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The Impact of Mergers and Acquisitions on Technological Innovation of Enterprises: Taking Apple as an Example

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Abstract: As market competition becomes increasingly fierce, in order to maintain a leading position in the industry, companies must enhance their core competitiveness to gain priority discourse power in the market. Corporate mergers and acquisitions are the act of acquiring property rights of other legal entities through certain economic means on the basis of equality, voluntariness, and equal compensation. They are a major form of capital operation and management for enterprises. This article aims to study the impact of mergers and acquisitions on technological innovation in enterprises, by analyzing the financial statements of enterprises and exploring the impact of mergers and acquisitions on their main business. Research has found that mergers and acquisitions are a business tool that can effectively enhance a company's technological level without increasing profits, while using less time cost. This provides a reference for enterprises to enhance their market competitiveness, differentiate their products, and adjust their business strategies.

Keywords: Mergers and Acquisitions, Technological Innovation, Research and Development.

1. Introduction

Technological innovation is not only crucial for tech companies to gain a competitive edge in the market but also central to driving high-quality development in the technology sector. It is especially crucial to ensure that enterprises steadily and continuously enhance their technological innovation capabilities. The rapid advancement of AI technologies has led numerous tech firms to strategically position themselves, aiming to gain a competitive edge in integrating artificial intelligence software and hardware. Currently, enterprises primarily adopt two approaches to bolster technological innovation: inward-oriented and outward-oriented innovation. Mergers and acquisitions serve as a significant method of outward-oriented innovation. This approach has also emerged as a new benchmark within industries dominated by tech giants like Google and Microsoft. Mergers and acquisitions can elevate a company's technological expertise, boost its patent portfolio, and consequently strengthen its innovation capacity, securing a competitive edge in the market.

In recent years, many studies have explored the merger and acquisition behavior of some enterprises, through the analysis of these studies, the impact of mergers and acquisitions on corporate technological innovation can be integrated from multiple perspectives. Xia et al. used the PSM-DID model to discover that the innovation ability and similarity of technical knowledge of the acquiring party have a significant positive impact on the company's overseas technology acquisition decisions [1]. This indicates that companies can effectively enhance their innovation capabilities through

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overseas mergers and acquisitions. There are many types of mergers and acquisitions in the industry, and digital processing technology is currently popular worldwide, making digital mergers and acquisitions an important part of the M & A model. Becoming an important M & A model for mainstream enterprises. Chen and Yang used the PSM-DID method to examine the impact and mechanism of digital mergers and acquisitions on total factor productivity of enterprises. Research has found that cross-border mergers and acquisitions can better enhance a company's total factor productivity [2].

After understanding the significant impact of mergers and acquisitions on corporate innovation and the current popular types of innovation, how to conduct mergers and acquisitions reasonably and efficiently has become the main issue that enterprises need to consider. In this regard, relevant research has already been conducted. Wang and Zhang started from two aspects of innovation capital investment and personnel investment, and the results showed that M & A behavior has a sustained positive effect on the improvement of enterprise innovation investment level [3]. At the same time, some studies have also shown that the role of mergers and acquisitions in helping companies improve their innovation capabilities is more pronounced in industries with higher technological requirements. Liang et al. on the impact of mergers and acquisitions of listed traditional Chinese medicine enterprises on innovation performance [4]. As well as Gantumur and Stephan's research on the determinants of innovation in mergers and acquisitions activities in the telecommunications equipment industry and the impact of mergers and acquisitions on technological potential and innovation performance, both propose that mergers and acquisitions have achieved significant growth in enterprise innovation performance [5]. Meanwhile, Chen et al. conducted research on integration and technological innovation after cross-border mergers and acquisitions from a resource perspective, and found that cross-border technology mergers and acquisitions have become an important means of achieving technological breakthroughs [6]. It is not difficult to find that compared to domestic mergers and acquisitions, cross-border mergers and acquisitions with a broader market perspective have a more significant impact on technological innovation.

