The Impact of R&D Investment on Enterprise Performance
Based on Wanhua Chemistry

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ABSTRACT
R&D investment has become one of the core elements for enterprises to gain core competitiveness in the fierce market competition. Through efficient R&D investment, enterprises can foster sustained innovation capabilities, accelerate the R&D pace of new products, and thereby enhance corporate operating performance. Corporate performance indicators are not only the outcomes of corporate strategy implementation but also the decision-making basis for enterprise management. Ultimately, the impact of R&D investment on corporate performance will feed back to the initial end of the industrial chain—R&D investment itself. Therefore, this paper adopts a case study method. On the basis of analyzing the overview of corporate R&D investment and its internal and external influencing factors, it examines the relationship between R&D investment and corporate performance of the case company from both financial and non-financial performance perspectives, so as to clarify their impact patterns and feedback mechanisms. The study finds that while R&D investment drives the sustainable development of enterprises, it can also promote the improvement of production capacity to a certain extent and enhance the enterprises' differentiated competitive advantages.

Keywords: *R&D investment, Enterprise performance, Financial indicators.*

1. INTRODUCTION

1.1 Research Background

Chemical products are closely related to people's lives, ranging from daily necessities to aerospace. To seize opportunities and meet challenges, various industries are constantly innovating and upgrading to meet market demand. Generally speaking, chemical products have a long life cycle. For enterprises to widen the gap and obtain higher profits, attaching importance to R&D investment is the best choice. Enterprise R&D investment is the internal driving force for promoting enterprise development and the key for the chemical industry to seize development opportunities and improve corporate performance.

1.2 Research Significance

The research on the relationship between R&D investment and performance of chemical enterprises not only helps to determine methods to improve corporate performance and provide new ideas for relevant industry enterprises to formulate R&D investment strategies, but also helps to strengthen the confidence of enterprise managers in increasing R&D investment, guide enterprises to effectively allocate resources, so that enterprises can achieve a reasonable allocation among R&D funds, R&D personnel, R&D equipment and other elements, thereby enabling enterprises to seize development opportunities and improve corporate performance.

2. LITERATURE REVIEW

2.1 R&D Investment

Liu Fangbiao (2021) found through a case study of Fosun Pharmaceutical that the heterogeneous resources such as intangible assets and R&D talents obtained by enterprises through R&D investment are conducive to enterprises improving their own

R&D capabilities, gaining monopolistic profits, and contributing to the long-term development of enterprises [1]. Cao Wenjing (2021) found through annual report analysis that the impact of a company's R&D personnel investment on the level of intellectual property such as patents is higher than that of R&D fund investment, and both have positive impacts. This indicates that R&D personnel investment promotes the generation of new products and technologies as well as the upgrading of technical equipment, which all contribute to the increase in the number of patents and other intellectual property rights and authorizations, thereby improving corporate performance [2].

2.2 R&D Investment and Corporate Performance

Li Yingjie (2017) analyzed the correlation between Huawei's R&D investment and corporate performance from three different perspectives: R&D funds, personnel and patents, and concluded that all three have a positive correlation with corporate performance [3]. Zhou Xiao (2019) took Shanghai Pharmaceutical Co., Ltd. as the case study object, and found through theoretical analysis and case study that the key to improving corporate performance and forming a unique competitive advantage, thereby affecting corporate performance, lies in continuously increasing R&D investment [4]. Jia Kun (2021) took Hengrui Medicine as an example, and through statistical analysis of 25 pharmaceutical enterprises, concluded that R&D investment has a positive effect on enterprise development and promotes various developments of enterprises [5]. Li Zhengbiao (2022) based on 67 research samples, used Meta-analysis method and found that R&D investment has a significant positive effect on corporate performance, and the relationship between corporate performance and R&D investment is significantly affected by factors such as the industry type of the enterprise and the level of regional economic development [6].

2.3 Literature Commentary

In summary, when studying the impact of R&D investment on corporate performance, scholars have focused on the relationship and impact paths between the two. A large number of research and analysis show that in general, corporate performance will be positively affected by R&D investment. However, in different industrial fields, the relationship between R&D investment and corporate performance indicators varies, including positive correlation, negative correlation and irrelevance. Therefore, based on the above differences, this paper analyzes various indicators of Wanhua Chemical to study the impact of its R&D investment on corporate performance.

