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Preface

The 3rd International Conference on Financial Technology and Business Analysis (ICFTBA 2024) is an annual conference focusing on research areas including digital economy, business, and finance. It aims to establish a broad and interdisciplinary platform for experts, researchers, and students worldwide to present, exchange, and discuss the latest advance and development in digital economy, business, and finance.

This volume contains the papers of the 3rd International Conference on Financial Technology and Business Analysis (ICFTBA 2024). Each of these papers has gained a comprehensive review by the editorial team and professional reviewers. Each paper has been examined and evaluated for its theme, structure, method, content, language, and format.

Cooperating with prestigious universities, ICFTBA 2024 organized four workshops in Murcia, London, Galati and Oxford. Dr. Ursula Faura-Martínez chaired the workshop “New Current Trends Related to Economics: Special Focus on Inequality and Poverty”, which was held at University of Murcia. Dr. An Nguyen chaired the workshop “Human Capital Management in a Post-Covid World: Emerging Trends and Workplace Strategies”, which was held at King’s College London. Dr. Habil. Alina Cristina Nuță chaired the workshop “Finance’s Role in the Just Transition”, which was held at Danubius University from Galati. Dr. Natthinee Thampanya chaired the workshop “Finance in the Age of Environmental Risks and Sustainability”, which was held at Oxford Brookes University.

Besides these workshops, ICFTBA 2024 also held an online session. Eminent professors from top universities worldwide were invited to deliver keynote speeches in this online session, including Dr. Manjeevan Singh Seera from Monash University Malaysia, Dr. Natthinee Thampanya from Oxford Brookes University, Dr. Javier Cifuentes-Faura from University of Murcia, etc. They have given keynote speeches on related topics of digital economy, business, and finance.

On behalf of the committee, we would like to give sincere gratitude to all authors and speakers who have made their contributions to ICFTBA 2024, editors and reviewers who have guaranteed the quality of papers with their expertise, and the committee members who have devoted themselves to the success of ICFTBA 2024.

Dr. Ursula Faura-Martínez
General Chair of Conference Committee

Workshops

Workshop – Murcia: New Current Trends Related to Economics: Special Focus on Inequality and Poverty



December 4th, 2024 (GMT+1)

Department of Quantitative Methods for Economics and Business, University of Murcia

Workshop Chair: Dr. Ursula Faura-Martínez, Professor in University of Murcia

Workshop – London: Human Capital Management in a Post-Covid World: Emerging Trends and Workplace Strategies



November 20th, 2024 (GMT)

King's Business School, King's College London

Workshop Chair: Dr. An Nguyen, Lecturer in King's College London

Workshop – Galati: Finance’s Role in the Just Transition



December 18th, 2024 (UTC+3)

Department of Finance and Business Administration, Danubius University from Galati

Workshop Chair: Professor Dr. Habil. Alina Cristina Nuță, Professor in Danubius University from Galati

Workshop – Oxford: Finance in the Age of Environmental Risks and Sustainability



October 24th, 2024 (UTC+1)

Oxford Brookes Business School, Oxford Brookes University

Workshop Chair: Dr. Natthinee Thampanya, Senior Lecturer in Oxford Brookes University

The 3rd International Conference on Financial Technology and Business Analysis

ICFTBA 2024

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China's Digital Economy: Examining Its Impact on Inequality Through the Lens of Employment, Income Disparity, Innovation, and Competition

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Abstract: This paper examines the impact of China's digital economy on inequality, focusing on employment, income inequality, innovation, and competition. Overall, the digital economy creates inequality in individuals and firms. It exacerbates the income disparity between high-skilled and low-skilled workers, and/or across different regions. It also creates an oligopolistic structure in the digital markets and new industries, where big firms use network effects and incumbency advantage to reduce competition. Therefore, challenges arise for antitrust enforcement due to the dynamic nature of the digital economy and attention platforms. Nevertheless, the digital economy optimizes employment structure, having a net effect of greater creation effect than substitution effect. It also increases innovation efficiency and opportunities for smaller players in the traditional sectors. Therefore, the digital economy has positive implications for economic growth. Overall, it is crucial to encourage equality and stimulate economic growth by implementing certain policies, including measures to enhance labor quality, reduce regional disparities, and strengthen antitrust regulations.

Keywords: digital economy, inequality, innovation, competition, employment

1. Introduction

The constantly evolving digital economy is the most significant economic form today. The G20 [1] described it as “a broad range of economic activities that include using digitized information and knowledge as the key factor of production, modern information networks as an important activity space, and the effective use of information and communication technology (ICT) as an important driver of productivity growth and economic structural optimization.”

The Chinese digital economy continues to expand. It reached a scale of 50.2 trillion yuan in 2022, an increase of 4.68 trillion yuan compared to the previous year, and its share of GDP surpassed 40% to reach 41.5% from 2021 to 2022 [2]. The digital economy increases marginal returns and diminishes marginal costs; economic benefits increase exponentially [3]. Furthermore, ensuring equality is crucial for sustainable economic growth and social stability. In China, regional inequality is significant, which can be noted in regional urbanization rates and regional per capita GDP[4]. Moreover, only 77.5% of the Chinese population were internet users in December 2023 [5]. Therefore, it is important to understand the effect that this new economic form has on China's inequality. This paper explores the influence of the digital economy on China's inequality by discussing its effects on

individual and firm inequality, focusing on employment, income inequality, competition, and innovation.

2. Employment and Income Inequality

2.1. Economy of Scale and Efficiency

The development of the digital economy introduces new jobs, new machines, and new industries. Since 2015, the government has added 158 new occupations to the list of recognized professions, with 97 related to the digital sectors [6]. Moreover, the technologies in the digital economy lead to automated production, thereby enhancing efficiency. This results in lower costs and higher production output, prompting companies to expand their operations and hire more labor [7].

Furthermore, the digital economy expands its scale by blurring geographical boundaries in employment, creating a new "work ecosystem." Since the COVID-19 pandemic of 2019, flexible work arrangements emerged, which refers to any of various work structures that change the regular time and/or location of work [8]. The proportion of employees in new flexible employment increased to 19.1 percent of all employees in the first quarter of 2023, compared to 13.8 percent in the same period of 2020 [9]. Furthermore, flexible employment especially increased in industries dependent on digitalization, including in the transport and logistics sectors, where flexible employment was at 44% [10]. Nevertheless, even though this enhances employment absorption capacity and total employment, challenges include concerns about providing adequate legal protection and social security coverage for the flexible workforce [11].

2.2. Employment Structure Optimization and its Risks

Advanced technologies in the digital economy optimize employment structure by creating high-skilled jobs while substituting low-skilled jobs. High-skilled job positions in financial accounting, sales, and research and development significantly increased, which is called the creation effect [12]. On the other hand, repetitive tasks performed by low-skilled workers are automated, which is known as the substitution effect. Indeed, nearly 50% of work tasks in China could be automated by 2030 [13]. Moreover, Ding et al.[14] found that there is a notable decrease in manufacturing employment where the substitution effect exceeds the creation effect. Therefore, the digital economy will exacerbate inequality in China by increasing the wage gap between high and low-skilled workers [15]. Under the versatile and evolving circumstances of the digital economy, highly educated human capital gains more value due to the ability to adapt to new tasks [16]. To this end, CSIS warns that China's education and health services may not adequately prepare workers for high-skilled jobs, especially in rural areas. Government intervention is necessary to improve these services and support disadvantaged groups.

Nevertheless, future projections indicate that the substitution effect will weaken, while the creation effect is expected to become more significant in the long term. [17]. Now, the substitution of digital technology for low-skilled labor does not significantly hinder employment due to increased high-skilled tasks, thereby increasing overall employment [18]. Furthermore, As automation grows, and costs relative to wages decrease, businesses might delay investing in advanced automation, favoring labor-intensive tasks instead. This helps maintain stable employment levels and ensures a substantial share of national income for labor.

2.3. Differentiated Development Across Regions and its Risks

The digital economy exacerbates income inequality across regions [19]. Employment is enhanced in eastern and western regions but not in the central region due to uneven regional development of the

digital economy and skill gaps [20]. Ma and Zhang [21] found similar results, stating that the digital economy exacerbates the income gap between Han Chinese and ethnic minorities among low-income groups. Therefore, the cross-regional mobility of labor is increased, potentially causing job shortages for developed regions and vice versa. Thus, there is a strong inverse relationship between the Gini coefficient of the digital economy and the employment quality index; it is crucial to narrow the gap between these regions to enhance employment quality for all [22].

Nonetheless, the digital economy could help narrow the income gap between regions.. With the rapid expansion of digital finance and e-commerce in rural areas, certain household incomes have increased significantly, especially among low-income groups [23]. Furthermore, the “spatial spillover effects” of the digital economy can also help reduce regional income inequalities if effective policies apply.

3. Competition & Innovation

3.1. The Network Effect and Challenges for Antitrust Enforcement

The digital economy increases inequality between firms due to the formation of an oligopolistic structure in China’s leading digital industries [24]. The network effect can lead to market concentration, potentially leading to market tipping [25]. Specifically, network effects create a positive feedback loop where a platform's value rises with user numbers. This results in a winner-takes-all scenario and reduces competition. For example, the ecosystem developed by China's "BAT" (Baidu, Alibaba, Tencent) tech giants has been a key driver of the digital economy's growth. In addition, reduced prices due to pricing strategies or scale advantages strengthen incumbents’ market power, limiting competition. Even though this can benefit consumers in the short term, in the long term, it results in limited choices, diminished quality, and reduced bargaining power for fair wages. [26].

Furthermore, the presence of multi-homing should suggest alternatives to market concentration in the digital market [27]. However, in China’s case, the digital market relatively exhibits less of this phenomenon due to the oligopolistic structure; dominant firms can deter new entrants by using strategies like killer acquisitions and mergers. For example, Tencent is providing a comprehensive suite of services on a single platform [28], reducing multi-homing. Furthermore, Didi consolidated the Chinese ride-hailing market in 2016 by combining with its competitor, so multi-homing was no longer prevalent[29]. In addition, large digital platforms in China, such as the "BAT" (Baidu, Alibaba, Tencent) companies, have been acquiring promising startups and emerging players [30].

Accordingly, challenges arise for antitrust enforcement. Firstly, antitrust authorities must perform a case-by-case examination of the strategies of dominant firms. Secondly, attention platforms complicate traditional market power assessments based on pricing strategies. Thirdly, traditional frameworks for assessing anti-competitive pricing may not fully capture the dynamics of digital markets. Indeed, the Central Economic Work Conference [31] has prioritized intensifying antitrust enforcement to prevent disorderly capital expansion.

3.2. Increased Innovation Efficiency and Increased Competition in Traditional Sectors

The digital economy has substantially reduced costs and increased the benefits of innovation while lowering risk [32]. For instance, it promotes the building of innovation networks [33] and reduces information asymmetry between firms [34]. Overall, data and technology in the digital economy optimize innovation, bolstering innovation capacity and fostering competition. Indeed, the digital economy boosts both the volume of patent applications and the probability of patent authorization for manufacturing firms [35], and the ratio of R&D capital expenditure to the enterprise’s operating income increases with the digital economy index [36].

Furthermore, Despite oligopoly in new industries, there is an increase in small and medium firms in traditional sectors, facilitated by their ease of market entry and connection with large consumer bases at low cost. This has led to the rising influence of smaller firms rather than the dominance of large companies.

4. Suggestions

Enhance the quality of labor in response to the digital economy: Encourage R&D studies at higher education levels to drive the development of core technologies essential for the digital economy. Additionally, integrate digital economy-related education, including technology skills and vocational training, into lower levels of education to better prepare individuals for the digital workforce.

Reduce the development gap between western, central, and eastern regions through targeted policies: Implement differentiated policies to support industries with comparative advantages in each region. Offer preferential tax policies, land grants, and other incentives to attract domestic and foreign investment in key sectors of the economy in less developed regions. Facilitate the transfer of technology and knowledge from more advanced regions to less developed ones to mitigate regional disparities and foster innovation and competitiveness.

Strengthen antitrust regulations: Develop robust mechanisms to address the impacts of killer acquisitions and mergers on innovation. Conduct thorough case-by-case assessments and ensure greater transparency in the review process. Establish clear guidelines and criteria for assessing impacts to ensure effective regulation.

5. Conclusion

In conclusion, the digital economy increases inequality for both individuals and firms, but it holds promising implications for economic growth. Its challenges and limitations can be effectively tackled by improving government policies.

Regarding employment, the digital economy has optimized job quality, leading to a net creation effect outweighing substitution. It creates employment opportunities through increased scale, flexibility, and improved quality. Yet, it also heightens uncertainty for low-educated individuals in rural areas while favoring high-educated individuals in urban centers. Although currently benefiting economic growth, this trend widens the income gap, posing a threat to long-term sustainability.

In terms of innovation and competition, China's digital markets and emerging industries exhibit an oligopolistic structure, dominated by large firms due to network effects, killer acquisitions, mergers, and incumbency advantages. These present challenges for antitrust enforcement, but the Chinese government is already addressing them through developed measures, which can be further strengthened and adjusted as the digital economy evolves. Nonetheless, the digital economy enhances efficiency through technological advancements, reducing startup risks and costs. This fosters more innovation, entrepreneurship, and opens avenues for smaller players to enter traditional sectors.

References

- [1] "G20 Digital Economy Development and Cooperation ..." G20 2016 China , 2016, www.mofa.go.jp/files/000185874.pdf.
- [2] "Chinese Digital Economy Development Report ." CAICT, 2023, pdf.dfcfw.com/pdf/H3_AP202307051592039604_1.pdf.
- [3] Li, Xiaoxuan, and Qi Wu. "The impact of digital economy on high-quality economic development: Research based on the consumption expansion." *PLOS ONE*, vol. 18, no. 12, 15 Dec. 2023, <https://doi.org/10.1371/journal.pone.0292925>.
- [4] Textor, C. "Regional Disparities in China - Statistics & Facts." *Statista*, 2023, www.statista.com/topics/7157/regional-disparities-in-china/#topicOverview.
- [5] "Penetration Rate of Internet Users in China from 2013 to 2023." *Statista* , Lai Lin Thomala, 26 Mar. 2024,

www.statista.com/statistics/236963/penetration-rate-of-internet-users-in-china/.

- [6] “Digital Transformation Creates New Types of Employment in China.” X Yang, S Yu. ENGLISH.GOV.CN, 2022, english.www.gov.cn/statecouncil/ministries/202210/02/content_WS633973fbc6d0a757729e0d18.html.
- [7] Xia, Tian, and Jingsong Pei. “The impact of digital economy on employment—thinking based on the epidemic situation in 2020.” *E3S Web of Conferences*, vol. 235, 2021, p. 03034, <https://doi.org/10.1051/e3sconf/202123503034>.
- [8] “Flexible Work Arrangements: A Definition and Examples.” Georgetown University Law Center, 2006, scholarship.law.georgetown.edu/cgi/viewcontent.cgi?article=1009&context=legal.
- [9] “New Flexible Employment Logs Rapid Expansion in China: Report.” Xinhuanet, Hua Xia, 2023, english.news.cn/20230914/2eb1e33e22b34891b8357a564a26acd7/c.html.
- [10] Yan, Mao Qiang. “Flexible Work Tipped to Expand in Digital Economy.” *Chinadaily.Com.Cn*, Oct. 2023, www.chinadaily.com.cn/a/202310/25/WS65387771a31090682a5ea8fa.html.
- [11] “200 Million Chinese Are in Flexible Employment. Is This Their Choice?” *ThinkChina*, 23 Feb. 2022, www.thinkchina.sg/200-million-chinese-are-flexible-employment-their-choice.
- [12] Yunxia, Wu, et al. “The effect of Digital Economy Development on labor employment.” *Journal of Global Information Management*, vol. 31, no. 6, 14 Apr. 2023, pp. 1–27, <https://doi.org/10.4018/jgim.321180>.
- [13] Lu, Yang, and Lu Lu Zhou. “Can digital economy improve employment structure?—mediating effect based on a spatial Durbin model.” *PLOS ONE*, vol. 18, no. 11, 2 Nov. 2023, <https://doi.org/10.1371/journal.pone.0287849>.
- [14] Ding, Chenhui, et al. “Bilateral effects of the Digital Economy on manufacturing employment: Substitution effect or creation effect?” *Sustainability*, vol. 15, no. 19, 9 Oct. 2023, p. 14647, <https://doi.org/10.3390/su151914647>.
- [15] Yang, G., Yao, S. & Dong, X. Digital economy and wage gap between high- and low-skilled workers. *DESD* 1, 7 (2023). <https://doi.org/10.1007/s44265-023-00009-y>
- [16] Azarenko, Natalia, et al. “The model of Human Capital Development with innovative characteristics in digital economy.” *IOP Conference Series: Materials Science and Engineering*, vol. 940, no. 1, 1 Sept. 2020, p. 012032, <https://doi.org/10.1088/1757-899x/940/1/012032>.
- [17] Mazzocco, Ilaria. “How Inequality Is Undermining China’s Prosperity.” *CSIS*, May 2022, www.csis.org/analysis/how-inequality-undermining-chinas-prosperity.
- [18] Acemoglu, Daron, and Pascual Restrepo. “The race between man and machine: Implications of Technology for Growth, factor shares, and Employment.” *American Economic Review*, vol. 108, no. 6, 1 June 2018, pp. 1488–1542, <https://doi.org/10.1257/aer.20160696>.
- [19] Deng, Xiang, et al. “Digital Economy Development and the urban-rural income gap: Evidence from Chinese cities.” *PLOS ONE*, vol. 18, no. 2, 28 Feb. 2023, <https://doi.org/10.1371/journal.pone.0280225>.
- [20] Liu, Tongyang, et al. “The impact of differentiated development of the digital economy on employment quality—an empirical analysis based on provincial data from China.” *Sustainability*, vol. 15, no. 19, 25 Sept. 2023, p. 14176, <https://doi.org/10.3390/su151914176>.
- [21] Ma, Kailiang, and He Zhang. “Has the digital economy improved income inequality for ethnic minorities? the case of China.” *Heliyon*, vol. 9, no. 12, Dec. 2023, <https://doi.org/10.1016/j.heliyon.2023.e22831>.
- [22] Liu, Tongyang, et al. “The impact of differentiated development of the digital economy on employment quality—an empirical analysis based on provincial data from China.” *Sustainability*, vol. 15, no. 19, 25 Sept. 2023, p. 14176, <https://doi.org/10.3390/su151914176>.
- [23] Yan, Jie, et al. “Does Digital economy strengthen the income distribution effect of fiscal expenditure? evidence from China.” *PLOS ONE*, vol. 18, no. 8, 10 Aug. 2023, <https://doi.org/10.1371/journal.pone.0290041>.
- [24] Zhang, Longmei, and Sally Chen. “China’s Digital Economy: Opportunities and Risks - WP/19/16.” *IMF Working Paper*, 2019, www.imf.org/-/media/Files/Publications/WP/2019/wp1916.ashx.
- [25] Stobierski, Tim. “What Are Network Effects?: HBS Online.” *Business Insights Blog*, 12 Nov. 2020, online.hbs.edu/blog/post/what-are-network-effects.
- [26] Calvano, Emilio, and Michele Polo. “Market power, competition and innovation in Digital Markets: A survey.” *SSRN Electronic Journal*, 2019, <https://doi.org/10.2139/ssrn.3523611>.
- [27] Jullien, Bruno, and Wilfried Sand-Zantman. “The economics of platforms: A theory guide for competition policy.” *SSRN Electronic Journal*, 2019, <https://doi.org/10.2139/ssrn.3502964>.
- [28] Tencent. “How Tencent Is Building an Ecosystem for Marketing, Engagement, and Sales on Weixin: Partner Content.” *Campaign Asia*, Campaign Asia, 4 July 2023, www.campaignasia.com/article/how-tencent-is-building-an-ecosystem-for-marketing-engagement-and-sales-on-weix/485126.
- [29] Bousquette, Isabelle. “IPO of Chinese Ride-Hailing Firm Didi Makes Its President a Billionaire.” *Forbes*, *Forbes Magazine*, 30 June 2021, www.forbes.com/sites/isabellebousquette/2021/06/30/ipo-of-chinese-ride-hailing-firm-didi-makes-its-president-a-billionaire/.
- [30] Ning, Susan, et al. “Key Developments in China.” *Global Competition Review*, 2022, globalcompetitionreview.com/guide/digital-markets-guide/second-edition/article/key-developments-in-china.

- [31] "All Set for the New Year: Revamped Merger Review Regime Approved in China." *Slaughter and May Insights*, 2024, my.slaughterandmay.com/insights/briefings/all-set-for-the-new-year-revamped-merger-review-regime-approved-in-china.
- [32] Peng, Siying, et al. "The impact of the Digital Economy on Chinese enterprise innovation based on intermediation models with financing constraints." *Heliyon*, vol. 9, no. 3, Mar. 2023, <https://doi.org/10.1016/j.heliyon.2023.e13961>.
- [33] "Understanding China's Digital Economy: Policies, Opportunities, and Challenges." *Doing Business in China*, www.china-briefing.com/doing-business-guide/china/sector-insights/understanding-china-s-digital-economy-policies-opportunities-and-challenges.
- [34] Li, Yunyi. "Regional Digital Economy Development, information asymmetry, and Enterprise Supply Chain Transparency: An empirical study based on Chinese listed companies." *Highlights in Business, Economics and Management*, vol. 13, 29 May 2023, pp. 307–322, <https://doi.org/10.54097/hbem.v13i.8875>.
- [35] Wang, Qiong, and Yihan Wei. "Research on the influence of digital economy on Technological Innovation: Evidence from Manufacturing Enterprises in China." *Sustainability*, vol. 15, no. 6, 11 Mar. 2023, p. 4995, <https://doi.org/10.3390/su15064995>.
- [36] Peng, Siying, et al. "The impact of the Digital Economy on Chinese enterprise innovation based on intermediation models with financing constraints." *Heliyon*, vol. 9, no. 3, Mar. 2023, <https://doi.org/10.1016/j.heliyon.2023.e13961>.

An Overview of Esports Business Model Research

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Abstract: Nowadays, e-sports has become one of the rapidly growing emerging industries in the world, and its business model is becoming increasingly mature. This paper provides a systematic review of academic literature on the eSports industry through the documentary method, demonstrates the rise of eSports as a cultural and economic phenomenon, and analyzes the dynamic development of eSports as an emerging industry and its business potential. By examining eSports business models, this paper not only discusses how eSports can attract a wide range of audiences and investors through innovative business models, but also explores the major challenges facing this industry and their implications for future business strategies, aiming to provide valuable recommendations for policymakers and researchers in the eSports industry. The study shows that the business model of eSports relies on diversified revenues, and its rapid development has not only benefited from technological innovation and globalization trends but also from policy support and the positive response and investment of the capital market. The eSports industry has become an important part of the global digital economy, with strong market potential and the possibility of sustained growth.

Keywords: e-Sports, business model, documentary method, business potential

1. Introduction

Esports refers to organized video game competitions that serve as a non-traditional model of sport that has established itself as a commercialized entertainment enterprise and produced hundreds of millions of dollars in revenue, especially over the past five years [1]. Today, this emerging industry has fostered a diverse and unique business model that is able to generate commercial value through multiple revenue streams, and has attracted a large number of investors as a result. In the existing literature, scholars' exploration of the eSports industry tends to focus on the competitive nature of the sport, thus ignoring the deeper value of the eSports industry under the commercialization model. However, with the gradual transformation of eSports from a marginalized entertainment activity to a global mainstream industry, the study of its business model is particularly important.

This study focuses on the complex business model of the eSports industry, exploring through literature research how today's eSports industry realizes multiple incomes in terms of commercial value and attracts diverse audiences and large investments through innovative business models. Secondly, this study also explores the challenges faced by the industry, such as policy regulation and restrictions, market saturation, and their impact on the future development of the industry. By

examining these aspects, this study can make useful recommendations for policymakers and business decision-makers in the industry to optimize their business models and operational strategies.

In addition, this study provides some predictions for the future development of the eSports industry, which is not only part of the global digital economy, but also a key player with strong market potential and prospects for sustained growth.

2. Overview of the Esports Industry

2.1. Market Size and Growth

E-Sports is generally regarded as a kind of sport, which is an intellectual confrontation between people with the help of an electronic device platform. E-Sports is essentially an extension of sports, extending physical confrontation sports to virtual intellectual confrontation sports [2]. Driven by the Internet, the global reach of eSports competitions has reached unprecedented levels. Tournaments are broadcast live to millions of viewers worldwide, creating a shared experience. eSports represents a transformative development in the field of competitive activities, offering new opportunities for participation and commercialization. Its rise has challenged traditional notions of sport and competition, marking a shift towards a more inclusive and technologically integrated approach to sport. As the industry continues to evolve, it may play a key role in shaping the future of global entertainment and sports culture.

Over the past decade, the eSports industry has not only become a popular entertainment option, but has also shown considerable economic growth globally. Especially in China, eSports has seen a significant surge in market size and user base, becoming an important part of the digital economy. From Figure 1, it can be seen that the size of China's eSports market has grown rapidly, from 53.22 billion yuan in 2016 to 88.7 billion yuan in 2018, an increase of 66.7 percent.

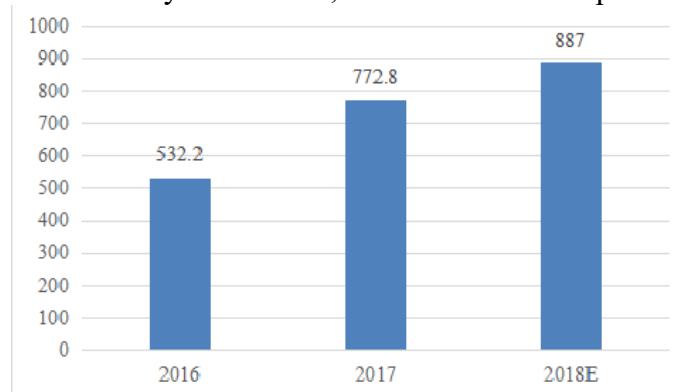


Figure 1: Chinese sports market size 2016 to 2018[2]

As shown in Figure 1, In 2019, China's eSports market size exceeded RMB 100 billion, a significant increase from the RMB 94 billion in 2018. Even in 2020, a year severely affected by the epidemic, the market size of the eSports industry reached 136.557 billion yuan. The user base of China's eSports reached 440 million people in 2019, growing to 490 million users by 2020. This shows the steady growth of the eSports market in terms of user size [3]. These figures illustrate not only the rapid popularity of eSports, but also its potential as a mainstream form of entertainment and a lucrative market segment.

The continued expansion of the eSports market can be attributed to several factors. Technological advancements and increasing popularity of digital platforms have enabled more viewers and gamers to participate from the comfort of their homes, further fueling the growth of the industry. Moreover,

the inclusion of eSports in major cultural events such as the Asian Games has enhanced its legitimacy and visibility, attracting more participants and sponsors.

In addition, venture capital and corporate investment in eSports companies has enabled the scaling up of operations, the expansion of professional leagues, and the improvement of broadcasting and streaming facilities. These developments have not only improved the spectator experience, but also attracted a wider audience, thus further expanding the market.

In short, the eSports industry in China is in the process of experiencing significant growth in market size and user engagement. This trend is expected to continue as the industry becomes more integrated with the mainstream entertainment and sports industries, providing significant opportunities for investors and policymakers alike.

2.2. Key Market Players and Influence

2.2.1. Game Developers

The eSports industry is driven by a number of key market players, including game developers, live streaming platforms, professional teams and corporate sponsors. These players shape the current and future of the eSports market from their own perspectives.

Game developers are the cornerstone of the promotion of eSports, having released games suitable for competitive play and continuing to actively organize tournaments to promote their games in an official capacity, such as Riot Games' League of Legends and Valve's Dota 2 and CS:GO. The competitive nature of these games can better motivate the audience and players during the tournaments, attracting more people to play their games.

2.2.2. Streaming Platforms

Streaming platforms such as Twitch and YouTube provide viewing platforms for eSports, greatly expanding the audience base for eSports. These platforms make it easier to watch eSports events by streaming them live, and also provide professional players with opportunities to monetize through advertising and subscriptions[4].

2.2.3. Professional Teams and Players

Professional eSports teams and well-known players have an equally significant impact on the market. Professional teams such as FaZe Clan and Team Liquid not only have large fan bases around the world, but also enhance their market presence through sponsorships and brand partnerships.

2.2.4. Corporate Sponsors

The entry of corporate sponsors from non-eSports industries into eSports has brought a significant injection of capital into the industry. As mentioned in the study of Yuji Zhi, well-known brands such as Intel and Coca-Cola have not only increased the visibility of their own brands through sponsorship of eSports events but also promoted the commercialization of the eSports industry [5].

Overall, these market players in the eSports industry have contributed to the development of the eSports industry in their ways, and have gradually explored the market potential, making the eSports industry more professionalized and globalized. With the active participation and entry of these players, the future of the industry will see more opportunities and create more business value.

3. Analysis of E-Sports Business Model

3.1. Revenue Model

The increasing popularity and exponential growth of esports as a worldwide phenomenon has created a whole new industry with important implications for the different key players in the value chain [6]. For the sources of income of these participants, they can be categorized into direct and indirect income models.

3.1.1. Direct Revenue Model

First of all, direct income sources refer to those that are directly derived from the core activities of eSports. For example, when various large-scale eSports events are held, they can attract a large number of spectators, and the sale of on-site tickets is an important source of direct income. Tickets for these large-scale events are often sold out quickly after they go on sale [7], which demonstrates the high market demand and potential of the eSports industry.



Figure 2: WCG Global Reach [8]

As shown in Figure 2 is WCG, Word Cyber Games, a world e-sports competition. Founded in 2000 and organized by International Cyer Marketing (ICM) in Korea, the slogan of the WCG is "beyond the game". The WCG aims to promote human communication in the Internet age, and is also known as the eSports Olympics due to the wide range of countries and regions participating in the competition.

At the same time, during large tournaments, game companies often produce official team apparel, game-related peripherals, and so on, for each participating team. These items are usually sold at the tournament site or on the official website, and the excitement of the tournament attracts consumers to buy them, which in turn generates revenue for the organizers.

In addition, game developers will also sell all kinds of virtual goods directly in the game, such as game skins, special props to directly obtain income profits, this income method is extremely important for free-to-play games, because they can not be charged through the system of buyout, the direct sales of the game mall is often their main source of income.

3.1.2. Indirect Revenue Model

Indirect revenues from eSports activities can be categorized into brand sponsorship and advertising revenues. By sponsoring eSports teams or tournaments, companies can increase their brand exposure and attract fans of the teams to buy their products to show their support for the teams. Studies have shown that eSports provide a platform for brands to reach young consumers around the world, and sponsors can effectively increase their market reach in this way. [9]

The live broadcast of eSports matches on various streaming media platforms provides advertisers with the opportunity to display their product advertisements, which usually appear during the breaks of the live matches or in content related to the tournaments, and are able to attract the attention of millions of global viewers in a short period of several dozens of seconds, which greatly increases the exposure of their products. Zhanxin Wang's research points this out, and specifically emphasizes the high importance advertisers place on this type of advertising [10]. This type of advertisement placement can leave an impression on more viewers at a close cost.

3.2. Business Opportunities and Challenges

3.2.1. Business Opportunities

The global expansion of the eSports industry is one of the most notable features of its business model. With the popularization of the Internet and the advancement of digital media technology, eSports has successfully broken the geographical and physical constraints faced by traditional sports and achieved wide access to a global audience.

And such rapid globalization is mainly due to the following factors. First, the rapid development of the Internet has led to the development of streaming media platforms, which not only enable tournament organizers to broadcast live events globally in real time, but also make it possible for audiences around the world to watch the games at the same time through various devices and interact with each other regardless of geographic constraints. Second, in order to serve the global audience, many large-scale eSports events provide multilingual commentary and content services. This linguistic inclusiveness greatly increases the participation of viewers from non-native-speaking countries and generates different features brought by different languages and cultures. The inclusiveness and diversity of eSports as a cultural phenomenon attracts young people from all over the globe. Video games serve as a common interest and cultural bond that crosses national and cultural boundaries.

3.2.2. Risks and Challenges

According to He Pei Yi's research, it was found that the eSports industry is still facing certain challenges and changes [11]. First, the eSports industry remains in a grey area of policy and regulation in many countries. Although governments encourage the development of eSports on a macro level, there are a variety of restrictive issues in specific regulations and implementation, as well as unclear responsibilities and powers, all of which limit the development of the industry, and there is always uncertainty about policies and regulations.

Secondly, the market development ability of the e-sports industry needs to be further improved. At present, although the e-sports industry has diversified profit models, the actual profitability is still weak. More mature and perfect tournament organizers and more effective profit models are needed to support the healthy development of the industry. The market development ability of the eSports industry needs to be further improved. Currently, although the eSports industry has diversified profit models, the actual profitability is still weak. More mature and perfect tournament organizers and more effective profit models are needed to support the healthy development of the industry. Although eSports is extremely popular among young people, it still faces a low level of social acceptance at the broader social level. This not only limits its room for development, but also affects the introduction of potential investment and advertising revenue.

4. Future Developments and Recommendations

4.1. Future Trends

Nowadays, eSports has become a global phenomenon with evolving business models and markets. With the development of science and technology, the future eSports industry will also incorporate technological innovation and integration. For example, increasingly mature technologies such as VR and AR are expected to be more widely used in eSports to provide audiences with a more immersive viewing experience [12]. Meanwhile, eSports will continue to expand its international market, especially in emerging markets such as Asia and Africa, to attract more viewers and consumers to understand and join the field. With the formalization of eSports, related education and vocational training will become more systematic in order to cultivate more professionals.

4.2. Strategic Recommendations

Based on the current state of development and future trends of the eSports industry, the study has also come up with a number of constructive recommendations. First, more diversified business models need to be developed, and more kinds of profit channels can increase the stability of the industry's income. Improving social recognition and policy support are also important prerequisites to ensure the healthy development of the industry. By educating the public and promoting policy support, the social recognition of eSports can be improved, so that more people can accept eSports and participate in eSports. In addition, the establishment of a complete eSports industry chain, including vocational education, tournament organization, and player management, as well as the strengthening of market supervision, can also ensure the healthy development and sustainable growth of the industry.

In the face of future development, the eSports industry also needs to effectively manage potential risks. Enhance the health and psychological support for eSports players, including regular physical examinations and psychological counseling to prevent occupational diseases and psychological problems [13]. Also, bring better welfare policies for retired professional players to ensure their stable income after retirement.

5. Conclusion

The eSports industry is not only growing rapidly, but its mature business model has also created a rich source of income for market participants. Despite challenges such as unclear policies and regulations, the risk of market saturation and lack of social acceptance, eSports still demonstrates great market potential and the possibility of sustained growth.

This study mainly finds that the business model of the eSports industry is highly diversified, realizing commercial value through multiple revenue channels and attracting a wide range of viewers and investors. Its continuous global expansion also brings infinite possibilities for the industry's future development potential, while the uncertainty of policies and regulations, the intensification of market competition, and the enhancement of social acceptance are the key issues that need to be resolved in the process of eSports industry development.

Future research can continue to focus on the sustainable development strategies of the eSports industry and explore how to further expand the business model of eSports through technological innovation and market strategies. At the same time, researchers should also consider the impact of eSports on social culture and how to improve the positive social image and influence of eSports while promoting the development of the industry.

Through these conclusions and recommendations, this study hopes to provide practical see recommendations for business stakeholders in the eSports industry and support the continued growth and development of eSports as an emerging form of global entertainment.

References

- [1] Joey Gawrysiak, Rick Burton, Seth Jenny and Dylan Williams (2020). *Using Esports Efficiently to Enhance and Extend Brand Perceptions – A Literature Review*. *Physical Culture and Sport. Studies and Research* ,86(1),1 – 14. <https://doi.org/10.2478/pcssr-2020-0008>
- [2] Xu Tan. *Business model and value assessment of e-sports companies*[D]. Shanghai Jiao Tong University,2020.DOI:10.27307/d.cnki.gsjtu.2019.000820.
- [3] Wang zhanxin,Xie ruile. *Research on the commercial value brought by e-sports industry--Taking the development of e-sports in China in 2020 as an example*[J]. *Marketing World*,2021(30):17-18.
- [4] Lei Xi,Xia Siyong. *Current Situation and Countermeasures on the Development of E-Sports Industry in China*[J]. *Journal of Beijing Sport University*,2005(08):1033-1035.DOI:10.19582/j.cnki.11-3785/g8.2005.08.009.
- [5] You Jizhi,Bute. *Research on the development status and prospect of e-sports industry chain in China*[J]. *Journal of Jilin Sports Institute*,2018,34(03):56-62.DOI:10.13720/j.cnki.22-1286.2018.03.011.
- [6] José Manuel Saiz-Alvarez (2021). *Knowledge Management in the Esports Industry: Sustainability, Continuity, and Achievement of Competitive Results*. *Sustainability* 2021, 13(19), 10890.<https://doi.org/10.3390/su131910890>
- [7] Chen X. *Analysis of the relationship between e-sports business development and capital ecological operation*[J]. *Journal of Jiamusi Vocational College*,2024,40(01):97-99.
- [8] Wu Yi. *Research on the Current Situation and Countermeasures of the Development of China's E-Sports Industry* [D]. Xi'an Sports Institute,2017.
- [9] Yang Yue. *Research on e-sports and e-sports industry in the new era*[J]. *Sports Science*,2018,38(04):8-21.DOI:10.16469/j.css.201804002.
- [10] Wang zhanxin,Xie ruile. *Research on the commercial value brought by e-sports industry--Taking the development of e-sports in China in 2020 as an example*[J]. *Marketing World*,2021(30):17-18.
- [11] He Peiyi. *Research on the current situation and development of China's e-sports industry* [D]. Shanghai International Studies University,2013.
- [12] Wang Feng. *Reflections on the business model of e-sports in China*[J]. *Sports Culture Guide*,2014(12):90-93.
- [13] LIU Yifei,TANG Xinghua. *Research on the development of e-sports in China and its countermeasures*[J]. *Martial Arts Research*,2020,5(12):150-153.DOI:10.13293/j.cnki.wskx.008746.

The Impact of Life-Sharing Social Media on Users' Consumption Behavior in the New Media Environment

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Abstract: In today's digital age, life-sharing social media has become an important part of an individual's daily life. These platforms, such as Instagram and Twitter, are not only places where people share their lives but also important influencers and disseminators of consumer culture. With the popularity of social media and the development of technology, consumers' purchasing behaviour and consumption awareness have also been affected in an unprecedented way. However, although it is known that these platforms play an important role in consumer behavior, the specific mechanisms of their influence and the actual impact on consumer behavior are still worthy of in-depth study. The purpose of this study is to explore the impact mechanism of life-sharing social platforms on consumer behaviour and their significance in digital marketing. Through the research method of comprehensive literature analysis, this paper analyzes the role of life-sharing social media platforms in consumer decision-making, brand cognition, and purchasing behaviour. The research finds that the development of social media platforms expands consumers' social networks and information access channels, which in turn affects their purchasing decisions and brand preferences. This finding has important academic and practical implications for optimizing social media marketing strategies and driving progress in the field of consumer behavior research.

Keywords: Media consumption, social media marketing, new media advertising, consumer psychology

1. Introduction

In recent years, with the rapid development of the new media industry, product content on social media platforms has become one of the most important reference factors when young people consume. Life-sharing social media with young users as the main body, such as Instagram, TikTok, and China's Red, have an increasing influence on consumption nowadays. In many ways, these platforms have rewritten the consumption behavior of the public. Users increasingly treat social media platforms as important sources of information for different types of products and services. Moreover, due to the highly interactive nature of social media, advertisements in social media are also not limited to officially published content but also include user-generated content. [1] Life-sharing social platforms connect users with life and consumption-related topics. This promotes the deepening of media consumption and also deepens symbolic consumption as well as its influence. The purpose of this

study is to explore the impact mechanism of life-sharing social platforms on young people's consumption behavior and its significance in the field of digital marketing. Through the research method of comprehensive literature analysis, this paper deeply analyzes the role of life-sharing social platforms in consumer decision-making, brand cognition, and purchasing behavior. In the past, the research on social media mainly focused on the political and cultural fields, but relatively little was involved in how social media affects consumption. The finding from this report has important academic and practical implications for deepening the understanding of digital marketing mechanisms, optimizing social media marketing strategies, and advancing the research field of consumer behavior.

2. A "Weak Relationship" Social Platform Where Life and Consumption Topics Converge

Lifestyle-sharing social media refers to online platforms that provide a platform for users to share their daily lives, experiences, hobbies, travel, food, etc, such as Instagram, TikTok, and China's Red. Compared with Twitter, WeChat, Line, and other social platforms, the content of life-sharing social media is more diversified and relaxed. And it shows a kind of "weak relationship" social. The following aspects also make such platforms bring users different experiences and satisfaction from Facebook and WeChat.

2.1. Broader Social Networks

Most of these platforms use "follow" rather than "add", which means a wider range of social networking. Users can not only interact with family or friends but also pay attention to more public accounts to get more information resources, such as some social media influencers or celebrities. This expanded social network structure allows users to reach out to content creators from different fields and backgrounds, not just their existing social circle, thus enriching their access to information and their social interactions. In addition, the platform itself uses an optional anonymity mechanism. Users can choose not to reveal their real identities and do not necessarily need to know the real identities of others. In such a social situation, users can express themselves more freely, show a more authentic mentality, and thus have more desire to express their attitude and show their life.