As is well known, the industry competition among technology companies is extremely fierce, with different sizes of companies joining or investing in cutting-edge technology industries every year. Cefis and Marsili's research found that through mergers and acquisitions, companies can persist in innovation efforts and output over time, and the impact on large companies is particularly strong. For small companies, mergers and acquisitions help them overcome innovation barriers [7]. It can be seen that mergers and acquisitions have a positive effect on both large and small companies. Technology is a powerful driving force for productivity progress, and mergers and acquisitions in the high-tech industry are an indispensable part of the M & A market. Firstly, relevant research has already been conducted in the basic manufacturing industry. Ma and Liu have already found in their research on manufacturing that complementary technology mergers and acquisitions can improve innovation performance [8]. In the high-tech field, Cloodt et al.examined the innovation performance of the four major high-tech industries after mergers and acquisitions, and found that non-technical mergers and acquisitions seemed to have a negative impact on the innovation performance of the acquiring companies after mergers and acquisitions. Indicating that the company should target acquisition "partners" who are neither too unrelated nor too similar in terms of knowledge base [9]. Therefore, how and how to conduct mergers and acquisitions in the high-tech industry has a significant impact on the development of enterprises. As a representative of the high-tech industry, the new energy industry's mergers and acquisitions have a good reference value for other types of enterprises. Zhong et al. studied the causal relationship and regulatory mechanism between new energy enterprise mergers and acquisitions, technological innovation, and green technology innovation, and found that mergers and acquisitions improve their technological innovation level [10].

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However, current research and analysis on mergers and acquisitions still have problems of being too scattered and not systematic enough, and there is a lack of research on mergers and acquisitions in high-tech, especially cutting-edge technologies represented by popular artificial intelligence. In summary, current research lacks timeliness and full process specificity in terms of research subjects.

2. Apple's Merger and Acquisition Process from 2020~2023

2.1. Details of Apple's Mergers and Acquisitions from 2020~2023

Apple has accumulated long-term experience in mergers and acquisitions. This article mainly aims to explore Apple's main M&A businesses from 2020~2023. As shown in Table 1, it is not difficult to find that Apple's M&A business in the past three years has focused on the AI field. Its M&A in the AI field is ahead of all other similar enterprises, and it has rapidly invested the technological advancements and patent inventions obtained from M&A into the production and research and development of new products.

Table 1: Apple's main mergers and acquistions from 2020~2023

Time	Acquisition Company/Business Name	Purpose of acquisition and application areas
2020	Voysis	Improving Siri's Understanding of Natural Language
2020	Inductiv Inc	Improve Siri's intelligence by automatically identifying and correcting errors in data
2020	Dark Sky	Weather application to enhance the user experience of the system's "weather" application
2020	Xnor.ai	Improve edge processing capabilities and enhance data privacy
2020	Silk Labs	Based on local machine learning services, protecting data privacy
2020	PrimeSense	3D sensing technology applied to facial recognition technology
2020	Shazam	Music recognition service, integrated into Apple Music
2021	DarwinAI	AI technology, mainly used for visual inspection in industrial manufacturing processes

2.2. Analysis of Apple's Current Advantages

As a global electronics consumer giant, Apple has many advantages in its market position. Apple, with its innovative products and strong brand influence, has a significant market share and loyal consumer base worldwide. Especially in the fields of smartphones, personal computers, wearable devices, etc., Apple products such as iPhone, iPad, Apple Watch, etc. occupy important positions. Meanwhile, Apple is renowned for its self-developed hardware and software ecosystem, including A-series and M-series chips, as well as operating systems such as macOS and iOS. These technological innovations have provided Apple with a competitive advantage in the market and built insurmountable technological barriers. Apple's service business, including App Store, Apple Music, iCloud, etc., has grown rapidly in recent years and has become one of the company's important sources of revenue. The growth of service business helps smooth out the cyclical fluctuations of company performance and provides new growth points. Apple has a huge influence globally, and its

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products and services are not only popular in developed country markets, but also have strong appeal and growth potential in emerging markets.