3. RELATED CONCEPTS AND THEORETICAL FOUNDATIONS

3.1 Related Concepts

3.1.1 Concept and Characteristics of R&D

R&D investment generally refers to the expenses required for research and development. R&D investment means putting various resources such as talents, equipment, and funds into exploratory and experimental activities to obtain advanced knowledge and technologies.

R&D investment is characterized by uncertainty, irreversibility, and competitiveness. The uncertainty of R&D investment is reflected in the uncertainty of R&D output results and changes in the external market environment. The irreversibility of R&D investment is manifested in the fact that most of the funds and equipment invested in R&D cannot be recovered or transferred. Competitiveness is reflected in the fact that an enterprise's R&D activities attract the attention of the same industry, and its investment (funds, human resources) and achievements are related to the industry structure and the future development of the enterprise.

3.1.2 Enterprise Performance

Enterprise performance refers to the operating income obtained by an enterprise through the optimal integration and allocation of its internal resources during a certain operating period, that is, the operating results achieved by the enterprise in its operations. The academic community generally analyzes the operating performance of enterprises from two perspectives: financial performance and non-financial performance. The financial performance perspective mainly includes changes in financial indicators during a certain operating period, while the non-financial performance perspective mainly includes the number of patents obtained by the enterprise and the market share occupied during this period.

3.2 Theoretical Foundations

3.2.1 Technology Innovation Theory

The concept of "Technology Innovation Theory" was first proposed by Joseph Schumpeter in his 1912 book *The Theory of Economic Development*. Schumpeter argued that innovation disrupts the balance of the economic system and drives it toward a new equilibrium, a process influenced by innovation activities and economic cycle fluctuations. Technological innovation permeates all stages of the product life cycle, covering product manufacturing, production methods, supply chains, markets, and organizational forms, and exists as a dynamic change within the entire production system.

3.2.2 Input-Output Theory

Proposed by economist Wassily Leontief in the 1930s, Input-Output Theory enables the simultaneous study of "inputs" and "outputs." "Inputs" refer to various production factors in economic activities, while "outputs" denote the results generated through a series of production processes. The theory suggests that investing resources in R&D activities can yield innovative outputs, including new technologies, products, and knowledge.

3.2.3 Core Competence Theory

First proposed by C. K. Prahalad and Gary Hamel in their 1990 work *The Core Competence of the Corporation*, this theory argues that an enterprise's unique technologies and capabilities can generate competitive advantages.

Core competence is critical to long-term enterprise development. It enhances enterprises' ability to address challenges, resist the impact of external market changes, and support stable and rapid growth. Characterized by competitiveness enhancement, barrier construction, and sustainability, core competence manifests as distinctive advantages (e.g., technologies, talents, and products) formed through resource integration that differentiate enterprises from competitors. Therefore, increasing R&D investment to adapt to market demand is vital for enterprises to gain sustained competitive advantages.

4. OVERVIEW OF WANHUA CHEMICAL'S R&D INVESTMENT AND INFLUENCING FACTORS

4.1 Enterprise Overview

Wanhua Chemical Group Co., Ltd. is a globally operating chemical materials company with an integrated industrial chain and a diverse product portfolio. As one of the world's leading MDI suppliers, Wanhua Chemical adheres to technological innovation as its core competitiveness and maintains a leading position in the industry through optimizing industrial structure, operational models, and solution offerings.

4.2 Overview of the Enterprise's R&D Investment

4.2.1 Direct R&D Investment

4.2.1.1 R&D Fund Allocation

From 2020 to 2024, Wanhua Chemical's R&D investment increased year-on-year, rising from 2.043 billion yuan to 4.550 billion yuan, with a cumulative total of 17.262 billion yuan and a growth rate of 122.71%. This indicates that sustained high-intensity R&D investment is one of the core drivers of the company's rapid and steady performance growth.

4.2.1.2 R&D Personnel Allocation

Committed to technological innovation as its primary core competitiveness, Wanhua Chemical has established multiple R&D centers worldwide and attaches great importance to R&D personnel investment. According to available data, the number of R&D personnel increased from 2,771 in 2020 to 4,763 in 2024. In terms of educational structure, master's degree holders dominate the R&D team, with most personnel under 40 years old, reflecting a trend toward higher academic qualifications and increasing requirements for professional and technical capabilities.