2.2. Sharing Content for Value

In such platforms, users can not only browse product-related posts but also further transition from consumers to contributors to branded content by commenting on or "liking" related posts. [2] In other words, they create unique content by sharing their lives, hobbies, or expertise to build a personal profile that attracts wider attention and interaction, thus turning their account into a public account. The widely used social network and the interaction mechanism on life-sharing social platforms enable individuals, brands, or products to gain greater exposure and influence through social communication. For many creators, sharing content can be both financially and psychologically rewarding. When creators themselves have influence and become "KOLs" (Key Opinion Leaders) to some extent, they can not only gain a subjective sense of achievement from the support of followers but also create their brands or cooperate with brand parties to obtain actual benefits.

2.3. Self-Expression and Cross-Reference of Life Experience

In life-sharing social media, users can freely share their life experiences, including but not limited to professional experience, personal growth, emotional experience, and consumption experience. The demands behind this are also various, such as showing their success, gaining the admiration of others, seeking comfort from others, and releasing the pressure of life. At the same time, users can also read,

share, and comment on other people's content to learn about others' lives and use it as a reference. They learn from or pursue other people's life attitudes, life experiences, and life quality, so as to reshape their own values, consumption outlook, and outlook on life.

2.4. Group Sense of Belonging

In addition, such platforms can usually display content and advertisements that meet users' personalized needs according to their interests, habits, and social relationships through algorithmic recommendations and personalized customization functions. Or they can provide a place of social identity and belonging. On the platform, users can share their lives and interact with people who have the same experiences or hobbies, thereby establishing new social relationships and communities, and receiving recognition and support from others.

The main theme of social media is about sharing and social interaction in daily life; however, with the frequent sharing of personal experiences, interests, and life views by users on the platform, these life topics often and inevitably turn into consumption topics. In this case, the life experiences and experiences shared by users are often closely related to consumption behaviors. These include shopping experiences, brand preferences, consumption decisions, etc. Therefore, life-sharing social media platforms are not only places for users to share their lives but also become important platforms to influence consumer behaviour and shape consumer culture.

3. The Symbol Consumption under Filter

3.1. Goods Endowed with Symbolic Meaning

Users can selectively display the products they have purchased or used on social media. In general, they are more likely to choose products that highlight their personal taste, lifestyle, or identity, rather than simply showcase the functionality or value of the product itself. At the same time, they will also add tags and descriptions to the content they share to highlight the product's features, brand, price, and other information. Additionally, they may add a personal point of view, emotional experience, or life story that gives symbolic meaning to the product beyond the product itself. Scholar Denish Shah et al. suggested the idea of "social media-centric consumption (SMCC) behavior".[3] In all SMCC instances, displaying consumption on social media is an integral part of the consumption experience. The need to seek attention, identity signals and social value becomes the primary motivation for SMCC. For this type of consumer, consumer satisfaction is determined by social media response rather than the quality of the consumer experience.

In addition, sharers often make use of filters, post-editing, and beautification tools to process the content they want to post on social media platforms. These filters not only enhance the beauty of the photo but also give the product a specific emotional color or cultural symbol. Then, through social interactions such as likes, comments, and re-posts on social media platforms, the symbolic meaning of the product is further strengthened and spread. The participation and feedback of other users will also affect the symbolization process of the product, further strengthening the social recognition and influence of the product.

In the social media of life sharing, the filtered life and consumption are often seductive, which often triggers people's pursuit and purchase desire. The presentation of individual consumption behavior is often selected and beautified, making the platform present a beautiful ideal world that surpasses reality. This leads to a sense of disappointment when people face reality under the guidance of such content. To some extent, the filtered world deepens individual anxiety, including appearance anxiety, body anxiety, financial anxiety, etc. When witnessing the beautified state and life of others, individuals tend to be more dissatisfied with themselves or jealous of others, even though they understand that the lives shared by others have been filtered.

3.2. Media Consumption under the Meaning of Commodity Symbols

Consumers may pursue utilitarian interests and hedonic interests when shopping online. [4] Utilitarian value and hedonic value are positively correlated with consumers' purchase intention respectively. In many cases, the utilitarian value of a product has an important impact on consumers' consumption experience. [5] And life-sharing social media just provides users with a platform to obtain both purposes. In this kind of platform, users can not only refer to, understand, and compare various products through others' sharing but also show their consumption as a sharer.

The symbolization of goods on social media is often closely related to the shaping of an individual's image. With the symbolization of goods on social media, individuals often pursue social identification associated with some specific brand, product, or lifestyle. They hope to gain social identity by buying and displaying these symbolized goods and being associated with a particular social group or social class. Individuals demonstrate their personal taste, attitude toward life, or social status by choosing a particular brand, product, or style. Create an image of yourself on social media and get noticed and recognized by others.

In addition, in media consumption under the meaning of commodity symbols, the sharing of others on social media will also stimulate the purchase demand of individuals for commodities. Even if the individual has no demand for the product in daily life, or is not interested in it. However, under the filter effect shared by others, an individual's consumption choice will often be affected, and then the purchase interest and demand for the product will be generated. This influence mechanism of sharing by others on social media further intensifies the utilitarian tendency of individual consumption behavior. As a result, individuals continue to follow the trend, chasing new and unique goods, while ignoring the actual demand and long-term impact of consumption. This utilitarian tendency of consumption behavior further intensifies the social consumption culture.

3.3. Commodity Display under "Life Sharing"

Media consumption is not only dependent on commerce, social networks are also very important, and online social media can promote the sale of goods or services both online and offline. [6] Life-sharing social media is a good example. It not only provides a platform for users to share their lives but also becomes an important part of business and consumer culture. On these platforms, the content shared by users seems to be a snippet of life, but behind it is often presented a large amount of commodity information. The life scenes shared by users are often interspersed with the display of various commodities or brands. These displays are presented implicitly or explicitly, thus indirectly or directly advertising and promoting a particular product or service. For example, when sharing a photo of a meal, a user may specifically label the brand of kitchenware or ingredient used. Additionally, when sharing a video of an outdoor activity, they might bring a specific brand of sports gear or outdoor equipment. Some common tags, such as "Outfit of The Day", "Room tour", "make up with me", etc., all of which contain a lot of potential consumption information. This phenomenon shows the close connection between life and consumption topics and encourages users to include their consumption behaviors in the scope of life sharing, forming a mode of linking life and consumption.

Secondly, the users on the life-sharing social platform are not only the showers of life but also the participants and disseminators of consumption. By sharing their consumption experience, brand preference, and shopping experience, users incorporate their consumption behavior into the scope of social interaction and communicate and share their consumption concepts and shopping mood with other users. The dissemination and sharing of such consumption content further introduces the topic of consumption into the social circle. This makes consumption not only an individual behavior but also a part of social relationships. Therefore, users' life-sharing content spreads commodity information and promotes commodity display, making consumer behavior a part of life and

promoting the dissemination and socialization of consumer culture. This pattern of interaction between life and consumption reflects the new characteristics of consumption in the digital age and the new trend of socialized consumption.

4. Group Consumption Under Social Interaction

Zygmunt Bauman once argued that consumption, unlike the enterprise of collective production, is a thoroughly individual, independent, and even solitary activity, driven primarily by individual needs and preferences. [7] However, with the rise of new media, especially the popularity of e-commerce platforms and life-sharing social platforms. These platforms collect people's consumption behaviors and further create a group consumption atmosphere and group consumption culture through social communication.

4.1. Group Interaction Stimulates Consumption Desire

In today's age of social media, group interaction plays an important role in stimulating the desire to consume. In social media platforms, products that are recommended by the masses, especially by social influencers, tend to generate widespread attention and discussion. The public opinion direction of social media content directly affects consumers' perception of the product. [8] In many cases, the emergence of new consumption hotspots is often through group interaction to shape a certain product into a sought-after consumption object, so as to arouse consumers' desire to buy. This phenomenon reflects a new type of consumption dynamic, in which the consumption tendency is often cultivated and strengthened through group interaction and social sharing.

Firstly, group interaction and social sharing provide consumers with a channel to access information and build trust. When a product is recommended and praised by multiple people or groups, consumers tend to feel that the product is trustworthy. This group recognition and resonance strengthen consumers' confidence in the product, thus promoting the formation and enhancement of consumption desire.

Secondly, group interaction and social sharing strengthen consumers' social identity and group belonging. When consumers share and discuss specific products with others, they are not only passing on information but also expressing their preferences and values. This strengthens social bonds and a sense of identity with one another. When users are in a self-defined community, consumption is often influenced and inspired by others in the community, thus forming a group consumption tendency and behavior pattern.

4.2. The Generation of Consumption Desire under Big Data Algorithm

Big data and algorithmic technologies play a crucial role in the operation of today's social media platforms. These platforms use algorithmic models to recommend personalized content to users by analyzing their behavioral data and interests and preferences. This personalized recommendation mechanism not only improves user experience but also serves as an important channel for users to interact with brands. This is despite research showing that some consumers are averse to big data tracking because of privacy concerns. This can exacerbate their negative attitudes toward social media advertisements and make them less willing to buy products. However, it is undeniable that when consumers are inundated with multiple types of digital information, they begin to see it as a social reality, leading to a more relaxed attitude towards privacy. [9]

Under the personalized recommendation mechanism, the platform strengthens the user's interest and purchase desire by continuously pushing similar products or content to the user. This recommendation mechanism enables users to immerse themselves in a personalized information environment and continuously receive product information that is in line with their interests and

preferences, thus strengthening their curiosity and purchase desire for these products. Under this mechanism, users can only be satisfied through the acquisition and consumption of the corresponding products. Even though sometimes it brings satisfaction and sometimes it brings disappointment.

The personalized recommendation mechanism reinforces the user's interest in and desire to buy a particular product. It promotes the actual consumption behavior of consumers and also provides huge business opportunities for product marketers. In the big data environment, product marketers analyze users' behavioral data and interests, and preferences through scientific and technological means, and use personalized recommendation algorithms to accurately position and promote products. In this way, they can control and guide consumers' purchase desires to a certain extent.

4.3. Follow Opinion Leaders

Studies show that consumers are increasingly using social media to identify product needs. When consumers become aware of a problem, they are forced to search for solutions to the problem through social media. [10] For the majority of consumers, celebrities are trusted sources of information online. Especially the smaller-scale "Instafamous" and blogger-type celebrities, are more trustworthy and reliable than traditional celebrities. Consumers are more likely to identify with these celebrities and perceive them as more approachable and trustworthy. [11] They can be summarized as the "KOL" (key opinion leader) mentioned below. These KOLs provide consumers with information, reviews, and advice about a particular product or service through content creation and sharing on the Internet. There is therefore a clear relationship between consumer sentiment and posts made by social media influencers. It is even said that social media users' judgments of products are more likely to favor the actual content shared by social influencers than the relevant posts published by the official product company on the media platform. [12]

In addition, according to the different transmission methods of product information, it can be regarded that the product information expressed by influencers on social media platforms is story news, while officially sponsored commercial advertisement posts are informational news. For users, Non-sponsored content with a strong story will tend to have a longer online attention duration (viewing time) because it resonates more with users. [13]

KOLs on media platforms have attracted a large number of fans and followers by sharing life experiences, shopping experiences, product reviews usage tips, etc. They provide product information and reviews in the content they create, helping consumers more accurately understand and evaluate the advantages and disadvantages of specific products. Although sometimes their sharing is not completely objective, but mixed with subjective interests, lacking truth and credibility. However, by inspiring consumers' inspiration and passion, they can still motivate consumers to make positive purchases. [14] KOLs' recommendations and suggestions tend to enhance consumers' confidence in specific products and facilitate the formation of purchase decisions. At the same time, KOLs can also promote the dissemination and promotion of specific products through their influence on social media, which brings exposure to brands and merchants and enhances the visibility and market competitiveness of products.

This new type of Internet group consumption model promotes interaction and socializing among people from a social point of view and enhances social connection and a sense of belonging. From an economic point of view, it drives the demand for goods and services and promotes the active market. However, at the same time, group consumption also brings a series of challenges and problems, such as the group pressure of consumers and the phenomenon of following the trend, as well as the social comparison and the distortion of value concepts brought by group-oriented consumption behavior.

5. Conclusion

Life-sharing social platforms play a vital role in today's digital age. It is not only the medium of information transmission, but also the shaper and disseminator of consumer culture. Through group interaction and social sharing, these platforms promote consumers' purchase desire and consumption behavior and strengthen the spread and strengthening of consumerist culture. The influence of personalized recommendation algorithms and KOLs has also further promoted consumers' purchase decisions and behavioral choices, bringing more business opportunities for brands and merchants. However, it can also be noticed that the process of group consumption is also a process in which consumers are continuously domesticated by the totality of consumption. It is necessary to balance the relationship between individual interests and social responsibility and strengthen the protection and supervision of consumers' rights and interests. Therefore, it is significant to study more deeply the impact mechanism of life-sharing social platforms on consumer behavior to explore sustainable consumption patterns and promote the healthy development of consumption culture and the sustainable progress of society.

References

- [1] Alalwan, A.A. (2018). *Investigating the Impact of Social Media Advertising Features on Customer Purchase Intention*. *International Journal of Information Management*, 42, pp.65–77.
- [2] Cao, D., Meadows, M., Wong, D. and Xia, S. (2021). *Understanding Consumers' Social Media Engagement behaviour: an Examination of the Moderation Effect of Social Media Context*. *Journal of Business Research*, 122, pp.835–846.
- [3] Shah, D., Webster, E. and Kour, G. (2023). *Consuming for content? Understanding social media-centric consumption*. *Journal of Business Research*, 155(113408), p.Part B.
- [4] Bridges, E. and Florsheim, R. (2008). *Hedonic and utilitarian shopping goals: The online experience*. *Journal of Business Research*, 61(4), pp.309–314.
- [5] Zhang, W., Zhang, W. and Daim, T.U. (2023). *Investigating consumer purchase intention in online social media marketing: A case study of Tiktok*. *Technology in Society*, 74(102289).
- [6] Liao, S.-H., Widowati, R. and Hsieh, Y.-C. (2021). *Investigating online social media users' behaviors for social commerce recommendations*. *Technology in Society*, 66(101655).
- [7] Bauman, Z. (2004). *Work, Consumerism and the New Poor*. Maidenhead ; New York: Open University Press, , Cop.
- [8] Zheng, Y.-H., Xu, T., Shi, G. and Jiang, L. (2023). *I want to go there too! Tourism destination envy in social media marketing*. *Heliyon*, 9(e22889).
- [9] Gutierrez, A., Punjaisri, K., Desai, B., Syed Alwi, S.F., O'Leary, S., Chaityasoonthorn, W. and Chaveesuk, S. (2023). *Retailers, don't ignore me on social media! The importance of consumer-brand interactions in raising purchase intention - Privacy the Achilles heel*. *Journal of Retailing and Consumer Services*, 72(103272).
- [10] Mason, A.N., Narcum, J. and Mason, K. (2021). *Social media marketing gains importance after Covid-19*. *Cogent Business & Management*, 8:1(1870797).
- [11] Djafarova, E. and Rushworth, C. (2017). *Exploring the Credibility of Online celebrities' Instagram Profiles in Influencing the Purchase Decisions of Young Female Users*. *Computers in Human Behavior*, 68, pp.1–7.
- [12] Zhang, Z., Keasey, K., Costas Lambrinoudakis and Mascia, D.V. (2024). *Consumer Sentiment: The Influence of Social Media*. *Economics Letters*, 237(111638), pp.111638–111638.
- [13] Stubb, C. (2018). *Story versus info: Tracking blog readers' online viewing time of sponsored blog posts based on content-specific elements*. *Computers in Human Behavior*, 82, pp.54–62.
- [14] Andonopoulos, V., Lee, J. (Jiyeon) and Mathies, C. (2023). *Authentic isn't always best: When inauthentic social media influencers induce positive consumer purchase intention through inspiration*. *Journal of Retailing and Consumer Services*, 75(103521).

The Research about the Connection Between Housing Prices and Unemployment

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Abstract: The aim of this research is to investigate the potential correlation between housing prices and unemployment rates in London. Specifically, the study focuses on analyzing the relationship between the average housing price and the unemployment rate in the city. To achieve this objective, this paper employs statistical methods such as the t-test and regression analysis to determine whether there is a significant connection between the two variables. Additionally, a line chart is utilized to visually represent the changes in housing prices over time, providing a clearer understanding of the trends and patterns. By conducting this comprehensive analysis, we hope to gain insights into the potential impact of unemployment on housing prices in London.

Keywords: housing price, unemployment, regional economy

1. Introduction

In recent decades, housing prices have become an important part of the economy, and sharp changes in housing prices usually portend a change in the economy and may cause an employment increase. However, if the number of employment changes, it is a question whether the housing price also changes. The number of unemployment can show the economic situation, and if there is really a connection between housing prices and unemployment, it may prove the factors that can influence the economy can also influence each other, then it may prove that economy is a whole composed of quite a lot of factors, is a dynamic balance. More succinctly, the paper wants to research whether housing prices have significant differences between different places and why there are differences. All data come from data.london.gov.uk/ and the research object of the paper is London.

There are many researches about housing prices, and they usually show why housing prices change and what factors influence housing prices. Chen Xiaoliang et al. did study shows monetary policy, demand factors and supply factors are all driving factors of housing prices but not the main driving factor [1]. The housing prices can be influenced by many different factors. This paper also shows some opinions like that, and it wants to research the change in London housing prices in recent years. First of all, the paper will show whether the different parts of London have significant differences by t-test and also show the change in average price in London with a line chart. Then, the paper will research whether there is a relationship between housing prices and the unemployment rate by linear regression. Unemployment can show the economic situation in some way, in fact, the better the economy, the lower the unemployment rate usually is. However, the housing price is not directly influenced by the economic situation. To be more specific, whether the housing price is too low or

too high can both be seen as economic problems, but if just use the unemployment rate to study the housing price, it may show a different answer, and make housing prices easier to predict.

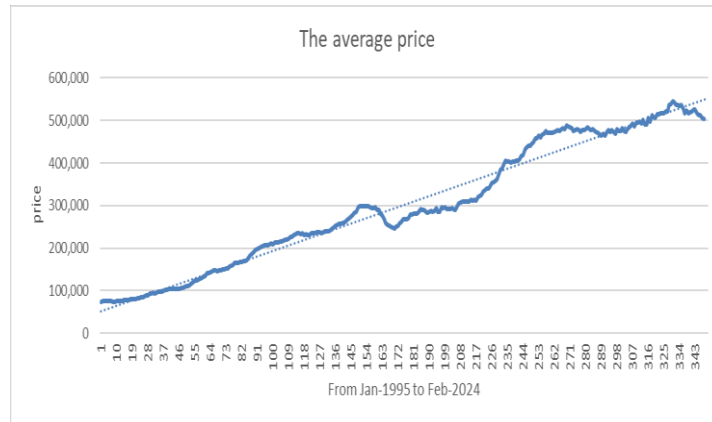


Figure 1: The average price of London price from Jan-1995 to Feb-2024

First of all, this paper uses the data on housing prices from 1995 – 2024 to plot a line chart, which shows that housing prices in London keeps increasing. If we look at a single house, the price may change because of its location, material and design, but if we look at the whole, the average housing price in the area can be influenced by changes in population, new relevant policies and the economic situation like currency inflation or change of interest rate. There are too many factors that can influence housing prices, so that is difficult to correctly predict it, but because having a place to live is an important part of human life, housing prices still can be seen as an important factor in measuring well-being and so on. Under normal conditions, the housing price is higher, the human well-being is lower because people need more money to have a house to live and may cause them to live in a worse place than before. As the trendline in the line chart shows, the housing price increased from January 1995 to February 2024, a total of 350 months. In January 1995, the average housing price in London was just 74436 pounds, but in February 2024, the average housing price has risen to 502690 pounds, almost seven times as many as it was in January 1995. There are multiple reasons to explain this change, mostly economic, and the change can affect the economy and many people's lives. This paper wants to research, whether housing prices have a connection with the unemployment rate, and if the answer is yes, what thoughts it can show.

2. Unemployment

Unemployment people are people who do not have jobs and do not have income to feed themselves. The number of unemployed people can show the economic situation of the local area and the balance between supply and demand. To research the connection between housing prices and unemployment people, the paper uses analysis of regression, and the result is here:

Table 1: The analysis of regression about housing prices and unemployment people and the analysis and the result of analysis

Analysis of regression	
Multiple R	0.936421
R Square	0.876884
Adjusted R Square	0.869988
Standard error	160023.7
Observed value	146

Table 1: (continued).

Analysis of variance						
	df	SS	MS	F	Significance F	
Analysis of regression	1	2.64E+13	2.64E+13	1032.753	1.45E-67	
Residual error	145	3.71E+12	2.56E+10			
total	146	3.02E+13				
	Coefficients	Standard error	t Stat	P-value	Lower 95%	Upper 95%
X Variable 1	1.44621	0.045002	32.13648	7.88E-68	1.357265	1.535155

This analysis of regression uses data of unemployment people and housing prices in from January 2012 to February 2024. In these twelve years, the housing price has increase and the number of unemployed people has totally decreased. In January 2012, there were 444360 people employed, almost 10% of the population in London, but finally, in February 2024, there were just almost 217000 unemployed people. It is a great decrease and shows the development of society in London. In the analysis of regression, there is a high R square, which means the model performed very well, and a high F, which means the model is significant on the whole. Overall, the independent variable has a significant influence on the dependent variable, and the coefficient estimates are very reliable. It shows that most of the time, the fewer number of unemployed people, the higher the house prices.

3. The Result

However, as said at the beginning, the change of economics is very complicated, and the housing price can be influenced by many factors, the number of unemployment is just one of them. The result shows they have a high connection may just because they have too many same characteristics, such as both of them would have great change in economic crisis, but then there is a question, if an area has a healthy economy, it of course has very few unemployment people, but whether it has low housing price, or completely opposite, because people have higher purchasing power, the housing price also increase to a higher level. The result above shows the answer is yes, when an area has less unemployment than before, the housing price also increases. It may mean that when the local economy improves, people need more money to keep them in the local area. In some opinion, it is a strange situation, because if people need more money to feed themselves, even if the environment they have become better, their well-being may not increase, so the development of economy may not have some significance, but in some other opinion, this situation is just necessary. The unemployed people become less, and the economy improves, then people have more purchasing power and the demand is changes. As the demand changes, there will be more supply and of course, higher prices, and all of them can make the GDP higher and the economy better. It is a positive cycle, which means prices would rise with economic growth, and higher prices would cause economic growth to rise further. Windsor et al. also think rising housing prices will increase residents' willingness to develop and enjoy consumption [2], which means the level up of consumption structure. It sounds good, and seem the rising housing prices mean good things. But there are also some different opinions, Muellbauer thought the increase of housing prices would make people save more money to buy houses and lower consumption [3]. On the other side, local people may afford heavier pressure from higher and higher prices during the period, and finally had to move to some more remote places. Monk made a study in 2000 showed the increase in housing prices make the labor force in the south-

east of England became shortage [4]. The research from Brakman also shows there is a negative impact of the increasing housing prices on the increase of the labor force [5]. This can be relieved by policy from the government, or the government can just indulge this situation because it can also make remote places have more population. In fact, Yijie Deng in his research shows high housing prices would drive labor to another city because it means the cost of living in the local area would rise [6], and if the government can take appropriate actions, it can make city has coordinated development of regional labor supply and do not cause a problem. The research of Smith & Ohsfeldt shows that the speed of housing price rise is related to the amount of public goods invested by the government [7]. It is one way for the government to control housing prices, as the research of Zhang Linfeng shows, the change in house property tax also can take influences in housing prices [8].

4. The Limitation of the Result

The result loses sight of many details and just look at the whole. This is because there are too many factors that can influence the economy and the paper cannot consider all of them. In fact, even in the different boroughs of London, the average housing price can have significant differences. There is the t-test about Barnet and Barking & Dagenham:

Table 2: the t-test about Barnet and Barking & Dagenham

	Variable 1	Variable 2
Mean	341794.9	182652.1
Variance	2.56E+10	8.26E+09
Observed value	350	350
Assumed mean difference	0	
df	553	
t Stat	16.16755	
P(T<=t) one tail	9.84E-49	
t one tail critical	1.647614	
P(T<=t) two tail	1.97E-48	
t two tail critical	1.964263	

It shows these two boroughs have significant differences, which means their housing price may need specific analysis and their environment may have great differences. However, the result is still right in the rough. Housing prices in different areas also have different influences on upgrading of consumption structure. As the research of Xu Rui et al. showed, the influence of upgrading of consumption structure from the change of housing prices has regional differences. In Shanxi and Henan it has a promoting effect, but in Anhui, Hubei, Hunan, and Jiangxi it has a restraining effect [9]. The study of Li Xiangjun shows for cities with different population sizes, the effect of housing prices on production efficiency is heterogeneous [10]. Although production efficiency is different from unemployment, it can still prove the influence of housing prices would change because of the population of the city. That mean though housing prices really have a connection with unemployment, the connection would change because of the specific situation. It is not a constant relationship.

5. Conclusion

The conclusion is there is a high and long-run connection between housing price and unemployment by using data of London. The unemployment is lower, and the housing prices are higher, and that led to thoughts about economic development and whether it can give a better life to local people. This

would be decided by multiple factors and the government affect the result to some extent by making relevant policies. Although the study not have a detailed explanation about this relationship and it is a one-side and not very accurate result because it ignores many factors that may can have influences in the two variables. It may need a more suitable algorithm to calculate and in the other side, this paper just gives a simple conclusion and it cannot show the relationship between housing prices and unemployment in detail. In fact, there have many people researched in similar subject, and if the paper has more citations of reference literature, it can be more convincing. However, the paper can still take some thoughts about economic development. In the future, the research can focus on other factors that can influence housing prices, and study whether they have different influences on housing prices and why they have different influences.

References

- [1] Chen Xiaoliang, Chen Kan, Wang Zhaorui, Xiao Zhengyan. *Identification of Influencing Factors of Housing Price Divergence in Different Cities [J]. Economic Theory and Business Management*, 2024,44(2):49-64.
- [2] Windsor C, Jskel J P, Finlay R. *Housing wealth effects: Evidence from an Australian panel[J]. Economica*, 2015, 82(327):552-577.
- [3] Muellbauer J., *Housing, Credit and Consumer Expenditure*, Symposium Paper, University of Oxford, 2008.
- [4] Monk, S. (2000) *The Key Worker' Problem: The Link between Employment and Housing*. In: Monk, S. and Whitehead, C., Eds., *Restructuring Housing Systems: From Social to Affordable Housing*, York Publishing Services, York 353-355.
- [5] Brakman, S. (2002) *New Economic Geography in Germany: Testing the Helpman-Hanson Model*. Hwwa Discussion Papers, No. 172, 14-29.
- [6] Deng Yijie. *The Influence of Housing Price on Wages in Chinese Cities—Based on the Empirical Analysis of 35 Large and Medium-Sized Cities in China [J]. ISSN:2160-7311*, 2022,12(5):479-492.
- [7] Smith, B.A. and Ohsfeldt, R. (1982) *Housing-Price Inflation in Houston, 1970-1976*. *Policy Studies Journal*, 8, 257-276.
- [8] Zhang Linfeng. *The Structural Change of House Property Tax on Housing Price [J]. ISSN:2169-2556*, 2022,11(2):594-599.
- [9] Xu Rui, Liu Xiaoying. *The Impact of Housing Price Fluctuations on the Upgrading of Urban Residents' Consumption Structure [J]. Productivity Research*, 2024(3):44-48.
- [10] Li Xiangjun, Xu Qiao. *The Influence Mechanism of Housing Price on Urban Total Factor Productivity: An Empirical Analysis Based on Tobit Model [J]. Journal of Technology Economics*, 2024,43(1):1-13.

Study on China's Homemaking Service Credit Optimization in Perspective of Game Theory

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Abstract: In recent years, the homemaking service industry in China has developed rapidly, with a market size of trillions RMB. However, conflicts and poor trust between homemaking service provider (companies and practitioners) and consumers remain prominent. Credit issues have become the main bottleneck for the high-quality development of the homemaking service industry. These credit issues are mainly caused by factors such as intermediary enterprise model, low capability and bad service quality for practitioners, information asymmetry, lack of industry credit system, etc. This article uses game theory to analyze the integrity mechanism in the homemaking service industry and proposes a targeted optimization method for the credit system of homemaking service. The case study shows that the enterprise's credit has decreased, and its production and operation have fallen into difficulties due to the dishonest operation during the game between the enterprise and consumer. Through game theory analysis, it can be found that information disclosure mechanisms and reward and punishment mechanisms play an important role in optimizing the credit of homemaking services. Cooperative games help build stable trust relationships and improve service quality.

Keywords: Homemaking service, Game theory, Credit.

1. Introduction

The homemaking service industry, as an indispensable part of social life, provides people with various convenient life services. However, with the development and growth of the industry, trust risks have gradually emerged. Considering the opening of consumer's personal property and private space to practitioners in the process of homemaking service, it would be important for consumers to choose a reliable, honest, and safe and quality homemaking service companies. Homemaking service is a huge industry in China, with a large number of employees and enterprises. In 2021, the size of China's homemaking service industry reached 1014.9 billion RMB, which enters the trillion-level market. In 2023, the industry size reached 1164.1 billion RMB. The number of homemaking service practitioners and enterprises was 37.6 million and 1.2434 million in 2021 [1,2]. Despite the rapid development of China's homemaking service industry, there is a prominent contradiction between homemaking service companies and consumers in term of no guarantee for service quality and poor industry credit. Strengthening and optimizing the credit system of the homemaking service industry is of great significance and a big role in alleviating the contradiction between consumers and service providers and promoting high-quality development of the homemaking service industry.

The lack of credit in China's homemaking service industry is particularly prominent. It is occasionally reported that homemaking service staff conceal true information, steal consumer's money and property, injury to the elderly, children, illness, and disability [3]. Homemaking service enterprises mislead consumers through unfair competition, price gouging, false advertising, etc. These cases bring harm on the safety of people's lives and property, seriously disrupt the order of the homemaking service market, and have adverse effects on the healthy development of the homemaking service industry. It is pointed out in the Report on the High-Quality Development Index of China's Home Service Industry (2022) that indicators such as the proportion of annual new market entities to current survival, the number of dishonest cases per 10000 market entities, and the readymade company index are not very optimistic. The overall index of high-quality development of the homemaking service industry is not high. And the classification index of development strength, development vitality, and innovation momentum is running at a low level [4]. From the current situation of China's homemaking service industry, the main reasons for the lack of credit system would be as follows.

1.1. No control and supervision on homemaking service practitioners due to enterprise's intermediary model

Although the number of homemaking service enterprises is surprising, most enterprises are small, scattered and weak. The number of enterprises operating in a chain, branded, networked, and large-scale manner is severely insufficient, and their market share is relatively low. More than 95% entities are small and medium-sized enterprises and individual businesses. More importantly, most homemaking service enterprises in China operate in an intermediary mode [5-7]. Intermediary homemaking service enterprises refer to a business model in which homemaking service personnel establish labor relations with employers through homemaking service intermediary companies, rather than labor relations. In this mode, homemaking service personnel are usually not formal employees of the company but provide services as temporary workers or freelancers. The intermediary company is mainly responsible for introducing homemaking service personnel to employers and collecting certain intermediary fees from them. The characteristics of this model are low market entry barriers, generally small enterprise scale. For example, some intermediary homemaking service enterprises can operate with just one table and two staff, lacking necessary control and supervision on practitioners. According to the survey, 41.8% and 37.6% consumers believe that homemaking service companies have no effective management and no standardized service respectively. Problems such as lack of standardization, inability to find and dissatisfaction to service are becoming huge obstacles to industry development.

1.2. Low capability and bad service quality for homemaking service practitioners

Due to practitioners' varied capability and professional skills, it is very difficult to guarantee service quality. In China, homemaking service practitioners are mostly migrant workers, urban laid-off workers, retired workers, and unemployed individuals. Due to differences in age, education, experience, and the knowledge and skills of homemaking service management that each person has, their service capability and quality varies greatly, and the service quality is very uneven. Meanwhile, there is currently a lack of unified training standards and certification systems for homemaking service practitioners in China, which results in different training quality and professional skills for each homemaking service personnel. Most importantly, due to lack of long-term cooperation between employers and homemaking service personnel, the job mobility of homemaking service personnel is relatively high, which may lead to unstable service quality.

1.3. Dishonesty risks brought by information asymmetry

There is a common situation of information asymmetry between consumers and homemaking service practitioners. Consumers may find it difficult to obtain accurate and comprehensive information about homemaking service enterprises, and may not fully understand their company background, service quality, and employee training, which leads to uncertainty in their choices. Meanwhile, it is also difficult for homemaking service enterprises to accurately evaluate the real needs and payment ability of consumers, which would result in integrity risks when signing contracts.

1.4. Lack of industry credit system

Due to the fact that most homemaking service practitioners in China do not have personal credit records, employers and even some homemaking service companies find it difficult to check whether the practitioners have any negative records in their previous work. Moreover, some experts admit that the certificates of many practitioners in the current market do not have legitimacy and can be purchased without training for a little money. Due to the current lack of a unified credit inquiry system for homemaking service workers, intermediaries and employers are unable to predetermine whether practitioners have any records of misconduct and verify the authenticity of their relevant documents, which may pose hidden dangers for future homemaking services.

2. Establishment and analysis of game theory model for homemaking service credit system

2.1. Market entities analysis in the homemaking service credit game

The application of game theory in the homemaking service market helps to understand and predict the behavior of market entities, promote the healthy development of the market, and provide theoretical support for policy formulation and corporate strategy [8-11]. The main entities in the homemaking service market include homemaking service personnel, homemaking service companies (including intermediary companies and employee-based companies), employers, and relevant regulatory agencies. There are complex game relationships between these market entities:

1. Homemaking service personnel and homemaking service companies: Homemaking service personnel usually rely on homemaking service companies to obtain job opportunities, while homemaking service companies require homemaking service personnel to provide services. There may be a game between homemaking service personnel and the company in terms of profit distribution, work arrangements, training opportunities, and other aspects.

2. Homemaking service companies and employers: Homemaking service companies need to meet the needs of employers to obtain business, while employers hope to obtain high-quality and reasonably priced services. There may be a game between the two parties regarding the quality, price, and service period of homemaking services.

3. Homemaking service personnel and employers: Homemaking service personnel hope to obtain stable work and reasonable compensation, while employers expect to receive satisfactory service. Both parties may engage in a game regarding the performance, compensation, and working conditions of homemaking service personnel.

4. Competition between homemaking service companies: Different homemaking service companies may compete for market share in terms of service quality, price, brand influence, etc.

5. Regulatory agencies and the homemaking service market: Regulatory agencies need to develop industry standards and norms to ensure the healthy development of the market. Homemaking service companies need to comply with these regulations, while regulatory agencies need to balance the relationship between market development and regulation.

2.2. Analysis of game model for homemaking service credit

To analyze the credit issues in homemaking services, a simplified game model can be constructed. Assuming that consumers and homemaking service practitioners have two strategies respectively: consumers can choose "trust" or "distrust", and homemaking service practitioners can choose "high-quality service" or "low-quality service". By constructing a payment matrix, it is possible to analyze the gains and losses of each entity under different strategy combinations.

Assuming that the probability of consumers purchasing homemaking services is P_1 , and the probability of not purchasing is $1-P_1$; The probability of honest operation among homemaking workers is P_2 , and the probability of dishonesty is $1-P_2$; E is the value of homemaking services (expressed in price), d_1 is the cost of providing homemaking services for homemaking workers when operating with integrity, and d_2 corresponds to the cost of homemaking workers when operating with dishonesty (usually $d_2 < d_1$). In actual market transactions, due to various constraints, homemaking service practitioners who do not comply with credit will be punished accordingly, such as customer churn, fines, etc. These costs are represented by n , and thus the income matrix table of the game between the two parties in homemaking service transactions is obtained (Table 1).

Table 1: Game matrix of homemaking service trading parties

Consumer	Homemaking service practitioners		
		honest	dishonesty($1-P_2$)
	purchasing(P_1)	$e, e-d_1$	$-e, e-d_2-n$
	Not-purchasing($1-P_1$)	$-d_1$	$0, -d_2$

Assuming that U_1 is the expected return for consumers and U_2 is the expected return for homemaking service workers, then.

$$U_1 = P_1[eP_2 + (-e)(1-P_2)] = eP_1(2P_2-1)$$

$$U_2 = P_2[P_1(1-d_1) + (1-P_1)(-d_1)] + (1-P_2)[P_1(e-d_2-n) + (1-P_1)(-d_2)] = P_2(d_2-d_1+nP_1) + (e-n)P_1-d_2$$

When homemaking service practitioners and consumers make choices with different probabilities, their expected returns also vary. Both buyers and sellers of services will make the choice to maximize their expected returns.

For consumers, when $2P_2-1 < 0$, i.e. $P_2 < 0.5$, then $P_1=0$, U_1 reaches its maximum value, which is 0; When $2P_2-1=0$, i.e. $P_2=0.5$,

So when $0 \leq P_1 \leq 1$, U_1 reaches its maximum value, which is 0.

When $2P_2-1 > 0$, i.e. $P_2 > 0.5$, then when $P_1=1$, U_1 reaches its maximum value, which is $-d_1P_2+eP_1-nP_1-d_2+nP_1P_2+d_2P_2$.

For homemaking service workers, when $d_2-d_1+nP_1 < 0$, i.e. $P_1 < (d_1-d_2)/n$,

So when $P_2=0$, U_2 reaches its maximum value, which is $(e-n)P_1-d_2$; When $d_2-d_1+nP_1=0$, i.e. $P_1=(d_1-d_2)/n$, then when $0 \leq P_2 \leq 1$, U_2 reaches its maximum value, which is $(e-n)P_1-d_2$; When $d_2-d_1+nP_1 > 0$, i.e. $P_1 > (d_1-d_2)/n$, then when $P_2=1$, U_2 reaches its maximum value, which is $(e-n)P_1-d_2$.

3. Application of game theory in homemaking service credit optimization

The Guiding Opinions on Establishing a Credit System for the Homemaking Service Industry issued by the Ministry of Commerce and the National Development and Reform Commission mentions that in order to standardize the development of the homemaking service industry, it is necessary to establish a complete set of credit records for homemaking service staff and enterprises, to solve the problem of credit deficiency, protect consumer rights, and create an honest and trustworthy environment for the development of the homemaking service industry. In addition, the construction

of a credit system for homemaking services also includes a disciplinary mechanism for dishonest enterprises and service personnel.

3.1. Design of Information Disclosure Mechanism

To reduce information asymmetry, effective information disclosure mechanisms can be designed. For example, establishing credit records for homemaking service practitioners, recording their service history and customer evaluations for customer reference.

3.2. Design of reward and punishment mechanisms

By designing a reasonable reward and punishment mechanism, employees can be incentivized to provide high-quality services. For example, rewarding high-quality service practitioners and punishing low-quality service practitioners.

3.3. Cooperative game and trust building

Through cooperative games, trust building can be promoted between customers and homemaking service practitioners. The strategy selection of cooperative games will help to form stable cooperative relationships and improve overall service quality.

4. Case study on homemaking service game

From the game between homemaking service enterprises and consumers, it can be seen that top homemaking service platforms, as shown in the reference [12], frequently engage in malicious incidents. Homemaking service personnel abuse consumers, exaggerate publicity, and service quality falls far short of user expectations, refusing refunds, and causing a large number of users to post online condemnations; The enterprise falsified information about their nannies and deceived employers, which attracted widespread social attention.

From the perspective of the game between homemaking enterprises and homemaking workers: According to the China Judgment Document Network, the enterprise has involved 69 types of dispute cases, mostly defendants, with labor disputes accounting for the majority. Disputes mainly focus on enterprise's arrears, withholding of nanny, cleaning, and monthly sister-in-law employee salaries, violent layoffs without compensation, and loss of corporate social responsibility.

From the game results, it can be seen that due to the dishonest operation of enterprises, their credit has decreased, and their production and operation have fallen into difficulties. From 2018 to Q1 2021, the enterprise suffered a huge loss of 1.965 billion RMB, while its operating revenue during the same period was only 1.917 billion RMB. Since Q2 2019, the average net loss rate of the enterprise has been nearly 90%, with a loss of 88.3 RMB per 100 RMB of operating revenue.

5. Conclusion and recommendations

Through game theory analysis, it can be found that information disclosure mechanisms and reward and punishment mechanisms play an important role in optimizing the credit of homemaking services. Cooperative games help build stable trust relationships and improve service quality. This study mainly adopts theoretical analysis methods, and in the future, more empirical research can be combined to further verify the practical effect of game theory in optimizing credit in homemaking services. At the same time, more credit optimization strategies can be explored to provide more comprehensive support for the healthy development of the homemaking service industry.

This study primarily employs theoretical analysis to explore these dynamics. However, to further substantiate the findings, future research should incorporate more empirical studies. Empirical

research would provide concrete evidence on the practical application and effectiveness of game theory in optimizing credit within the homemaking service industry. This combination of theoretical and empirical approaches would offer a more robust understanding of how game theory can be practically applied to real-world scenarios.

