iterative upgrades that align with policy regulations while meeting market-oriented demands.

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