4.2.2 Indirect R&D Investment

4.2.2.1 R&D Institutions and Platforms

Wanhua Chemical has several wholly-owned subsidiaries engaged in technological R&D, including four specialized institutions focused on experimentation, product technology development,

research, design, and the R&D of organic peroxides and tert-butanol. In recent years, Wanhua Chemical has invested heavily in building a global R&D center in Yantai. The operation of existing R&D centers and innovation platforms marks the realization of its global R&D layout.

4.2.2.2 Acquisition and Industrial Layout

Wanhua Chemical optimizes its industrial chain through acquisitions. For example, its joint venture acquisition of Ningbo Donggang Electrochemical Co., Ltd. has strengthened its upstream industrial chain position, reduced reliance on imported raw materials, and controlled costs. Meanwhile, it has expanded downstream MDI applications in energy-saving building materials and ecological adhesives, broadening product application scope and market share.

4.3 Influencing Factors of the Enterprise's R&D Investment

4.3.1 Internal Influencing Factors

4.3.1.1 Corporate Strategy

Guided by its core values, Wanhua Chemical prioritizes customer needs, adheres to independent R&D and mechanism innovation, and builds innovation platforms. In the field of high-tech, high-value-added chemical new materials, the company consistently pursues a diversified and low-cost development strategy.

Wanhua Chemical has strived to create an open and transparent business environment and safe and efficient digital operations, which support its sustained development.

4.3.1.2 R&D System Construction and Outcome Conversion

Wanhua Chemical adheres to building an integrated industry-university-research R&D system, enabling the rapid conversion of research outcomes into products that meet customer requirements and market demand. The company boasts a complete R&D system covering basic research, product application, industrial integration, and environmental safety, mastering multiple cutting-edge technologies in related industries. Its R&D outcomes feature competitive advantages such as environmental friendliness, high efficiency, and low cost.

4.3.1.3 Enterprise Resources and Core Competitiveness

Wanhua Chemical upholds the concept of technological innovation as its primary core competitiveness, continuously optimizing industrial structure, upgrading products, and expanding business scope. R&D personnel investment is a key pillar of the company's technological innovation capabilities. It allocates 2%–4% of annual sales revenue to R&D and stimulates R&D enthusiasm through project incentives (for significant contributions to new product development and process improvement) and an incentive system including employee stock ownership, scientific research rewards, and performance appraisal, promoting a virtuous cycle of R&D activities.

4.3.2 External Influencing Factors

Enterprise development overseas relies on national strength, government and financial institution support, as well as the company's own international talents, management, culture, and independent innovation technologies. Wanhua Chemical has established a complete R&D process and project management mechanism covering basic research, engineering project implementation, process optimization, and product R&D, forming an innovative R&D system.

China's chemical industry is transitioning toward refinement, high-endization, and intelligence. Despite resource and environmental challenges associated with scale expansion, the industrial structure is continuously optimized—shifting from scale-driven growth to structural adjustment and technological innovation—and gradually moving toward high-end internationalization, with some areas reaching world-leading levels.

5. ANALYSIS OF THE IMPACT OF R&D INVESTMENT ON WANHUA CHEMICAL'S CORPORATE PERFORMANCE

5.1 Analysis from the Perspective of Financial Performance

5.1.1 Analysis of Operating Capacity

R&D investment drives product technology upgrading, production capacity improvement and scale expansion, thereby reducing unit costs. Cost-

effective products attract consumers, accelerate sales, increase revenue, reduce inventory backlogs, improve asset utilization, and enhance the company's operational capabilities. Wanhua Chemical's inventory turnover rate has generally increased in the past five years, reflecting faster inventory realization, enhanced market competitiveness, and improved operational capabilities. The company's total asset turnover rate has generally remained stable above 80% for a long time, indicating its strong sales capacity and stable product market.

5.1.2 Profitability Analysis

R&D drives product improvement and the development of new products, enhancing product added value and competitiveness, thereby expanding market share, increasing sales volume, and strengthening the profitability of enterprises. Although the return on net assets of Wanhua Chemical fluctuates significantly, it remains stable overall. Despite the impact of the market and international situation, it still maintains stable profits, indicating strong profit resilience supported by R&D investment. However, the net profit margin on sales and gross profit margin on sales showed a downward trend during the period, which may be related to internal operation and management, concentrated investment in R&D platform construction funds, and external factors.