References

- [1] *Homemaking service industry: An AI media report reveals that home cleaning and homemaking services are important service scenarios* [N], Sina Finance, May 24, 2024
- [2] *Analysis of the 2023 Homemaking Service Industry: With the increasingly severe aging of China's society, the industry is developing rapidly.* [N], NetEase, July 12, 2023
- [3] Yang Junjian, *Main Problems and Countermeasures of Homemaking Service Quality in China* [J], *Economic Research Guide*, 2021 (04): 147-150
- [4] *"Report on the High Quality Development Index of China's Homemaking Service Industry (2022)"* [N], *Business Data Center of the Ministry of Commerce of the People's Republic of China*, March 25, 2022
- [5] *The homemaking service industry has shifted from an "intermediary system" to an "employee system"* [N], *China Economic Network*, January 11, 2024
- [6] Tan Min. *Why does the "good recipe" for homemaking service staff encounter "coldness"?* [N] *Zhengzhou Daily*, 2019-08-16
- [7] *The homemaking service industry is shifting towards an "employee system"* [N], *China Women's Network*, January 11, 2024
- [8] *Guiding Opinions of the Ministry of Commerce and the National Development and Reform Commission on Establishing a Credit System for the Homemaking Service Industry (Commercial Service Trade Letter [2019] No. 269)* [EB/OL], Chinese Government website, 2019-06-28
- [9] *Opinions of the General Office of the State Council on Promoting the Improvement and Expansion of the Homemaking Service Industry (State Council Document No. 30, 2019)* [EB/OL]. China Government Network, 2019-06-26
- [10] Li Hegui, Xie Guojin, Yang Hui, *Research on the Construction of Credit System for Small and Medium sized Enterprises from the Perspective of Game Theory* [J], *Credit Reporting*, 2011 (2): 69-72
- [11] Wang Fan. *Analysis of Integrity Issues in C2C E-commerce Transaction Models - Based on Game Theory Perspective* [J], *China Management Informatization*, 2014 (2): 109-110
- [12] *Report on China's Internet Homemaking Service Industry in 2021* [N], *Snowball*, August 5, 2021

Marketing Plan and Research Report of GREGGS

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Abstract: The COVID-19 pandemic has significantly impacted the global economy, with the food sector particularly affected due to the necessity to maintain operations amidst health and safety challenges. This research report examines the operational dilemmas faced by Greggs, a prominent British bakery chain, in the wake of the pandemic. Utilizing PESTLE analysis, the study explores the political, economic, social, technological, legal, and environmental factors influencing Greggs' strategic decision-making and operations. Key findings indicate that Brexit and health regulations have introduced uncertainties and risks, while technological advancements offer opportunities for improved customer experience and operational efficiency. The study employs the SMART model to outline Greggs' goal of expanding its retail presence while maintaining food quality and safety. Market research methodologies, including questionnaires, interviews, and focus groups, reveal consumer preferences and the impact of COVID-19 on Greggs' accessibility and sales. The report concludes with a marketing mix summary, emphasizing the need for digital transformation and innovative strategies to adapt to the new consumer landscape shaped by the pandemic.

Keywords: COVID-19 Impact, Food Sector, PESTLE Analysis, Market Research, Marketing Mix.

1. Introduction

The COVID-19 pandemic has severely hit the global health and world economy. With most companies shutting down completely due to government restrictions, the food sector in the entire supply chain must keep operational for consumption by countries. In such a challenging time, maintaining high food safety and consumer confidence is of paramount importance, while maintaining the health and safety of workers is also crucial. However, since the coronavirus spread worldwide and workplaces closed, millions of employees lost some or all of their income. [1] Even though they are still working, many workers have to accept a shorter time and/or different wage reductions.

According to the research result, Greggs, as a prominent British bakery chain also faces the dilemma of the operation of Greggs was heavily affected by COVID-19, and many stores were forced to stop, resulting in severe damage to their profits. [2] This research is going to identify whether Covid 19 has seriously affected the operation of Greggs. Trying to find out why this situation exists by analysing its current strategy and generate possible solutions to solve how Greggs could minimize the negative effect on employees and the business itself, as well as address the deep-rooted labour organisational fragilities and structural inequalities of Greggs that the pandemic has exposed.

£m	H119	H219	FY19	H120
Revenue	546.3	621.6	1,167.9	300.6
Growth y-o-y	14.7%	12.4%	13.5%	(45.0%)
Like-for-like growth y-o-y*	10.5%	8.1%	9.2%	(49.0%)
Gross profit	356.6	399.1	755.7	178.4
Gross margin	65.3%	64.2%	64.7%	59.3%
Operating profit/(loss) before exceptionals	43.9	69.8	120.7	(61.5)

Figure 1: Financial summary of Greggs. (Appendix 1)

2. Environment analysis & Marketing strategy

PESTLE analysis is utilized to discuss the external environment of Greggs that impacts on its strategy-making and operation. PESTEL analysis offers valuable insights into the operational challenges that Greggs in the food industry seems to face, and therefore related companies may also face.

From the political and legal side, political factors have a crucial impact on the long-term profitability and sustainability of Greggs. Greggs is a British bakery with over 1,700 stores in the UK. Due to the relatively stable laws and regulations in the long time, it does not have to keep changing. However, with the recent withdrawal of the United Kingdom from the European Union, changes in the political system have brought certain risks to Greggs, and an understanding of the overall competitive landscape will prevent managers and investors from engaging in any risky venture capital. Greggs predicts that due to rising costs, fewer stores will be opened this year than previously expected. [3] Political instability has caused managers to stop their expansion. Besides, political factors affecting Greggs include health and safety regulations for employees, Greggs therefore must pay special attention to safe operations to avoid unnecessary harm to customers or employees. [4] At the same time, the company must also abide by food safety and hygiene regulations of the government to ensure that there is no cross-contamination, pathogens or food poisoning happens. In the current COVID crisis, Gregg puts safety in the first place so that he can continue to provide basic food delivery services.

This also involves another important factor about legal. In countries with food safety legislation such as the United Kingdom, the temperature that meat products need to reach is regulated, and there is also legislation on holding food and how long food does not need to be held.[5]

In terms of economics, the Brexit of the United Kingdom will lead to uncertainty in domestic financial market fluctuations. [6] In addition, Greggs can predict the company's overall economic situation in the future through indicators such as consumer spending and retail growth. However, due to the COVID-19 pandemic, consumers' spending power has also shown a not optimistic trend.

From a social perspective, the emergence of e-commerce and social media has stimulated online shopping behavior. Young consumers are more inclined to shop online, so it is necessary to consider generational differences to get a better understanding of the current shopping behavior. Greggs should consider the increasing popularity of mobile phones and social networking sites when making strategies and formulating marketing. Greggs should also try to understand the consumption motives of consumption behavior and current social trends. Consumers' leisure interests should also be studied, with more emphasis on enhancing customer experience.

In terms of technology, Greggs was affected by the development of computer technology, which brought new advertising methods to the company. Additionally, their check out way is also improved, which enables the bank card to just be tapped against the terminal and the payment will be made. This

improvement on technology can effectively reduce queuing during peak periods and increase customer satisfaction.

Greggs is also committed to making itself more environmentally friendly through reduction, recycling, and reuse. The company also donates some unsold food to charity.

The SMART model is a useful tool to make an organization's goal achievable. It can also make the organization's work change from passive to active. The implementation of management by objectives can make employees work more efficiently. At the same time, the subsequent performance appraisal of the company can also be based on the established goals. Greggs' specific goal is to develop more than 2500 retail stores nationwide, while having an independent supply chain. Thus, every customer can enjoy high-quality fresh food. To achieve this purpose, Greggs needs more employees to support the development of the organization. At the end of 2019, there are already 2050 Greggs retail stores in the UK. [7]

3. Marketing research

Market research is one of the ways to communicate with the appropriate target audience. It can improve profits by understanding and improving customer experience, so as to understand whether an organization can better adapt to the market after changing its business model. Qualitative research with a constructivist method is statistics driven and it is objective to the research results. Qualitative data will be collected through questionnaire, interviews and focus groups. The sample population of the questionnaire are people from Northeast of England with age range from over 18 years old. The most efficient way to gather opinions for the purpose of leveraging on-going reflection in a secondary setting was specified as through using questionnaires. [8] Questionnaire surveys are cost-effective and can obtain critical opinions or feedback from the target audience. The sample population of the questionnaires was drawn from one hundred people from different fields. The survey was conducted for people over the age of 18, and the results also showed that most of the respondents chose Greggs as their top choice. However, due to the impact of COVID-19, Greggs' stores are closed in some areas, making it difficult for consumers to shop in Greggs.

Based on the results of questionnaires, random sampling would be used to recruit participants from people who participated in the research with size of 20. For the interview, extract key questions from the questionnaire in advance as the main questions to prepare the overall structure. Most of the problems were related to the reasons that participants felt affected their purchase of products of Greggs recently, their expectations of products of Greggs and their suggestions of how Greggs could improve its operation. More detailed open-ended questions were asked when they emerged during the interview.

The results of the questionnaire and interview can be generated by semi-structured techniques. More useful data and analysis of the data can also be generated simultaneously through the technical analysis.[9]

Focus groups were then formed with 6 people, three of them were from the questionnaires and 3 of them were not from the questionnaires. The focus groups were recorded with written consent for each participant of the focus group required before commencing and transcribed after the completion of each. By combining statements of participants with open-ended questions, we found that most participants indicated that Greggs' brand is attractive to them, and the recognition of the product is relatively high. However, the impact of the Covid 19 epidemic has made it difficult for customers to access the brand, and it has also affected their consumption to a certain extent.

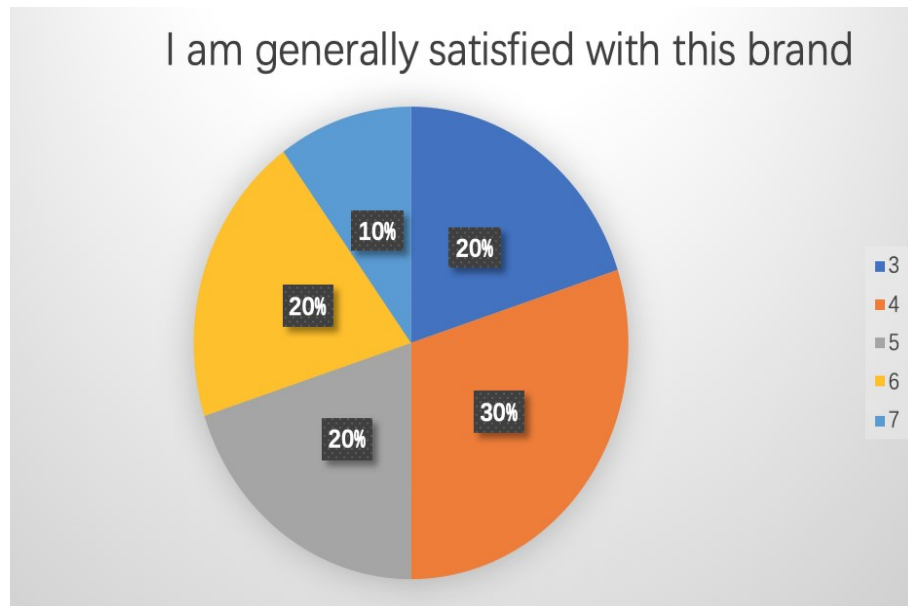


Figure 2: Satisfaction with the brand

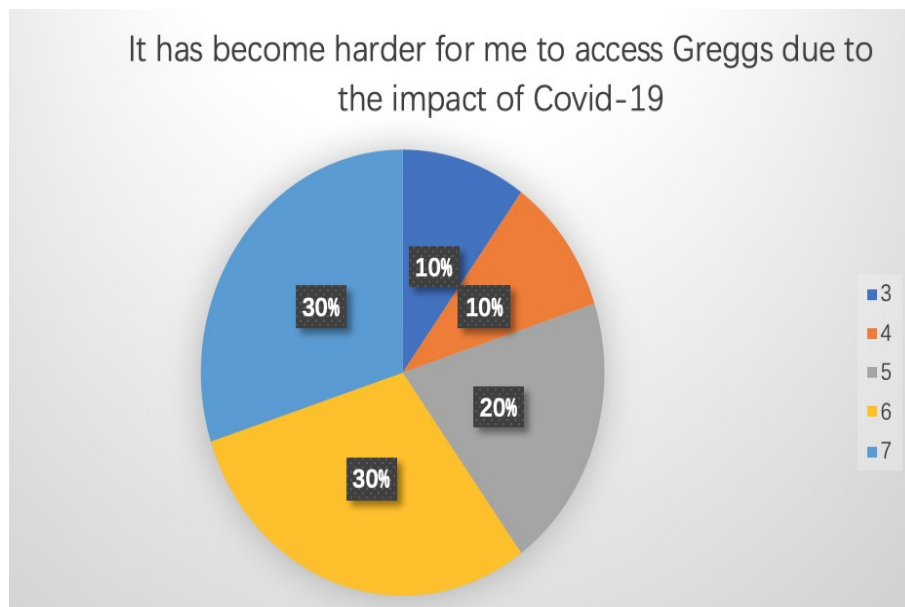


Figure 3: Impact of COVID-19

By using preliminary information from questionnaires and focus groups to revise questions and address essential concepts whilst using the critical incident technique, the COVID-19 might be the major reason, which led to the decrease of revenue of Greggs. Based on this information, secondary data can be used to conduct further research. By collecting data from literature and online resources, comparing the data of operating differences of Greggs before and after the COVID-19 epidemic. [10]

And then the t-test was adopted to analyse the collected quantitative data. The null hypothesis was supposed to be the current sales with the impact of COVID-19 and the other hypothesis is the normal sales as before. Using the 95% as the confidence interval. According to Greggs, 2020 Interim Results final, Greggs' revenue in the first half of 2019 was 546.3 million pounds, while total sales in the first half of 2020 were 300.6 million pounds. Based on the concept of t- test, the annual sales of Greggs is

affected by COVID-19 significantly. Therefore, the enterprise needs to generate possible solutions to address how Greggs could minimize the negative effect caused by COVID-19.

4. Marketing mix summary table

Table 1: Marketing mix summary of Greggs

Price	For certain products, try to use optional product pricing strategies, where prices are provided for the base product, and separate prices for the attached accessories. Introduce discounts and allowances to lower prices in a short period of time to attract customers and gain market share It charges higher prices for products sold online. This is because the delivery cost is already included in the product price. Use psychological pricing for product pricing, for example, set the price of a product worth £10 to £9
Place	During the COVID 19 epidemic, stores were opened on social media and other websites, and their products were sold on these platforms along with social media posts. Integrate online stores and social media pages to provide users with convenient navigation. During the epidemic, particular attention should be paid to improving online websites to make them more user-friendly and easy to use. Make sure to sell products to large retailers through personal sales. These large retailers have grown in recent years and have attracted a large number of customers. This will ensure an increase in its sales.
Promotions	Initiate advertising campaigns and send customer product-related news on all websites and other platforms. This helps to increase the brand awareness in the minds of customers. Perform various digital marketing techniques to improve online traffic on their website. Including banner ads, search engine optimization and creating its blog

Table 1: (continued).

Product	Introduce product portfolio and expand new product lines to meet customer needs. Greggs should also improve its product packaging and express delivery methods to make it safer during the COVID 19 epidemic, making it more convenient for transportation and use.
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5. Detailed strategy of promotion:

With the spread of the coronavirus, the operations of Greggs have been severely affected. To deal with the impact of the COVID 19 epidemic, the promotion process of Greggs needs to be transformed. In this scenario, social distancing may affect our way of eating in the next few years, therefore, digital transformation should be accelerated.

Greggs has responded to the restrictions raised by COVID-19 as much as possible, adjusted its business model to only take-out and roadside pick-up services, as well as strengthened disinfection and cleaning work to ensure customer safety. Although these changes may help restaurants survive in the short term, they may not make the sales situation of Greggs back to normal.

To address this issue, the marketing team of Greggs should consider future prospects and how to adapt to climate change.

The food industry relies on interacting with people to create unforgettable experiences. [11]The shortening of the actual distance in COVID 19 period does not mean that the restaurant needs to stop interacting with customers. Social media and online messaging channels can help with creating an experience even beyond in-house dining. This is due to the reason that listening to customers on modern channels can be an important source of innovation and inspiration for Greggs. Utilizing digital conversation streams can help Greggs discover unparalleled customer insights, leading to new ideas and opportunities.

In addition, the analysis of online conversations shows that compared with the same period last year, the willingness to purchase self-owned products has declined, which was replaced by conversations about basic products. For companies in the food industry, this means focusing on "long-term competition" is more important than ever. Rather than short-term promotions and sales, the key performance indicators of the media should shift to a strong focus on brand awareness and community building. In order to think ahead, Greggs need to ensure that they can target interested audiences when they open the door again.

Furthermore, Greggs need to closely link customer service with marketing. They can directly communicate with consumers through Twitter, online chat, etc., besides, establishing a one-to-one relationship with consumers for food services in the COVID-19 phase. At the same time, interaction with the customer service team can help Greggs' digital marketers obtain a large amount of data to better understand what is important to customers.

There is no doubt that the food industry is one of the worst-hit industries in the COVID-19 pandemic. However, despite the challenges, this may also be the time to accelerate digital innovation across the food industry. By using online social channels to listen to customers' real thoughts and build meaningful relationships with them, Greggs is able to maintain or even strengthen customer engagement in this new environment.

6. Conclusion

According to the literature, the conclusion is that qualitative and quantitative research methods are used to determine the impact of the COVID 19 epidemic on Greggs, which may help Greggs to develop cooperation and establish a positive corporate culture. [11]Through in-depth analysis of the feedback collected by questionnaires, interviews, focus group, etc. Greggs can discover the impact of COVID 19 on the company and make appropriate strategies to improve the problem.

Before conducting the market research, it is important to effectively solve the ethical considerations in the research. Compliance with ethics is very essential, since it promotes research purposes and minimizes errors, promoting the value, which is essential to collaborative work, and ensures that all participants are accountable for results. Besides, in order to meet the ethical requirements for collecting basic research, all participants need to sign a consent. As Randy stated, that this means that a person consciously, voluntarily and intelligently expresses consent in an obvious and obvious way. [12]There are some terms involved in the consent, such as respect for anonymity and confidentiality, agreement of audio-recorded and transcribed of interview and focus group. Ensure that the entire research is conducted under the premise of respecting the researcher's value system and ethics

In the whole research process, qualitative research methods help Greggs improve the understanding of the process. At the same time, it helps to gather more in-depth views from the feedback of participants and try to explain the meaning from these responses to help the company understand the problem more clearly. In addition, compared with set questions, semi-structured and open-ended questions leave room for customers to generate various answers and discussions, while targeted questions are sexual questions that are more aimed at narrow answers. Participants can flexibly express their opinions and opinions in the most convenient way. [13]Also, through the opportunity of in-depth interviews and exchanges in focus groups, information can be highly reliable.

However, in the process, qualitative research methods also have certain limitations. In the analysis process, interviews are time-consuming.[14]Since the interviewees will hear the opinions of others, they will be easily influenced by each other. By comparing answers, authoritative bias may appear during the inquiry process, and customers are vulnerable to the opinions of other more radical respondents. Therefore, the results cannot be generalized. In addition to the methods already based on the analysis of PESTEL and market mix, Greggs also needs to combine its own situation and unique background in practice to solve this problem.

References

- [1] OECD (2020), *The impact of the COVID-19 pandemic on jobs and incomes in G20 economies*. Available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_756331.pdf, [Access: 29 December, 2020].
- [2] Skynews (2020), *COVID-19: Greggs to cut more than 800 jobs as coronavirus lockdown hits business*. Available at: <https://news.sky.com/story/covid-19-greggs-to-cut-more-than-800-jobs-as-coronavirus-lockdown-hits-business-12132093>. [Access: 29 December, 2020].
- [3] Greggs (2020), Available at: <https://www.greggsemployeeinformation.co.uk/> [Access: 29 December, 2020].
- [4] Frue, K. (2017) *PESTEL analysis for the food industry*. Available at: <https://pestleanalysis.com/pest-analysis-example-for-the-food-industry/> [Access: 29 December, 2020].
- [5] Food standard (2020) Available at: <https://www.food.gov.uk/about-us/key-regulations> [Access: 29 December, 2020].
- [6] Belke,A.,I.Dubova, and T.Osowski (2018).*Policy Uncertainty and International financial markets: the case of brexit*. *Applied Economics* 50(34-45), 3752-3770
- [7] Lock, S. (2020). *Number of Greggs shops in the United Kingdom (UK) from 2006 to 2019*. Available at: <https://www.statista.com/statistics/631011/greggs-number-of-outlets-united-kingdom-uk/> [Access: 29 December, 2020].

- [8] Wongsurawat, W. (2011) *What's a comment worth? How to better understand student evaluations of teaching, Quality Assurance in Education*, 19(1), 67-83.
- [9] Urla, J. & Alvarez, R. (2002) *Tell me a good story: using narrative analysis to examine information requirements interviews during an ERP implementation. The Database for Advances in information systems*, 33(1), 38-52.
- [10] Greggs (2020), Available at: <https://www.greggsemployeeinformation.co.uk/> [Access: 29 December, 2020].
- [11] Flutter, J. (2007) *Teacher Development and Pupil Voice. Curriculum Journal*, 18 (3).
- [12] Randy, E. (2002) *Consenting to form contact. Available at: https://scholar.google.com/scholar?cluster=15417050183691477030&hl=en&as_sdt=0,5#d=gs_qabs&t=1719894693679&u=%23p%3DJiBNg3Vd9NUJ* [Access: 29 December, 2020].
- [13] Cohen, L. & Morrison, K. (2007) *Action Research. Research in Education*, 297–313.
- [14] Hum, D. (2000). *Reflections on commercializing university research. Canadian Journal of Higher Education*, 113-126.

Appendices

Appendix 1: Greggs Summary financial accounts(2020)
<<https://tools.morningstar.co.uk/uk/stockreport/default.aspx?tab=10&vw=fs&SecurityToken=0P00007ODO%5D3%5D0%5DE0WWE%24%24ALL&Id=0P00007ODO&ClientFund=0&CurrencyId=BAS/>> [Accessed 7th March 2020]

The Importance of Corporate Culture, Governance Structure, and Laws and Regulations in the Fintech Ecosystem

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Abstract: With rapid technological development, technologies such as artificial intelligence, blockchain, cryptocurrency and mobile payment are constantly promoting changes in the traditional financial industry and deriving the emerging ecosystem of financial technology. This article mainly discusses how corporate culture, governance structure, laws and regulations in the financial technology ecosystem affect financial technology companies to maintain a certain competitiveness in the relevant ecosystem. Among them, a strong cultural atmosphere can help fintech companies stabilize their position in the system, and a stable governance structure can help fintech companies and enterprises avoid risks and make correct strategic decisions, thereby promoting the development of the entire fintech industry. Laws and regulations are mainly reflected in fintech companies' compliance with financial regulations in different regions, such as anti-money laundering, anti-terrorist financing, and the protection of customer data and privacy, thereby enhancing customers' trust in fintech companies. These three aspects jointly stabilize the position of financial technology companies in the financial technology ecosystem and promote the continuous development of the financial technology ecosystem.

Keyword: fintech, corporate culture, organizational structure, laws and regulations

1. Introduction

1.1. Why Fintech

Itay Goldstein, Wei Jiang, G Andrew Karolyi mentioned that, as the name suggests, financial technology is the integration of finance and technology [1]. Thomas Puschmann stated that financial technology is the embodiment of digitalization in the financial services industry [2]. Fintech here mainly refers to the revolution in the financial industry caused by the development of information technology (IT). The rapid development of information technology has caused changes in the services of the financial industry. People reduce unnecessary face-to-face communication and make more asset management and investment decisions through the Internet. At present, the development of fintech is gradually penetrating into public life. The 2015 report of the World Economic Forum classified fintech related fields, which mainly consist of six parts: payments, deposits and loans, insurance, capital increase, investment management, and market supply.

1.2. The composition of the fintech ecosystem

Rose, J. W., Andrews, K., & Kenny, K. pointed out that fintech is a multidimensional ecosystem, with important participants being decentralized cryptocurrencies without a central corresponding currency [3]. Financial technology includes various tools such as distributed ledger technology, various blockchain-based services, artificial intelligence, venture capital and mobile banking. In Lee, I., & Shin, Y. J. analysis of the financial technology ecosystem, he pointed out that the financial technology ecosystem mainly consists of five major categories: financial technology companies, traditional financial companies, governments, related customers and technology developers [4].

Among them, emerging financial technology companies are driving the continuous development and evolution of the financial technology ecosystem. Fintech companies compete with traditional financial institutions in the market to promote the continuous development of fintech technology and further deepen the depth of the fintech ecosystem. Traditional financial companies, including but not limited to traditional banks, insurance companies, bond investment banks and other financial institutions, are also engaging in further cooperation while competing with financial technology companies. On the other hand, the government is the main regulator, and its main purpose is to maintain market stability and safeguard consumer rights by issuing relevant laws, regulations and regulatory requirements. Customers are the ultimate beneficiaries of financial technology services and are also consumers in the system. Their main role is to put forward their own needs and require financial technology companies to provide corresponding solutions. Technology developers are the cornerstone of the entire fintech ecosystem. They are responsible for developing and providing relevant fintech technologies and providing them to fintech companies or traditional financial institutions, thereby broadening the coverage of the fintech market.

The main feature of the fintech ecosystem is decentralization, which eliminates intermediaries, simplifies processes, and improves the efficiency of financial services. Collaboration and partnership. In the fintech ecosystem, while there is competition between fintech companies and traditional financial institutions, there is also cooperation, using the advantages of each participating company to obtain more customers and resources. Relevant regulatory requirements and laws and regulations are crucial to the fintech ecosystem, mainly to ensure that participants do not harm consumer rights and stabilize the market.

This article mainly discusses the importance of organizational culture, governance structure, laws and regulations for financial technology companies in the financial technology ecosystem, and explores the challenges that need to be faced. Organizational culture includes its composition and positive impact on the emergence of financial technology companies. Governance structure mainly involves different management structures and corresponding functions in financial technology companies. Laws and regulations mainly refer to the laws and regulations and corresponding regulatory requirements promulgated by various governments and international organizations for financial technology. It also elaborates on the responses of financial technology companies to different laws and regulations.

2. The importance of organizational culture in fintech

2.1. The definition and related components of organizational culture

A strong organizational culture plays a crucial role in the success, development, and sustainable development of a company. The culture within FinTech organizations shapes their values, beliefs, behaviors, and norms, which in turn influence their interactions with customers, employees, regulatory agencies, and other stakeholders. Mercedal, Trudy pointed out that organizational culture refers to the formal environment and norms that characterize a specific organization, as well as the

informal behaviors and social phenomena that occur between individuals within the organization [5]. Organizational culture is one of the important determinants of organizational behavior and can also be seen as a factor providing organizational performance and work efficiency. People in organizations often recruit like-minded individuals, so organizations often have a cohesive culture. Yoonjin Choi, Paul Ingram, and Sang Won Han believe that cultural consistency among organizational members can enhance the cohesion of fintech organizations, enhance task coordination, and thereby improve work efficiency, which has a positive impact on organizational performance [6]. Chatman et al. argue that the culture of each organization consists of three components: the content of norms, the level of agreement among members towards norms, and the intensity of organizational members towards specific norms [7]. A company with a high cultural consensus performs well if its normative content strongly emphasizes adaptability.

2.2. Strong Culture in the Context of Financial Technology

Promote innovation: The development of fintech companies cannot do without innovation, and only by continuously developing new technologies can they occupy a certain position in the fintech ecosystem. It creates an environment where employees feel capable of challenging traditional wisdom, exploring new ideas, and developing breakthrough solutions to address customer needs and pain points. By promoting innovation, a strong culture enables fintech companies to maintain a leading position and competitive advantage. Alzyadat, M., Baruah, B., & Ward, A. concluded that creating an internal entrepreneurial culture, providing clear strategies, and ensuring the integration of supporting management practices serve as the main framework for promoting internal entrepreneurial capabilities among engineers [8].

Attracting and retaining talent: A strong organizational culture has become a key factor in attracting and retaining top talent. Financial technology companies usually look for talents who are passionate about technology and entrepreneurship and are willing to have a meaningful impact. A culture that emphasizes teamwork, collaboration, and a sense of mission can greatly attract talented professionals to share the company's values and mission.

Confidence building: Trust is a very important factor in financial services. Financial technology companies need to handle sensitive customer data when providing services, so establishing a strong organizational culture with transparency, integrity, and ethical behavior can build trust with customers, regulatory agencies, and partners. This reflects the commitment of fintech companies to customer information, compliance with regulatory requirements, and ensuring fair and responsible practices.

Customer-centric: Fintech is essentially a service industry, so it is necessary to focus on customers and provide them with convenient and personalized financial services. It is indispensable to establish a strong organizational culture with customers at the center of decision-making. By encouraging employees to think deeply about customers' needs, promote empathy, and constantly improve products according to customers' requirements and their own judgments.

Adapting to regulatory changes: Legal regulation is another important aspect of the fintech industry. Financial technology companies operate in complex regulatory environments and must comply with laws and regulations to ensure consumer rights, data privacy, and financial integrity. A strong organizational culture that values compliance, ethical behavior, and actively responds to regulatory changes can help fintech companies effectively respond to the regulatory environment. This organizational culture can ensure that employees understand and comply with compliance requirements, actively participate in risk management processes, and thereby reduce the risk of organizational non-compliance.

2.3. Conclusion

A strong organizational culture is crucial for fintech companies to thrive in a dynamic and fiercely competitive industry environment. Its ability to drive innovation, attract top talent, establish trust, and cultivate a customer-centric mindset has a positive impact on the organization's position in the financial technology ecosystem.

3. The role of a robust governance structure in the financial technology ecosystem

3.1. The composition of the governance structure

A robust governance structure is an important component of the fintech ecosystem, providing a framework for effective decision-making, risk management, and regulatory compliance for fintech companies.

In fintech companies, the governance structure generally consists of the following points:

Risk management: Currently, fintech companies face various risks in the environment, including not only network security threats, operational interruptions, and financial challenges. Establishing a robust governance structure can effectively identify, evaluate, and come up with appropriate solutions for these risks. In response to these risks, fintech companies can proactively manage risks and ensure business continuity by establishing clear accountability, defining risk management processes, and implementing appropriate controls, ensuring that the company is not affected by these risks.

Compliance with regulatory requirements: In the current financial technology ecosystem, there are various related requirements, such as data privacy, consumer protection, anti money laundering (AML), and Know Your Customer (KYC). A robust governance structure provides a necessary framework for financial technology companies to monitor and comply with these regulations. Fintech companies establish internal policies and procedures, implement controls, and ensure compliance with legal and regulatory obligations.

Accountability and transparency: Financial technology companies can further promote effective communication and information sharing by establishing clear reporting relationships, defining roles and responsibilities. This transparency enhances internal control mechanisms, promotes ethical behavior, and reduces the likelihood of fraud or misconduct.

Effective decision-making: In the current rapidly changing competitive environment, timely and accurate decision-making is crucial for fintech companies. A robust governance structure promotes effective decision-making processes by providing a clear governance framework, establishing decision-making bodies, and ensuring accurate and reliable information is obtained. This governance structure can enable fintech companies to quickly respond to market opportunities and adjust their strategies, while constantly changing their business models to adapt to changing customer needs and industry trends.

Maintaining financial stability: Compliance with regulations can be helpful for financial stability within the fintech ecosystem. Regulations on capital requirements, risk management, and operational flexibility help ensure that fintech companies have sufficient capacity to withstand potential economic shocks and disruptions. This way, in the face of sudden fund breakage or investment failure, fintech organizations have a certain buffer, which can stably weather various unexpected events and also reduce the risk of turbulence in the fintech ecosystem.

Investor confidence and partnership: Financial technology companies typically require external investors to invest, including venture capitalists, private equity firms, and strategic partners. A robust governance structure can attract and maintain investor confidence. Investors seek companies with strong governance practices because a robust governance structure can demonstrate a commitment to ethical behavior, risk management, and long-term sustainability.

Scalability: A robust governance structure can help fintech companies expand. In response to the increasing regulatory requirements and the gradual expansion of the company, a good governance structure can stabilize the internal structure of the company while controlling risks, laying a solid foundation for further expansion. A good governance structure can not only enable organizations to rapidly expand in new markets, but also avoid conflicts with the regulation of new markets.

3.2. Conclusion

A robust governance structure is an indispensable part of the success of fintech companies. They can achieve effective risk management, compliance with regulatory requirements, accountability, transparency, and informed decision-making. By establishing and maintaining strong governance practices, fintech companies can improve operational efficiency, establish trust with stakeholders, and confidently navigate a dynamic and regulated fintech ecosystem.

4. Comply with laws and regulations in the field of fintech

4.1. The regulatory environment of fintech

SHALA, A., & PERRI, R. pointed out that there are certain challenges in regulating the emerging new financial technologies, not only to keep up with the progress of financial technology, but also to understand and manage the regulatory risks involved [9]. In the current regulatory environment, this is undoubtedly a huge challenge. Moreover, the current financial regulatory system is not unified and does not exist in the same era, which further exacerbates the difficulties of financial regulation. Kirkpatrick, K., Stephens, A., Gerber, J., Nettesheim, M., & Bellm, S. mentioned in their article that with the globalization of digital assets and the growth of cryptocurrency applications, regulatory agencies around the world have shifted their focus to anti money laundering [10]. This means that in the current environment, market participants should have an understanding of relevant laws and regulations when entering the digital currency market. At the same time, in the face of emerging financial technology technologies, the national regulatory system has proposed a new regulatory method, sandbox supervision, which was first proposed by the British government and involved the first six financial technology companies [11].

4.2. Legal Obligations of Financial Technology Companies

Licensing and regulatory compliance: Firstly, if fintech companies want to operate legally in the financial services industry, they need relevant licenses or authorizations. The specific types of licenses vary depending on the financial services provided by the company, such as payment, lending, digital currency, or investment management. This requires Fintech companies to establish a relevant regulatory framework, engage with regulators, and ensure compliance with applicable laws and regulations, such as financial regulations, anti-money laundering (AML) requirements, consumer protection laws, and data privacy regulations, such as the General Data Protection Regulations (GDPR).

Data privacy and security: Secondly, according to the current business provided by fintech companies, they usually come into contact with a large amount of private data from customers, so they must comply with data protection and privacy laws to protect customer information. Here, the obligation of financial companies is not only to protect customer information, but also to promptly inform customers of data breaches to avoid greater losses.

Anti Money Laundering (AML) and Know Your Customer (KYC): Financial technology companies typically need to fulfill AML and KYC obligations to prevent money laundering, terrorist financing, and other illegal activities. These obligations require a strong identity verification process,

continuous monitoring of customer transactions, and reporting of suspicious activities to regulatory authorities. When conducting financial technology business, this will have a certain impact on some customer experiences. This requires financial technology companies to balance the relationship between the two and set up corresponding departments to handle the special requirements of certain customers. In controlling While taking risks, retain customers and enhance customer experience.

Promoting market access and partnerships: Compliance with laws and regulations is usually a prerequisite for market access and partnerships in the fintech industry. Regulatory and financial institutions require fintech companies to meet certain compliance standards before entering new markets or collaborating with established companies. Demonstrating compliance helps fintech companies establish credibility, obtain regulatory approval, and unleash opportunities for expansion and collaboration.

Liability and Legal Risk: Financial technology companies face legal risks and potential liabilities for errors, omissions, system failures, or unauthorized access to customer data. It is necessary to develop appropriate legal risk management strategies, including insurance coverage and contract protection, to mitigate potential legal risks.

Multi market operation: When fintech companies expand their business scope, they need to be familiar with the relevant laws and regulations of the target market in advance and comply with different regulatory frameworks when entering other markets.

Sandbox supervision: Sandbox supervision is a new type of supervision model. It mainly allows financial technology companies to innovate and test new products within the scope defined by the regulatory agency. It limits the scope of customer groups and testing time, thereby making risks controllable. . Regulators can also provide their own guidance, in which they can understand new technologies and improve their regulatory capabilities.

4.3. Conclusion

Compliance with laws and regulations is crucial for financial technology companies to operate legally, reduce risks, protect consumers, and maintain market integrity. However, the innovation of the financial technology ecosystem also needs to be balanced with compliance. When innovating, it is also necessary to communicate and cooperate with relevant regulatory agencies to ensure that relevant innovations comply with laws and regulations. Sandbox supervision is a good example, achieving a balance between innovation and compliance. However, there are also some problems, such as whether there is an imbalance in market competitiveness between companies participating in sandbox supervision and companies that do not participate in sandbox supervision. Whether a certain degree of transparency can be provided during the testing process, etc.

Although the current regulatory environment and related fintech laws are still complex and cannot provide a unified standard, how to legally comply remains the most important step in the development of fintech organizations.

5. Conclusion

To summarize, culture, governance framework, and legal regulation are the three pillars in the financial technology ecosystem. Among them, a strong culture is closely related to the cohesion of fintech organizations, representing the retention of talents and the promotion of innovative development, and determining the position of fintech organizations in the entire ecosystem. A sound governance framework is the foundation of the entire fintech organization. Only if a fintech organization has a sound and solid governance framework can it control its own risks, continue to expand its market, and stabilize its position. And laws and regulations, or compliance, are the bottom line of the entire fintech ecosystem. If any fintech company does not comply with laws and

regulations, it will have an impact on the entire ecosystem, exacerbating the difficulties for regulatory agencies. Therefore, complying with laws and regulations is an unbreakable bottom line. However, as fintech continues to develop and gradually replace the traditional financial industry, there are still many challenges, such as international supervision. Currently, there are still differences in the supervision of the fintech industry in different countries and regions, which is a problem for some multinational companies. Fintech companies create challenges in how to comply with regulations while operating in different countries. Facing these challenges, the financial technology ecosystem needs to continuously develop new technologies while promoting multi-field and global cooperation to solve these challenges at all levels.

References

- [1] Goldstein, I., Jiang, W., & Karolyi, G. A. (2019). *To FinTech and Beyond*. *The Review of Financial Studies*, 32(5), 1647–1661. <https://doi.org/10.1093/rfs/hhz025>
- [2] Puschmann, T. *Fintech*. *Bus Inf Syst Eng* 59, 69–76 (2017). <https://doi.org/10.1007/s12599-017-0464-6>
- [3] Lee, I., & Shin, Y. J. (2018). *Fintech: Ecosystem, business models, investment decisions, and challenges*. *Business Horizons*, 61(1), 35–46. <https://doi.org/10.1016/j.bushor.2017.09.003>
- [4] Rose, J. W., Andrews, K., & Kenny, K. (2021). *Introduction to the FinTech Ecosystem*. *Department of Justice Journal of Federal Law and Practice*, 69(3), 23–38.
- [5] Mercadal, T. (2022). *Organizational culture*. *Salem Press Encyclopedia*.
- [6] Choi, Y., Ingram, P., & Han, S. W. (2023). *Cultural Breadth and Embeddedness: The Individual Adoption of Organizational Culture as a Determinant of Creativity*. *Administrative Science Quarterly*, 68(2), 429–464. <https://doi-org.uoelibrary.idm.oclc.org/10.1177/00018392221146792>
- [7] Chatman, J. A., O'Reilly, C. A., & Caldwell, D. F. (2014). *The role of fit in organizational culture: How strong cultures foster positive outcomes*. *California Management Review*, 56(3), 84–104.
- [8] Alzyadat, M., Baruah, B., & Ward, A. (2021). *How to Drive Innovation by Tapping Into the Intrapreneurial Capabilities of Engineers?: A Case Study of a FinTech SME*. *Proceedings of the European Conference on Innovation & Entrepreneurship*, 1105–1113.
- [9] Shala, A., & Perri (Shkurti), R. (2022). *Regulatory barriers for fintech companies in Central and Eastern Europe*. *Eastern Journal of European Studies*, 13(2), 292–316. <https://doi.org/10.47743/ejes-2022-0214>
- [10] Kirkpatrick, K., Stephens, A., Gerber, J., Nettesheim, M., & Bellm, S. (2021). *Understanding regulatory trends: digital assets & anti-money laundering*. *Journal of Investment Compliance*, 22(4), 345–353. <https://doi-org.uoelibrary.idm.oclc.org/10.1108/JOIC-07-2021-0033>
- [11] Brown, E., & Piroška, D. (2022). *Governing Fintech and Fintech as Governance: The Regulatory Sandbox, Riskwashing, and Disruptive Social Classification*. *New Political Economy*, 27(1), 19–32. <https://doi.org/10.1080/13563467.2021.1910645>

Strategic Engagement and Brand Perception: An Analysis of Social Media Marketing in the Luxury Automobile Industry

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Abstract: Internet marketing has undergone significant changes in the digital age, greatly influencing customer behavior, purchasing habits, and corporate marketing strategies. This research examines the impact of social media marketing on increasing strategic engagement and brand awareness in the luxury automotive industry, with a specific focus on Mercedes-Benz compared to other luxury brands. By conducting comparative analysis, case studies, and data analysis, this study demonstrates how luxury automotive companies employ social media content to enhance brand awareness and engage consumers. The results indicate that Mercedes-Benz's comprehensive social media strategy, which includes visually appealing content and interactive campaigns, has successfully improved brand equity and consumer response. This research underscores the importance of implementing an advanced social media marketing strategy for luxury brands to uphold their reputation and cultivate long-term customer loyalty.

Keywords: Social media marketing, luxury automobile industry, brand equity, consumer engagement, Mercedes-Benz

1. Introduction

Internet marketing has changed in the digital age, affecting customer lives and buying habits. Social media is crucial for luxury marketing techniques in many industries. Social media has created a new type of advertising using the Internet or online media platforms, called digital marketing, due to the sizeable economic market potential [1]. Luxury automakers and other businesses have used sophisticated social media marketing tactics to reach their target customers. Luxury social media marketing studies highlights higher revenue, brand loyalty, and customer interaction. However, extensive study on the luxury vehicle industry's strategy and results is lacking. This disparity highlights the need for targeted research on social media marketing's impact on luxury vehicle businesses.