2.3. Reasons for Apple's Promotion of Mergers and Acquisitions

Although Apple has many advantages, it also faces challenges from various aspects. In terms of market competition, with the return of Chinese brands such as Huawei and the emergence of other competitors, Apple's sales in the Chinese market are being tested, and the market demand for iPhones and iPads is cooling down; In terms of AI technology development, Apple has not yet shown a significant presence, which has raised concerns in the market that it may fall behind in emerging technology fields; in terms of product innovation, new products such as Vision Pro headsets and foldable phones have not yet become popular in the market, and abandoning car manufacturing projects has also had an impact on the company's image; In terms of technological progress, Apple needs to maintain technological leadership in fields such as artificial intelligence, augmented reality, and 5G to compete with competitors and meet market expectations.

2.4. Analysis of Apple's Mergers and Acquisitions in the Past Three Years

Based on this situation, Apple has been continuously conducting mergers and acquisitions in the past three years to help it quickly and efficiently improve its technological level in the short term and gain more market competitive advantages. To achieve this goal, it is necessary to gain substantial leadership in the currently hottest AI field. Therefore, in 2020, Apple began to deepen its layout in the field of AI. One of the most eye-catching acquisitions is Voysis, an AI startup dedicated to improving the natural language comprehension capabilities of digital voice assistants. Apple's move aims to enhance the intelligence and user experience of its virtual assistant Siri. In the same year, Apple also acquired Inductiv Inc., a company focused on automatically identifying and correcting errors in data, which is crucial for improving Siri's accuracy and machine learning model accuracy. Entering 2021, Apple has not slowed down its acquisition pace in the AI field. Apple continues to strengthen its accumulation and innovation capabilities in AI technology through acquisitions. In 2022, Apple's acquisition activities have become more frequent. One important acquisition is Canadian AI startup DarwinAI, which focuses on visual inspection of printed circuit boards (PCBs) in industrial manufacturing processes. Its technological advantages lie in miniaturized AI systems and high processing speeds, which aligns with Apple's strategy of running AI locally on devices rather than in the cloud. Until 2023, Apple's acquisition reached a climax. According to a report by market research firm Stocklytics, Apple acquired a total of 32 AI startups in the same year, ranking first in the number of acquisitions by major technology companies. These acquisitions cover multiple fields from video compression technology (such as WaveOne) to facial expression recognition technology (such as Emotion), further enriching Apple's AI technology reserves and potentially being applied in future products and features. Through these acquisitions, Apple not only strengthens its technological advantages in existing features such as Siri and FaceID, but may also expand its presence in multiple emerging fields such as autonomous driving, augmented reality, and music services. Apple's acquisition strategy demonstrates its profound consideration for future technological development and relentless pursuit of innovation. With the continuous advancement of AI technology and the expansion of application areas, these strategic acquisitions by Apple will undoubtedly bring them long-term competitive advantages.

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3. Analyzing the Impact of Mergers and Acquisitions on Apple's Technological Innovation through Financial Changes

3.1. Impact of Mergers and Acquisitions on Enterprise Innovation in R&D Investment

It is feasible to analyze the impact of mergers and acquisitions on Apple's technological innovation by analyzing the financial indicators of a company, which can intuitively show the changes in certain fields. The most intuitive one is R&D investment, with Apple investing $21.9 billion in R&D in 2021. This number is slightly lower than in 2022, but still maintains a high level. In terms of the proportion of R&D investment: In the past three years, Apple's R&D investment has fluctuated between 6% and 7% of revenue, indicating that while maintaining revenue growth, Apple also focuses on continuous investment in R&D. Meanwhile, Apple's research and development expenses in 2022 reached approximately $26.25 billion. This number demonstrates Apple's sustained high investment in research and development. Apple's R&D expenditure in 2023 reached approximately $29.544 billion, a year-on-year increase of 17.02%. This indicates that Apple continues to invest in research and development, driving cutting-edge technology, continuously improving and creating outstanding products. Its research and development investment not only covers hardware, but also includes multiple fields such as software, artificial intelligence, and user interface design, ensuring the comprehensive quality and user experience of Apple products.

3.2. Impact of Mergers and Acquisitions on Corporate Innovation of Gross Profit Margin

The gross profit margin is also an important measure of the impact of mergers and acquisitions on corporate innovation through financial evaluation. Apple's gross profit margin was 45.59% as of March 30, 2024, 42.16% as of December 30, 2023, 45.05% as of September 30, 2023, and 45.59% as of July 1, 2023. This shows that Apple's overall gross profit margin remained around 45% in 2023 and slightly increased in March 2024. This indirectly demonstrates that the new technologies and product innovations brought about by mergers and acquisitions can help enhance product value, enhance market competitiveness, and thus increase gross profit margins.