5.1.3 Solvency Analysis

R&D investment enhances the industrial chain attractiveness of enterprises' products, technologies and services, promotes sales growth, market share expansion and performance improvement, releases positive signals to the market, thereby increasing enterprise valuation and stock prices, and ultimately strengthens solvency.

5.1.3.1 Short-term solvency

From "Table 1", it can be concluded that Wanhua Chemical's current ratio has been lower than 1 for many years, reflecting insufficient liquidity of current assets and potential problems in fund management. The gap between the quick ratio and the current ratio is gradually narrowing, which is related to the increase in R&D investment improving product competitiveness and reducing inventory. However, the quick ratio is far lower than the theoretical value of 1, indicating that its short-term solvency is weak and its risk resistance needs to be enhanced.

Table 1. Short-term solvency indicator data sheet of Wanhua Chemical

	2020	2021	2022	2023	2024
Current Ratio	0.59	0.74	0.54	0.57	0.56
Quick Ratio	0.47	0.55	0.35	0.38	0.36
YoY(%)	19.84	55.07	7.96	19.32	11.51
R&D intensity (%)	2.78	2.18	2.07	2.33	2.50

5.1.3.2 5.1.3.2 Long-term Solvency

It can be seen from "Table 2" that the asset-liability ratio of Wanhua Chemical has been at a relatively high level over the five years, rising all the way from 48.97% in 2018 to 62.33% in 2021, which reflects that the proportion of its debt funds is relatively high. The specific use of the borrowed funds needs further research, which may be related to the enterprise's expansion of production scale, construction of R&D platforms, as well as the impact of the social and international environment. This also shows that with the increasing influence of Wanhua Chemical, the enterprise has smooth financing channels. Continuous R&D investment promotes performance improvement, demonstrates development potential and debt-servicing ability, and helps to make internal and external financing easier to achieve.

Table 2. Data table of Wanhua Chemical's long-term solvency indicators

	2020	2021	2022	2023	2024
DAR(%)	61.38	62.33	59.50	62.67	64.72
YoY(%)	19.84	55.07	7.96	19.32	11.51
R&D intensity(%)	2.78	2.18	2.07	2.33	2.50

5.1.4 Analysis of Development Capability

The article selects two indicators, net profit growth rate and operating income growth rate, to analyze the development capacity of Wanhua Chemical from 2020 to 2024. All its research and development expenses are expensed, which not only conforms to the evaluation standards for high-tech enterprises but also can increase net profit through additional deductions. The charts show that both indicators have generally fluctuated and declined, which is related to internal and external

factors such as increased R&D investment, raw material price hikes, and intensified market competition. The fluctuating changes of the two indicators indicate that the enterprise is in a period of global expansion, and its development is greatly affected by internal and external factors, with instability and uncertainty.(“Figure 1”)

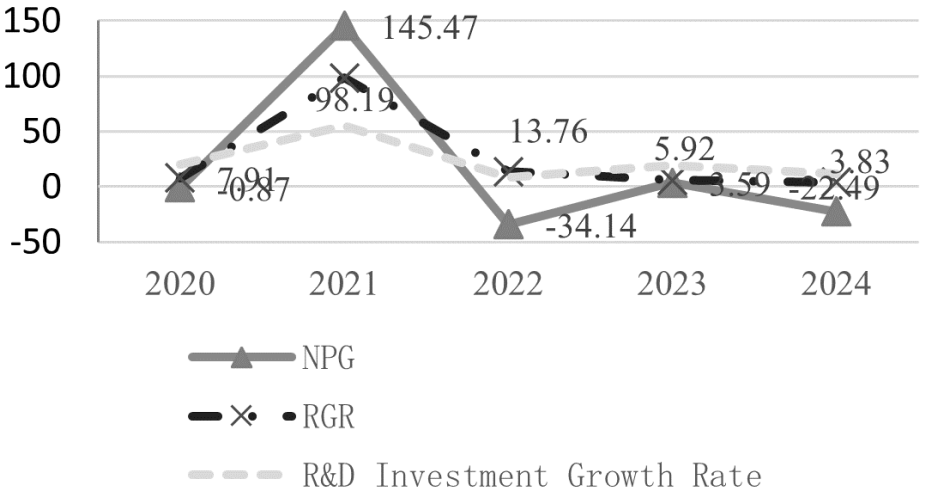

Figure 1 Trend chart of changes in Wanhua Chemical's development capability indicators.