This study examines how social media marketing improves luxury automobile firms' strategic engagement and brand perception, focusing on Mercedes-Benz compared to other premium firms. The article also utilizes Customer-based brand equity to examine how social media marketing works in luxury companies. This study examines how luxury automobile companies develop social media content to increase brand awareness and consumer engagement.

The paper does this through comparative analysis and case studies. To better understand their efficacy, this research compares Mercedes-Benz's social media marketing tactics and content against those of other luxury vehicle companies. This study may help luxury car companies reflect on and compare their social media marketing approaches. This report again points out the social media marketing data of major and well-known brands to refer to and help companies improve their digital strategies and increase brand awareness and engagement. This study adds to the academic literature and provides recommendations for luxury automobile professionals.

2. Introduction to Social Media Marketing in the Luxury Automobile Industry

Initially, digital marketing, which involves promoting products or brands on social media platforms, is presented appealingly by utilizing various applications, including Instagram, WhatsApp, Line, Twitter, and YouTube. In the meantime, social media marketing is employed to promote their products on both company and individual platforms, thereby boosting their online business sales [1]. It is especially pertinent to the luxury automotive industry, where consumer engagement and brand recognition are indispensable. Luxury automotive brands can expand their consumer base while preserving their distinctive identity through social media. It is particularly crucial for luxury brands that depend on maintaining high prestige and appeal that social media can enhance their core value through original and interactive applications [2].

Luxury brands have historically hesitated to implement Internet-based marketing strategies because they are concerned about preserving their distinctive image. Luxury brands must maintain their elitism and image control, as well as the Internet's classification as a largely non-selective mass communication medium [2]. Consequently, luxury brands and the Internet communication medium are not initially considered to be in alignment. Nevertheless, luxury brands gradually acknowledged the necessity of adapting to the evolving consumer behavior and the increasing significance of a digital presence. In recent years, all luxury labels have begun to establish their websites, and some have even launched online stores [2]. This signifies a significant transformation in how luxury brands market themselves and interact with consumers.

Luxury automotive brands use social media to increase brand awareness and engagement. The utilization of high-quality visual content is a current trend essential for effectively communicating a luxury experience. Social media marketing can significantly enhance brand equity and consumer response [3]. Instagram and YouTube are particularly popular due to their visual-centric nature, enabling brands to demonstrate their vehicles' performance and aesthetic features effectively. Photo and video-sharing platform Instagram has over 800 million monthly active users, and 200 playful advertisers cut more focus on visual content [4]. Furthermore, there is an increasing trend toward interactive and personalized content. Brands like Mercedes-Benz and BMW implement interactive campaigns that enable users to personalize the brand's virtual experience, thereby enhancing their perceived value and engagement.

3. Case Study: Mercedes-Benz social media marketing data and tactics in recent years

3.1. Overview of Mercedes-Benz's social media strategy

In the last few years, Mercedes-Benz has been a leader in social media marketing to enhance brand awareness and consumer engagement. The social media strategy of this brand is multifarious, encompassing a diverse range of platforms and content categories to accommodate the diverse segments of its audience. Mercedes-Benz employs a comprehensive strategy for social media marketing, emphasizing the development of visually enticing, high-quality content that resonates with its target audience. The brand maintains an extensive social media presence on prominent

platforms, including YouTube, Instagram, and Facebook. A customized marketing strategy is implemented for each platform to optimize brand awareness and engagement.

3.2. Target Audience and Market Situation

Before describing Mercedes-Benz's social media strategy, first outline its brand's target audience, market situation, and brand perception. Mercedes-Benz targets middle-aged individuals over 40 and young adults 25–40. Mercedes-Benz B-Class advertising dubbed “Safest Car Around For Young Families”, and “2017 She's Mercedes” campaign targeted female drivers [5]. On average, Mercedes-Benz owners in the U.S. earn \$145,000, and 72% are highly educated [5]. Mercedes targets upper-middle and upper-class managers and executives who value luxury and riches. The 2018 commercial states that your Mercedes-Benz is more than just a car; it's part of your life and an expression of your style [5]. Mercedes-Benz automobiles are bought for engine performance, attractiveness, safety, and practicality. As collectors, wealthy people may acquire many luxury cars [5]. Mercedes-Benz targets young and upper middle-aged individuals. Middle-aged individuals cherish social class and stability, whereas young people's spending power grows. The image of affluent business people consistently portrayed in the advertisements and the high product price create the impression that Mercedes-Benz cars are symbols of wealth [5]. Mercedes-Benz targets youth with personalization and individualization. Creating a database with personalized information for the new generation shows the brand's focus on young consumers and invites them to enjoy a customized and unique shopping experience [5]. Mercedes-Benz attracts younger customers via celebrity endorsements and promotions. Saturated blues and pinks in Mercedes-Benz ads and the exploration of futuristic technologies leave an impression of novelty in the minds of young people [5]. Mercedes-Benz defines itself as an approachable, cool brand targeting young consumers.

Mercedes-Benz targets young people on social media. Mercedes-Benz has over 20 million Facebook fans and regional accounts for different countries [5]. The brand's Facebook approach involves uploading high-quality photographs, racing news, and automotive innovations. Mercedes-Benz U.S.A. broadcasts high-quality images, racing news, and automotive inventions to promote its historic values [5]. Working with racing stars and journalists helped them create exciting material for their accounts. This technique supports the brand value and engages visitors with regular updates and interactive content.

3.3. Social Media Platform Strategies

Mercedes-Benz has 1.2 million Instagram followers, mainly in the U.S. Mercedes-Benz has 1.2 million followers on its U.S. Instagram account, which is utilized for branding [5]. Brands publish 5-7 times each day on the site to promote themselves. High-quality photography and unique campaigns like #MBPhotoP, a campaign for famous globetrotter Kelly Lund, garnered thousands of likes and shares. In return for a C.L.A. model, the business teamed with Casey Neistat, a well-known American filmmaker who made multiple movies about his driving experiences [5]. This strategy emphasizes visually appealing content and user-written brand tales to boost engagement and loyalty.

Mercedes-Benz's YouTube campaign has 280 million subscribers and 60,822,513 views. Li & Wang [5] state that Mercedes-Benz has over 280 million subscribers and 60,822,513 total views on YouTube. Instead of text advertising, the business posts YouTube videos that boost brand recognition. The “Style Pit, Stop” series comprises documentary-style conversations with Daisy Lowe and Tinie Tempah driving Mercedes-Benz A-Class automobiles. Celebrities can build trust and awareness among youth [5].

3.4. Content Categories and Consumer Engagement

The brand employs various post categories to captivate consumers, as evidenced by a content analysis of Mercedes-Benz's social media posts. For instance, emotionally branded posts can have a substantial and advantageous effect on consumer endeavors, contingent upon the post type, as they can evoke strong emotions and establish an emotional bond between the consumer and the brand. For instance, Emotionally branded posts evoke emotions in consumers by presenting inspiring stories that generate stronger feelings and emotions, thereby establishing an emotional relationship between the consumer and the brand [6]. These postings typically include high-quality visuals or inspiring stories that resonate with viewers and improve brand equity based on digital customers.

Additionally, brand resonance posts substantially benefit share rates, reinforcing the brand's image and personality. The brand's strategy involved effectively distinguishing itself in the minds of consumers, thereby strengthening its association with prestige and luxury. Share rates were positively and significantly influenced by brand resonance posts, reinforcing the brand's image, personality, imagery, and associations [6]. Promotional postings are particularly effective in consumer response because they encourage audiences to take action, which drives engagement and conversion. In terms of response, promotional brand posts are the most effective. This is to be anticipated, as these posts encourage consumers to take action [6].

Mercedes-Benz's social media marketing strategy is a comprehensive approach that effectively leverages various platforms to increase brand recognition and consumer engagement. The brand's emphasis on engaging and high-quality content attracts the target audience. The brand's strategic utilization of emotive and empathetic posts to foster consumer engagement and long-term brand loyalty was somewhat successful. This exhaustive approach is a valuable resource for luxury automotive brands seeking to enhance their social media marketing strategies.

4. Comparison between social media marketing data and other luxury car brands

Mercedes-Benz, BMW, Audi, Porsche, and Land Rover are prestige automotive brands widely recognized and have a substantial social media presence. The subsequent comparative analysis analyzes their strategies about the data provided, emphasizing their Instagram and Facebook campaigns.

Table 1: Findings for Official Facebook account [6]

Facebook Page Content					
Categories		Brand Names			
	Mercedes-Benz	BMW	Audi	Porsche	Land Rover
Follower / Visitor	1,988,008	1,189,996	1,164,162	111,524	378,914
Shared Total Content	321	194	266	176	159
Shared Total Photos	257	169	221	115	134
Shared Total Videos	64	25	45	61	25
About	Present	Present	Present	Present	Present
Mission & Vision	Present	Present	Present	Absent	Present
URL	Present	Present	Present	Present	Present
Contact	Present	Present	Present	Present	Present
Visual Design Element	Present	Present	Absent	Absent	Absent

Table 1: (continued).

Commemoration of the Founders	Present	Absent	Absent	Present	Absent
Logo/Logo Design	Present	Absent	Absent	Present	Absent
Status Messages	Present	Present	Present	Present	Present
Special Days/National Holidays	Present	Present	Present	Present	Present
Corporate Magazine / Publication	Present	Absent	Absent	Absent	Absent
Content For Marketing Support					
Categories		Brand Names			
	Mercedes-Benz	BMW	Audi	Porsche	Land Rover
Post Like	1,703,231	1,884,631	1,723,399	230,029	741,072
Post Comment	26,088	18,608	22,186	2136	4603
Post Sharing	45,529	39,523	52,910	6110	14,108
View Message	1,067,485	2,079,077	11,857,900	2,904,300	1,597,800

Mercedes-Benz is the leader in numerous critical metrics on Facebook, such as the number of followers and the total amount of content shared. According to Table 1, Mercedes-Benz is the most followed brand, with 1,988,008 followers, and has shared 321 pieces of content, including 257 photos and 64 videos [7]. Their frequent and diversified posting strategy maintains interest and engagement of users, as evidenced by the high level of engagement. BMW is a close second, with 1,189,996 followers and 194 shared content items. Audi and Land Rover share a smaller amount of content in total, but they maintain a consistent presence by utilizing distinctive features, including interactive content and high-quality imagery [7]. Mercedes-Benz consistently updates its fans on automotive inventions and racing-related news and posts high-quality photos [5]. This all-encompassing strategy guarantees that Mercedes-Benz remains at the vanguard of the social media landscape.

Table 2: Findings for Official Instagram Accounts [7]

Categories	Brand Names				
	Mercedes-Benz	BMW	Audi	Porsche	Land Rover
New product / Series	Present /131	Present/97	Present/85	Present/35	Present/75
Design / Production	Present/17	Present/12	Present/4	Present/10	Present/24
Activities (CSR, festivals, etc.)	Present / 44	Present/16	Present /13	Present/11	Present/7

Table 2: (continued).

Instagram Activities (contest, draw, etc.)	Present / 19	Present / 7	Present /18	Present / 9	Present/4
Brand's Promotional	Present/2	Absent	Present/3	Present / 7	Absent
Online service (online product, service)	Present/6	Absent	Present/6	Present / 3	Absent
Campaign	Present/ 1	Present / 2	Present/4	Absent	Present/3
Instagram Page					
Categories			Brand Names		
	Mercedes-Benz	BMW	Audi	Porsche	Land Rover
Number of posts	309	177	164	120	172
Photograph	274	150	139	93	156
Video	55	27	30	53	22
Likes	802,191	447,855	414,629	37,742	100,279
Comment	8006	3407	3236	466	595
View	839,791	419,953	477,648	111043	76017
Number of followers	257,000	257,000	264,000	70,800	76,500
Number of followings	11	Absent	21	Absent	1

Mercedes-Benz maintains its position as the most popular brand on Instagram, with 257,000 followers, as indicated by Table 2 [7]. BMW follows closely behind with the same number of followers. The content strategy emphasizes posts that generate substantial engagement, such as 274 photographs and 55 videos. Mercedes-Benz's Instagram content consisted of visually appealing campaigns like #MBPhotoP and partnerships with influencers like Casey Neistat [5]. The Mercedes-Benz post received 802,191 likes and 8,006 comments, demonstrating the efficacy of this strategy in generating a high volume of interactions. BMW and Audi have a robust Instagram presence, with content strategies that prioritize user engagement activities and product demonstrations. Audi, for instance, implements contests and sweepstakes to enhance consumer engagement and brand loyalty. Audi's Instagram campaigns, which encompass contests and sweepstakes, significantly engage followers and encourage user-generated content [7].

Mercedes-Benz and BMW prioritize the development of new product lines and the cultivation of consumer interest in specific product categories. Mercedes-Benz, for instance, released 42 items to stimulate interest in new product categories, surpassing all other brands. This illustrates their strategic emphasis on the generation of audience interest in new developments and effective education. Mercedes-Benz is more active in generating interest in product categories and emphasizes new product promotions than any other brand [7]. Mercedes-Benz was distinguished by a substantial number of post favorites, remarks, and shares in terms of marketing support. Mercedes-Benz's post received 1,703,231 likes and 45,529 shares, indicating a high level of consumer engagement. Their sales and brand image were significantly enhanced by their approach of incorporating corporate accomplishments, sponsorships, and event announcements into social media content.

5. The social media marketing effectiveness of Mercedes-Benz

Mercedes-Benz, BMW, Audi, Porsche, and Land Rover are recognized for their substantial presence in the luxury automobile market. This section offers a comparative analysis of the efficacy of Mercedes-Benz's social media marketing compared to its competitors. The concentration is on customer-based brand equity (CBBE).

It is imperative to comprehend the concept of Customer-Based Brand Equity in order to comprehend the efficacy of social media marketing. Brand equity is the mechanism by which social media marketing influences consumer reflection. The differential impact of brand knowledge on consumer responses to the brand's marketing is the definition of consumer-based brand equity [8]. Customer perceptions of brand ethics, brand awareness, and customer brand attitudes were designated as the three primary determinants of brand equity [8]. Brand loyalty results from the psychological processes and non-random behavioral responses that decision-making units exhibit over time toward one or more alternative brands within a set [3]. Brand loyalty is defined in the luxury literature as the degree to which consumers assert that they have purchased a specific brand and will continue to do so in the future [3].

Mercedes-Benz's brand recognition is enhanced by frequent and visually appealing posts on platforms such as Instagram and Facebook. Mercedes-Benz employs interactive content, video, and high-quality imagery to guarantee that the brand remains at the forefront of its audience's consciousness. Mercedes-Benz reinforces positive brand associations by consistently associating its vehicles with high-quality visuals and influencers. Influencers and celebrity campaigns are instrumental in developing an ideal brand image that aligns with the values and aspirations of the target audience. The meticulous presentation of Mercedes-Benz vehicles through professional photography and high-definition video enhances the perceived quality. A welcoming appearance and photographs can influence sales, as everyone is uploading images or videos for everyone to view on Instagram and other significant social media platforms [9]. The brand emphasizes the visual allure of its cars' performance and luxury features, solidifying Mercedes-Benz's status as a premium brand. A robust, passionate bond between the brand and its consumers is cultivated by providing engaging content and consistent engagement with followers. This connection results in brand loyalty, as consumers are more inclined to remain loyal to a brand that consistently engages with and resonates with them on social media.

Mercedes-Benz's social media strategy effectively improves its customer-based brand equity by leveraging strategic partnerships and high-quality content to establish brand awareness, association, perceived quality, and loyalty. The study revealed a strong and meaningful correlation between social media advertising and social media promotions, which serve as indicators of corporate-generated content, and the consumer-based brand equity of the automobile brand [10]. This comparative analysis demonstrates that Mercedes-Benz dominates in numerous critical metrics due to its comprehensive and engaging approach, despite the fact that other luxury brands have implemented effective social media strategies. Mercedes-Benz has effectively established and sustained robust brand equity by integrating CBBE principles into social media marketing.

6. Conclusion

In conclusion, this study provides numerous significant insights regarding the efficacy of social media marketing for luxury vehicle manufacturers, emphasizing Mercedes-Benz. A thorough examination of Mercedes-Benz's social media strategy, as well as a comparison with other luxury brands such as BMW, Audi, Porsche, and Land Rover, reveals that Mercedes-Benz excels at using high-quality visuals, interactive content, and influential strategic partnerships to boost brand awareness, engagement, and loyalty. The study's findings show that customer-based brand equity

considerably influences consumer awareness and behavior, emphasizing the significance of visual appeal and continuing interaction in preserving a premium brand image.

This study is significant because it provides a complete evaluation of the current social media marketing in the luxury vehicle business, which will be helpful to academic scholars and industry experts. By deconstructing the techniques that lead to effective brand equity, this study provides a framework for luxury firms to improve their digital marketing strategy and build relationships with customers in the digital era.

However, the study also has limitations. This research, which focuses exclusively on Mercedes-Benz, may not completely reflect the intricacies of other premium brand tactics. Furthermore, given the continuous growth of social media platforms, the techniques found in this study may need to be updated regularly to stay effective. Future study should involve a broader range of businesses and investigate the long-term effects of social media marketing on brand equity. Furthermore, researching emerging platforms and technology may reveal new insights into how luxury firms may reinvent their marketing tactics to preserve a competitive edge.

References

- [1] Adiyono N.G., Rahmat T.Y., Anindita R. (2021) *Digital marketing strategies to increase online business sales through social media. Journal of Humanities, Social Science, Public Administration and Management (HUSOCPUMENT)*. Apr 29;1(2):31–7.
- [2] Geerts A., Veg-Sala N. (2011) *Evidence on Internet Communication Management Strategies for Luxury Brands [Internet]. papers.ssrn.com. Rochester, NY. Available from: <https://ssrn.com/abstract=1874898>*
- [3] Godey B., Manthiou A., et al. (2016) *Social media marketing efforts of luxury brands: Influence on brand equity and consumer behavior. Journal of Business Research*. Dec;69(12):5833–41.
- [4] Pegah Barakati, Bertini F., Corsi E., Maurizio Gabbrielli, Montesi D. (2024) *Luxury Car Data Analysis: A Literature Review. Data (Basel)*. Mar 30;9(4):48–8.
- [5] Li Y., Wang Y. (2021) *What Marketing Strategies Did Mercedes-Benz Use to Succeed in the US Market?. Atlantis Press; pp. 649–54. Available from: <https://www.atlantis-press.com/proceedings/icemci-21/125966282>*
- [6] Risitano M., Ragione G., Quintano M. (2022) *Social media marketing practices and consumer reactions: a content analysis on Facebook brand pages. 21st International Marketing Trends Conference 2022. Available from: <http://archives.marketing-trends-congress.com/2022/pages/PDF/032.pdf>*
- [7] Ulas S., Akinci Vural Z.B. (2019) *Social Media Usage Practices of Luxury Brands: A Case of Luxury Automobile Brands' Corporate Social Media Applications. Online Journal of Communication and Media Technologies*. Feb 26;9(1).
- [8] Jayasuriya N., Ferdous Azam S.M., Khatibi A., Dharmaratne I.R. (2018) *The Role of Social Media Marketing on Brand Equity-A Literature Review. [J] Global Journal of Management and Business Research..*
- [9] Soegoto ES, Utomo AT. (2019) *Marketing Strategy Through Social Media [c] IOP Conference Series: Materials Science and Engineering*. Nov 1;662(3):032040.
- [10] Adetunji R.R., Mohd Rashid S., Mohd Ishak S. (2018) *Social Media Marketing Communication and Consumer-Based Brand Equity: An Account of Automotive Brands in Malaysia. Jurnal Komunikasi, Malaysian Journal of Communication*. Mar 26;34(1):1–19.

Investigation of Influential Factors of Housing Price

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Abstract: The fluctuation of housing prices and its influencing factors are important research topics in economics. Under the current background of rapid globalization and urbanization, understanding the driving factors of housing prices is not only an important contribution to academic research but also has important guiding significance for policymakers and individual home buyers. This paper explores the key factors affecting housing prices, focusing on the impact of variables such as living space, land space, housing landscape, housing conditions, housing quality, and housing construction year on housing prices. This study uses multiple regression analysis to analyze the US housing price data set. The results show that living space, housing landscape, housing quality, and housing construction year have statistically significant effects on housing prices at a significance level of 1%. This study provides an effective reference to real estate developers, policymakers, and individual home buyers, which can help them understand market demand more deeply, make decisions that are more in line with market trends, and promote the dynamic and functional development of the real estate market.

Keywords: Real Estate, Housing Price, Predictive Analytics, Market Insights.

1. Introduction

Housing prices are one of the topics that people cannot do without and pay special attention to in their daily lives. People will mention the high or low housing prices in daily conversations, or require an independent residence when getting married. Housing prices are also an important measure of the economy, which can be seen from the bubble in the Japanese real estate market. From personal experience, when housing prices are high, individuals are under great pressure. People's wages are not enough to support them to buy a house. When housing prices are low, they are often in a period of poor economic conditions. People also do not have enough funds to buy a house. In addition, owning a house is related to personal happiness. Owning a house can bring a sense of belonging. Excessively high housing prices will reduce an individual's disposable income, which is also related to personal happiness. What is even more striking is that housing prices have undergone great changes during the epidemic. According to the analysis of Bernstein et al., the additional influencing factors brought by the epidemic will disappear with the end of the epidemic, but its impact will remain for a long time [1]. Therefore, housing prices affect the living conditions of most people in society. In order to better understand the profound impact of housing prices on society, it is particularly important to delve into the driving factors of housing prices. The research topic of this paper explores the main factors affecting housing prices. The specific question of the research is which factors impose an

influential impact on housing prices. Relying on the Housing dataset, this paper uses quantitative research methods to determine these factors in the Housing dataset. A better understanding of housing prices can help predict future market conditions, thereby providing relevant planning and investment strategies for governments, businesses, and individuals.

2. Literature Review

There are different aspects of research on housing prices. Some researchers study housing prices to reveal the health of the entire property market and the impact of its price changes on the economy. Cerutti et al. studied the relationship between housing finance characteristics and real estate booms [2]. The authors used econometric models to analyze data to reveal the correlation and causal relationship between financial variables and the market. They found the importance of strict housing finance management and supervision because they play an important role in maintaining economic stability and preventing overdevelopment of the housing market and thus triggering financial crises.

Some researchers explore elements of housing prices, such as income, employment rate, and population changes. Some researchers focus on the impact of human behavior and psychology and the impact of people's consumption behavior on housing prices. Kruniawan et al. investigated the factors that influence the home purchase decision of millennials in Indonesia, and the results emphasized the importance of affordability, location, developer reputation, property characteristics, etc. [3] Similarly, San Ong explored the various factors that affect Malaysian housing prices, aiming to use these factors to help stakeholders make informed decisions and formulate corresponding strategies to stabilize Malaysia's real estate market [4]. In the author's opinion, economic conditions, population trends, supply relations, government policies and market sentiment are closely related to price fluctuations in the real estate market.

Some researchers also use housing price research to measure the effectiveness of policies and regulations, which helps to provide effective suggestions for policymaking. Li et al. studied how the housing purchase restriction policies influence the housing prices in the real estate market [5]. Through the analysis of actual data in Beijing suburbs, they found that housing purchase restriction policies can effectively reduce speculative buying and selling activities. This shows that government policies are conducive to helping people in need obtain housing.

Some researchers have kept up with the times and focused on understanding the impact of technological progress and environmental changes on housing prices. Wittowsky et al. found that convenient public transportation and facilities have a positive impact on housing prices [6]. Besides, the authors mentioned that adding new facilities to old residential buildings is associated with rising housing prices. Similarly, Yang et al.'s results highlight the close relationship between the presence of subways and surrounding housing prices. In addition, they suggest that sustainable urban development can benefit from urban planning and transportation policies [7].

Other researchers explore overall trends in the housing market, and they usually do this by comparing housing market conditions in different countries and regions. In the study, the authors considered the economic conditions, cultural characteristics, and policies and regulations of different countries and regions to summarize the general characteristics of the real estate market. Duca et al.'s study used econometric models to analyze and compare the housing price cycles of multiple countries [8]. They believe that policies and regulations are conducive to preventing the negative impact of extreme fluctuations, thereby achieving stability in the real estate market. Fischer et al.'s article reveals the effect of monetary policy in different regions of the United States [8]. Their research results show that the US government should consider the differences in different regions when formulating policies and strive to make the policies have the desired effect. The research on the real estate market covers economics, society, human behavior, policies, technology, and cross-regional aspects, providing a comprehensive reference for people to understand the real estate market.

Although the current research on housing prices has covered many aspects, there are still some key gaps in the research on the real estate market. First, housing price data mostly comes from large cities, and there is a blank in the research on housing prices in rural areas. The real estate market in rural areas is very different from that in cities in many aspects, such as economic development level, population density, infrastructure, etc. Understanding the real estate market in rural areas is crucial to help reach a clear understanding of the real estate market in the whole country.

Second, housing prices may be affected by some non-traditional factors, such as climate change, fire, and advanced technology. At present, the impact of these non-traditional factors is not well understood. Climate change may affect the safety and comfort of the living environment, while fire will directly affect the safety and market reputation of housing. With the advancement of technology, the application of emerging technologies such as smart homes and green buildings may also have an important impact on housing prices. Additionally, the long-term impact of COVID-19 also needs more in-depth research. The complexity of these factors requires more research to reveal the specific impact.

Third, the population structure of many countries has changed greatly. For example, many countries have entered the stage of aging population. People know little about the impact of population aging on housing prices, which is also a topic that needs to be explored. This involves the housing needs and changes of the elderly. Understanding the actual situation in this regard can provide policymakers with more effective information and a more scientific plan to deal with market challenges that may arise in the future. Research in this area will help real estate stakeholders have a deeper understanding of this market and make more informed decisions, which will also help shape a more stable and fairer real estate market. For example, real estate developers can adjust the focus of market strategies and project designs according to the specific needs of different regions and different groups of people. Policymakers can also use the research results to formulate more targeted policies to promote the healthy operation and development of the real estate market.

3. Methodology

This study mainly relies on the Housing dataset. This dataset has 19 variables, among which the variable price is the dependent variable. The detailed description of the variables is shown in Figure 1. The Housing dataset has the variables that are concerned in traditional research, such as the number of rooms, floor space, building age, region, etc., and also includes some non-traditional or relatively subjective factors, such as whether it overlooks the waterfront, the condition of the house, and the building quality rating. Therefore, exploring the variables in this dataset helps individuals to comprehensively evaluate the price of a house.

Variables	Description
price	price of each home sold
bedrooms	Number of bedrooms
bathrooms	Number of bathrooms, where .5 accounts for a room with a toilet but no shower, .75 is a bathroom that contains one sink, one toilet and a shower or a bath
sqft_living	Square footage of the apartments interior living space
sqft_lot	Square footage of the land space
floors	Number of floors
waterfront	0 = not overlooking the waterfront, 1 = overlooking the waterfront
view	An index from 0 to 4 of how good the view of the property was: 0 = No view, 1 = Fair, 2 = Average, 3 = Good, 5 = Excellent
condition	An index from 1 to 5 on the condition of the apartment: 1 = Poor Worn out, 2 = Fair-Badly worn, 3 = Average, 4 = Good, 5 = Very Good
grade	An index from 1 to 13, where 1-3 falls short of building construction and design, 7 has an average level of construction and design, and 11-13 have a high quality level of construction and design.
sqft_above	The square footage of the interior housing space that is above ground level
sqft_basement	The square footage of the interior housing space that is below ground level
yr_built	The year the house was initially built
yr_renovated	The year of the house's last renovation
zipcode	What zipcode area the house is in
lat	Latitude
long	Longitude
sqft_living15	The square footage of interior housing living space for the nearest 15 neighbors
sqft_lot15	The square footage of the land lots of the nearest 15 neighbors

Figure 1: Variable Description Table

This article uses multiple regression to explore the factors that influence housing prices. First, a basic understanding of the dependent variable price is required, including the use of histograms to reflect the overall distribution of variables and the use of five numbers to understand the specific characteristics of variables. Second, a simple understanding of the relationship between the dependent variable and the related dependent variables is required. This relationship can be displayed using scatter plots. With this understanding, which independent variables may have a significant impact on price can be preliminarily identified. By observing the scatter plot, it can be recognized whether the relationship between the two variables is linear or nonlinear. If there is a strong correlation between the two variables, it can provide a basis for subsequent multiple regression analysis. Finally, multiple regression is applied to find influential variables. In multiple regression, all selected independent variables are included in the model, and the degree and direction of their impact on the dependent variable are determined by evaluating the significance and regression coefficient of each independent variable. Multiple regression can not only determine the significant independent variables, but also quantify the magnitude of these effects, thereby providing individuals with a more powerful analytical tool.

4. Result and Discussion

Firstly, it is important to have a basic understanding of the dependent variable, Price. Figure 2 shows the distribution of housing prices in the dataset. The distribution is right-skewed. Most prices are gathered in the lower level, but few are high, pulling the tail of the distribution to the right.

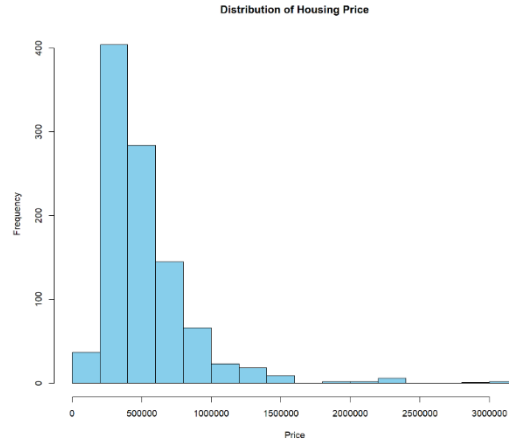


Figure 2: Distribution of Housing Price

Table 1 displays the descriptive statistics of housing prices. The mean is 520646, which is greater than the median of 43500, and it is consistent with the right-skewed distribution. The range, which means that the difference between the most expensive house and the cheapest house, is 2995000. Although there are some outliers in the dependent variable, not deleting the outliers aims to get a model that can reflect different situations.

Table 1: – Descriptive Statistics of Housing Price

Mean	SD	Median	Min	Max	Range	Skew	Kurtosis
520646.5	339579.4	435000	80000	3075000	2995000	2.97	13.84

Secondly, it is necessary to explore the relationship between dependent variable and independent variables. From the dataset, Living Space (sqft_living), Land Space (sqft_lot), Housing View (view), Housing Condition (condition), Housing Quality (grade), and Housing Built Year (yr_built) are selected as independent variables. Among them, Living Space, Land Space, and Housing Built years can be regarded as numeric variables, and others are categorical variables. With the help of R programming, the relationships between Price and other numeric variables are presented in Figure 3.

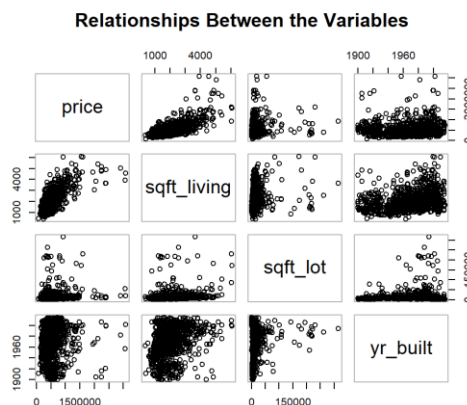


Figure 3: Relationships Between Price and Other Variables

The relationship between Price and Living Space is relatively clear and positive. The relationship between Price and Land Space as well as the relationship between Price and Built Year are not clear

from the scatterplots. Furthermore, correlation is applied to determine the relationships between Price and other interested variables, and the result is shown in Figure 4. The circle size indicates the strength of the correlation. From this figure, the correlations between Price and Living Space, Housing View, and Housing Quality are relatively high.

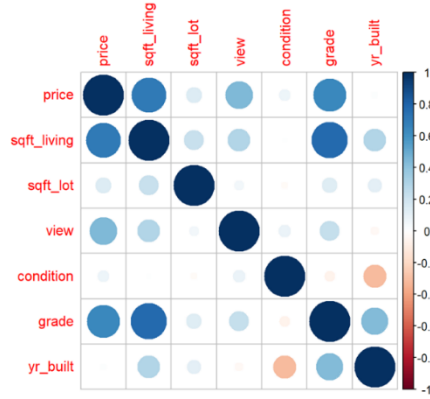


Figure 4: Correlation Between the Variables

Finally, the regression model is used to evaluate the significance of independent variables. Figure 5 shows the best model by using the variables in the Housing dataset. Price is the dependent variable, Living Space (sqft_living), Land Space (sqft_lot), Housing View (view), Housing Condition (condition), Housing Quality (grade), and Housing Built Year (yr_built) are independent variables. Among the six independent variables, four variables, Living Space, Housing View, Housing Quality, and Housing Built Year, are statistically significant at a 1% level. Specifically, Living Space, Housing View, and Housing Quality are positively correlated to Price, while Housing Built Year is negatively related to Price. This means that an older house is more likely to have a lower price. On the contrary, the year a house was built is negatively correlated with its price, which is consistent with the common perception that older houses may be cheaper.

Living space refers to the size of the house, and its coefficient is 158.42, indicating that the price will increase by 158.42 for a one-unit increase in the size of the house. This is because a larger living space can bring a more comfortable living experience. People can get a more comfortable living environment and meet more needs. In contrast, land space did not show significance, indicating that land area is not a significantly important factor. This may reflect that current home buyers pay more attention to living quality rather than the size of the land occupied by the house. Housing landscape and housing quality can be regarded as important representatives of quality of life. Good housing landscape can improve the beauty and comfort of the living environment, which makes home buyers voluntarily pay higher prices. High-quality houses usually mean better building materials and craftsmanship, which makes consumers believe that such houses can have a long service life and higher living comfort. In addition, the coefficient of the variable grade is very high, which means that home buyers will adopt the opinions of third parties when purchasing houses. The higher the rating of the house, the higher the transaction price. This also reflects the attention of new home buyers to non-traditional factors. They are willing to follow the guidance of big data and choose houses that perform well in big data [9].

Dependent variable:	
price	
sqft_living	158.416*** (12.031)
sqft_lot	0.205 (0.231)
view	98,128.190*** (8,973.513)
condition	-4,867.347 (9,982.265)
grade	113,259.900*** (9,451.113)
yr_built	-3,240.113*** (272.363)
Constant	5,704,707.000*** (528,096.800)
observations	999
R2	0.639
Adjusted R2	0.637
Residual Std. Error	204,719.900 (df = 992)
F Statistic	292.326*** (df = 6; 992)
Note: ***p<0.01; **p<0.05; *p<0.1	

Figure 5: Regression Model Output

5. Conclusion

Through the multiple regression analysis of housing prices, people can gain a more comprehensive understanding of the impact of each variable on housing prices and their significance. The results show that living space, housing landscape, housing quality and housing construction year are the key factors affecting housing prices, among which living space, housing landscape and housing quality are positively relevant to housing prices, while housing construction year is negatively correlated. These findings provide effective references for real estate developers, policymakers, and individual buyers. For example, individual buyers can bring the situation of a certain house into the existing multiple regression equation and determine whether to buy the house by comparing the predicted housing price with the actual housing price in the same area.

Although this study provides some valid references, there are still some limitations. On the one hand, as a data set to reveal the national real estate market, the sample size of the data set used in this study is only 1,000. The outliers in the dependent variable were not removed, which led to uncertainty as to whether the existence of outliers made some variables not show significance. On the other hand, different regions and markets have uniqueness and corresponding regulations. These non-traditional factors may affect the applicability of big data analysis and the universality of the results.

This study also provides some insights for future research. The credibility of the research can be enhanced by improving data quality. Battisti et al.'s research reveals the great potential of big data in changing real estate risk management [10]. Through predictive analysis, real-time monitoring, and data integration, companies can enhance relevant risk management strategies and provide operational efficiency and management capabilities. Future research can also focus on the role of policies in the property market. Due to the volatility of the market economy and the cyclical nature of economic crises, policies can play a stabilizing role. How to formulate effective policies will become a matter of great concern. A study of 256 cities in China led by Jia et al. showed that changes in public policies have a significant impact on China's urban expansion, emphasizing the importance of constantly evaluating and adjusting relevant policies to adapt to urban dynamics [11].

References

- [1] Bernstein, J., Tedeschi, Ernie., & Robinson, S. *Housing Prices and Inflation*, by The White House. Sep 9, 2021.

<https://www.whitehouse.gov/cea/written-materials/2021/09/09/housing-prices-and-inflation/#:~:text=Rising%20home%20prices%20have%20direct,important%20role%20in%20overall%20inflation.>

- [2] Cerutti, E., Dagher, J., & Dell'Ariccia, G. *Housing finance and real-estate booms: A cross-country perspective*. [J] *Journal of Housing Economics*, vol. 38, 2017, pp.1-13.
- [3] Kurniawan, C., Dewi, L. C., Maulatsih, W., & Gunadi, W. *Factors influencing housing purchase decisions of millennial generation in Indonesia*. [J] *International Journal of Management*, vol. 11, no. 4, 2020, pp.350-365.
- [4] San Ong, T. *Factors affecting the price of housing in Malaysia*. *Journal of Emerging Issues Economics, Finance and Banking (JEIEFB)*, vol. 1, no. 5, 2013, pp. 414-429.
- [5] Li, Y., Zhu, D., Zhao, J., Zheng, X., & Zhang, L. *Effect of the housing purchase restriction policy on the Real Estate Market: Evidence from a typical suburb of Beijing, China*. [J] *Land Use Policy*, vol. 94, no. 104528, 2020.
- [6] Wittowsky, D., Hoekveld, J., Welsch, J., & Steier, M. *Residential housing prices: impact of housing characteristics, accessibility and neighbouring apartments—a case study of Dortmund, Germany*. [J] *Urban, Planning and Transport Research*, vol. 8, no. 1, 2020, pp.44-70.
- [7] Yang, L., Yu, B., Liang, Y., Lu, Y., & Li, W. *Time-varying and non-linear associations between metro ridership and the built environment*. [J] *Tunnelling and Underground Space Technology*, vol. 132, no. 104931, 2023.
- [8] Duca, J. V., Muellbauer, J., & Murphy, A. *What drives house price cycles? International experience and policy issues*. [J] *Journal of Economic Literature*, vol. 59, no.3, 2021, pp.773-864.
- [9] Fischer, M. M., Huber, F., Pfarrhofer, M., & Stauffer-Steinnocher, P. *The dynamic impact of monetary policy on regional housing prices in the United States*. [J] *Real Estate Economics*, vol. 4, no.4, 2021, pp/1039-1068.
- [10] Battisti, E., Shams, S. R., Sakka, G., & Miglietta, N. *Big data and risk management in business processes: implications for corporate real estate*. [J] *Business Process Management Journal*, vol. 26, no.5, 2021, pp.1141-1155.
- [11] Jia, M., Liu, Y., Lieske, S. N., & Chen, T. *Public policy change and its impact on urban expansion: An evaluation of 265 cities in China*. [J] *Land Use Policy*, vol. 97, no.104754, 2020.

Digital Transformation of China's E-Commerce Industry

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Abstract: China's e-commerce industry has experienced a substantial digital transition following the COVID-19 outbreak. This transformation is evident in various dimensions, such as technical advancements, shifts in customer behavior, and adaptations in operational frameworks. This article looks at how COVID-19 has affected China's e-commerce sector and how it has affected businesses' digital transformation. It is discovered through data and case analysis analysis that digital transformation improves competitiveness, lowers costs, and increases efficiency. However, it also emphasizes that a variety of issues, including personnel, management, technology, and so forth, must be taken into account while implementing digital transformation. Lastly, a few recommendations are made to help China's e-commerce sector succeed in the digital revolution.

Keywords: Digital economy, e-commerce, digital transformation

1. Introduction

The world economy has been greatly impacted by the COVID-19 pandemic, and China's e-commerce sector has developed and changed significantly during this time. Strict lockdown and quarantine regulations, enforced by the Chinese government to manage the outbreak, have negatively impacted offline business operations. Customers' travel options were restricted, and some physical stores were forced to close. Customers' purchasing habits have altered as a result of spending more time alone at home, and there is a noticeable increase in demand for internet shopping [1].

There has never been a better time for businesses and the economy as a whole to embrace digital change. In addition to keeping businesses open during the pandemic, digital transformation promotes ongoing innovation and economic growth. Business continuity is ensured by internet sales and telecommuting. Businesses may enhance the scientific and accuracy of decision-making, carry out precision marketing and customized services, better understand consumer demands, foster innovation and new business models, and more by utilizing big data analytics and AI technologies [2]. This essay examines the state of digital transformation in the context of the pandemic, the challenges it faces in the new environment, and the pertinent digital transformation policies from the perspective of e-commerce.

2. Digital Transformation under the Impact of COVID-19

2.1. The Pandemic-Related Push By the Government for Digital Transformation

The COVID-19 pandemic has significantly impacted the e-commerce sector and presented a once-in-a-lifetime chance to digitally alter government governance. To be more precise, the government is fostering digital governance through developing intelligent surveillance systems, monitoring and controlling epidemic dynamics in real-time, and bolstering big data analysis capabilities nationwide to precisely develop and modify preventative and control measures. Accurate data collection and analysis are essential to this process because it helps predict the epidemic's progress and direct efforts toward prevention and control.