3.3. Role of Mergers and Acquisitions in Net Profit Margin for Corporate Innovation

Net profit margin is also an important measurement indicator. Apple's sales net profit margin was reported as 27.36% in mid-2024, 28.36% in the first quarter of 2024, and 25.31% in the annual report of 2023. In addition, the third quarter report for 2023 was 25.20%, the mid year report for 2023 was 25.55%, and the first quarter report for 2023 was 25.61%. The net profit margin for the 2022 annual report was 25.31%, the third quarter report was 26.00%, the mid year report was 26.96%, and the first quarter report was 27.94%.

From these data, it can be seen that Apple's net profit margin slightly decreased in 2023, but rebounded slightly in 2024, maintaining an overall range of 25% to 28%, demonstrating Apple's strong and stable profitability. The technological innovation brought by mergers and acquisitions to Apple can be well utilized in the latest products and production lines, differentiating its products in the industry, helping to better attract users and enhance market competitiveness, thereby increasing net profit margins.

3.4. Merger and acquisition achievements in the field of AI

Although financial data cannot directly link mergers and acquisitions with the improvement of a company's innovation capabilities, the numerous data mentioned above indicate that Apple will adopt mergers and acquisitions to effectively enhance its technological strength in a short period of time

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when it discovers its own technological shortcomings or areas that need to be strengthened. The invention patents obtained and cutting-edge technology mastered will undoubtedly be applied in the latest technological hardware or software. Apple has acquired 32 AI startups in 2023, ranking first in the number of major technology companies acquiring related companies. Apple is accelerating the expansion of mergers and acquisitions in the AI field. Recently, Apple's equity and additional investment in intelligent technology are far ahead of other competitors, accounting for about 21%, while Microsoft accounts for 12% and Alphabet accounts for 8%. For example, in the 2024 WWDC, Apple officially announced that it will add Apple Intelligence to iOS 18. Apple Intelligence also integrates ChatGPT under OpenAI, allowing Siri to use ChatGPT's expertise to answer questions and provide assistance in system level writing tools. The core of Apple Intelligence lies in its powerful data processing and situational awareness capabilities, which can deeply understand the data in the device (such as photos, emails, information, etc.) and provide personalized intelligent services to users based on it. This is an amazing achievement that Apple has produced after years of layout in the AI field. Although the project is still in its early stages, it has immeasurable prospects and has opened up a new track in the software field.

4. Conclusion

This article studies the impact of mergers and acquisitions on corporate technological innovation. Through financial performance such as net profit margin and R&D in corporate financial statements, it is found that mergers and acquisitions can help companies improve their technological level, thereby bringing higher profit margins. Additionally, research is conducted on the release and sales of new products, and it is found that relevant companies will apply the technological innovation obtained through mergers and acquisitions to the development and production of software and hardware, and launch new product lines and software ecosystems based on new technologies, enabling companies to gain more market share. At present, the impact of technological innovation on hardware development is becoming smaller and smaller, which greatly awakens the crisis awareness of enterprises. Managers find it difficult to make significant breakthroughs in hardware in a short period of time and thus gain a leading position in the industry. As is well known, Apple's products not only rely on powerful hardware performance updates to conquer consumers every year, but also have a stable and unique software ecosystem, which is another important means for Apple to increase customer conversion costs and maintain its market advantage. And in recent years, due to the bottleneck of hardware technology research and development, it has become even more important to make breakthroughs in the software ecosystem.Apple itself has a strong technological level, and its recent mergers and acquisitions in the AI field have helped its products achieve significant breakthroughs in software, making its already proud system software even more powerful. Therefore, taking Apple as an example, it can help many similar enterprises try to use mergers and acquisitions as an outward oriented business behavior when they are difficult to break through from the internal bottleneck period. This is how their originally weak aspects become stronger, and their originally strong businesses become even stronger.

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