5.1.5 Analysis of Earnings Per Share Indicators

R&D investment drives the upgrading of product technology and the improvement of production equipment, enhances product performance and customer satisfaction, expands the market, improves corporate reputation and product prices, increases gross sales profit, and thereby boosts earnings per share. From 2020 to 2024, Wanhua Chemical's earnings per share showed an upward trend, reaching 7.85 yuan in 2021. It grew in the same direction as R&D investment and net profit, all hitting recent peaks, reflecting that R&D investment has helped the company improve profitability and increase dividend distribution, with an overall positive development.

5.2 Analysis from the Perspective of Non-Financial Performance

5.2.1 Analysis of R&D Investment and Output of Achievements

5.2.1.1 Number of Patents

Wanhua Chemical attaches great importance to R&D investment. In 2022, Wanhua Chemical filed 1,002 domestic and foreign invention patents and newly obtained 1,058 authorizations. During 2024, it filed 1,220 domestic and foreign invention patents and newly obtained 649 authorizations. The growth trend of its patent quantity is consistent with the trend of increasing R&D investment of the enterprise. A strong enterprise intellectual property protection system has promoted the development of the enterprise's products and technologies, driven the improvement of the enterprise's production capacity, further expanded its market share, and is beneficial to the further development of the enterprise.

5.2.1.2 Production Capacity and Capacity Utilization Rate

The production capacity of Wanhua Chemical's major projects has gradually increased with the increase in R&D investment. Among them, the MDI project increased from 2.1 million tons per year to 3.8 million tons per year from 2020 to 2024. From 2020 to 2024, the capacity utilization rate of all projects showed an overall upward trend, with the utilization rate of MDI and PO/AE projects remaining above 88% annually. In addition, after the commissioning of newly launched projects such as PMMA and PC, both production capacity and utilization rate have performed well, fully demonstrating the remarkable results of R&D investment.

5.2.2 R&D Investment and Product Market Analysis

Market share is an important indicator reflecting a company's competitive position and profitability. Taking MDI, the core industry of Wanhua Chemical, as an example, its market share rose to 33% in 2024, and it has long remained the market leader in multiple industrial fields. Even in the face of changes in the external environment, the company can still continue to expand its market share. This is due to its long-term adherence to R&D strategies, improvement of the R&D system, and continuous capital investment, which have promoted the enhancement of product development capabilities and competitiveness, expansion of scale, and reduction of costs. Furthermore, this has contributed to performance growth through product attractiveness and price advantages.

6. CONCLUSION

6.1 Summary

This paper analyzes Wanhua Chemical's R&D investment in recent years and its impact on financial and non-financial performance, and draws the core conclusion: The impact of R&D investment on corporate performance is indirectly lagging. Although the increase in R&D investment drives the synchronous growth of corporate revenue, enterprises still need to strengthen accounts receivable management and risk control. At the same time, R&D investment positively improves enterprise production capacity and production capacity efficiency, helps achieve economies of scale and reduce unit costs, which is also a key path for the chemical industry to improve operational efficiency.

In addition, R&D investment helps Wanhua Chemical cultivate a differentiated competitive advantage. By establishing an R&D and innovation system and optimizing product performance, it forms a unique market competitiveness. At the same time, it provides material guarantee and competitive support for the sustainable development of the enterprise, enabling R&D investment and enterprise development to form a positive cycle and promoting the long-term stable development of the enterprise.

6.2 Implications

The case of Wanhua Chemical shows that R&D investment has a positive effect on corporate performance, providing the following inspirations for the chemical industry, especially for enterprises in the stage of rapid development. Firstly, enterprises should increase R&D investment and improve the R&D system. Continuous innovation is of vital importance to corporate development. Enterprises should build a unique competitive advantage through continuous innovation, comprehensively enhance technological innovation capabilities by establishing R&D platforms and strengthening independent innovation of key technologies, and inject sustained impetus into their long-term development. Secondly, enterprises need to pay attention to market changes and mitigate R&D risks. They should continuously monitor various indicators such as profitability, solvency, and operating capacity, avoid management vacuum and weakened risk resistance capacity, and ensure efficient corporate operation. Thirdly, enterprises should focus on customer needs and improve R&D efficiency. Guided by market and customer demands, enterprises should conduct R&D activities, meet diverse needs through product diversification and personalized customization, attract high-quality customers, and consolidate their market competitive advantages.

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