By placing a high value on information construction, government agencies have been able to respond to citizen requests much more quickly and efficiently. One example of this is the intelligent logistics system's ability to guarantee a steady supply of basic necessities. The widespread use of cloud computing enhances information exchange between various government agencies and boosts response times for public health situations[3]. A number of e-commerce rules were introduced at a faster pace by the government during the period of epidemic prevention and control, which further contributed to the rapid development of the digital economy. Higher standards for the protection of customers' personal privacy, for instance, are imposed by the introduction of stricter data security regulations for the oversight of the online market [3]. This surely contributes to the long-term, healthy development of the e-commerce platform. Currently, e-commerce companies can surely take advantage of these new digital governance techniques and technologies to speed up their own company's online, digital, and intelligent transformation.

2.2. The Digital Transformation of Industries

The COVID-19 pandemic has expedited China's e-commerce sector's digital transition. Consider the "618" shopping festival as an example. A large number of celebrities attended the live delivery of goods as guests, which not only contributed to the rapid rise of live e-commerce's entertainment and theater-style delivery mode but also greatly enhanced the user experience [4]. The emergence of this model accelerates the rate of digitalization of the industry's upstream suppliers while also signaling the integration of e-commerce live streaming with traditional media, such as TV stations, and live events, such as concerts and music festivals. In order to incorporate more high-quality supply chain resources, China's e-commerce platforms are supporting the direct supply model from factory to consumer by concentrating on the industrial belt structure. The local market, which is less erratic than the effects on other markets, offers a steady stream of orders and encourages the improvement and streamlining of the domestic supply chain. The need for digital transformation is especially pressing and significant. By working together with e-commerce platforms, manufacturers and brand owners can reduce resource waste in the industrial chain, increase the accuracy of industrial supply, and enhance production and marketing plans through data feedback. E-commerce systems' precise supply and demand docking not only satisfies customers' varied wants for commodities, but it also lowers inventory costs and boosts sales productivity for retailers [5].

In addition, every link in the supply chain is changing due to the rapid advancement of online, digital, and cognitive technologies, particularly in the area of e-commerce. The acquisition of raw materials, manufacture, and processing, as well as final sales and logistics distribution, are all making supply chain management more transparent and effective thanks to digital technology [6]. The new offline retail formats in the e-commerce industry have started to employ technology to speed the growth of online businesses due to the pressure of modernization and transformation as well as the epidemic-induced decrease in passenger flow. There is a steady emergence of new online forms,

including retail malls, live broadcasting in commercial areas, local life services, and brand stores. A portion of the deep cultural analysis and consumption patterns that are part of the upgrading and digital transformation of China's e-commerce can also be seen in the ongoing development of new business and service models that are tailored to the specific needs of the local market. A key requirement is the intimate fusion of social culture and municipal policy, which is both a profound integration of society and culture and a technological innovation and cannot simply continue the old way of information construction [7].

2.3. Digital Businesses Transformation in the Surroundings.

The new coronavirus epidemic has spread worldwide, posing previously unheard-of opportunities and difficulties for China's e-commerce sector, particularly in driving businesses toward digital transformation. Due to the epidemic's suddenness and persistence, businesses must speed up digitization, adapt swiftly to changes in the market, and optimize their online business processes. The e-commerce platform has steadily grown its penetration of the upstream of the industrial chain, forcing the traditional retail formats that were forced to close to depend on it. For instance, Taobao, Jingdong, and other e-commerce behemoths have introduced the "factory direct supply" model, which aims to achieve one-stop direct supply services from the production base to consumers by reducing intermediate links, opening up production and marketing links, and integrating superior resources. By modifying production schedules in real time, manufacturers that have been negatively impacted by the epidemic can efficiently address the issue of overcapacity thanks to this model's effective reduction of inventory costs and improvement of supply chain efficiency [8].

Concurrently, the expansion of electronic commerce speeds up the process of digitally modernizing factories and production areas. This not only enables manufacturing companies to promptly adapt to market demands, but also establishes the groundwork for their subsequent realignment within the global supply chain framework. Furthermore, the e-commerce platform leverages its data analysis capabilities to assist retailers in achieving tailored suggestions and precision marketing, hence increasing the rate at which products are sold. Technology-wise, e-commerce platforms are always looking for new ways to apply AI, big data, cloud computing, and other technologies that are widely used in logistics management, product recommendation algorithm optimization, and consumer behavior prediction[9]. This helps businesses better understand market dynamics and cater to the individual needs of their customers while also making their platform more user-sticky and competitive.

3. Problems and Challenges of Digital Development in the New Environment

3.1. Governance Challenges

The COVID-19 pandemic's long-term effects have encouraged China's e-commerce business to refocus on digital transformation; yet, this process of digital e-commerce development is fraught with both opportunities and difficulties. Among them is the requirement to reinforce the government's excellent digital governance framework. Information islands, shoddy data exchange mechanisms, and challenging interdepartmental cooperation are some of the issues facing government digital governance today. The absence of government support for the creation of industry digital standards and the application of regulatory laws is caused by several causes. For instance, the e-commerce platform quality control system installation faces challenges with supervision and low violation costs because of the absence of universal data standards and exchange channels.

In addition, the government's digital governance structure needs to be improved through cross-departmental coordination, unified data interfaces, and regulatory technology upgrades due to the lack of interdepartmental cooperation in preventing risks associated with e-commerce platforms and

establishing and improving consumer rights and interest protection mechanisms. Regulators must use big data technology to conduct intelligent monitoring and early warning on the sales behaviour of e-commerce platforms to realize real-time discovery and treatment of problematic commodities, given the frequency with which e-commerce sold phoney and subpar goods during the anti-epidemic period. In order to ensure that a good market order is maintained in the complex and dynamic network market environment, we also need to build and improve the digital governance framework in the field of e-commerce, introduce professionals, formulate effective policies and measures, and optimize the digital response mechanism to implement accurate policies. In conclusion, the government's digital governance is essential to the healthy and sustainable growth of China's e-commerce sector. The only way we can adjust to the new challenges and trends facing the e-commerce sector in the modern era is to continuously enhance and refine the structure of digital governance.

3.2. Development Imbalance Among Regions

China's e-commerce industry has developed at a high-level thanks in large part to the digital transformation. The digital divide between regions is the most significant problem facing the digital development of e-commerce during the COVID-19 pandemic. This divide is particularly evident in regional variances in digital skills, availability of e-commerce services, and uneven digital infrastructure. For instance, there are still certain developing nations and areas with limited access to high-speed Internet, which prevents local companies and consumers from fully benefiting from the ease and opportunity that come with e-commerce. Furthermore, county-level and township markets' consumers' digital awareness, logistics distribution efficiency, and access rate to electronic payments lag significantly behind those of first-tier cities, which puts a direct brake on the growth and popularization of e-commerce. Regarding e-commerce platforms, an upper-level design model is frequently adopted, which is insufficient to meet the precision marketing based on regionally differentiated needs, despite attempts to compensate for this difference through the strategy of sinking the market. This is because there is a lack of thorough understanding of local consumption habits and cultural characteristics in actual operation.

The lack of e-commerce merchants in some areas is also a result of the unequal regional distribution of digital talent, making it difficult for such areas to sustain sophisticated digital operations and administration. This exacerbates the already existing digital divide between the regions. In response, the development of regional digital infrastructure—particularly the augmentation of network coverage and speed—has emerged as a crucial requirement for the accomplishment of digital transformation. Establishing a more thorough regional differentiated e-commerce development strategy, utilizing the unique qualities and possibilities of each region, and achieving accurate service and operation of differentiated markets are also essential. Additionally, in order to address the skills deficit in the e-commerce sector and facilitate the closing of the digital divide between regions, it is imperative that universities and businesses collaborate to train composite talents to meet the demands of the future digital economy.

3.3. Lack of Data Protection

Even though China's e-commerce sector has rapidly transformed digitally since the COVID-19 pandemic, there have been numerous issues and difficulties along the way. In particular, the limitations in social data governance have been more apparent. Big data use in contemporary e-commerce systems typically faces issues including inconsistent data quality, non-standard data collection, and insufficient data privacy protection. Using the live delivery mode that is being aggressively investigated by e-commerce behemoths as an example, it creates a new consumption trend but also generates a vast amount of data, such as supply chain data, transaction data, and user

behavior data [9]. Ensuring user privacy and security is challenging without sufficient compliance management, and data loss and misuse are commonplace. Furthermore, the current e-commerce data governance system is not yet complete and lacks systematic and modular data processing and analysis tools, which makes it difficult to fully develop and utilize data value and results in low data governance efficiency in the face of ever-expanding types of data and massive data scale [10].

However, the issue of data islands persists due to the absence of a mechanism for sharing data. There are still a lot of ambiguous boundaries and seamless integrations in data governance, which definitely exacerbates data security threats and prevents digital transformation from progressing deeply. The industry has come up with solutions to this issue, such as introducing blockchain technology to ensure immutable data traceability and concentrating on the creation of a transparent and secure data governance architecture. In conclusion, a sound data governance system must be built first in order to ensure the long-term and healthy development of the e-commerce industry. Standardized management of various links, such as data collection, storage, and analysis, must also be strengthened. Sharing of data resources must also be actively encouraged, and data resources must be optimized and integrated among Internet enterprises, a unified data governance platform must be established, and data security oversight must be strengthened. Raise the general public's understanding of data governance and its significance.

4. Policy Suggestions for Promoting Digital Transformation in Our Country

4.1. Government Management Perspective

Promoting China's e-commerce industry's digital transformation has become a primary priority in light of the unique coronavirus epidemic. For the time being, the government should expedite its own digital transformation in order to raise the bar for modern government governance. Measures that can be taken in the area of government services include putting in place the development of e-government cloud platforms, encouraging the use of big data analysis in public decision-making, and creating platforms for cross-departmental government information sharing in order to accomplish data interconnection. By creating a uniform system to standardize the e-commerce platform's transaction process, the government can play a regulatory and guiding role while upholding the principles of digital governance and enhancing the transparency and equity of the sector as a whole. Additionally, small businesses can be encouraged to modernize their technology and be guided in their transition to digital platforms through government procurement and other channels. In particular, the quality and transformation efficiency of the e-commerce business will be strongly impacted by support in the areas of mobile payment, cloud computing services, and intelligent logistics. In addition to bolstering government oversight of the market, this can encourage businesses to advance their digital and intelligent direction in order to provide customers a wider range of handy services. The government must enhance pertinent laws and policies to foster an atmosphere that motivates businesses to invest in R&D, innovation, and digital economy adaptation in order to assist the digital transformation of businesses. To lessen the financial strain on businesses undergoing transition, it is recommended that the government boost fiscal and tax incentives, offer tax breaks to businesses that spend extensively in digital construction, and provide financial support for technological innovation. In addition, to train and introduce technical staff, an enterprise-wide study and research personnel training system must be established. Professional technical training must also be provided, along with a framework for talent development and incentive. This means that in order to collaboratively produce highly innovative talent that will satisfy the demands of future e-commerce development, the government must work with universities and research institutions. Ensuring the sustainable development of digital platforms during the digital transformation process necessitates bolstering the protection of personal privacy and data security[10].

In addition to providing thorough guidance and technical support for the security of businesses during the data processing, storage, and transmission processes, it is imperative to establish strong legal protection for the security of consumers' personal information through legislation and technological means. In conclusion, the government has recommended the following policies for digital transformation: creating an e-government cloud and big data analysis platform; creating a cross-departmental system for sharing government information; supporting businesses in their digital transformation efforts with policy guidance and tax and fiscal incentives; collaborating with the education sector to develop professional and technical staff; and bolstering data security and privacy protection. We have good reason to think that China's e-commerce sector will be more stable while it undergoes digital transformation as a result of these initiatives.

4.2. Extend the Digital Industry Chain

The post-pandemic digital transformation of e-commerce is largely attributed to the new generation of information technology, whose extensive use not only increases the operational effectiveness of businesses but also sparks the creation of numerous creative business models. The following policy suggestions are made in an effort to strengthen information technology integration and vertical segmentation in the e-commerce industry: First and foremost, there should be more funding allocated to the study and development of critical technologies like 5G, the Internet of Things, big data, cloud computing, and artificial intelligence [11]. These technologies can then be applied in vertical industries like supply chain management and e-commerce logistics. By using 5G technology, for instance, warehouse management systems may be upgraded, items can be automatically picked by drones and robots, real-time cargo information tracking and updating is possible, and logistics distribution efficiency is significantly increased. In addition, conventional e-commerce sites and businesses engaged in scientific and technical innovation are urged to collaborate on research projects, enhance recommendation system precision through algorithm optimization, and accomplish effective and targeted marketing. In addition, the government ought to implement policies that are conducive to the digital upgrading of businesses in specialized industries, like tax exemptions, capital subsidies, and innovation rewards. Through this initiative, market participants will be encouraged to be more dynamic, openly share data resources, fully utilize the benefits of a variety of application scenarios, collaborate within the industry and across borders, expand new consumption scenarios, and provide customers with a more colorful shopping experience.

Lastly, a special fund for e-commerce digital transformation is suggested, with an emphasis on supporting the modernization of e-commerce businesses' data analysis skills and intelligent algorithm applications, encouraging the creative creation of personalized services and precision marketing, strengthening the capacity to safeguard user privacy and data security, and constructing the fundamental security defence line of digital transformation. By using these strategies, China's e-commerce sector will undergo a digital revolution propelled by a new generation of information technology, which will actually realize a comprehensive upgrade in terms of efficiency, safety, and wisdom. Additionally, these strategies will offer robust support for the industry's healthy and sustainable growth as well as for economic transformation and upgrading.

5. Conclusion

The COVID-19 pandemic has sped up the evolution of China's e-commerce sector, encouraging innovation in technology and alterations in consumer behavior. The e-commerce sector will continue to encounter new opportunities and difficulties in the future. To stay competitive and fulfill the evolving needs of customers, the sector must continuously adjust to changes in the market. After the COVID-19 outbreak, promoting the digital transformation of China's e-commerce sector will require

cooperation and coordinated efforts from a variety of angles. Businesses should aggressively pursue technology innovation and strategic repositioning, and the government should support policies and give legal assurances. Strengthening consumer education and guidance is also necessary. By taking these steps, the e-commerce sector may become more competitive, develop sustainably, and respond to changes in the market.

References

- [1] Y. Chen, M. Hou, Y. Lou, and Y. Zhao, 'The Impact of the Epidemic on E-commerce Industry', presented at the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022), Zhuhai, China, 2022. doi: 10.2991/aebmr.k.220307.360.
- [2] Jing Wu, Feng Zhang, Yi Sun, Yongbin Zhu, and Changxin Liu, 'COVID-19 Response Fuels China's Digital transformation: Opportunities and Challenges', *Proceedings of the Chinese Academy of Sciences*, vol. 35, no. 3, pp. 306–311, 2020, doi: 10.16418/j.issn.1000-3045.20200229002.
- [3] J. Zhu, 'After the epidemic, China's economy will seek new ways to change', *New Finance (Government Finance)*, 2020.
- [4] Chen Ting Zhang and Yue Wang, "New Changes in Digital Marketing under the Epidemic", *Furniture and Interior Decoration*, no. 3, pp. 16–17, 2020, doi: 10.16771/j.cn43-1247/ts.2020.03.003.
- [5] Liu Jie, "Digital Transformation and Collaborative Development of Physical Retail in China under the impact of COVID-19", *Business Economics Research*, no. 2, pp. 25–28, 2021.
- [6] Chaoxian Wang, Liangtao Guo, and Weidong Zhang, "Three Major Effects of COVID-19 on China's Digital Transformation", *New Economics Guide*, no. 3, pp. 63–69, 2020.
- [7] Li Dong and Fan Hailin, 'Thinking about Digital Transformation Practices under the COVID-19 Pandemic', *Electronic Finance*, no. 3, pp. 31–33, 2020.
- [8] Zhang Qian, "The epidemic promotes the digital transformation and upgrading of China's economy", *information construction*, no. 3, pp. 54–55, 2020.
- [9] H. Abbu, D. Fleischmann, and P. Gopalakrishna, 'The Case of Digital Transformation in Grocery Business: A Conceptual Model of Digital Grocery Ecosystem', in *2021 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, Cardiff, United Kingdom: IEEE, Jun. 2021, pp. 1–9. doi: 10.1109/ICE/ITMC52061.2021.9570219.
- [10] Wang Hao-chen and Wen Ke, 'An Opportunity in the Crisis of the COVID-19 Epidemic -- Accelerating China's digital transformation', *scientific research*, vol. 38, no. 3, pp. 393–395, 2020, doi: 10.16192/j.cnki.1003-2053.2020.03.006.
- [11] Shen Jianguang, 'COVID-19 Drives a New Round of Industrial Digital Transformation in China', *New Finance (Government Finance)*, no. Z1, pp. 65–67, 2020.

The Analysis of Global Mask Import and Export During the Epidemic

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Abstract: Since late 2019, the worldwide disease outbreak has been identified as a new coronavirus. The virus rapidly disseminated all around the world, resulting in the COVID-19 pandemic. Lockdown measures, social distancing protocols, and the use of face masks have been implemented in order to mitigate the transmission of the virus. Healthcare systems globally confront significant obstacles as researchers strive to expedite vaccine development and carry out clinical trials. International medical professionals are collaborating to exchange knowledge and expertise in combating the outbreak. This paper employs a literature review and case study methodology to examine the worldwide import and export of masks during the outbreak period. This study reveals that masks were imported and exported with greater frequency worldwide over the specified time period. The quantity of masks exported and imported varied in accordance with the production levels of different countries.

Keywords: pandemic, mask, export and import

1. Introduction

In September 2019, the world faced a serious outbreak of COVID-19 pandemic. From then on, cases have been distributed globally except for Antarctica. By June 12th 2020, more than 7,500,000 people were confirmed cases of COVID-19, and have been reported globally. Approximately 3,500,000 cases were cured and more than 421,000 infected were died, with a global death-to-cases ratio 5.61 %. [1]. The research conducted by the Johns Hopkins University Center for Systems Science and Engineering clearly shows that the regions with the highest number of deaths are mainly concentrated in northern Asia (Russia), North America (United States), South America (Peru, Brazil, Colombia, Argentina, and Chile), Europe (Bulgaria, Hungary, Croatia, Bosnia and Herzegovina), southern Africa (South Africa and Namibia), and the Middle East (Iran) [2]. This signifies that the COVID-19 pandemic has impacted nearly every region of the globe, emerging as a pressing global health concern that requires immediate attention.

The Role of Masks in Preventing Novel Coronavirus Infection and Their Selection and Use published by Guangzhou Institute of Respiratory Health states that the primary ways the novel coronavirus spreads are through respiratory droplets and close contact. Aerosol transmission can occur in enclosed spaces where individuals are exposed to high quantities of particles for an extended period of time [3]. Aerosol transmission is the phenomenon in which droplets in the air lose their water content, resulting in the formation of droplet nuclei composed of protein and microorganisms. These particles can travel significant distances in the form of aerosols, resulting in the transmission of

diseases over large distances. Aerosols have the ability to acquire an electric charge, and their particles are relatively large, usually exceeding 10 micrometers, with a significant number being larger than 50 micrometers. The most crucial preventive actions include avoiding the inhalation of virus-containing droplets and aerosols, as well as practicing frequent handwashing. As a result, there has been a significant increase in the worldwide demand for masks, leading to a shortfall of supply.

Through a method of literature review, this paper helps people to have a comprehensive understanding of the global overview of the novel coronavirus epidemic and the protective effect of masks on people during the period, which will pave the way for further understanding of the global trade of masks in the epidemic.

2. Global trend

From an international perspective, countries choose to export or import masks based on their own needs and production capacities, leading to a significant increase in the global circulation of masks. For China, the primary trend in mask movement is export.

2.1. Trend of other countries

The bar chart illustrates a significant surge in the sales volume of COVID-19 preventative products in Russia between February 17 and March 8, 2020, in comparison to the sales at the end of 2019. In only three months, the sales of medical masks had a significant increase of 380%, while Rotivoviral medications saw a rise of 220%. Additionally, antiviral and immune-stabilizing treatments witnessed a more modest growth of 16%. Undoubtedly, the sales of medical masks experienced a significantly higher increase compared to the sales of Rotivoviral medications and antiviral and immune-stabilizing pharmaceuticals. This underscores the substantial surge in the need for medical masks within a brief timeframe of approximately eight months, showcasing the heightened consciousness and significance individuals attribute to their well-being and safeguarding against the COVID-19 pandemic.

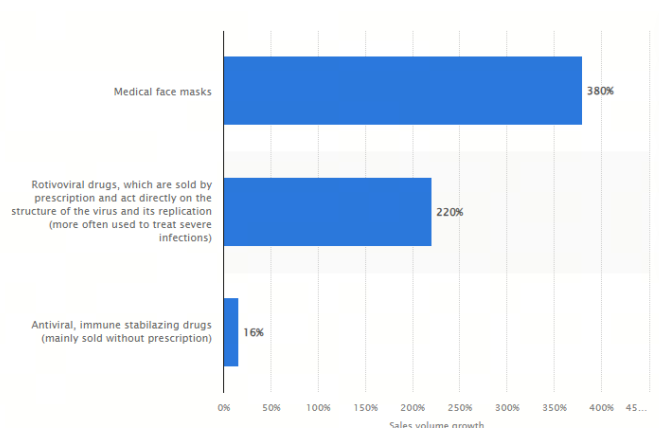


Figure 1: sales volume growth of masks and other things [4]

Based on the Value of Breathing Appliances and Gas Masks Imported to the UK from 2003 to 2022, the importation of masks in the UK was consistently low and stable prior to 2020, with yearly imports not surpassing 1,000,000 units. During the pandemic outbreak in 2020, the United Kingdom experienced a significant spike in mask imports, which were nearly three times higher than that in prior years. By mid-2020, the number of imported masks reached 370,000 units. These findings unequivocally demonstrate a substantial increase in the demand for masks in the UK during the duration of the pandemic.

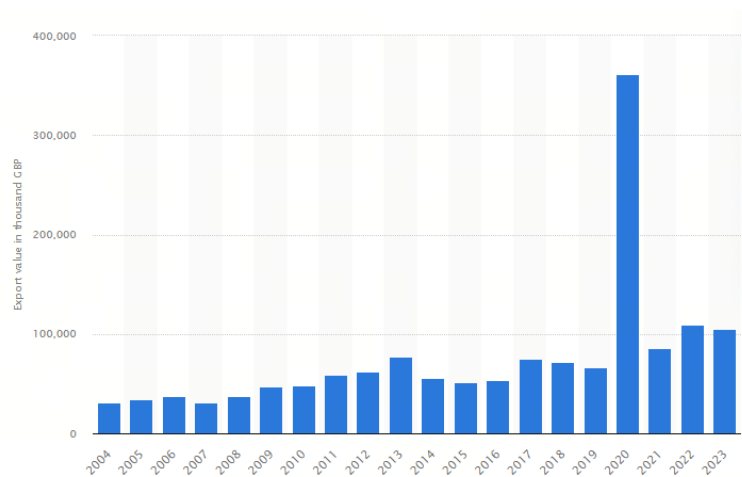


Figure 2: Value of masks imported to UK [5]

2.2. National trend

Having analyzed the mask import and export status in different countries worldwide, this paper will redirect the attention to China in order to comprehend its mask export scenario amidst the pandemic.

The following figure illustrates the trajectory of mask exports from China in 2020. During the year, the figure rose sharply to 224.2 billion units, which represents a sharp rise of the usage of respiratory masks. This substantial volume illustrates the substantial growth in China's mask exports amid the pandemic.

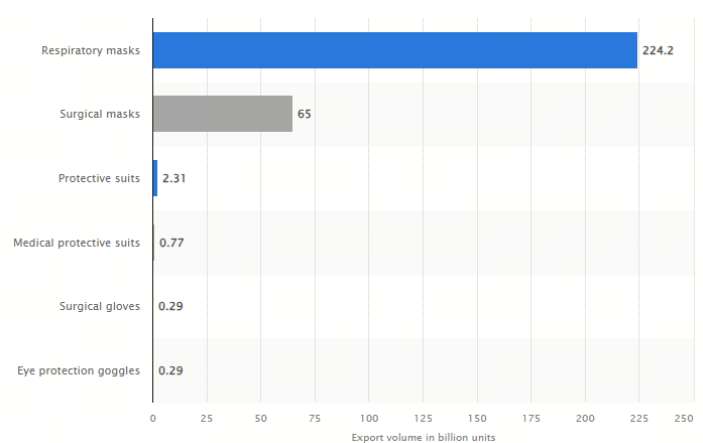


Figure 3: China's mask export volume in 2020 [6]

According to a report by New Delhi Television, China produced over 220 billion masks in 2020. From the pie chart that illustrates the share of exports of face masks by country in 2017, it is evident that before the pandemic, China already accounted for 41% of the world's total mask exports. Based on the previous line chart, we can infer that after the pandemic outbreak, China's mask export share of the global total should be significantly higher than 41%.

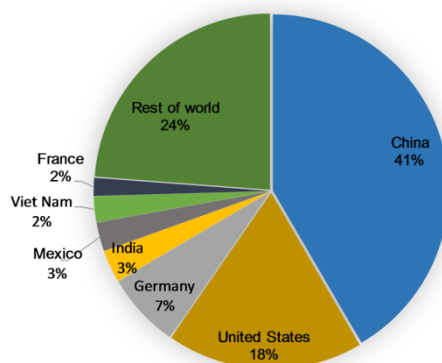


Figure 4: Share of exports of face masks by country in 2017 [7]

3. Data analysis

The Heckscher-Ohlin (HO) model posits that traded commodities can be understood as combinations of inputs of production, namely land, labor, and capital. International commodity trade involves the indirect arbitrage of factors, allowing the movement of immobile factors of production from areas where they are plentiful to areas where they are scarce. In certain situations, this form of indirect arbitrage has the ability to entirely eradicate disparities in factor prices. The HO model suggests that when factor services can be sold internationally through the exchange of commodities, it expands the scope of the market from local to global. Consequently, the demand for inputs that are sourced from other industries becomes more responsive to changes in price, and this responsiveness is also more consistent across different countries [8].

Based on the basic understanding of China, China is a country with relatively abundant labor force, that is, the labor-capital ratio in China is larger than that in developed countries [9]. The mask process is simple, do not need advanced technology, but need a lot of labor resources, so the mask is a labor-intensive industry. In this case, masks are mainly produced in China and exported to most developed countries. From the pie chart, it can be found that relatively underdeveloped countries, such as Africa, exported little or no masks. Learning from the news that, on May 31, 2020, African countries had established a platform to fight the COVID-19, and it would be put into operation in June. By then, Chinese government would provide 80 million masks to the African every month through the platform, which would greatly alleviate the shortage of medical supplies on the African continent, and every African countries would benefit from it. This suggests that China produced masks and exported them to Africa during the COVID-19.

The Ricardian model is a trade theory model that explains the phenomenon of international trade based on the differences in labor productivity between countries. Through the data, China and Africa have a big difference in the production of masks technology.

The fully automatic mask production machine was developed in China during the COVID-19. It can produce 100 masks a minute. In a factory ,there were 3 million masks produced per day. The produced mask is a standard surgical mask that can isolate viruses. While in Kenya, each tailor can produce 120 masks a day, and the entire factory can produce only 8,400 masks a day.

Combining with the Ricardian model, the opportunity cost of producing masks in China is much smaller than that in Africa. Therefore, China has a comparative advantage in producing masks, which is why masks are produced in China and exported to Africa.

According to the Hirschman Herfindahl Index, we can know from this formula that the square of the export volume of masks in the total export volume is 0.0004, which is a very small number. As

can be seen from the figure 5 and the table 1 below, China's HHI in 2020 was 0.05. The HHI of masks accounted for a very small proportion of the total HHI. so China's exports are not concentrated on masks, which indicates that China's foreign trade is rich even during the COVID-19 and is developing steadily.

$$HH = \sum_{i=1}^n \left(\frac{x_i}{\sum_{k=1}^n x_k} \right)^2 \quad [8]$$

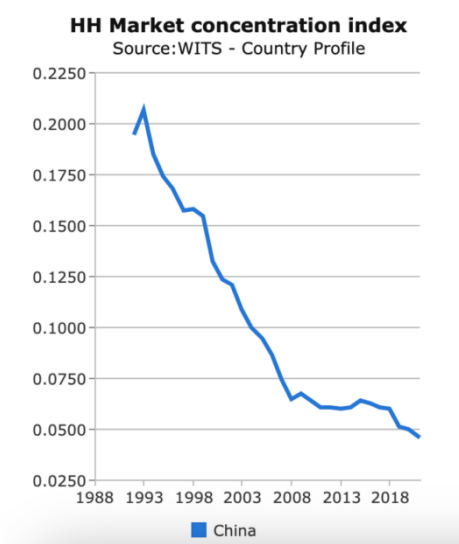


Figure 5: HH market concentration index[8]

Table 1: China's HH index from 2019 to 2021 [8]

Country name	before 2019	2019	2020	2021
China	0.06	0.05	0.05	0.05

4. Conclusion

During the epidemic, the import and export of medical masks has become an important part of international trade. Some countries may face a shortage of medical masks due to the surge in demand caused by the outbreak. At this time, imported medical masks can help meet domestic demand and ensure the normal operation of the medical system. On the other hand, some countries may export medical masks because of their strong production capacity. Through the import and export of medical masks, international cooperation and resource sharing can be achieved to help those regions facing shortages of medical supplies. Such international cooperation not only helps control the spread of the epidemic worldwide, but also reflects the spirit of solidarity and cooperation of the international community.

Without data analysis and field investigation, the arguments in the article mainly refer to existing literature and data, and some places may not be comprehensive and lack their own unique insights. Having experienced the epidemic, medical personnel around the world have been on high alert, the medical level and research and development level of countries have been greatly improved, and there are many friendly co-operations between the international community during the epidemic. It is believed that in the future, if there are such major medical problems, countries will learn from the experience of the COVID-19 outbreak, deal with new problems in a more leisurely manner, and strengthen international cooperation and help to minimize losses.

References

- [1] Peng, M. (2020). *Outbreak of COVID-19: An emerging global pandemic threat*. *Biomedicine & Pharmacotherapy*, 129, 110499.
- [2] Dong, E., Ratcliff, J., Goyea, T. D., et al. (2022). *The Johns Hopkins University Center for Systems Science and Engineering COVID-19 Dashboard: data collection process, challenges faced, and lessons learned*. *The lancet infectious diseases*, 22(12), e370-e376.
- [3] Wang, P., Ye D., Zheng Z. (2020). *The role of masks in preventing novel coronavirus infection and their selection and use*. *Guangdong Medical Journal*, 41(9), 4.
- [4] Statista. (2024). *Sales volume growth of coronavirus (COVID-19) preventive products in Russia from February 17 to March 8, 2020, by type**.
<https://www.statista.com/statistics/1104626/russia-sales-growth-of-covid-19-preventive-goods/>
- [5] Statista. (2024). *Value of breathing appliance and gas masks imported to the United Kingdom (UK) from 2004 to 2023*.
<https://www.statista.com/statistics/517534/breathing-appliances-and-gas-masks-import-value-united-kingdom-uk/>
- [6] Statista. (2024). *Export volume of personal protective equipment from China in 2020, by product type*.
<https://www.statista.com/statistics/1269002/china-export-volume-of-medical-protective-equipment/>
- [7] Organisation for Economic Co-operation and Development. (2020). *The face mask global value chain in the COVID-19 outbreak: Evidence and policy lessons*. OECD Publishing.
- [8] Leamer, E. E. (1995). *The Heckscher-Ohlin model in theory and practice*.
- [9] Tayler, J. B. (1923). *Labour and Industry in China*. *Int'l Lab. Rev.*, 8, 1.

Predicting Edwards Lifesciences' Stock Prices Using Machine Learning Model

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Abstract: Predicting stock prices in the stock market is difficult work because the price can fluctuate up and down throughout the trading day, influenced by so many factors. However, the researchers can also use some advanced algorithms to capture the trajectory of the stock market as much as possible. This paper chooses the adjusted closing price as the stock price and aims to predict it for the next trading day based on opening prices, highest prices, lowest prices, volume, and date. Exploratory data analysis is conducted to explore hidden relationships in our stock data. Then, four machine-based learning models: linear regression, K-nearest, support vector machine, and random forest are applied to make predictions for our outcome: adjusted closing price. By comparing the root mean squared error, the model with the best performance is selected and treated as one of the candidates for future stock price prediction. Although these models are relatively fundamental and may not fully capture the complexities of stock prices, they provide a solid foundation for future work.

Keywords: Random Forest, K-Nearest neighbours, linear regression, Support Vector Machines, stock price prediction

1. Introduction

A stock price is the present valuation of a particular share of a company that can be purchased or sold on the stock market. It mirrors the amount at which interested investors are willing to buy in a specified time frame. The price may fluctuate throughout the trading day, dependent on a diversity of factors, including market conditions, performance of the company, investor attitude, and numerous others. Researchers have employed various methods to try to predict stock prices with relative accuracy. For example, they used News Articles [1], Candlestick Charts [2], and Crossover Simple Moving Averages (SMA) [3] to predict stock price movement. However, because of the complex nature of the stock market, it's still difficult to predict a completely convincing result. Nowadays, more developed techniques come out, which could make more accurate predictions to a large extent. Among them, machine learning is one of the representatives. It offers the ability to analyze a vast amount of data and capture the complicated features of the stock market that traditional methods miss. For this project, the method of machine learning is used to capture the features of the stock market and predict stock prices using the historical data from Edwards Lifesciences Corporation (EW). This is an essential and valuable subject that helps investors and analysts make informed decisions, develop strategies, and manage risks effectively.

2. Methodology

2.1. Encryption of Data

The dataset was collected from Kaggle. But in fact, the data is downloaded from finance.yahoo.com, which shows the historical stock prices of Edwards Lifesciences Corporation (EW) from 2000 to 2017. By observing the first rows of our data, it is composed of seven variables, including date (the date of the stock data), open (the Opening price of the stock on a given day), high (the highest price reached during the day), low (the lowest price during the day), close (the closing price of the stock on a given day), adj-close (the adjusted closing price, which accounts for corporate actions), and volume (the number of shares traded during the day). There are 4392 observations and no missing data, which are great for our subsequent exploratory data analysis and model building. However, after checking the type of each variable, the Date variable is categorical while all others are numerical. Since this paper aims to predict the stock price, regression models are appropriate to fit quantitative data. Thus, it's more convenient to convert all categorical variables to numerical form.

2.2. Data Conversion

Let's begin to make a data conversion. The chosen method is to choose a reference date and convert each date to the number of days since that reference date. The following steps are needed to complete our data conversion.

Convert the date column to the date time format using the `pd.to_datetime()` function that is used to convert a column to a date time format, which allows us to convert these dates to numerical values later.

```
stock_data['Date'] = pd.to_datetime(stock_data['Date'])
```

Choose the first date in our data as our reference date.

```
reference_date = stock_data['Date'].min()
```

Convert the column to the number of days since the chosen reference date.

```
stock_data['Date2'] = (stock_data['Date'] - reference_date).dt.days
```

	Date	Open	High	Low	Close	Adj_Close	Volume	Date2
0	2000-03-27	3.812500	4.156250	3.812500	4.125000	4.125000	3675600	0
1	2000-03-28	4.125000	4.125000	4.000000	4.015625	4.015625	1077600	1
2	2000-03-29	4.000000	4.031250	3.953125	4.000000	4.000000	437200	2
3	2000-03-30	4.000000	4.000000	3.843750	3.843750	3.843750	1883600	3
4	2000-03-31	3.734375	3.734375	3.390625	3.390625	3.390625	7931600	4

Figure 1: Statistics of the updated dataset

By checking the first rows of our data again, a new variable has been added called Date2 which is numerical.

2.3. Visualization

After data conversion, the next step is the visualization. But before doing that, it's important to define the response and predictors. Compared to the closing price, the adjusted closing price is more appropriate to be the response, since it accounts for dividends and stock splits, which provides a more accurate representation of the stock's value over time. Thus, the adjusted closing price is chosen as our response, and other remaining variables: date, open, high, low, close, and volume, as our predictors. Then, visualization can be used to explore the underlying features of data.

Firstly, a time series plot of the adjusted closing price can be created to check whether the price could change over time.



Figure 2: Stock Closing Price Over Time

According to the plot, the overall trend of adjusted closing prices is upward. During that process, starting from 2014, the upward process is evident. In 2017, the price rarely decreased sharply from 120 to 80 due to some reasons. However, it recovered to the normal in 2018. Therefore, although sometimes the adjusted closing price could decrease, the overall trend is upward. Secondly, plot the histogram to explore the distribution of our response.



Figure 3: Distribution of Closing Prices

The graph shows a distribution that appears to be positively skewed, which means there are more occurrences of lower adjusted closing prices and fewer occurrences of higher prices. The peak of the histogram, which is the most common price, ranges from 4 to 16.

After exploring the response, the highest price is an interesting term that deserves to be analyzed. For example, what is the highest price throughout the trading days? The boxplot is chosen to draw a box plot to observe the observation of highest prices each trading day.

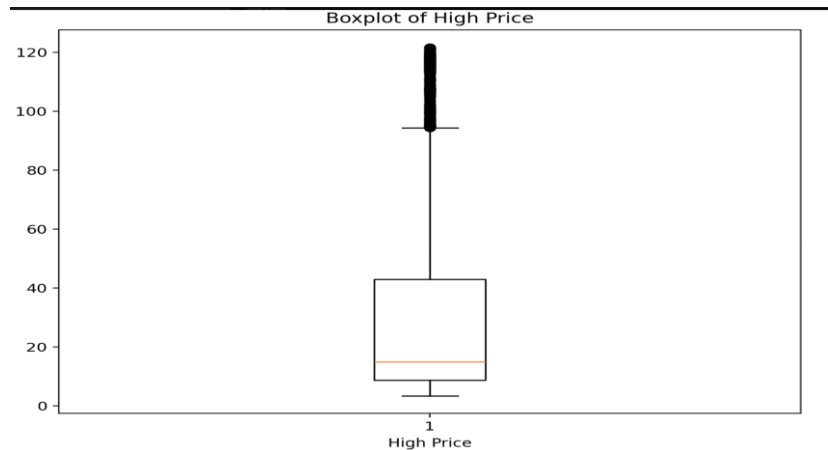


Figure 4: Boxplot of Highest Prices

The boxplot shows that the high prices of the stock have a median value of around 20, with most values falling between 10 and 40. There are many high-value outliers, which indicates some days, the stock price was significantly higher than usual.

Finally, plot a correlation plot, which is a convenient way to visualize each relationship between variables.

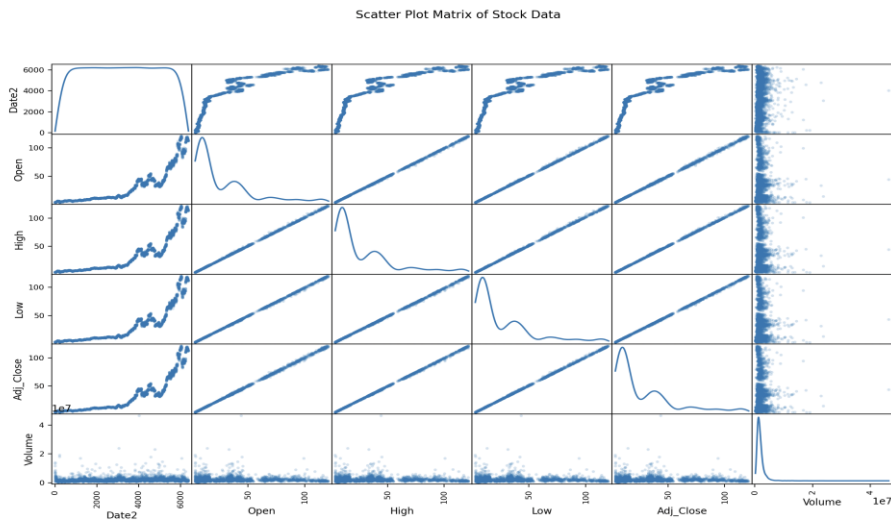


Figure 5: Scatter Plot Matrix of Stock Data

According to the plot, the variables open, high, low, and adj_close show a clear upward trend over time (date2). This indicates that the prices have generally increased over time covered by the data. In addition, there are strong linear relationships between open, high, low, and adj_close prices. However, the volume in the plot doesn't show a clear trend over time and any strong relationship with all price variables, which indicates that the volume has remained relatively stable, and the prices are not influenced by it.

2.4. Model Selection

Let's begin to build our models. Since the outcome is quantitative, models should be used for regression cases. Here, some common regression models are selected: linear regression model [4], random forest model [5], K-nearest neighbours model [6], and support vector machines model [7].

Before fitting these models to the data, it's important to split data into two parts: a training set and a testing set. The training set is used to train and fit the models. Then, the performance of models needs to be tested using the testing set, and the best-performing one is chosen based on testing RMSE (root mean squared error). A lower RMSE represents a better fit of our model to the data, which means the predicted values calculated by the model are closer to the actual values. Thus, the best-performing model will have the minimal value of testing RMSE.

Following the process above, each model is fitted to the training set and evaluated using the testing set. Finally, the values of RMSE are calculated for each model.

Table 1: RMSE for each model

Linear Regression	Random Forest	K-Nearest neighbors	Support Vector Machines
0.2923	0.1377	22.953	30.684

According to the table, the random forest model performs the best because it has the lowest value of testing RMSE. It's not surprising because this model always performs well. After all, it is non-parametric and doesn't assume a parametric form, which makes it more flexible. In addition, it's also normal that K-Nearest neighbors and support vector machines perform badly. For KNN, it relies heavily on the distance metric to find the nearest neighbors. Hence, as the number of features increases, the data points will become sparse, which will lead to poor performance. For SVM, it performs badly possibly because of the improper feature scaling. Since the support vector machines model is sensitive to the scale of input features, it could perform badly if the features are not normalized. The only surprising point is the low RMSE value of the linear regression model. The nature of the stock market is generally volatile and nonlinear. Thus, the final performance of the linear regression model may not be as expected.

Date	Open	High	Low	Close	Adj_Close	Volume
2000/3/27	3.8125	4.15625	3.8125	4.125	4.125	3675600
2000/3/28	4.125	4.125	4	4.015625	4.015625	1077600
2000/3/29	4	4.03125	3.953125	4	4	437200
2000/3/30	4	4	3.84375	3.84375	3.84375	1883600
2000/3/31	3.734375	3.734375	3.390625	3.390625	3.390625	7931600
2000/4/3	3.5	3.703125	3.4375	3.4375	3.4375	11486800
2000/4/4	3.53125	3.578125	3.09375	3.5	3.5	13136800
2000/4/5	3.46875	3.5625	3.453125	3.484375	3.484375	6349600
2000/4/6	3.5	3.59375	3.46875	3.578125	3.578125	7181200
2000/4/7	3.59375	3.8125	3.59375	3.609375	3.609375	13904800
2000/4/10	3.6875	3.75	3.625	3.640625	3.640625	5280800
2000/4/11	3.578125	3.65625	3.5625	3.578125	3.578125	6590000

Figure 6: Statistics of the dataset

By observing the first rows of our data again, for Edwards Lifesciences Corporation (EW), the fluctuation range between prices on different trading days is very small, which may lead to a higher performance of the linear regression model.

3. Limitations

Admittedly, some places limit the overall accuracy of our models. For instance, an excessively low RMSE value might show that the model is overfitting the training data, which could lead to poor

performance on unseen data. Besides, according to the correlation plot, the strong correlations among independent variables may lead to multicollinearity, which might inflate standard errors and produce inaccurate results. Finally, due to the limitation of our data, it's hard to completely capture the trend of the stock market, because it only provides basic data such as the open price, highest price, and lowest price of each trading day. Although linear regression and other methods can be applied using this data and perform relatively well, the limitations of the dataset restrict the comprehensive analysis necessary for accurate real-life stock price prediction.

4. Conclusion

In short, this project has been meaningful in demonstrating the application of different machine learning models in stock price prediction and their effectiveness. Linear regression and random forest models performed well and were able to provide valuable predictions and analyses for practical investment decisions. Although the KNN model is not as effective as the first two, it is still a useful tool for understanding the data. These results not only enhance our understanding of stock price prediction but also provide a solid theoretical foundation and methodological guidance for practical applications. However, that is just the beginning. There are many places for improvement in the future. For instance, additional data variables could be included, such as Market Sentiment Indicators [8], Macroeconomic Indicators [9], Technical indicators [10], News and Events, and Company Fundamentals [11]. In addition, adopting more advanced models to more accurately fit the data of the stock market, such as Long Short-Term Memory (LSTM) [12], convolutional Neural Network (CNNs) [13], and Gated Recurrent Units (GRUs). [14] In a word, although our project has a lot of restrictions, it provides a solid foundation for using more developed techniques to predict stock prices later.

References

- [1] Gidófalvi, Győző. "Using News Articles to Predict Stock Price Movements." *Department of Computer Science and Engineering, University of California, San Diego*, June 15, 2001.
- [2] Lee, K.H., and G.S. Jo. "Expert System for Predicting Stock Market Timing Using a Candlestick Chart." In *Expert Systems with Applications*, vol. 16, no. 4, May 1999, pp. 357-364.
- [3] Kardile, Rucha, Trishna Ugale, and Sachi Nandan Mohanty. "Stock Price Predictions using Crossover SMA." *2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)*, Amity University, Noida, India, Sep 3-4, 2021.
- [4] Hope, Thomas M. H. (2020). *Linear regression*. In *Machine Learning: Methods and Applications to Brain Disorders* (pp. 67-81).
- [5] Biau, Gerard. (2024). *Analysis of a Random Forests Model*. *Universite Pierre et Marie Curie – Paris VI, LSTA & LPMA*.
- [6] Zhang, Zhongheng. (2016). *Introduction to machine learning: k-nearest neighbors*. *Annals of Translational Medicine*, 4(11), 218.
- [7] Kecman, V. (2005). *Basics of machine learning by support vector machines*. In *Real World Applications of Computational Intelligence* (pp. 49-103).
- [8] Beer, Francisca., & Zouaoui, Mohamed. (2013). *Measuring stock market investor sentiment*. *The Journal of Applied Business Research*.
- [9] Ali, Rafiqat, Muhammad Abrar ul Haq, and Shafqut Ullah. "Macroeconomic Indicators and Stock Market Development." vol. 5, no. 9, 2015.
- [10] Oriani, Felipe Barboza, and Guilherme P. Coelho. "Evaluating the impact of technical indicators on stock forecasting." In *2016 IEEE Symposium Series on Computational Intelligence (SSCI)*. IEEE.
- [11] Ozlen Serife. "The Effect of Company Fundamentals on Stock Values." *European Researcher*, vol. 71, no. 3-2, 2014. *Ishik University, Erbil, Iraq*.
- [12] Roondiwala, Murtaza, Harshal Patel, and Shraddha Varma. "Predicting Stock Prices Using LSTM." *International Journal of Science and Research (IJSR)*, ISSN (Online): 2319-7064, 2015. *Index Copernicus Value: 78.96 | Impact Factor: 6.391*.
- [13] Lopez Pinaya, Walter Hugo, Sandra Vieira, Rafael Garcia-Dias, and Andrea Mechelli. "Convolutional Neural Networks." In *Machine Learning*, 2020, pp. 173-191.

- [14] Rahman, Mohammad Obaidur, Md. Sabir Hossain, Ta-Seen Junaid, Md. Shafiul Alam Forhad, and Muhammad Kamal Hossen. "Predicting Prices of Stock Market using Gated Recurrent Units (GRUs) Neural Networks." *IJCSNS International Journal of Computer Science and Network Security*, vol. 19, no. 1, January 2019.

Asset Backed Securitization Development Studies

--Based on Guojin Railway Construction Chongqing YuSui Expressway Closed Infrastructure Projects

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Abstract: The Asset Backed Securitization (ABS) finance model is a technique of financing that involves the securitization of assets from a project. This model is secured by the projected revenue generated by project assets and a project financing strategy that involves raising funds through issuing bonds in the capital market. The existing ABS financing model, widely used as a project financing mechanism in the global capital market, holds immense importance for both the financial market and economic progress. Furthermore, it has consequently garnered the interest of numerous researchers. This study examines the comparative development of asset-backed securities domestically and internationally, as well as their actual application and implementation in China. This text explores the origins and development processes, characteristics, and advantages of domestic and overseas ABS financing structures. This article utilizes global expertise and real-world examples to present a future outlook for the extensive implementation of ABS in China. It aims to offer valuable insights for China's market development, compliance with financial institution regulations, alignment with market demands, and informed decision-making for relevant stakeholders in the field.

Keywords: Project financing model, ABS, risk analysis

1. Introduction

The Asset-Backed Securitization (ABS) originated in the United States. During the 1970s and 1980s, residential mortgage pass-through securities were first developed to meet the financing requirements of home buyers, providing a large source of funds to support house demands of the baby boomer generation. Banks have expanded the range of their underlying assets in response to the success of residential mortgage securitization, which has led to the inclusion of commercial real estate, student loans, credit cards, vehicle loans, and other areas in asset securitization. The progress of interest rate liberalization has led to the adoption of asset securitization, which facilitates the restructuring of banks' business models and fulfills the requirements of institutional investors, such as money market funds, for assets that are both low-risk and highly liquid [1]. The ABS financing model relies on project assets and generates funds by issuing bonds in the capital market, offering firms and projects

diverse channels for financing. Asset-backed securities differ from stocks and conventional bonds in that they do not represent ownership in a specific corporate company. Instead, they represent a claim on the cash flow or residual interests created by a pool of underlying assets. These securities are a novel type of investment that is supported by asset credit. Therefore, the revelation of information regarding the underlying asset pool serves as a crucial foundation for investors of asset-backed securities to assess risks and make informed investment choices. Strengthening the information disclosure of the underlying asset pool in credit asset securitization is highly important, which helps to accurately represent the risk and return status of the underlying assets, safeguard investor interests, mitigate risks, and facilitate the sound growth of the credit asset securitization industry [1].

This paper presents suggestions for the development of Asset-Backed Securities (ABS) models in China, based on research and analysis of the Chongqing Yusui Expressway project by Guojin Railway Construction. It also provides a comprehensive overview of relevant ABS financing models from both domestic and international cases. The findings of this study contribute to the existing research in this field.

2. The origin of ABS abroad

ABS first appeared in the U.S. financial market in the 1970s for alleviating the lack of liquidity of financial institutions. In the late 1960s, the United States experienced a surge in suburbanization, leading to increased demand for housing financing. Additionally, the post-war baby boom generation reached the age of home purchases, further straining the traditional residential financing system. As a result, people started exploring the capital market as an alternative source of funds to support housing financing. The main method used is that deposit and lending institutions issue long-term bonds, referred to as collateral-backed bonds, as collateral for the mortgage loans they issue. However, the efficiency of this financial instrument is not satisfactory. The major drawback is that the issuance of such bonds requires the thrift institution to provide over-guarantee, with the value of the mortgages used as collateral is often two to three times the face value of the bonds issued. The suboptimal utilization of collateral significantly hampers its capacity to support collateral-backed bonds, necessitating the development of more efficient financial instruments in capital markets. Since the 1970s, the government's financial liberalization and deregulation of financial regulations have objectively provided a relatively relaxed environment for mortgage securitization innovation and development. The rise of a large number of non-depository financial institutions, such as mortgage banks, pension funds, insurance companies, mutual funds, etc., as well as the development of financial innovation and electronic information technology, have provided new development opportunities for the increasing securitization, marketization, and globalization of housing finance in the United States. Therefore, mortgage securitization is a natural choice for the United States to construct a housing finance system based on the market economy. In the mid-80s of the 20th century, mortgage securitization spread to the European and American markets, mainly represented by the United Kingdom, Germany, Sweden and Canada. Mortgage securitization in the Asian market began to emerge in the mid 1990s, with Hong Kong being the most successful one [2].

In the 21st century, the United States has the largest asset securitization market globally. Consequently, its expertise in developing and implementing financial instruments has garnered international interest. Moreover, the US is crucial in driving global economic growth. Although the subprime mortgage crisis in the US 2007 was mostly caused by asset securitization, it did not lead to the disappearance of the nation asset securitization market. Instead, the industry has adapted and become more favorable through swift legislative changes [3].

Professor Wang Yuanzhang from Wuhan University discussed the global financial crisis caused by the subprime mortgage crisis. He highlighted that the US subprime mortgage crisis impacts the global economy, and given that the US credit asset securities have a well-established marketization

and credit rating system, their crisis poses a challenge for China in promoting the securitization of credit assets. This is because China's credit rating system is still being established and the level of marketization could be more advanced. Therefore, China may need to slow down or halt the asset securitization process. However, supporters argue that China's asset securitization pilot is very different from that of the United States regarding macroeconomic background, underlying asset quality, and regulatory strictness. Therefore, they believe China will not make the same mistakes as the United States [4].

3. The current situation of domestic ABS

For example, in August 1996, Zhuhai City issued two batches of debt totaling 200 million US dollars with the support of transportation registration fees and highway tolls, which were arranged by Morgan Stanley, a well-known investment company in the United States, and were rated BBB and BB, respectively, and oversubscribed. This marks the inaugural implementation of ABS financing in China [5].

The main reason for the slow progress of asset securitization in China in the early stages is that asset securitization, as a structured finance product, involves the cooperation of accounting, taxation and legal aspects, whether it is asset transfer or securities issuance [1].

The ABS financing model was first introduced in Chongqing, China in 1998 as a pilot program. Over time, it has been steadily implemented across the country and has now become a significant approach for project financing. However, in recent years, the scale of China's asset-backed securities market has shown a trend of expanding year by year, which is due to the gradual enrichment of product categories, from the initial consumer loans, auto loans, to the current ABS products of diversified underlying assets such as enterprise accounts receivable, infrastructure charges, and cultural industries. China's economy is improving as the market develops. Private assets are increasing, and the investor structure of China's asset-backed securities is becoming more complex. This includes not only traditional investors like financial institutions, enterprises, and funds but also long-term funds such as pension funds and social security funds. Their entry into the market has increased market activity. The government is highly focused on developing the asset-backed securities market and has implemented various policy measures in recent years. These measures simplify the issuance approval process, encourage innovation, and support infrastructure, all of which promote the healthy growth of the domestic asset-backed securities market. However, there are still some shortcomings in China's asset-backed securities, and there is a need to continuously strengthen the legal and regulatory system, product innovation, investor education, credit rating system, and the quality of the underlying assets.

Zhang Chaoying highlighted that despite the efforts of various regulatory departments such as the State Council, the People's Bank of China, the China Banking Regulatory Commission, and the China Securities Regulatory Commission to promote asset securitization and expand its pilot project, the reality is that asset securitization is currently facing challenges in China. The primary objective of asset securitization is to enhance the liquidity of credit assets, increase the share of direct financing, and improve the asset-liability structure of commercial banks. He believes that the main reason for this situation is that the policy system and market demand are not well integrated. The application of securitization in China should be carried out on the basis of basic principles and in light of the actual situation of China's financial industry. The spirit of realism held by financially developed foreign countries in the application and development of securitization technology may be worth learning from. The specific Chinese model encompasses both the overall framework and specific details, which banks, asset management companies, and securities firms may need to gradually understand in their respective practices [6].

Li Guanxiong believes that the continuous improvement of the asset securitization pricing method can improve the pricing mechanism, and the improvement of the pricing mechanism can solve the current problem of insufficient liquidity and narrow investor group in China's asset securitization market, and China should further liberalize the types of underlying assets that can be securitized, guide the healthy development of the asset securitization market, eliminate artificial obstacles in the exchange and interbank market, build a unified trading market platform, make asset securitization products trade freely, and give full play to the value discovery function and risk pricing mechanism of the market. One can also utilize big data to create a dedicated database for each asset pool of asset securitization products, enabling big data processing in asset securitization. This not only streamlines the application of asset securitization pricing methods but also supplies strategic data and theoretical backing for future product development [7].

4. Case analysis

Chi Junhui believes that asset securitization, like other financial instruments, is neutral, but only a tool, and there are problems with how to use it. The recent subprime mortgage turmoil in the United States is related to the large number of institutions holding mortgage-backed securities (MBS) and more complex structured financial products. The emergence of this crisis is not an inevitable product of asset securitization, nor is it a systemic risk in the asset securitization system, “but the result of the wrong or even malicious use of securitization as a financial instrument by lending institutions in the absence of supervision.” Of course, the outbreak of the subprime mortgage crisis in the United States and the global financial turmoil have had a negative impact on the rapidly developing asset securitization business and the financial derivatives market. However, a comprehensive analysis of this crisis shows that it can warn the construction of China's asset securitization system in the following aspects: it can improve the credibility of credit ratings, establish a comprehensive, truthful and objective information disclosure system for asset-backed securities, and also improve the risk and prevention of prepayment of loans, and the risk warning of investors [1].

Taking the Chongqing Yusu Expressway Closed Infrastructure Project of Guojin Railway Construction as an example, the financial risk disclosure and benefit analysis made by the project are briefly summarized.

The project carries several significant risks, including market risk, management risk, concentrated investment risk, fluctuation risk of fund asset value, net value change risk of the fund, liquidity risk, transaction risk associated with the overall fund structure, risk of the fund manager, financial adviser, custodian, special plan manager, special plan custodian, and other institutions not fulfilling their duties, risk of early termination of special purpose vehicles such as special plan, risk of external borrowing, risk of related party transactions and conflict of interest, risk of tax and policy adjustments, and risk of failure of offering, termination of listing risk, economic cycle risk, credit risk. Key market risks are policy risk, economic cycle risk, interest rate risk, credit risk, purchasing power risk, and reinvestment risk.

Table 1: Forecast consolidated income statement [8]

Project	2022	2023
1.Revenue	693,196,213.59	736,807,524.27
Operating income	693,196,213.59	736,807,524.27
2.Total cost of business	600,565,911.84	602,884,603.76
Cost of business	580,099,352.29	583,101,450.20
Taxes and surcharges	9,783,624.35	9,649,490.24
Selling expenses	-	-

Table 1: (continued).

Management expenses	996,748.20	720,000.00
R&D expenses	-	-
Finance expenses	-	385,800.30
Remuneration of the manager	9,224,940.00	8,597,964.78
Custodian expenses	461,247.00	429,898.24
Add: Other earnings	-	-
Fair value change gain	-	-
Credit impairment losses	-	-
3.Operating profit	92,630,301.75	133,922,920.51
Add: Non-operating income	-	-
Subtract: Non-operating expenses	-	-
4.Gross profit	92,630,301.75	133,922,920.51
Subtract: Income tax expense	20,317,617.23	27,253,761.27
5.Net profit	72,312.684.52	106,669,159.24
6.Total comprehensive income	72,312.684.52	106,669,159.24

The aforementioned cases demonstrate that as the asset-backed securities market has grown, China's financial regulatory authorities have consistently enhanced relevant policies, reinforced capital risk disclosure requirements for ABS projects, increased market transparency, and progressively intensified information disclosure for relevant projects. These measures enable investors to gain a clearer and more comprehensive understanding of project risks. Regarding the disclosure of ABS project information, there is variation in the adequacy of information provided. Some disclosures are relatively sufficient, while others are relatively insufficient. This discrepancy can impact investors' ability to assess project risks. Therefore, enterprises should enhance their disclosure practices, and the government should establish relevant regulations.

5. Conclusion

In general, with the gradual maturity of the domestic market economic system, some basic conditions for the implementation of asset securitization in China have been met. For example, a complete financial regulatory system has been established, a certain scale of asset securitization has been assured, commercial banks have a certain internal motivation to develop asset securitization, and the investment group in the capital market has been basically formed. Asset securitization is a product of the deepening of financial development, which objectively needs a series of mature basic conditions as support. Compared with developed market economy countries and regions, some of the necessary conditions for asset securitization are still relatively weak in China, and they need to be continuously improved in the development process of domestic asset securitization.

Upon reviewing the aforementioned research, this essay asserts that despite China's ABS financing model being implemented later than in other nations, it still possesses distinctive advantages. China has amassed significant financial capital as a result of the economic growth that followed the reform and opening up. Investors have also expanded in size and have a desire for the increase in value. The Chinese government consistently advocates for supply-side structural reforms and enhances financial innovation, which increases the likelihood of the ABS financing model capitalizing on its benefits in project financing. This would not only bolster economic development but also further advance the ABS finance model on a worldwide scale, providing funding options for diverse projects.

Although the ABS financing model offers numerous benefits, it also entails significant risks and problems. Variables like as volatility in financial markets and alterations in regulatory laws may have an influence on the ABS financing model. Hence, China must formulate appropriate policies by thoroughly taking into account its fundamental national circumstances while drawing lessons from successful overseas practices. Furthermore, it is necessary to implement a set of reforms, which involves the creation of relevant legislation and regulations, in order to guarantee the standardized and sound growth of asset securitization in China. Further comprehensive and meticulous research is required to fully comprehend the factors to be taken into account and the extent to which ABS is applicable in China.

References

- [1] J., Chi. *Analysis on the current situation and risk prevention of asset securitization in my country*[J].*International Business Research*,2010,31(03):43-50. 10.13680/j.cnki.ibr.2010.03.009
- [2] M., Wang. *Research on asset securitization and its application in real estate*[D]. Graduate School of Chinese Academy of Social Sciences, 2006.
- [3] L., Zhang. *Research on American asset securitization*[D].Jilin University, 2013.
- [4] Y., Wang, X., Tu.*An analysis of the development and suggestions of asset securitization in my country*[J].*Contemporary Finance*, 011,(03):67-72.
- [5] X., Xian.*Difficulties and countermeasures of introducing asset-backed securities model into my country's cultural industry* [J].*Open Herald*, 2010,(04):63-69.
- [6] C., Zhang.*The essence and effect of asset securitization*[D]. Fudan University, 2004.
- [7] G., Li.*Research on asset securitization pricing*[D]. Central University of Finance and Economics, 2016.
- [8] *Guojin Railway Construction Chongqing Yusui Expressway Closed Infrastructure Securities Investment Fund Prospectus*.https://www.sse.com.cn/disclosure/fund/announcement/c/new/2024-06-04/508008_20240604_JT3J.pdf

Review on the Impact of Corporate ESG Practices on China's Economy and Society

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Abstract: ESG has become a popular topic in the current international community, and it is also an important direction and perspective for academic research at home and abroad. There are many empirical studies on ESG, but few review literatures. Based on the methods of literature research, comparative analysis, and historical research, this paper sorts out and summarizes the existing Chinese literature on ESG and its connotation, corporate performance, corporate governance, macroeconomic transformation, and ESG localization. The results show that ESG practices positively correlate with corporate financial performance, and good corporate governance helps improve corporate management. In addition, ESG is conducive to improving corporate resource utilization efficiency, promoting corporate green transformation, helping enterprises cope with economic transformation challenges, promoting China's social transformation, and building a localized ESG system.

Keywords: ESG, Sustainability, Chinese Economy, Literature Review, Corporate Performance.

1. Introduction

ESG theory was first proposed in 2004, and was first put forward in the report "Who Cares Wins" by the United Nations Global Compact organization; in 2006, the United Nations Principles for Responsible Investment (UNPRI) was released, which further integrated ESG internationally. ESG is an abbreviation for Environment, Social Responsibility, and Corporate Governance, and requires companies to assume social responsibility while pursuing profit. It embodies the sustainable development concept of the trinity of economic development, environmental protection and social justice, and plays an important role in the decision-making process of the government's regulatory departments to formulate corresponding policies, pro-social managers who adhere to the ESG concept and investors, helping countries better respond to the multiple challenges of the new Coronavirus, climate change, and economic recession, and is becoming a new signpost for corporate development[1-3].

"ESG" is in line with the requirement of "companies should assume the social responsibility" in the Company Law passed by China in 1993. The development of ESG in China began in 2018. The CSRC revised the "Corporate Governance Guidelines for Listed Companies", and added the chapter of "Stakeholders, Environmental Protection and Social Responsibility". It stipulated: that listed

companies should disclose environmental information (E), fulfil social responsibilities such as poverty alleviation (S), and corporate governance-related information (G), and officially establish China's basic framework for disclosure of environmental, social responsibility and corporate governance (ESG) information. Combined with China's basic national conditions, in 2022, the relevant departments of The State Council formulated and issued an "Action Plan", which raised the domestic environmental, social and governance (ESG) management and information disclosure requirements to a higher level. It proposed to "implement the new development concept, explore the establishment of a sound ESG system, and strive to achieve 'full coverage' of the disclosure of relevant special reports by 2023."

At present, many listed companies in China are writing corporate ESG reports. ESG concepts have developed initially in China and presented a rising development trend, but most of them are empirical studies, and there are few review articles [4]. This article summarizes the existing Chinese literature by using the methods of literature research, comparative analysis and historical research, and attempts to construct a relatively complete research framework by focusing on the influence of ESG on the financial performance of Chinese enterprises, the role of corporate governance, the impact on the transformation of China's macro-economy, the role in promoting corporate social responsibility, and the ideas and general principles of Chinese ESG practices in existing literature, to provide some theoretical support for the study of ESG in the academic community and contribute to the sustainable and high-quality development of China's economy.

2. ESG Implementation of Enterprises

2.1. ESG Concept

As mentioned above, ESG represents Environment (E), Social Responsibility (S), and Governance (G), which originated from the United Nations Global Compact's 2004 report "Who Cares Wins: Connecting Financial Markets to a Changing World". However, the definition and application of ESG concepts have not yet formed a clear and fully recognized unified definition worldwide [5-6]. There are currently three main categories of disagreement. The first category is the expression of "ESG" as "Environment, Social and Governance"; the second category of scholars expresses "S" as "Social Responsibility"; the third category of scholars expresses "G" as "Corporate Governance". This article follows the earliest definition of the United Nations Global Compact and defines ESG as "Environment, Social and Governance".

Several scholars have pointed out that the concept of ESG performance is substantively related to socially responsible investing (SRI), corporate social responsibility (CSR), and the concept of sustainability [7]. CSR, namely Corporate Social Responsibility, emphasizes that while creating profits, enterprises need to assume Stakeholder Theory responsibility, and stakeholders refer to employees, consumers, and society. However, compared with CSR, ESG focuses more on striking a balance between justice and profit, emphasizing that in addition to managing enterprises well, assuming responsibility to shareholders or stakeholders, and ensuring sustainable development of the enterprises, attention shall also be paid to the interactive influence between the enterprises, the environment, and the society. In comparison of ESG with SRI, namely socially responsible investment, ESG focuses more on comprehensive consideration of relevant risks and opportunities.

ESG is currently often used as an adjective. ESG refers not only to ESG ratings or scores but also to ESG practices, ESG policies, ESG information disclosure, etc [8]. The ESG rating process abroad is divided into three steps. First, the listed company publishes an ESG report according to the relevant framework and requirements. Second, a professional rating company rates the company's ESG performance. Third, the company adjusts and improves its governance structure based on the rating. At the same time, it is worth mentioning that investment institutions in the

capital market complete ESG investment decisions for listed companies based on ESG ratings [9]. However, due to the lack of a unified ESG evaluation standard, China's ESG development still faces many challenges. Some scholars have studied the ratings and scores of three listed companies in different rating agencies (Wind, SynTao Green Finance, Mio Tech, Sino-Securities) and found that direct horizontal comparison of the results of different rating agencies is not directly comparable, which greatly weakens the reference value of the rating results for investment decisions, and at the same time increases the risks and uncertainties of the investment market [10].

2.2. Corporate Implementation of ESG Progress

According to the data of "ESG Rating Analysis Report of A-share Listed Companies" released by SynTao Green Finance, the number of listed companies issuing ESG reports on the A-stock market has experienced significant growth, from 371 in 2009 to 1,439 in 2022. The ESG report release ratio in 2022 exceeded 31%, of which the ESG report release ratio of Shanghai and Shenzhen 300 companies in 2022 was close to 90%, reaching the highest in nearly 14 years; in 2022, a total of 1245 A-share listed companies had ESG ratings of B (inclusive) or above, accounting for 28.4%. Comparing the companies that belong to the CSI 800 constituent stocks in 2022 and 2023, 46.7% of the companies have upgraded their ESG ratings, 49.6% of the companies have maintained their ratings, and only 3.7% of the companies have downgraded their ratings; while the rating change structure of CSI 800 constituent stocks from 2021 to 2022 was 38.5% upgraded, 48.5% remained the same, and 13% downgraded. It can be seen from this that the ESG management level of the vast majority of listed companies is improving or maintaining a stable level, and the proportion is increasing. Fewer and fewer companies are experiencing a decline in ESG performance.

3. Research on the Influence of Corporate ESG Practices on China's Economic Transformation and Upgrading

3.1. ESG Practices and Corporate Financial Performance

Literature generally holds that there is a positive correlation between enterprises' ESG practices and corporate performance[11]. Some studies have found that enterprises with high ESG scores tend to have higher financial performance, are regarded as low-risk investments, and help to attract more long-term investors. In the context of China, enterprises that attach greater importance to ESG usually enjoy higher market value and better stock price performance.

Specifically, the transmission path is that corporate ESG performance will have an innovation effect on enterprises, and it will improve corporate innovation performance by promoting effects such as optimizing fund liquidity and enhancing employees' innovation efficiency and risk-taking level [12]. It is worth mentioning that Zhang Lin, Yan Weixiang and Liang Biming all found that ESG performance has a significant heterogeneous impact on the financial performance of state-owned and non-state-owned enterprises, large and medium-sized enterprises, and manufacturing and non-manufacturing enterprises. Among them, non-state-owned enterprises, small and medium-sized enterprises, and manufacturing enterprises have a stronger positive promotion effect [13-15]. However, Yang Ruibo found that the relationship between ESG performance and corporate performance is affected by corporate pollution level, corporate nature, regional economic development level, and low pollution, non-state-owned, eastern region, and non-provincial capital cities. The ESG rating of enterprises can significantly improve corporate performance [16].

As a result, to win the favor of investors and the wide recognition of stakeholders, companies with ESG advantages should strive to build a comprehensive and sound ESG ecosystem and continuously improve their ESG performance [17]. This includes demonstrating greater responsibility and contribution in terms of environmental practices, social responsibility, and

corporate governance optimization, so as to demonstrate the company's firm commitment to sustainable development.

3.2. Corporate Governance and Its Role in ESG Practices

Research on the dimension of governance shows that a sound corporate governance structure and high transparency can improve the level of corporate management, reduce corruption and management risks, promote efficiency and innovation, and lay a solid corporate foundation for economic transformation. Lei Lei pointed out that the data of 2371 A-share listed companies in China from 2007 to 2019 were used to verify two opposing mechanisms, namely, corporate collaborative governance and collusive fraud, proposed from the micro perspective of common institutional shareholding [18]. The results show that common institutional shareholding will significantly reduce the ESG performance of enterprises. The reason is that it will enhance the market monopoly position of enterprises and weaken the internal motivation and pressure of enterprises' ESG investment.

Other studies have also found that the governance performance of corporate party organizations plays a positive role in promoting ESG performance. [19]. Based on the empirical test of corporate ESG practices, Wang Jiayue conducted a heterogeneity analysis on the corporate environment, natural environment, and social environment and found that: The promoting effect of chain shareholders is more significant on the ESG performance of mature corporate enterprises, corporates with party organizations participating in corporate governance, and enterprises in regions with higher carbon emissions [20]. Liu Xuexin further pointed out that compared with state-owned enterprises, the governance of party organizations in non-state-owned enterprises has a more obvious impact on ESG; ESG performance positively affects enterprise value, but has a long lag effect [21]. To effectively promote the in-depth construction of China's ESG system, the leadership of the party should penetrate deeply into the two-way governance model of state-owned enterprises, and organically integrate economic indicators into its long-term governance mechanism, to achieve more stable and sustainable development.

3.3. ESG and the Impact on Corporate Resource Efficiency

Some studies focus on the impact of the environmental dimension of ESG on resource efficiency, arguing that the implementation of ESG helps green innovation of enterprises [22]. Sheng Mingquan believes that enterprises actively assume environmental responsibilities, which can alleviate the environmental regulation and industry norm pressure on enterprises from organizations such as governments, reduce the risk of violations, create a good corporate image, enhance the trust of stakeholders in all aspects, and achieve the purpose of accumulating reputation capital [23]. Liu Shangshu pointed out that the good ESG performance of heavily polluting enterprises has a positive impact on enterprise upgrading because good ESG performance can bring good reputation and external investment to enterprises, thereby reducing their agency costs, obtaining resources for green innovation technology research and development, carrying out low-carbon emission reduction, improving production efficiency, and realizing enterprise upgrading [24]. Peng Baichuan took China's A-share listed companies as samples, and found through empirical research that when enterprises implement green innovation strategies, their ESG performance has a positive impact on green innovation efficiency through two core channels: strengthening risk response capabilities and enhancing supply chain influence [25]. At the same time, the advancement of digital transformation provides a positive regulatory effect on the relationship between corporate ESG performance and green innovation efficiency. In particular, for non-heavily polluting industries and enterprises that

actively implement voluntary information disclosure, their excellent ESG performance has a more significant role in promoting green innovation efficiency.

Overall, enterprises' efforts in energy saving, emission reduction, waste disposal and recycling might improve operational efficiency, reduce production costs, and promote technological progress through innovation, digital transformation, and improvement of ESG performance, which will help the development of green technology innovation in enterprises.

3.4. ESG and Macroeconomic Transformation

Regarding the relationship between ESG practices and the macroeconomy, the literature points out that ESG helps to promote China's transformation from an investment- and export-oriented economy to a consumption- and innovation-oriented economy. Chen Hong pointed out that while implementing the ESG development concept, enterprises should also attach importance to the role of social digital transformation and promote the coordinated development of ESG and digital transformation [26].

In the aspect of environmental protection, the green development strategies of enterprises are coordinated with the national policies and work together to promote the green transformation of the economy. The wide acceptance and extensive adoption of the ESG investment concept, not only can effectively enhance our strength and level of responding to the challenges from global climate change through guiding the behavior models of enterprises, financial institutes and regulatory authorities in China but also promote the economy to transform to the direction of greener and lower carbon, ensuring the smoothness and high efficiency of the transformation process [27].

3.5. ESG Practices with Chinese Characteristics

ESG practices in China have different characteristics from those in the West. In the West, ESG is often driven by market and social forces, while in China, the government plays a more prominent role in guiding companies to practice ESG. Chen Honghui pointed out that foreign institutions' low ESG ratings of Chinese state-owned enterprises are affected by the "evaluator effect". Florian Berg explains the so-called "evaluator effect" as "the evaluator's overall view of the company will affect the measurement results of specific categories". In other words, the evaluators of all ESG rating agencies first evaluate a specific company based on the firm's overall information, which is mixed with the influence of factors such as the rating agency's geographical culture and the personal values of the raters. There are obvious differences between China and European and American countries in terms of national governance, economic development stage, economic development model, and socioeconomic and cultural backgrounds. Therefore, Western countries cannot accurately grasp the ESG performance evaluation of Chinese state-owned enterprises [28].

Scholars pointed out that, China should combine the new development concept, in the current context of the "14th Five-Year Plan", based on the existing domestic and foreign ESG information disclosure standards, combined with the basic national conditions, specifically analyze the characteristics of various industries in China, and build a Chinese characteristic ESG information. The disclosure standard includes but is not limited to the implementation of mandatory disclosure full coverage and appropriate inclusion, intelligent upgrade of information disclosure model and supervision model, and the inclusion of special modules such as state-owned enterprises, small and medium-sized enterprises, biodiversity, climate change, and dual carbon into the formulation reference of special standards. Ways to make ESG "localized" [29-30].

4. Conclusion

In conclusion, ESG practices not only enhance the financial performance and sustainability of an enterprise itself, but also play an important role in promoting transformation and upgrading of China's economy, addressing the challenge of global climate change, and achieving sustainable and high-quality development for society as a whole.

Although this article explores methods such as literature research, it lacks empirical research to support its conclusions. In addition, while the author has summarized a large amount of existing literature, there are few references and comparisons to advanced international research, failing to comprehensively summarize the latest developments in ESG research internationally. While the study emphasizes the importance of ESG localization, specific application examples and operational suggestions are lacking.

The prospects for future research are as follows: First, future research can explore the impact of ESG practices on corporate financial performance and social responsibility more deeply through empirical analysis, especially the differentiated performance in different industries and business scales. Secondly, we can strengthen the research on international ESG practices, combine China's national conditions, deeply explore the characteristics and challenges of Chinese enterprises' ESG practices, and propose more targeted localized strategies. Third, we can explore establishing an evaluation system that includes environmental protection, social responsibility, and corporate governance, more accurately evaluate the application effect of ESG in Chinese enterprises, and promote the further improvement of ESG standards and practices.

References

- [1] TANG Di, JIN Xingye. *ESG Investor Behavior and Related Research Frontiers Under the Carbon Neutrality Background: A Review and Extension*[J]. *Economic Research Journal*, 2023, 58(09):190-208.
- [2] Riedl A, Smeets P. *Why do investors hold socially responsible mutual funds?* [J]. *The Journal of Finance*, 2017, 72(6):2505–2550.
- [3] Cai Guilong, Zhang Yanran. *Commitment Effect of ESG Investment in Funds: A Natural Experiment from Public Funds Signing PRI* [J]. *Economic Research*, 2023, 58(12):22-40.
- [4] Chen Honghui, Liu Mengdie. *Prospect, Current Research and Future of ESG Studies* [J/OL]. *Contemporary Economic Management*, 1-21 [2024-05-23].
- [5] Li, Ting-Ting & Wang, Kai & Sueyoshi, Toshiyuki & Wang, Derek. (2021). *ESG: Research Progress and Future Prospects*. Sustainability. 13. 11663. 10.3390/su132111663.
- [6] Pollman, E., "The Making and Meaning of ESG", *ECGI Working Paper Series in Law, Working Paper N°659/2022*, 2022.
- [7] Zhou Xuefeng, Wang Daying. *Research Review and Prospect of Corporate ESG Performance*[J]. *Accounting Monthly*, 2024, 45(02):56-62.
- [8] Xiao Hongjun. *Deconstruction and Reconstruction: Revisited ESG*[J/OL]. *Sun Yat-sen University Journal (Philosophy and Social Sciences)*, 1-30 [2024-05-23].
- [9] Li Xiaorong, Xu Tengchong. *Research progress of Environmental-Social Responsibility-Corporate Governance*[J]. *Economic Dynamic*, 2022, (08):133-146
- [10] Lai Yan, Liu Weiwei, and Wang Linjing. *Research status, hot issues, and prospects of ESG in China* [J]. *Finance and Accounting Monthly*, 2023, 44(14):80-85
- [11] Yongjia Lin, Xiaoqing Fu, Xiaolan Fu, "Varieties in state capitalism and corporate innovation: Evidence from an emerging economy" *Journal of Corporate Finance* Volume 67, 2021, 101919, ISSN 0929-1199.
- [12] Fang Xianming, Hu Ding. *Enterprise ESG Performance and Innovation-Evidence from A-share Listed Companies*[J]. *Economic Research*, 2023, 58(02): 91-106.
- [13] Zhang Lin, Zhao Haitao. *Does Corporate ESG Performance Affect Corporate Value? -An Empirical Study Based on Listed Companies in A-share Market* [J]. *Wuhan Finance*, 2019(10):36-43.
- [14] Yan Weixiang, Zhao Yu, Meng Defeng. *Research into the Impact of ESG Ratings on Listed Company Financial Performance* [J]. *Journal of Nanjing Audit University*, 2023, 20(06):71-80.
- [15] Liang Biming, Xu Xiaodong. *ESG performance, dynamic capability and corporate innovation performance* [J]. *Accounting Monthly*, 2023, 44(14):48-55.

- [16] Yang Ruibao, Deng Chengtao, Hou Xiazhou. *A Study on the Impact of ESG Performance on Corporate Financial Performance*[J]. *Technology Economics*, 2023, 42(08):124-134.
- [17] Mao Qilin, Wang Yueqing. *Research on Job Effects of ESG: Evidence from China's Listed Companies* [J]. *Economic Research*, 2023, 58(07): 86-103.
- [18] Lei Lei, Zhang Dayong, Ji Qiang. *Shared Institutional Holdings among Firms and Corporate ESG Performance*[J]. *Economic Research*, 2023, 58(04):133-151.
- [19] Su Lifang. *The trend of responsibilities of state-owned enterprises under ESG goals and the new direction of corporate governance* [J]. *Accounting Communication*, 2022, (18): 133-136+147.
- [20] Wang Jia Yue, Zhang Qi Wen ZHANG, Fan Ya Don. *Do chain shareholders promote corporate green governance? — From the perspective of ESG fulfillment of responsibilities*[J]. *Accounting Monthly*, 2024, 45(10): 40-48.
- [21] Liu Xuexin, Li Huayang, Kong Xiaoxu. *Study on the impact of party organization governance on ESG performance of enterprises*[J]. *Finance and Economics Journal*, 2022, (01):100-112.
- [22] Zhou Ying. *ESG Performance; Its Impact Mechanism on Circulating Company Green Technology Innovation* [J]. *Journal of Business Economic Studies*, 2023 (23): 164-167.
- [23] Sheng Mingquan, Yu Lu, Wang Wenbing. *ESG and total factor productivity of family firms* [J]. *Financial Research*, 2022, (02): 58-67
- [24] Liu Shangshu, Han Liangliang, Xu Jie. *ESG performance and enterprise upgrading of heavily polluting enterprises under the "dual carbon" target* [J]. *Commercial Research*, 2024(02):123-132.
- [25] Peng Baichuan, Zhang Ying, Wang Zhi. *Research on the Impact of Corporate ESG Performance on Green Innovation Efficiency* [J]. *Statistics and Decision*, 2024, 40(05):172-176.
- [26] Chen Hong, Zhang Lingxiao. *ESG Performance, Digital Transformation and Enhancement of Enterprise Value* [J]. *Journal of Central South University of Finance and Economics*, 2023 (03): 136-149.
- [27] Chen Xiao, Zhang Ming. *Promoting economic structural transformation through ESG investment: international experience and China's practice*. *Academic Research*, 2022(08):92-98.
- [28] Chen Honghui, Liu Mengdie, Yang Shuo. *ESG Localization* [J]. *Enterprise Management*, 2023, (07):10-15.
- [29] Hou Dongde, Wei Yajun. *Construction of ESG Information Disclosure Framework of Listed Companies - Based on the Perspective of New Development Concept* [J]. *Finance law*, 2023(05):3-17.
- [30] Zhongjuan Sun, Zhuyu, Yutong Lu. *The current status of the development of ESG information disclosure standards in China, problems and suggestions* [J]. *Accounting Communication*, 2023(08): 9-14.

Research Progress in the Application of Artificial Intelligence in the Financial Field

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Abstract: In the financial field, the application of artificial intelligence (AI) has become a key force driving industry innovation and transformation. However, there is still a significant gap in the comprehensive and systematic application of artificial intelligence in the financial field. This article reviews the research progress of AI in the financial field to fill this gap, aiming to provide a comprehensive perspective on understanding how AI reshapes the financial industry and its future development potential, and to provide some reference and inspiration for subsequent research. This article discusses the development stages of AI in the financial field, including the initial stage, penetration stage, and integration stage. Then, in-depth research was conducted on the application of AI in various aspects of the financial field, such as consumer end, investment end, financing end, etc. Finally, the challenges and future prospects faced by AI in the financial field were discussed. This article finds that AI has been deeply integrated and widely applied in the financial field, creating enormous value and promoting the intelligence, personalization, and customization of financial services. However, the challenges that come with it, such as data privacy and algorithm transparency, are new directions that require our continued attention and research. Therefore, this article not only provides us with a comprehensive perspective on the application of AI in the financial field, but also points out future research directions, so as to promote further development in this field.

Keywords: the application of artificial intelligence in the financial field, development stages, application directions, challenges, and future prospects.

1. Introduction

In today's era of rapid technological development, artificial intelligence (AI) has become one of the important technologies guiding future development. Especially in the financial field, the widespread application of AI has become a development trend, which not only greatly promotes innovation in the financial industry, but also gradually changes the form of financial services, achieving intelligent, personalized, and customized service models. The application of artificial intelligence in the financial field has significant research value and significance. According to data from the American Banking Association (ABA), 77% of banks in the United States are currently utilizing artificial intelligence to improve service quality and efficiency, further enhancing customer experience. For example, through AI technology, banks can evaluate customer credit ratings through predictive models, which could

reduce bad debts and improve operational efficiency. There has been a large amount of research on the application of artificial intelligence technology in a specific scenario or problem in the financial field, but there is still a significant gap in the comprehensive and systematic application practice of artificial intelligence in the financial field. Therefore, this article aims to comprehensively and systematically review and summarize the existing research results on the application of artificial intelligence in the financial field to provide a comprehensive perspective for understanding the application of AI in the financial field. This article will cover the development stages and specific application directions of artificial intelligence in the financial field, as well as the challenges and future prospects of artificial intelligence in the financial field. It will demonstrate a unique thinking logic, provide systematic reference and inspiration for subsequent research, and also provide some practical reference for the financial industry.

2. Development stage

With the rapid development of technology, artificial intelligence (AI) is gradually penetrating into every corner of the financial field. From its initial simple application to today's deep integration, it has gone through three main stages: initial, penetration, and integration [1].

2.1. Initial stage

The application of artificial intelligence (AI) in the financial field began in the late 1980s, which can be seen as the initial stage of AI's application in the financial field. The main characteristics of this stage are mainly pilot and exploration, and the application breadth and depth of AI are relatively limited, mainly reflected in credit scoring, fraud detection, and transaction execution [2].

2.1.1. Credit score

As early as the 1990s, banks began to introduce AI technology for credit scoring. For example, Fair Isaac (FICO) in the United States has developed a credit scoring system based on neural networks. This system can evaluate the applicant's repayment ability based on various financial and personal information, such as credit history, debt level, family status, etc. This not only improves the accuracy of credit evaluation, but also greatly accelerates processing time [3].

2.1.2. Fraud detection

In addition, fraud detection is also an important area for the early application of AI in the financial field [4]. For example, credit card companies such as Visa and Mastercard use AI algorithms to detect abnormal transactions in order to prevent credit card fraud. These systems effectively prevent a large number of financial fraud behaviors by analyzing each transaction in real-time and discovering transactions that do not match the user's consumption patterns in a timely manner.

2.1.3. Transaction execution

In terms of transaction execution, high-frequency trading (HFT) companies have begun to introduce AI technology for automated trading. These AI systems can execute a large number of transactions at the millisecond level, improving transaction speed and efficiency. HFT companies such as Virtu Financial and Tradebot Systems were early leaders in using AI technology for automated transactions [5].

In summary, the initial stage of artificial intelligence in the financial field was mainly focused on pilot and exploration, and its impact on financial business was relatively shallow. However, the

attempts and explorations at this stage have laid the foundation for the deep application of AI in the financial field, effectively promoting the progress of financial technology.

2.2. Infiltration stage

The penetration stage of artificial intelligence (AI) in the financial field began in the early 21st century, characterized by the widespread application of AI technology in various services in the financial industry, such as investment consulting, consumer loans, risk management, compliance checks, etc. [6].

2.2.1. Investment consulting

In terms of investment consulting, many financial institutions have begun to use AI technology to provide investment strategy advice [7]. Many wealth management systems of wealth companies use machine learning algorithms to conduct in-depth analysis of global stock market data, predict market trends, and provide investment advice to clients [8].

2.2.2. Consumer loans

In terms of consumer loans, AI technology is applied in the approval process of loan applications. For example, many Internet finance companies, such as LendingClub and Zopa, are using AI technology to evaluate users' loan applications. These evaluation systems can analyze user credit history, financial status, occupational information, and other data to quickly and accurately determine credit limits [9].

2.2.3. Risk management

In terms of risk management, AI technology has also shown significant advantages. For example, many banks and financial institutions are using AI technology to achieve more effective credit risk management. These systems collect and analyze a large amount of data, including customer transaction records, consumption habits, social network information, etc., to promptly identify potential credit risks [10].

2.2.4. Compliance inspection

In terms of compliance checks, AI technology is being used to identify and prevent non-compliant behaviors such as fraud and money laundering. For example, banking giant HSBC utilizes AI technology to automatically review a large number of transaction records to identify and prevent potential money laundering activities [11].

In summary, during the penetration stage of artificial intelligence in the financial field, the application of AI has penetrated into various aspects of financial business, and its impact on the financial industry is becoming increasingly profound.

2.3. Integration stage

The integration stage of artificial intelligence (AI) in the financial field began in the past decade. Its characteristic is that AI technology is not only widely applied within the financial field, but also deeply integrated with other fields such as data science and blockchain. It has become the core driving force for innovation and transformation in the entire industry, achieving comprehensive intelligence and personalization of financial business [12].

2.3.1. Intelligent financial services

At this stage, AI technology has been widely applied in financial market trading, risk management, asset allocation, stock selection, and other aspects, greatly improving the efficiency and quality of financial services. For example, institutions such as Fidelity Investments and Vanguard have used AI-driven trading robots to provide customers with 24-hour online services. They can analyze large amounts of data, generate investment strategies, and even execute transactions directly [13].

2.3.2. Intelligent risk management

Risk management is the core link of the financial industry. During the integration phase, many financial institutions have started using AI technology for real-time risk monitoring and early warning [14]. For example, JPMorgan Chase's COIN system can automatically analyze and interpret complex regulatory regulations, helping banks avoid compliance risks.

2.3.3. Personalized financial products

AI technology is also used to develop personalized financial products. Financial institutions such as Citigroup and Morgan Stanley have begun to use AI technology to provide customers with personalized investment strategies and wealth management products. These systems analyze customer investment behavior through deep learning and machine learning algorithms, understand their risk preferences, and provide customers with the most suitable investment advice.

In summary, during the integration phase, AI has not only been deeply applied in various financial services, but also deeply integrated with other technologies, promoting the intelligent and personalized development of the financial industry.

The application of artificial intelligence in the financial field has gone through three stages: initial, penetration, and integration, each of which has brought many innovations and changes. With the continuous development and improvement of AI technology, its application in the financial field will also be more extensive and in-depth. In the future, it is worth looking forward to more financial products and services transforming and upgrading with the help of AI, making greater contributions to the development and prosperity of the financial market.

3. Application direction

With the continuous progress of artificial intelligence technology and the continuous expansion of its application fields, its application directions in the financial field are also becoming increasingly rich and diversified. From the consumer end to the investment end, and then to the financing end, artificial intelligence is playing an increasingly important role.

3.1. The application of artificial intelligence in the consumer end of the financial field

Artificial intelligence (AI) is playing an increasingly important role in the consumer end of the financial industry. By providing personalized services, optimizing user experience, and enhancing security and efficiency, AI is reshaping the financial experience of consumers. The following are some specific applications and detailed examples of AI in the financial consumer end.

3.1.1. Personalized financial advice

AI can provide more personalized financial advice. Machine learning algorithms can provide personalized budget recommendations, investment strategies, etc. based on user transaction history,

income levels, consumption habits, and other data [15]. For example, financial technology company Mint.com utilizes AI technology to provide users with customized savings and investment advice.

3.1.2. Virtual Assistant and Customer Service

AI virtual assistants can simulate the behavior of human customer service and provide 24/7 online services. Through natural language processing (NLP) technology, virtual assistants can understand user questions and provide corresponding answers [16]. This not only improves the response speed of customer service, but also reduces the operating costs of financial institutions. For example, many banks have launched AI-driven virtual customer service assistants that can handle simple queries, transactions, and complaints.

3.1.3. Contactless payment and smart wallet

AI technology has driven the development of contactless payments and smart wallets, providing consumers with more convenient and secure payment methods. Through near-field communication (NFC) technology, consumers only need to place their phones or smart bracelets close to the payment terminal to complete the payment. The smart wallet application can manage users' bank cards, coupons, and loyalty plans, providing a one-stop payment and financial management experience.

3.1.4. Credit approval and personal loans

AI technology simplifies the credit approval process, making personal loans faster and easier. By analyzing the user's credit history, income status, and expenditure patterns, AI systems can automatically evaluate the borrower's repayment ability and risk level, and quickly make loan decisions [17]. Some online lending platforms have achieved rapid approval and lending through AI technology, meeting the immediate funding needs of consumers.

3.1.5. Insurance customization and intelligent claims management

AI technology can provide customized insurance products and services based on the personal situation and needs of consumers. Through big data analysis, AI systems can predict potential risks and losses, and recommend corresponding insurance products to consumers. In addition, AI can simplify the claims process and quickly process claims requests through automated review and intelligent loss assessment.

3.1.6. Risk management and anti-fraud

AI technology also plays an important role in risk management and anti-fraud [18]. By analyzing consumer transaction behavior and patterns, AI systems can identify suspicious transactions and issue warnings. This helps financial institutions to detect and prevent fraudulent behavior in a timely manner to protect the financial security of consumers [19].

In summary, artificial intelligence has been widely and deeply applied in the consumer end of the financial field, providing consumers with more convenient, personalized, and secure financial services. With the continuous progress and innovation of technology, the application of AI in the financial consumer end will become more rich and diverse in the future.

3.2. The application of artificial intelligence in the investment end of the financial field

Artificial intelligence (AI) plays a huge role in the investment side of the financial field, providing investors with more accurate and efficient investment strategies and services through data analysis,

market trend prediction, automated trading, and risk management. The following are some specific applications and detailed examples of AI in the financial investment end.

3.2.1. Data analysis and prediction model

AI technology can process and analyze a large amount of financial data, including historical prices, transaction volumes, financial reports, news events, etc., to discover patterns and trends in the data. Through machine learning and deep learning algorithms, AI can construct predictive models to predict stock prices, market trends, and asset values [20]. For example, AI systems such as AlphaGo use deep neural networks to learn market data and achieve high-precision prediction of financial markets.

3.2.2. Automated and algorithmic trading

AI technology can achieve automated and algorithmic trading. By setting trading rules and algorithms, AI can automatically execute trading operations when the market changes, reducing human interference and errors. This trading method can quickly respond to market changes in a short period of time, and improve trading efficiency and accuracy [21]. Many financial institutions and investors use AI-driven algorithmic trading platforms to achieve fast trading and asset allocation.

3.2.3. Personalized portfolio optimization

AI technology can optimize investment portfolios and achieve optimal asset allocation based on investors' risk preferences, return goals, and asset allocation requirements. By analyzing market data through algorithms, AI can recommend diversified investment portfolios for investors to diversify risks and increase returns. Some intelligent investment advisory platforms utilize AI technology to provide users with personalized asset allocation plans and investment portfolio management [22].

3.2.4. Risk management and hedging strategies

AI technology can be applied to risk management and the formulation of hedging strategies. Through in-depth analysis and prediction of market data, AI can assess investment risks and develop corresponding hedging strategies to reduce investment risks. AI can also monitor market fluctuations and abnormal situations and issue timely risk warnings to help investors adjust investment strategies and risk management measures in a timely manner [23].

3.2.5. Intelligent investment research and market analysis

AI technology can improve the efficiency and accuracy of investment research. AI can deeply mine and analyze market data, identify investment opportunities and risk points, and provide investors with comprehensive market analysis reports [16]. At the same time, AI can also automatically collect, organize, and analyze various financial news and events, providing investors with timely market dynamics and investment advice.

In summary, artificial intelligence plays an important role in the investment side of the financial field. Through data analysis, automated trading, personalized portfolio optimization, risk management, and intelligent investment research, it improves investment efficiency and accuracy, providing investors with more intelligent and convenient investment services.

3.3. The application of artificial intelligence in the financing end of the financial field

Artificial intelligence (AI) technology is playing an increasingly important role in the financing end in the financial field. The application of AI not only improves financing efficiency, but also reduces risks and brings more convenience to financial institutions and borrowers. The following are specific applications and detailed examples of AI in the financing end of the financial field.

3.3.1. Loan approval and risk assessment

AI technology can conduct in-depth analysis of borrowers' credit history, financial status, industry prospects, etc. through machine learning algorithms to quickly and accurately assess loan risks. Compared to traditional manual approval, AI approval is more objective and efficient, and can process a large number of loan applications in a short period of time. For example, some banks have automated loan approval using AI technology, greatly improving approval efficiency and reducing the risk of human intervention [24].

3.3.2. Customer segmentation and market positioning

AI can help financial institutions more finely segment customer groups, identify the needs and behavioral characteristics of different customers, and thus develop more targeted financing products and services [25]. For example, some fintech companies use AI technology to analyze customer data and develop loan products targeting specific customer groups, such as credit loans for small and micro enterprises and personal consumption loans for consumers.

3.3.3. Intelligent recommendation and asset allocation

AI technology can intelligently recommend the most suitable financing products and asset allocation plans based on the borrower's needs and risk tolerance. This can not only improve the satisfaction of borrowers, but also help financial institutions optimize their asset portfolios and reduce risks. Some online lending platforms use AI algorithms to recommend personalized financing solutions to meet the diverse needs of different users.

3.3.4. Automated credit scoring and anti-fraud

AI technology has the capability to construct precise credit scoring models that can automatically assess the creditworthiness of borrowers [2]. Additionally, AI can be utilized for anti-fraud detection to recognize and prevent potential fraudulent activities. For instance, many financial institutions employ AI algorithms to authenticate the identity information of borrowers, guaranteeing the lawful utilization of loan funds and decreasing the possibility of fraud.

3.3.5. Dynamic Pricing and Risk Management

AI technology can adjust the pricing of financing products and risk management strategies in real-time based on market conditions and risk changes. This helps financial institutions better cope with market fluctuations and improve profitability. Some financial institutions use AI technology to predict market interest rates in order to adjust loan interest rates in a timely manner and achieve optimal pricing strategies.

In summary, the application of artificial intelligence in the financing end of the financial field not only improves financing efficiency and risk management level, but also brings more convenience and opportunities to financial institutions and borrowers. In the future, with the continuous development

and improvement of AI technology, its application in the financing end of the financial field will be more extensive and in-depth.

In summary, the application direction of artificial intelligence in the financial field is extensive and far-reaching, covering various sections from the consumer end to the investment end, and then to the financing end. With the continuous advancement of technology and the expansion of application scenarios, artificial intelligence will bring more intelligent, efficient, and personalized service experiences to the financial field.

4. Challenges and Future Prospects

Artificial intelligence has had a significant impact on the financial field, changing the way of life and bringing revolutionary changes to the financial industry. However, although AI brings many advantages, it also brings some challenges while being widely applied. Firstly, data privacy and protection is an important challenge, as AI applications in financial services require the collection, storage, and processing of large amounts of sensitive personal and corporate data. Thus how to protect user privacy and prevent data leakage or malicious use while collecting and using this data is currently a major challenge faced by AI applications in the financial field [26]. Secondly, the interpretability and transparency of AI systems is also a major challenge. Although AI can provide important support in financial decision-making, such as credit approval, risk assessment, and investment advice, the decision-making process of these AI models is mostly opaque and referred to as the "black box" [27]. This makes it difficult for financial advisors and consumers to understand how AI makes these decisions, which may threaten AI's trust and acceptance in the financial field. Furthermore, the regulation and compliance of AI is also an important challenge [28]. Although some countries and regions have introduced relevant policies and guidelines, there are still difficulties in regulating these new technologies. Especially with the continuous development of AI technology and the expansion of its applications in the financial field, how to formulate more targeted regulatory policies to ensure the safety, fairness, and transparency of AI is a current issue that needs to be considered and solved.

Despite these challenges, the future development of AI in the financial field is still full of hope. It is expected that in the future, artificial intelligence will be more deeply integrated into various aspects of financial services. Moreover, as researchers deepen their understanding of AI, it is expected that more methods and technologies will be developed in the future to improve the transparency and interpretability of AI. For example, there are already some studies exploring how to build interpretable AI models, or how to help people understand the decision-making process of AI through visualization and other methods. In addition, with the continuous deepening and widespread application of AI in the financial field, it is expected that more regulations will be introduced in the future to regulate and guide the application of AI in the financial field. These regulations not only protect the rights of consumers, but also provide clearer guidance for financial institutions to better utilize AI technology and achieve innovation and optimization in financial services.

Overall, although the application of artificial intelligence in the financial field still faces some challenges, its future is still full of infinite possibilities. As long as these challenges can be properly addressed, the application of artificial intelligence in the financial field can be fully utilized, bringing greater value to society.

5. Conclusion

This article conducts a comprehensive and in-depth study on the application of artificial intelligence in the financial field, with the aim of deepening the understanding of how to effectively utilize AI to improve financial services, enhance financial efficiency, reduce risks and provide better services, and providing strong support and inspiration for subsequent research. After sorting and analyzing a large

amount of literature, it was found that the application of artificial intelligence technology in the financial field has made significant progress. Artificial intelligence has not only deeply integrated with the financial field, but its application in the financial field is also becoming increasingly widespread and diversified, playing an important role in various application directions such as the consumer end. However, the widespread application of artificial intelligence has also brought some problems and challenges, such as data privacy, algorithm fairness, and transparency [29]. Although this article has provided a comprehensive overview and analysis of the application of artificial intelligence in the financial field, there are still many issues that have not been fully explored and resolved. For example, this study has not yet explored in depth how to fully utilize AI technology while ensuring data security. In addition, ensuring the fairness and transparency of algorithms when implementing the widespread application of AI technology is also an urgent problem that needs to be solved. For these issues, it is suggested that future research can focus on the combination of AI technology and financial regulation, optimization and innovation of AI algorithms, as well as ethical and moral issues related to AI technology. This paper comprehensively summarizes the development stages, application directions, challenges, and future development trends of AI in the financial field by reviewing a large amount of literature. It provides a comprehensive perspective for understanding the application of AI in the financial field and promoting its practical application. Moreover, while discussing the application of AI in the financial field, this article also clearly points out the problems and challenges it faces, which provides useful insights and directions for researchers to further explore the application of AI in the financial field.

References

- [1] *Machine learning in finance: history, technologies and outlook (2023).*
- [2] Remesh, V. P. (2021) *Role of ai in banking.* SSRN Electronic Journal. DOI:10.2139/ssrn.3803749.
- [3] Zhiron, V., Staroverova, N., Shustrova, M. and Tomilova, M.N. (2021) *Neural network as a tool to solve the problem of credit scoring.*
- [4] Yazici, Y. (2020) *Approaches to fraud detection on credit card transactions using artificial intelligence methods.* DOI:10.5121/csit.2020.101018.
- [5] Arifovic, J., He, X.Z. and Wei, L.J. (2019) *High Frequency Trading in FinTech age: AI with Speed.*
- [6] *The evolution of the financial sector: how AI is redefining operations (2023).*
- [7] Hu, Z. (2020) *Research on fintech methods based on artificial intelligence.* Journal of Physics Conference Series, 1684, 012034.
- [8] Singh, N., Khalfay, N., Soni, V. and Vora, D. (2017) *Stock prediction using machine learning a review paper.* International Journal of Computer Applications, 163(5), 36-43.
- [9] Maknouzi, M.E.H.E., Sadok, H. and Sakka, F. (2022) *Artificial intelligence and bank credit analysis: A review.* Cogent Economics & Finance.
- [10] Milojević, N. and Redzepagic, S. (2021) *Prospects of Artificial Intelligence and Machine Learning Application in Banking Risk Management.* Journal of Central Banking Theory and Practice, 10(3), 41–57. doi:10.2478/jcbtp-2021-0023.
- [11] Alhajeri, R. and Alhashem, A. (2023) *Using Artificial Intelligence to Combat Money Laundering.* Intelligent Information Management.
- [12] Longbing Cao (2020) *AI in Finance: A Review.* Social Science Research Network.
- [13] Abraham, F., Schmukler, S. L. and Tessada, J. (2019) *Robo-advisors: investing through machines.* Research and Policy Briefs.
- [14] Arsić, V.B. (2021) *Challenges of Financial Risk Management: AI Applications.* Management: Journal of Sustainable Business & Management Solutions in Emerging Economies, 26(3), 26–32. doi:10.7595/management.fon.2021.0015.
- [15] Kwak, J., Ahn, J., Lee, J. and Park, S. (2022) *Shai-am: A Machine Learning Platform for Investment Strategies.* Available at: <https://search-ebscohost-com-s.elink.xjtlu.edu.cn:443/login.aspx?direct=true&db=edsarx&AN=edsarx.2207.00436&site=eds-live&scope=site> (Accessed: 24 March 2024).
- [16] Veloso, M. M. A. (2020) *AI for Intelligent Financial Services: Examples and Discussion.*
- [17] Christopher K. Odinet. (2021) *Fintech credit and the financial risk of ai.* Social Science Electronic Publishing.

- [18] El Hajj, M. and Hammoud, J. (2023) *Unveiling the Influence of Artificial Intelligence and Machine Learning on Financial Markets: A Comprehensive Analysis of AI Applications in Trading, Risk Management, and Financial Operations*. *Journal of Risk & Financial Management*, 16(10), 434. doi:10.3390/jrfm16100434.
- [19] Ping Li (2020) *Research on the application and security of artificial intelligence in financial industry*. *IOP Conference Series: Materials Science and Engineering*.
- [20] Editors, T. (2018) *Call for papers: special issue on 'ai and machine learning in finance'*. *Quantitative Finance*, 18.
- [21] Cohen, G. (2022) *Algorithmic Trading and Financial Forecasting Using Advanced Artificial Intelligence Methodologies*. *Mathematics* (2227-7390), 10(18), 3302–N.PAG. doi:10.3390/math10183302.
- [22] Rahmel, J. (2020) *Applying artificial intelligence in finance and asset management: A discussion of status quo and the way forward*. 67-74.
- [23] Cao, L., Yuan, G., Leung, T. and Zhang, W. (2020) *Special issue on ai and fintech: the challenge ahead*. *IEEE Intelligent Systems*, 35(2), 3-6.
- [24] Xie, M.Z. (2019) *Development of Artificial Intelligence and Effects on Financial System*. *Journal of Physics: Conference Series*.
- [25] Mogaji, E., Farquhar, J., van Esch, P., Durodi é, C. and Perez Vega, R. (2022) *Guest editorial: Artificial intelligence in financial services marketing*. *International Journal of Bank Marketing*, 40(6), 1097–1101. doi:10.1108/IJBM-09-2022-617.
- [26] Maple, C., Szpruch, L., Epiphaniou, G., Staykova, K.S., Singh, S., Penwarden, W., Wen, Y., Wang, Z., Hariharan, J. and Avramovi ć, P. (2023) *The AI Revolution: Opportunities and Challenges for the Finance Sector*. Available at: <https://search-ebscohost-com-s.elink.xjtlu.edu.cn:443/login.aspx?direct=true&db=edsarx&AN=edsarx.2308.16538&site=eds-live&scope=site> (Accessed: 24 March 2024).
- [27] Zetzsche, D. A., Arner, D. W., Buckley, R. P. and Tang, B. (2020) *Artificial intelligence in finance: putting the human in the loop*. *Social Science Electronic Publishing*.
- [28] Cath, C. (2018) *Governing artificial intelligence: ethical, legal and technical opportunities and challenges*. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*.
- [29] Fukuda, K. (2017) *How ai is transforming financial services*. *NEC TECHNICAL JOURNAL*, 11(2), 16-20.

Analysis of the Strategy of Real Estate Promotion Combined with Internet Media Methods

— Take the Example of Country Garden Holdings Company Limited's Online Live Broadcasting

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Abstract: The main research direction of this paper is the combination of modern Internet media methods and real estate promotion, and the marketing and promotion methods of Country Garden Holdings Company Limited's online live broadcasting as an example for in-depth discussion, to develop a case study paper. This article is mainly divided into the following parts: firstly, it introduces the background of Country Garden Holdings Company Limited as a real estate developer and the development history of online live promotion activities. Second, it analyzes the current trend of combining the promotion methods of the real estate industry with Internet media, and discusses the impact of this combination on the industry. Subsequently, the implementation process of online live broadcasting in BGG is described in detail, including the selection of live broadcasting content, platform strategy and other aspects. In addition, the advantages and challenges of online live broadcasting are analyzed, focusing on the advantages in terms of high interactivity and user participation, as well as the challenges in terms of content quality control and user participation. Finally, through collecting user feedback and evaluating the effect, the successful case of BGG's online live broadcasting activities is analyzed, and suggestions for future development trends and real estate promotion strategies are put forward. This paper aims to provide reference and inspiration for the promotion strategies of real estate enterprises in the field of Internet media.

Keywords: Media, Internet, Live Streaming, Real Estate, Country Garden Holdings Company Limited.

1. Introduction

With the development of the Internet and the increasing popularity and mass popularization of short-video live broadcasting platforms, the change of information technology in the media industry has brought about many new business models and commercial value. As a leading real estate company in China, Cinnamon Garden takes the lead as an industry representative to combine real estate marketing with the times and innovation in the media industry, and embarks on the tip of the times to create a new mode of real estate operation and promotion --- to sell houses in the form of online

live broadcasting [1]. This mode in recent years through the online live Internet media platform for promotional activities, has achieved certain results. Therefore, taking BGG online live broadcast as a case study, we can deeply analyze how real estate enterprises use Internet media to expand the market, increase sales, and achieve competitive advantage in the fierce market competition. By analyzing the implementation process, effect evaluation and successful cases of BGG online live broadcasting activities, this paper aims to provide a reference for real estate enterprises to explore the strategy of combining real estate promotion with Internet media methods and how to achieve success in this field. Finally, this paper will also look forward to the future development trend of real estate promotion and Internet media, and put forward corresponding suggestions and prospects.

2. Case Analysis

BGI Holdings Limited is one of the largest urbanized residential developers with the largest sales scale in China [2], Located in Shunde, Guangdong Province, is a famous domestic real estate as the main business, covering construction, decoration, property management, hotel development and management, education and other industries Comprehensive enterprise group, China's top ten real estate enterprises, currently the largest and No. 1 ranked developer in China, ranked 283 in the global top 500 enterprises and listed on the main board of Hong Kong in 2007. With the arrival of new infrastructure and 5G era, real estate enterprises without traffic will lose the fulcrum of continued development in the future, and the correct application of digital tools will comprehensively reshape the value chain of enterprise marketing, and become the admission ticket for enterprises to enter the next wave of market competition. [3] BGG as a representative of the real estate industry first hit the real estate promotion and media innovation of the new model, opening the form of live online sales of real estate, cross-border live broadcasting the first "55 home purchase festival The first cross-border live broadcast of the "55 Home Buying Festival". BGG's live home-buying festival integrates the WeChat video number, small program, expression rain SoYiSuo and other high-quality marketing resources under Tencent, the brand content is fresh and interesting, and the click jump is more convenient, to promote the customer from attention to the purchase of the marketing efficiency has increased dramatically. The unprecedented scale of the live broadcast, a wide range of housing, popular stars strong "eye-catching", with the real estate V professional analysis, bringing unprecedented discounts strength spoiled powder, once again triggered a new upgrade of real estate marketing.

3. Industry Dilemma

In recent years, the media has been developing rapidly, and the means of communication have been changing rapidly. From the telegraph in the 19th century to the popularization of radio and television in the early 20th century to today's era of blossoming media [4] The opportunities for production and consumption brought about by media renewal and upgrading have directly affected various industries, for example, the emergence of live broadcasting has led to a wave of online live streaming with goods. According to the data released by the National Bureau of Statistics, in the whole year of 2019, the national online retail sales amounted to as much as 10,632.4 billion yuan, an increase of 16.5% over the whole year of 2018, and exceeded the 10 trillion marks for the first time. [5] The lower cost brings the maximization of influence and promotion. China's real estate in the form of the past decade of the "buy real estate investment" era of thought has passed, in recent years, the economic situation downturn, people for the idea of buying a house more conservative, the real estate situation is deteriorating. Real estate is vacant, the purchase rate is reduced, more and more rotten buildings, these are the current real estate companies are facing major problems. At this time, it is necessary to keep pace with the times, real estate reform from the marketing and promotion of the media industry

to follow the development of the stream, real estate marketing and promotion of the Internet media is the trend. Borrowing the Internet large scale, wide range, the strong influence of the advantages of real estate and the Internet combined, the Internet media for real estate companies to provide a wealth of online marketing channels, including social media, search engine marketing, content marketing and so on. Through these channels, real estate companies can interact more directly with potential customers and enhance brand exposure. [6]

Opportunities are always reserved for those who are prepared, and Country Garden Holdings Company Limited started to make digitalization attempts a long time ago. And heart management, long-term persistence, in the road of digital marketing innovation. The IP of "55 Live Festival" is the excellent result of BGY's digital marketing innovation. It is reported that "5" has special significance for BGY: "Give you a five-star home" is the brand concept that BGY has always insisted on; BGY's newly upgraded "five good houses" products also advocate "good house". The newly upgraded "Five Good Houses" product of BGL also advocates that a "good house" should have five components, including good products, good quality, good environment, good supporting facilities and good properties. These five elements have gripped the hearts of consumers as the pain points of marketing. In the selection of live content and channels, Cinnamon is also well-prepared. This year's "55 Live Festival", BGL Liaoning region in the form of a great deal of innovation, in the preferential at the same time increased efforts. Cinnamon Garden Liaoning region in the evening of May 5, 19:30 live, to create the real estate first fairy theme "5 forests outside the earning" home-buying festival, the scene invites the famous comedian Dabing station, not only sent "5.5 yuan against 5,500 yuan, 55 sets of the president of the direct signing of the listings, the purchase of subsidies as low as 90% off" and other great efforts. 9% off" and other large discounts, but also 50,000-yuan carp awards and other lucky draw gifts. According to statistics, within three hours of the live broadcast, the cumulative number of online viewers of the Liaoning regional live broadcast reached 12.4W+.

Of course, the emergence of new things will also be accompanied by the sprouting of new problems. Although the mode of life with goods is hot, but the limitations of the product and targeting is very limited, live industry with goods are generally some relatively cheap, daily and cost-effective daily necessities. Targeted consumer population for the live form of goods as most people, for a new thing to take a wait-and-see attitude, some consumers choose to buy things in the live room because of the discount is cheap, as well as the lower cost of trial and error, even if the quality of the product and quality control problems will not have a greater loss. This is a huge challenge for the real estate industry, a set of houses can easily be tens of millions of dollars, in the live broadcast room to sell the house, for many customers in the heart is a huge question mark. The quality of the content of the live online broadcast directly affects the audience's viewing experience and trust. Companies need to ensure the professionalism and authenticity of the live content to avoid false propaganda or inaccurate information, which is a challenge for real estate companies [7]. Using the live broadcast platform to promote and increase the brand influence and product awareness of BGY is one of the purposes of the live broadcast, but the real volume of transactions and to what extent the delivery rate is a problem that cannot be avoided by the live broadcast platform. Real estate as a bulk commodity, as a large asset-based things, in the live broadcast marketing and activities under the impulse of people to buy, for follow-up, contract signing and network fraud and the emergence of a variety of legal issues, consumers will still be after the exit of the live broadcast for the just decision to pay? Real estate transactions are also different from other small live products, not a simple process of shipping and signing after a successful order. For the supply of real estate, subsequent financial and ownership changes to follow up, the authenticity of the house in the live room, etc., these are real estate promotions with the form of the live room need to face the problems and challenges.

The combination of real estate promotion and Internet media will show a diversified and digitalized trend in the future. Real estate companies need to strengthen content planning, provide

diversified and attractive content, and focus on interactive experiences to enhance audience participation. At the same time, optimize technical support and data analysis capabilities, and in-depth mining of user data to achieve precision marketing. Cross-platform integration and promotion is the key, need to promote on multiple platforms and strengthen the brand building to establish a good brand image. It is recommended that real estate companies strengthen the construction of internal technical teams, and cooperate with Internet media organizations to jointly carry out online promotional activities to enhance market competitiveness and user experience. In addition, for online and offline resource sharing, information synchronization capabilities also need to be managed and improved. The obscurity of the Internet is whether consumers see what they see as what they get, and it is important to deal with offline delivery methods while a large number of online orders occur at the same time. Strengthen the legal popularization of Internet transactions to prevent people from using this virtual channel for illegal benefits. [8]

From the perspective of marketing communication theory, the practice of BGY's online live broadcasting activities reflects a variety of communication effects and strategies. For example, with the help of the online live broadcasting platform, BGY can realize a wide coverage of information dissemination and attract more potential customers to pay attention to its properties. In addition, through the interactive links during the live broadcast, viewers can communicate directly with the host, ask questions and get instant responses, thus enhancing the audience's sense of participation and trust. This is in line with the important concepts of interactivity, participation and trust in marketing communication theory [9]. Secondly, from the perspective of Internet media theory, the practice of BGY's online live broadcasting activities reflects the influence of Internet media on communication methods and effects. One of the characteristics of Internet media is the immediacy and globalization of information. BGY's live broadcasting activity can realize real-time dissemination of the latest property information and attract the attention of the audience, which is consistent with the immediacy and globalization in the theory of Internet media. In addition, through the online live broadcast platform, BGY is able to collect data from viewers to understand their needs and behaviors, which can provide a reference for subsequent promotional activities. This reflects the importance of data-driven communication in Internet media theory [10].

4. Conclusion

According to the strategic analysis of the combination of real estate promotion and Internet media in the analysis of the combination of practical and theoretical frameworks of the online live broadcasting activities of Country Garden Holdings Company Limited, and have come to some important conclusions. First, this paper found that online live broadcasting, as an emerging promotion method, has great potential in the real estate industry. Through online live broadcasting, real estate companies can achieve real-time dissemination of information, enhancement of interactive experience, and increase of user participation, which helps to improve the promotion effect and brand influence. Second, it is believed that marketing communication theory and Internet media theory play an important role in understanding and explaining BGY's online live broadcasting activities. The marketing communication theory helped us understand the mechanism and influencing factors of information dissemination, while the Internet media theory helped us recognize the influence of Internet media on the dissemination methods and effects, which helped us better guide the development and implementation of practical activities [11]. Finally, this paper recognizes that the future development trend of real estate promotion combined with Internet media is diversified and digital. Real estate enterprises need to continuously innovate and strengthen content planning, technical support and data analysis to adapt to the changes in the market and enhance the promotion effect. At the same time, enterprises also need to strengthen brand building, establish a good brand image, and enhance the user experience to win an advantageous position in the market competition.

To sum up, real estate enterprises should focus on combining marketing communication theory and Internet media theory in future promotion practice, continuously innovate, strengthen technical support and data analysis, and enhance brand influence and user experience, to achieve better promotion effect and market performance.

References

- [1] CAI Yu. "Country Garden operating capacity analysis. *SME Management and Technology*.03 (2023): 187-189.
- [2] Han Junli. Advantages and challenges of we-media e-commerce live delivery. "Mall modernization. 13(2024):32-34.doi:10.14013/j.cnki.scxdh. 2024.13.015.
- [3] Wang V." Research on marketing and promotion strategy of real estate industry based on Internet." *Modern Business* .36(2022):19-22. doi:10.14097/j.cnki.5392/2022.36.016.
- [4] Yu Shanshan, and Sun Minggui. The effect of the host feature on consumers' online purchase intention. *Operation and Management*. 06(2024):72-78.doi:10.16517/j.cnki.cn12-1034/f. 2024.06. 007.
- [5] Guo Qing, Zhao Yi, and Jiang Yiqi. "Strengthen public opinion guidance, and do a good job in live news broadcast in the era of financial media. *News Front* 11 (2024): 61-63.
- [6] Chang Chunmei. "Strategic innovation of real estate advertising in the context of the new era." *Journal of Bengbu Institute*, vol. 8, no. 3, 2019, pp. 8-11.
- [7] "The Complete Modern Real Estate Advertising Strategy - 1001 Latest Property Creative Essence." *Sound Screen World: The Advertiser*, no. 5, 2001, pp. 115-115.
- [8] Daixin Huang. "A Talk on English Translation Strategies for Real Estate Advertisements." *Journal of Guangdong Technical Teachers College*, no. 11, 2008, pp. 93-97, <https://doi.org/10.3969/j.issn.1672-402X.2008.11.022>.
- [9] Jie Zhao. *2.0 Marketing Communication Interactive Integrated Marketing Communication Strategy*. Xiamen University Press, 2009.
- [10] McGregor Eric, et al. *History of Communication Theory A Sociological Perspective*. Communication University of China Press, 2009.
- [11] Hang Zhiwen Lei Lei. "Research on the integration of real estate promotion channels based on value engineering." *Operations Manager*, no. 4X, 2011, pp. 98-98.

Research on the Pricing Model of Financial Derivatives

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Abstract: Based on the importance of the pricing model of financial derivatives, this paper points out the defects and risks of the current model and proposes some possible solutions. The research method is mainly to summarize the framework of the existing model by searching the academic literature and commercial examples related to the pricing model. The final conclusion is that an obvious flaw of the pricing model is that it is based on an idealized market state and cannot predict hidden market trends, but through random volatility, consideration of market friction, and the development of mathematical technology, the market can refine the pricing model. Research and forecast risk premium, market liquidity and asset price changes in advance when considering pricing. In addition, the market is also supported to consider the application of large machines in the portfolio as well as the issue of options panels, so as to deepen the understanding of the movement of financial products.

Keywords: pricing model, Financial derivatives, risk management.

1. Introduction

Although the research on financial derivatives has been very rich, there are still some research gaps and challenges:

Pricing and risk management of complex derivatives: While many models have been used to price standard derivatives such as options, futures and swaps, effective pricing and risk management methods for more complex derivatives such as structured products and hybrid derivatives are still inadequate.

Derivative pricing in incomplete markets: Most existing pricing models are based on the perfect market assumption, but in real markets, this assumption often does not hold. For example, there may be friction in the market, such as transaction costs, restrictive trading, or the behavior of market participants may deviate from rational expectations. For these cases, this paper needs to develop new theories and methods.

The systemic risk of derivatives: The financial crisis showed that derivatives transactions can affect the stability of the entire financial system. However, our understanding of how derivatives transmit and amplify systemic risk remains limited.

Regulation of derivatives: Effective regulation of derivatives markets is an important issue that requires further study. In particular, issues such as the transparency of the over-the-counter derivatives market, the derivatives trading practices of hedge funds and other non-bank financial institutions, and the clearing and guarantee mechanisms for derivatives need to be studied in depth.

Application of Big Data and artificial intelligence in the derivatives market: With the development of technology, big data and artificial intelligence have begun to play a role in financial markets. How to use these new technologies to improve the pricing, trading and risk management of derivatives is a new research direction.

These are just a few of the possible research gaps and challenges, the study of financial derivatives is an ever-evolving field, with new questions and opportunities always emerging. This essay will discuss the pricing model of financial derivatives, including its types, deficiencies and solutions.

2. Pricing Model of Financial Derivatives

The pricing of financial derivatives is an important research area of financial mathematics and financial engineering. The research on the pricing model of financial derivatives mainly focuses on the theoretical and empirical research of the following models:

Black-Scholes Model: Developed in 1973 by Fischer Black and Myron Scholes, this pricing strategy is among the most widely used [1]. The model assumes that interest rates and volatility are both known and constant and that asset values follow geometric Brownian movements in an idealized market. The Black-Scholes model remains the foundation for both theoretical research and empirical analysis, despite the fact that these assumptions are not entirely true in the real market.

The Binomial Model is a discrete option pricing model that was first put forth by Cox, Ross, and Rubinstein in 1979 [2]. The Binomial model, in contrast to the Black-Scholes model, enables the simulation of asset price movements in a sequence of discrete steps, beginning in the future. The asset price may increase or decrease at each stage, forming a binary tree. Even while the Binomial model has a higher computational complexity than the Black-Scholes model, it is more adaptable and can handle a wider range of scenarios, including American-style option pricing.

Stochastic volatility models: These models relax the assumption of constant volatility in the Black-Scholes model, allowing volatility to change over time. The Heston model is a very effective stochastic volatility model. Such models can better capture the volatility smile phenomenon in the market.

Jump diffusion models: This type of model introduces a jump component into the asset price dynamics, that is, prices can have large discontinuous movements at certain moments. Such models capture extreme events in the market, such as stock market crashes.

The above model is only a part of the pricing model of financial derivatives, in fact, there are many other complex models, such as stochastic volatility jump model, stochastic interest rate model and so on. They are designed to better match the price of financial derivatives in the actual market and improve the accuracy of pricing. However, the complexity of the model increases the difficulty of the calculation, so it is necessary to find a balance between the accuracy of the model and the efficiency of the calculation in practical applications.

Methods: The tools and methods to study the pricing model of financial derivatives mainly include mathematical tools, econometric methods, programming languages and software. Here are some specific tools and approaches:

Mathematics and probability theory: Financial derivatives pricing models are mostly based on stochastic process theory, so it is necessary to master advanced mathematics, probability theory, stochastic process and other relevant knowledge. In addition, mathematical tools such as partial differential equations, Monte Carlo simulations, and optimization methods are often used to price derivatives.

Meaning: Financial derivatives play an important role in the global financial market, so the study of them is very important. Specifically, the importance of studying financial derivatives can be seen from the following aspects:

Risk management: Financial derivatives are the main tools for enterprises and individuals to manage risks. By understanding and studying financial derivatives, this paper can help enterprises and individuals design effective hedging strategies to reduce the impact of market risk, interest rate risk, credit risk, etc., on their wealth and business.

Investment decision: Financial derivatives are also an important tool for investors to obtain income. By studying financial derivatives, this paper can help investors understand the nature and risks of these products and make better investment decisions.

Market stability: The 2008 global financial crisis showed that derivatives transactions can have an impact on the stability of the entire financial system. The study of financial derivatives can help us to understand this impact and design better regulatory policies to prevent the risk of financial instability.

Market efficiency: Financial derivatives provide investors with a variety of trading strategies, which helps to improve the liquidity and efficiency of the market. At the same time, the existence of the derivatives market may also affect the behavior and nature of the spot market, such as price volatility, trading volume, etc.

Theoretical development: In terms of mathematical models, the financial derivatives market provides a large number of theoretical and empirical questions, which helps to promote the development of financial theory. For example, the Black-Scholes model is not only a basic strategy for setting a price but also has an important impact on other financial fields.

Regulatory policy: The development of the derivatives market has brought a series of regulatory issues, such as market transparency, systemic risk, etc. This requires a deep understanding of the derivatives market in order to develop effective regulatory policies.

In general, the study of financial derivatives helps us to understand the operation mechanism of financial markets, improve the ability to manage risks, forecast and explain asset prices, and formulate effective financial policies.

3. Examples of Models

Next, this paper will introduce in detail the two most classic financial derivatives Pricing models: Black-Scholes Model and Binomial Option Pricing Model, including their theoretical basis, as well as their respective advantages and disadvantages.

The Black-Scholes model, also known as the Black-Scholes-Merton model, assumes that there is no friction in the market and that the logarithmic returns of stock prices follow a normal distribution. According to these assumptions, the model can deduce the analytical pricing formula of European option.

Advantages: The biggest advantage of Black-Scholes model is that it can give the analytical pricing formula of option, which is convenient to calculate the option price quickly in the actual business. In addition, the theoretical basis of the model is solid, which is helpful to understand the factors affecting option prices.

Disadvantages: However, the assumptions of the Black-Scholes model are too strict and often do not correspond to reality. For example, it assumes that the logarithmic return on stock prices follows a normal distribution, but in fact, the distribution of the logarithmic return on stock prices tends to have a fat tail. Moreover, the model assumes that there is no friction in the market, allowing for unlimited risk-free arbitrage, which is also impossible in reality.

Black-Scholes model gives the theoretical price of European options under the condition of no arbitrage.

The binary tree model, also known as the Cox-Ross-Rubinstein model, simulates the process of stock price changes by constructing a binary tree, and then calculates the price of options by backward induction.

Advantages: The main advantage of the binary tree model is that the model is simple, easy to understand, and suitable for various types of options. The model does not require analytical solutions, only numerical solutions, so the assumptions of the model can be more flexible.

Disadvantages: The disadvantage of the binary tree model is that the calculation amount is relatively large, especially for long maturity periods or multi-asset options, it needs to build a large binary tree, and the calculation efficiency is low. In addition, the approximation degree of the binary tree model to the continuous-time model depends on the choice of steps, too many steps will increase the amount of computation, too few steps will reduce the accuracy.

This is a discrete option pricing model that calculates option prices by constructing a binary structured stock price model.

The above two models are the most basic and classic models to study the pricing of financial derivatives. They have their own advantages and disadvantages and are suitable for different situations. Understanding these two models can not only help us understand the basic principles of option pricing, but also lay the foundation for subsequent research on more complex derivative pricing models.

Hull-White Model: The Hull-White model is a pricing model for interest rate derivatives that assumes that the evolution of short-term interest rates is a random process.

Heston Model: The Heston model is a stochastic volatility model that assumes that volatility itself is a stochastic process.

The above four examples are only a small part of the pricing models of financial derivatives, in fact, there are many other pricing models, such as jump diffusion model, GARCH model, LIBOR market model, etc., each has its own scope of application and advantages and disadvantages.

4. Drawbacks

The pricing model of financial derivatives is very important in practical applications, but there are some shortcomings. These problems arise mainly from the hypothesis of this model and the complexity of the real financial marketplace.

Idealization of assumptions: Many derivatives pricing models, such as the Black-Scholes model, are based on idealized assumptions such as perfect market efficiency, friction-free, no market risk, and normal distribution of logarithmic returns. However, these assumptions often fail in real-world market conditions. Empirical studies (such as Lo, A. W.'s "The Adaptive Markets Hypothesis") [3] find that markets are not always efficient, price fluctuations often have a "fat tail" characteristic, and there is a lot of friction in financial markets.

Ignoring market liquidity: Many models do not take market liquidity into account when pricing, but liquidity has a significant impact on prices in real markets. For example, Amihud, Y., & Mendelson, H. [4] proposed in the article "Asset pricing and the bid-ask spread" that poor market liquidity would lead investors to demand extra returns for holding these assets, thus affecting asset prices.

Undertreatment of underlying factors: For example, many models do not adequately account for the result of important factors such as margin of interest and stock market fluctuation. In Hull, J. C., & White, A., [5] "The pricing of options on assets with stochastic volatilities" the authors point out that the Black-Scholes model does not think over the volatility effect on option prices, which makes the pricing results of this model often proved to be biased by the market.

Complexity and computability: When pricing more complex derivatives, such as complex derivative structures or multi-asset derivatives, high-dimensional mathematical calculations or complex numerical methods are involved, which undoubtedly increases the complexity and computational cost of the model.

These are some of the shortcomings of the pricing model of financial derivatives, and one of the goals of academic research is to try to overcome these shortcomings and develop more accurate and practical pricing models.

5. Solutions

In order to solve the shortcomings of the financial derivatives pricing model, academia and industry are taking various measures to improve:

Relaxation or change of assumptions: For example, the Heston model [6] introduced random volatility based on the Black-Scholes model, bringing the model price closer to the market standard.

Direct consideration of market friction: for example, the introduction of transaction costs into the model, or the effect of introducing market liquidity. For example, Daniel C. Jefferies [7] in "Option Pricing with Transaction Costs Using a Markov Chain Approximation" article considers the effect of transaction costs on option pricing.

The development of efficient numerical methods such as Monte Carlo simulation [8], wavelet analysis [9], and finite difference methods [10], among others, have made the pricing of complex derivatives possible.

Leveraging machine learning and Big Data: For example, Dixon et al. [11] in "Sequence Classification of the Limit Order Book Using Recurrent Neural Networks" has published an article on the use of deep learning methods to price financial derivatives.

Risk-neutral pricing: Converting the various risks in the market into a unified risk premium, making the pricing of derivatives more concise. For example, Geman, H., El Karoui, N. & Rochet, J.C [12] in "Changes of Numeraire, Changes of Probability Measure and Option Pricing" is discussed in detail.

These are some of the methods currently being used to improve pricing models for financial derivatives. Each of these methods has its advantages and disadvantages, and no method can completely solve all problems and often needs to be combined. Up to now, the pricing of financial derivatives is still one of the hot topics in finance research.

Expect those methods, it is necessary to improve the pricing model of financial derivatives from the following aspects:

Add more practical factors: Basic derivatives pricing-setting models, such as the Black-Scholes model, often contain idealized assumptions, such as frictionless markets and a normal distribution of stock price fluctuations. To get closer to reality, this paper can add more practical factors to the model, such as transaction costs, market liquidity, jumping behavior of asset prices, random volatility, etc.

Leveraging data-driven approaches: With the development of big data and machine learning technologies, data-driven approaches are becoming more widely used in the pricing of financial derivatives. Using a large amount of historical data can help us estimate model parameters more accurately and also help us capture richer market information. For example, a deep learning approach can be used to learn a model that automatically captures a variety of complex market dynamics.

Developing more efficient numerical methods: Many financial derivatives pricing problems rely on numerical methods, such as Monte Carlo simulation, finite difference method, binary tree method, etc. To solve these problems more efficiently, this paper need to continuously develop and improve these numerical methods [13].

Interdisciplinary knowledge and technology: finance, mathematics, physics, computer science and other aspects of knowledge and technology can be used to improve the pricing model of financial derivatives. For example, many methods in quantitative finance are derived from physics, such as quantum finance, thermodynamic models, and so on. In addition, optimization methods, high performance computing and other computer science techniques have also played an important role in the pricing of financial derivatives.

A deep understanding of the market: Improving the pricing model of financial derivatives is not only a technical problem, but also a problem of understanding the market. Only with a deep understanding of the operating mechanism of the market can this paper develop a pricing model that is closer to reality.

6. Conclusion

Financial derivatives are a long-term subject, with the development of The Times, this paper also needs to put forward methods to keep pace with The Times, and constantly improve its pricing model system. In addition to this, this paper also has many other research directions, such as risk premium, the possibility of big data and machine learning techniques for dynamic portfolio selection, the problem of parameter inference and dynamic state recovery from options panel data, and the method of option pricing using fast Fourier transform. All in all, financial derivatives is an area that all researchers need to pay attention to at all times, and actively face new problems and new challenges that constantly arise.

References

- [1] Andersen, T. G., Fusari, N., & Todorov, V., 2015. *Parametric Inference and Dynamic State Recovery From Option Panels*. *Econometrica*, 83(3), pp.1081-1145.
- [2] Bollerslev, T., Tauchen, G. and Zhou, H., 2009. *Expected Stock Returns and Variance Risk Premia*. *The Review of Financial Studies*, 22(11), pp.4463-4492.
- [3] Brandt, M.W. and Santa-Clara, P., 2006. *Dynamic portfolio selection by augmenting the asset space*. *The Journal of Finance*, 61(5), pp.2187-2217.
- [4] Black, F., & Scholes, M. (1973). *The pricing of options and corporate liabilities*. *Journal of Political Economy*, 81(3), 637-654.
- [5] Carr, P., & Madan, D., 1999. *Option valuation using the fast Fourier transform*. *Journal of Computational Finance*, 2(4), pp.61-73.
- [6] Cox, J. C., Ross, S. A., & Rubinstein, M. (1979). *Option pricing: A simplified approach*. *Journal of Financial Economics*, 7(3), 229-263.
- [7] Dixon, M. F., Klabjan, D., & Bang, J. H., 2019. *Classification-based financial markets prediction using deep neural networks*. *Algorithmic Finance*, 8(2), pp.137-158.
- [8] Gatheral, J., 2006. *The Volatility Surface: A Practitioner's Guide*. John Wiley & Sons.
- [9] Geman, H., El Karoui, N., & Rochet, J.C, 1995. *Changes of Numeraire, Changes of Probability Measure and Option Pricing*. *Journal of Applied Probability*, 32(2), pp.443-458.
- [10] Healy, P. M., & Palepu, K. G., 2001. *Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature*. *Journal of Accounting and Economics*, 31(1-3), pp.405-440.
- [11] Heston, S. L. (1993). *"A Closed-Form Solution for Options with Stochastic Volatility with Applications to Bond and Currency Options."* *The Review of Financial Studies*, 6(2), 327-343.
- [12] Merton, R. C. (1976). *"Option Pricing when Underlying Stock Returns are Discontinuous."* *Journal of Financial Economics*, 3(1-2), 125-144.
- [13] Zerilli, P., 2001. *Option Pricing and Replication with Transaction Costs and Dividends*. *Journal of Economic Dynamics and Control*, 25(11), pp. 1783-1821.

Construction and Analysis of New Quality Productivity Evaluation Index System in Shanghai

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Abstract: The development of new quality productivity is a significant strategic decision focused on high-quality economic development. Shanghai, as an influential international metropolis, leads the nation in scientific innovation, technological innovation, and industrial innovation, playing a pioneering and demonstrative role in promoting new quality productivity. This paper constructs an evaluation index system by collecting relevant data on new quality productivity from authoritative websites and integrating these data to present and analyze the evaluation index system for new quality productivity in Shanghai. The constructed evaluation index system comprises four primary indicators: scientific and technological innovation, industrial development, talent, and green development, along with corresponding secondary indicators. The study reveals that although there is room for improvement in innovation efficiency in Shanghai, the city shows a positive development trend in new quality productivity, particularly in the number of high-tech enterprises and investment in scientific research. This paper aims to provide a comprehensive understanding of the development status of new quality productivity in Shanghai and offer reference value for analyzing new quality productivity nationwide.

Keywords: Shanghai, New Quality Productivity, Development Level Measurement, Evaluation Index System.

1. Introduction

In the context of profound global economic transformation and rapid technological advancement, new quality productivity has emerged as a new engine driving economic and social development, becoming a crucial factor in national competitiveness. As China's economic center, the development level of Shanghai's new quality productivity is not only vital for the region's economic transformation and upgrading but also has far-reaching impacts on the national and global economic landscape. Therefore, analyzing the development level of Shanghai's new quality productivity is of great significance for understanding development trends and formulating effective policy measures. This paper first introduces the foundational overview of the development of new quality productivity in Shanghai, emphasizing the importance and objectives of the research. Subsequently, the paper constructs a comprehensive evaluation index system and, through the collection and processing of relevant data, analyzes the development level of Shanghai's new quality productivity. This provides

a new perspective and basis for understanding the development status of new quality productivity in Shanghai and helps inform relevant decision-making.

2. Overview of the Development Foundation of Shanghai's New Quality Productivity

"The acceleration of new quality productivity development to solidify high-quality growth" [1] highlights China's strategic shift towards "new" and "quality" in economic development. Since the formal introduction of the concept of new quality productivity, the academic community has extensively explored its connotations and characteristics. New quality productivity refers to a comprehensive ability driven by innovation, aimed at improving production efficiency and quality through technological advancements, informatization, and intelligence, characterized by high technology, high efficiency, and high quality. Unlike traditional productivity, it is a new engine for economic and social development and a new driving force for Chinese-style modernization [2]. New quality productivity encompasses various fields, including intelligent manufacturing, new-generation information technology, new energy technology, and biotechnology. The development in these areas has disrupted traditional production methods and development paths, reconstructing high-quality economic development. The development of new quality productivity is particularly prominent in the Yangtze River Delta urban agglomeration. By 2023, the GDP of the Yangtze River Delta accounted for about a quarter of the national total, with an economic aggregate reaching 30.5 trillion yuan. As the leading city in the Yangtze River Delta integration, Shanghai plays a pivotal role in "high quality" development. Shanghai, also the top economic center city in the country and a global metropolis, achieved a regional GDP of 4.721866 trillion yuan in 2023, maintaining its position as the leading national economic center city. At constant prices, this represents a 5.0% increase over the previous year. From the perspective of industrial growth, the added value of the tertiary industry was 3.55096 trillion yuan, an increase of 6.0%. In terms of per capita disposable income, the per capita disposable income of Shanghai residents was 84,834 yuan in 2023, a nominal increase of 6.6% over the previous year, with a real increase of 6.3% when adjusted for inflation. Overall, Shanghai's economic development is progressing steadily, with a solid promotion of high-quality economic growth, forming an essential foundation for the development of new quality productivity. Shanghai has a leading advantage in developing new quality productivity, excelling in scientific and industrial innovation nationwide and having made significant efforts in new quality productivity layout. Furthermore, with the deepening of a new round of technological revolution and industrial transformation, many new technologies and industries are still in their infancy, and the foundational and developmental levels among countries are relatively similar. This provides an opportunity for Shanghai to seize the moment and continually develop new quality productivity, achieving breakthroughs through strategic maneuvering [3]. Despite the rising complexity, severity, and uncertainty of the external environment, economic development faces challenges. Shanghai is still in a transition period between old and new industries and between traditional and new drivers of growth, relying significantly on old drivers. Additionally, industrial development faces constraints from population, resources, and the environment. In 2023, the national intensity of research and experimental development (R&D) expenditure (as a percentage of GDP) was 2.64%, with basic research funding accounting for 6.57% of R&D expenditure. The proportion of basic research in total social R&D investment during the 14th Five-Year Plan period still lags significantly behind developed countries. Although China's overall R&D investment is comparable to the EU average, the shortfall in basic research investment is substantial, with a significant gap compared to developed countries. Moreover, many scientific research achievements in China have not been commercialized or converted into actual productivity. In developing new quality productivity, Shanghai needs to pioneer mechanisms for the industrialization of scientific and technological achievements to set an

example. How to enhance the quality of the economy has become a crucial issue in Shanghai's development of new quality productivity.

3. Construction and Analysis of Shanghai's New Quality Productivity Evaluation Index System

3.1. Data Sources and Index System Construction

New quality productivity encompasses aspects such as innovation-driven development, green and low-carbon initiatives, open integration, and human-centric intrinsic values. To assess the development level of new quality productivity in Shanghai, a series of measurement indicators need to be established. Given the incomplete nature of data collection, this paper selects representative indicators to construct a comprehensive evaluation system composed of 4 primary indicators and 9 secondary indicators. The primary indicators are: Technological Innovation, Industrial Development, Talent, and Green Development. The secondary indicators are further detailed as follows: Technological Innovation Indicators: Number of High-Tech Enterprises, Number of High-Value Invention Patents per 10,000 People, and Research and Development (R&D) Expenditure (in 100 million yuan). Industrial Development Indicators: Proportion of the Tertiary Industry and Added Value of Core Digital Economy Industries. Talent Indicators: Number of High-Skilled Talents and Gross Enrollment Rate in Higher Education. Green Development Indicators: Energy Consumption Reduction Rate per Unit GDP and Forest Coverage Rate. Data for the past four years were collected from relevant authoritative departmental websites. These indicators were compiled and analyzed using cluster analysis to identify differences and characteristics of various indicators, which serve as a reference for evaluating the development level of new quality productivity in Shanghai [4].

Table 1: Construction of the Index System

Technological Innovation Indicators	2023	2022	2021	2020
Number of High-Tech Enterprises	Over 24,000	Over 22,000	Over 20,000	17012
Number of High-Value Invention Patents per 10,000 People	50.2	40.9	33.2	60.21
R&D Expenditure (in 100 million yuan)		1981.6	1700	

Table 1: (continued)

Industrial Development Indicators	2023	2022	2021	2020
Proportion of the Tertiary Industry	75.2 %	74.12%	73.3%	73.1%
Added Value of Core Digital Economy Industries (in 100 million yuan)	6600	5500		
Talent Indicators	2023	2022	2021	2020
Number of High-Skilled Talents (in 10,000 people)				116
Gross Enrollment Rate in Higher Education (%)	60.2%	59.6%	57.8%	
Green Development Indicators	2023	2022	2021	2020
Energy Consumption Reduction Rate per Unit GDP (%)		6.1%	1.5%	

Table 1: (continued).

Forest Coverage Rate (%)	18.81%	18.51%	19.42%
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3.2. Analysis of the Index System

Based on the data from Shanghai's technological innovation indicators, the number of high-tech enterprises has shown a significant growth trend, increasing from less than 10,000 in 2020 to over 24,000 in 2023. This indicates a tremendous potential for growth in high-tech enterprises in Shanghai, showcasing robust innovation vitality and strong momentum for the development of new quality productivity. Regarding the number of high-value invention patents per 10,000 people, it peaked at 60.21 in 2020, achieving the “13th Five-Year Plan” target. Despite a steady year-on-year increase, from 33.2 in 2021 to 40.9 in 2022 and 50.2 in 2023, the growth rate of innovation activities has slowed down. In terms of Research and Development (R&D) expenditure, it increased from 170 billion yuan in 2021 to 198.16 billion yuan in 2022, an approximate growth of 16.56%. This demonstrates a continuous increase in investment in R&D, reflecting the high importance placed on technological innovation by the government and enterprises. Overall, Shanghai's technological innovation indicators show a positive development trend, with the significant growth in the number of high-tech enterprises indicating notable success in nurturing innovative enterprises. The steady increase in R&D funding provides a solid material foundation for ongoing technological innovation. However, the stagnation in the peak number of high-value invention patents per 10,000 people since 2020 suggests that Shanghai needs to focus on enhancing innovation quality and efficiency, avoiding the mere pursuit of quantity growth. To further enhance technological innovation capabilities, it is recommended that Shanghai continue to optimize the innovation environment, increase R&D investment, and improve R&D output efficiency. Additionally, strengthening intellectual property protection and encouraging more original research and innovation activities by enterprises and individuals are crucial. Furthermore, fostering cross-regional cooperation to create a collaborative innovation environment will promote the overall technological innovation level in the Yangtze River Delta region [5].

According to the industrial development indicators of Shanghai, the proportion of GDP from the tertiary industry has grown from 73.1% in 2020 to 75.2% in 2023, indicating a slight upward trend. This shows that the tertiary industry is playing an increasingly important role in Shanghai's economic development. Regarding the added value of the core digital economy industries, it was 550 billion yuan in 2022, increasing to 660 billion yuan in 2023, maintaining about 13% of the city's GDP. This significant growth reflects the rapid expansion of the digital economy in Shanghai, contributing substantially to overall economic efficiency and competitiveness. Given the rapid growth of the digital economy and the increasing proportion of the tertiary industry in GDP, it is expected that Shanghai's economy will continue to transition towards a service-oriented and digital economy. The government and enterprises should continue investing in digital infrastructure and the service industry to accelerate the development of new quality productivity in Shanghai.

From the talent indicators, it is evident that in 2020, Shanghai formed a large-scale, high-quality skilled talent pool well-aligned with industrial development needs. Statistics show that the proportion of high-skilled talent among registered skilled laborers in Shanghai reached 35.03% in 2020, with a total of approximately 1.16 million high-skilled talents. This demonstrates Shanghai's strong attractiveness and competitiveness for talent nationwide, with the concentrated flow of high-skilled talents promoting knowledge and technology dissemination, accelerating regional innovation activities, and optimizing economic structure. In terms of the gross enrollment rate in higher

education, the data for Shanghai was 59.6% in 2022, an increase from 57.8% in 2021, continuing to grow in 2023. The increase in the gross enrollment rate in higher education over the past three years reflects the richness and quality of higher education resources in Shanghai, which is crucial for attracting and cultivating high-end talents. These quality educational resources are also key drivers for technological innovation and industrial upgrading. The growth trend in the gross enrollment rate in higher education in Shanghai indicates a further enhancement of potential in talent cultivation and scientific research innovation in the future.

Combining the data from industrial development and talent indicators, it is clear that Shanghai demonstrates strong advantages in attracting talent and higher education resources. This advantage creates a virtuous cycle: on one hand, the rich talent resources and high-quality university resources mutually promote each other, enhancing regional innovation capabilities and economic vitality; on the other hand, the growth of the digital economy further attracts more outstanding talents, creating a talent aggregation effect. However, the high concentration of talent might also pose challenges such as rising housing prices, increased living costs, and competitive pressures, potentially affecting long-term talent retention and development. Therefore, while benefiting from the talent dividend, Shanghai needs to continuously improve relevant policies to ensure the sustainable development and utilization of talent resources. From a practical perspective, Shanghai's significant advantages in talent quantity and educational resources are crucial for the continuous and healthy development of new quality productivity. At the same time, it is important to address potential challenges through policy guidance and management innovation to achieve coordinated progress in talent and economic and social development in Shanghai.

According to the green development indicators of Shanghai, the energy consumption reduction rate per unit GDP decreased from 1.5% in 2021 to 6.1% in 2022. The energy consumption per unit GDP reflects the amount of energy consumed to produce one unit of Gross Domestic Product (GDP), indicating the relationship between economic growth and energy consumption. The increase in the energy consumption reduction rate per unit GDP shows that Shanghai has managed the relationship between economic growth and energy consumption well, achieving effective control over energy consumption while maintaining or increasing economic output. This implies that Shanghai is making strides in more efficient energy use and optimizing industrial structure upgrades. On the other hand, the forest coverage rate reflects the richness of forest resources and the state of ecological balance. The forest coverage rate decreased from 19.42% in 2021 to 18.51% in 2022 but rebounded to 18.81% in 2023. The fluctuation in forest coverage rate may reflect the trade-offs between economic development and environmental protection in Shanghai. Balancing economic growth with environmental protection is a significant challenge that the Shanghai government and enterprises need to address. Overall, these two indicators show that Shanghai is striving to achieve green development while pursuing economic growth. The reduction in energy consumption per unit GDP and the fluctuation in forest coverage rate indicate that Shanghai is attempting to achieve a win-win situation for economic growth and environmental protection through technological innovation, industrial upgrades, and policy guidance.

4. Conclusion

As China's economic center and an international metropolis, Shanghai has demonstrated significant leadership and exemplary effects in the development of new quality productivity. By constructing a comprehensive evaluation index system that encompasses four core dimensions—technological innovation, industrial development, talent support, and green development—this paper provides an in-depth analysis of the current state and trends of new quality productivity in Shanghai. Despite the room for improvement in innovation efficiency, the strong momentum and substantial development potential in the field of new quality productivity in Shanghai are evident. This paper not only

elaborates on the advantages and challenges of Shanghai's new quality productivity but also provides policymakers and researchers with a set of quantitative evaluation tools through meticulous data integration and analysis. These tools are instrumental in accurately identifying and promoting the key elements of new quality productivity, thereby fostering sustainable high-quality economic development. In the future, Shanghai is expected to further leverage its robust technological foundation and open innovation environment to optimize resource allocation, enhance innovation efficiency, and lead new quality productivity to higher levels. This will contribute more "Shanghai wisdom" and "Chinese solutions" to national and global economic development.

References

- [1] *People's Daily*. (2024, February 2). *Accelerate the development of new quality productivity and steadily promote high-quality development*. *People's Daily*, p. 1.
- [2] Zhang, X., & Yu, M. M. (2024). *Narration and discussion of new quality productivity: Epoch significance, practical paths, and Chinese modernization*. *Journal of Hebei University of Economics and Business*, 1-9. <https://doi.org/10.14178/j.cnki.issn1007-2101.20240708.004>
- [3] Gong, Z. (2024, May 24). *Accelerate the development of new quality productivity to inject strong momentum into high-quality development*. *Study Times*, p. 1. <https://doi.org/10.38216/n.cnki.nxxsb.2024.000098>
- [4] Lu, J., & Guo, Z. A. (2024). *New quality productivity in urban areas: Level measurement, spatiotemporal evolution, and influencing factors—A study based on panel data of 277 cities in China from 2012 to 2021*. *Journal of Social Sciences*, 1-10. <http://kns.cnki.net/kcms/detail/21.1012.C.20240704.1451.004.html>
- [5] Wu, J. F., & Wan, X. Y. (2024). *Measurement of development level, regional disparity, and dynamic laws of new quality productivity in China*. *Technology Economics*, 43(04), 1-14.

Research on Multi-round First-price Sealed Bidding Strategy Based on Bidders' Incomplete Information Game

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Abstract: Bidding mechanisms are essential for the market and policies because bidding patterns have an impact on economic rationality and are crucial for the functioning of the construction industry. Thus, this paper consolidates the findings from the multiple rounds of combinatorial auctions, the winner's curse in incomplete information auctions, and game theory. There is no doubt that bidding mechanisms play an important role in markets and policies in economic activities. This paper's related topics of interest would be multi-round combinatorial auctions, winner's curses in project bidding, and game theory in incompletely informed auctions. This paper reviews the literature and employs the models based on the Nash equilibrium. There are many types of bidding strategies such as first, second, and successive bid bidding strategies, cooperative bidding, non-cooperative bidding, and how information asymmetry plays a critical role in these strategies. As mentioned before, criterion-based adaptive bidding strategies are not sensitive to market conditions and can provide near-optimal solutions. In the same way, iterative learning also prevents the occurrence of the winner's curse in the multi-stage bidding context. UK auctions are seen as more efficient relative to other locations because information costs are lower, while game-theory-based strategies improve mechanisms for obtaining tasks and cost optimization in mobile crowdsourcing tasks. The use of electronic auctions can help a market become more fully rational and efficient. The methodology of game theory helps explain the outcomes of auctioning and emphasizes innovations in automation as well as policies. Therefore, this paper's implications are significant to the current and ongoing literature on efficiency, strategic behaviour, and policy in bidding mechanisms across different markets.

Keywords: Bidding mechanisms, Combinatorial auctions, incompletely informed auction, Game theory.

1. Introduction

The study of bidding mechanisms in economic activities is crucial for understanding market dynamics and improving policy decisions [1]. Bidding behavior, particularly in the construction industry, has significant implications for economic efficiency and rationality [2]. This summary explores the key findings from various research studies on bidding mechanisms, including multi-round combinatorial auctions, the winner's curse in construction bidding, and the role of game theory in auctions with incomplete information.

Literature Review: Arai and Morimoto analyzed the economic rationality of bidding behavior in the construction industry in Shikoku, highlighting the inefficiencies of new market entrants in bidding lower prices and the importance of these findings for policymaking. Sui and Leung proposed an adaptive bidding strategy for multi-round combinatorial auctions, demonstrating its effectiveness in various market environments without prior knowledge. Ahmed et al. examined the winner's curse in construction bidding, suggesting that a multistage bidding environment can mitigate this issue through learning from past decisions. Milgrom provided a primer on auction formats, discussing their efficiency and common pitfalls for bidders. Coppinger, Smith, and Titus compared different auction formats, revealing that English auctions are the most efficient. Wang et al. introduced a multi-round bidding strategy based on game theory for crowdsensing tasks, showing its superiority in task acquisition and cost reduction. Harsanyi explored games with incomplete information, emphasizing the strategic uncertainty and the role of Nash equilibria. Engelbrecht-Wiggans and Katok investigated the impact of regret on bidding behavior in sealed-bid auctions, highlighting behavioral anomalies. Bag et al. proposed SEAL, a sealed-bid auction protocol without auctioneers, enhancing transparency and integrity. Levin provided a comprehensive overview of auction theory, including the concepts of revenue equivalence and the winner's curse.

Research Findings: Arai and Morimoto found that new entrants in the construction industry were less efficient in bidding lower prices, emphasizing the need for informed policymaking to address these inefficiencies. Sui and Leung's adaptive bidding strategy in multi-round combinatorial auctions demonstrated robustness in adapting to different market conditions and achieving near-optimal outcomes. Ahmed et al. highlighted the prevalence of the winner's curse in construction bidding and suggested that multistage bidding environments could help mitigate its effects through iterative learning. Milgrom identified that auction formats like the English auction are more efficient due to their simplicity and lower information costs. Coppinger, Smith, and Titus confirmed the higher efficiency of English auctions compared to Dutch auctions and sealed-bid formats. Wang et al. showed that their game theory-based multi-round bidding strategy significantly improved task acquisition and cost efficiency in mobile crowdsensing. Harsanyi underscored the complexity of strategic interactions in games with incomplete information, proposing probabilistic models to manage uncertainties. Engelbrecht-Wiggans and Katok demonstrated that regret significantly influences bidding behavior, often leading to overbidding in sealed-bid auctions. Bag et al. introduced an innovative auction protocol that ensures transparency and integrity without the need for auctioneers. Levin explained that while revenue equivalence holds in certain auction formats, common value auctions can lead to the winner's curse, which can be mitigated through information aggregation in large auctions.

In conclusion, these studies collectively enhance our understanding of bidding mechanisms, revealing critical insights into efficiency, strategic behavior, and policy implications in various auction formats and market environments.

2. Theoretical basis

2.1. Game theory

Games are defined as the organismic relationship existing between two or more individuals, each of which tries to impose on the others the fulfillment of his own volition under threat of equivalent retaliation [3].

Cooperative and non-cooperative games It is important to categorize games as cooperative or non-cooperative games. In the framework of cooperative games, which participants can make and give promises in advance, there are cooperative and non-cooperative games.

There are yet two more classifications that can be made regarding games: the zero-sum games and the non-zero-sum games. A zero-sum game means that the entire benefit, especially in terms of power, goes to only one of the participants while in a non-zero-sum game, the benefit that goes to the participants is otherwise.

As with other approaches, games can also be classified according to the extent of information that is revealed among the players: complete information games and incomplete information games. In complete information games, the strategy set of the players is perfectly known by each of the players; in incomplete information games, the strategy set of the players is only partially known by each of the players [4].

Overview of Nash equilibrium:

The Nash equilibrium refers to the specific strategies where a player will not have an incentive to alter their strategy if the other players in the game are going to play those strategies involved [5].

This is the best defensible strategy of participants in the game, given the strategic move of the opponents. It is one of the major theories that govern the interaction of players in the game, and it defines the reasonable behavior of the players.

It is important to note that in some cases, a game's positive solution is not unique, meaning that there might be several Nash equilibria. Nash equilibrium can be applied to many situations and can explain and even predict outcomes in social situations.

2.2. Single-round first-price sealed auction model

This is where the bidders put forward bids simultaneously without seeing what others have bid, typical of oral auctions. Finally, whoever bid the highest gets the object of auction and he pays for the amount bid by him. All participants provide the offer at the same time enclosed in envelopes and no participant has the knowledge of the offers of the others [6]. According to the rules of the auction the participant with the greatest offer gets the object, and the price is the offer he gives.

This mechanism is rather rigid and can be implemented on its own, and while it has no major complications, it is not without drawbacks. For instance, envisage the participant understating its true worth, which means that the object is overpriced on sale [7].

Common multi-round bidding mechanisms include English auction and Dutch auction. In English auction, players are allowed to either raise a bid or pass on passing the bidding back and forth until typically only one bid remains [8]. The last person bidder pays his bid. In Dutch auction, the first price that the auctioneer announces is quite high, and as the price drops, the participants are expected to buy at any price offered. Communicative bidding can be multiple rounds because each round is aimed at participants' improvements of their valuations based on the bidding signals they saw.

2.3. Incomplete information game

There is always imperfect information in incomplete information games, and this leads to there being some information that some of the players have that the other players don't. Some of the variables involved in a game, for example, the costs and preferences of the other players, cannot be known by the other participants and therefore, participants must have a look at their opponents through some signals. Some of these signals may involve, but are not limited to, analyzing the opponent's track record, and their utterances, among others by synthesizing the signals, participants will develop a set of beliefs that act as the basis of decisions.

However, the participant behavior can also involve selective information sending to modify the conative plan of other participants. For instance, by acting appropriately, individuals can effectively demonstrate that they are a certain type of participant, and therefore stand out from all other types of participants. This signal transmission is thus a significant communication tool for the parties to

engage in negotiations in a way that may optimally balance the information gap. Thus, the actual decision-making behavior of the contributors is determined by the beliefs of other contributors. This is possible because, in the conditions of incomplete information, the only way for the participants to get the best benefits is to make the best decision as they see their opponents.

3. Equilibrium Analysis

3.1. Single-round bidding equilibrium

In a single-round bidding scenario with two participants, A and B, the true value V of the bidding target is uncertain and follows a specific probability distribution. Participants A and B each have their own valuations, v_A and v_B respectively, and must choose their bids accordingly. The set of strategies available to each participant includes all possible bids. If A bids b_A and B bids b_B , the outcome depends on the comparison of these bids. If $b_A > b_B$, A wins the target and earns a profit of $V - b_A$, while B's profit is zero. Conversely, if $b_A < b_B$, B wins and earns $V - b_B$, while A earns nothing. If the bids are equal, the target is randomly assigned, and the expected profit for each participant is $(V - b_A)/2$ or $(V - b_B)/2$.

To determine the Nash equilibrium, consider the optimal strategies for both participants. If Participant B adopts strategy b_B , participant A's optimal strategy is to bid $b_A = v_A$. Similarly, if participant A adopts strategy b_A , participant B's optimal strategy is to bid $b_B = v_B$. This leads to the conclusion that the strategy pair $(b_A = v_A, b_B = v_B)$ is the Nash equilibrium in this single-round incomplete information bidding game.

If Participant A deviates from the equilibrium strategy and bids $b_A' \neq v_A$, while Participant B continues to bid v_B , A's profit is reduced to $V - b_A'$, which is less than $V - v_A$. If A bids b_A while B deviates to $b_B' \neq v_B$, A's profit becomes zero, resulting in a loss compared to following the Nash equilibrium strategy. Similarly, any deviation by B from $b_B = v_B$ leads to a reduction in B's benefits when A bids v_A .

Therefore, any deviation from the equilibrium strategy results in lower benefits for the deviating participant, confirming that the strategy pair $(b_A = v_A, b_B = v_B)$ constitutes a stable Nash equilibrium [9].

3.2. Multi-round bidding dynamic equilibrium

In a multi-round bidding game, participants need to determine the optimal bidding behavior in each round based on a dynamic equilibrium strategy [10]. To solve this type of dynamic equilibrium strategy, dynamic programming is required.

First, it is necessary to define the strategy space of participants in each round, such as "bid" or "give up". Secondly, it is necessary to design the profit function of each round, considering not only the profit of the current round, but also the expected profit of future rounds.

Taking a two-round bidding game as an example, in the second round, the optimal strategy of the participant is to bid equal to his own valuation. In the first round, the bidding strategy of the participant needs to be combined with the expected profit of the second round. The optimal bidding strategy of the first round can be determined by the dynamic programming method, that is, the bid must be less than or equal to the expected profit of the second round.

Suppose there are two rounds of bidding games, the valuation of participant A is 100, and the valuation of participant B is 80. According to the dynamic equilibrium strategy, the optimal bid of A in the first round should be less than or equal to the expected profit of the second round, that is, 100. If A chooses to bid 90, he will get a profit of 90 in the first round and continue to get a profit of 100 in the second round, with a total profit of 190. If A chooses to bid higher than 100 in the first round,

although he may get higher returns in the first round, he will lose the target in the second round because he cannot afford the bid, and the total return will be reduced. Therefore, bidding 90 is A's optimal strategy, which conforms to dynamic equilibrium.

Through the above steps, the dynamic equilibrium strategy of each round in the multi-round bidding game can be determined. Next, it is necessary to analyze the stability of this dynamic equilibrium strategy. Specifically, it is necessary to consider whether the participants will deviate from the equilibrium strategy, what changes will occur in the benefits if the deviation occurs, and finally determine whether there is an incentive to change the strategy.

In the two-round bidding game, it is assumed that the equilibrium strategy of the first round is to bid less than or equal to the expected return of the second round. Participants may consider deviating in the first round and bidding higher than the expected return of the second round [11]. However, through analysis, it can be found that doing so will obtain higher returns in the first round but may lose the target in the second round because they cannot afford the bid. Overall, participants cannot obtain higher dynamic expected returns by changing the first-round strategy, so the dynamic equilibrium is stable.

3.3. Impact of incomplete information on equilibrium

In premise to the following proposition, when the undertakings are thrashing out the dynamic equilibrium strategy in a multi-round bidding game with incomplete information, the following factors are bound to play a major role. Firstly, the unclear value of participants themselves will affect the bid of them, and hence, influence the balance of the whole process in games. Second, since the valuation of the opponent is not certain, the participants will also be able to forecast the possible bidding strategy by the opponent which in turn influences the right bidding strategy the participants need to take to maximize profitability [12]. Due to the information insufficiency, it is equally challenging for the participants to predict the expected payoffs for future rounds where they intend to bid; this aspect will also have an impact on the current bidding decision.

Simultaneously, because of these stochastic factors, participants must achieve dynamic equilibrium on the playing field. On the other hand, they may also decrease the level of bidding aggressiveness for the decrease of risks. On the other hand, they can also proactively accrue more market information to eliminate gaps where possible [13]. In cases of significant unknown risks, people can choose strategies of expressionless bidding and make decisions based on probability distribution.

4. Conclusion

This paper analyses the phenomenon of bidding in economic activities, more so the winner's curse in construction bids and the use of game theory in incomplete information auctions. According to the analysis, it can be concluded that criteria-based adaptive bidding strategies which are able to withstand shocks in the market environment are close to optimal. In the context of multi-stage bid scenarios, iterative learning is able to substantially lessen the impact of the curse of the winning bidder and enhance the rationality and efficiency of the bid. Mobile crowdsourcing activities can be analyzed using Game theory techniques, especially in the bidding process with multiple bidders and where the cost is a critical factor. Furthermore, the fact that electronic auctions are deemed a means of enhancing market rationale suggests the proposition that strategic innovation can help make auction transactions more efficient.

As this study has both theoretical and practical findings, it is of commercial benefit to policy-forming institutions. It can therefore be concluded that by detailing the bidding strategies and their economic consequences, this research advances the understanding of how bidding practices should

be enhanced in order to rationalize the market. In construction organizations, this knowledge enables them to come up with more effective bidding strategies; avoid the winner's curse, and generally, control for the cost of acquiring projects. These insights will be helpful to policymakers to frame laws, which will act as a level playing field and encourage companies to carry out transparent bidding processes.

However, it is worthy to note that this study has its own limitations: The main source of data used in the study was secondary data hence limits the insights of the study. This involves a lack of first-hand information such as questionnaires or interviews which may restrict bidder behaviour and preference information. Future research could fill this gap by conducting primary data collection to capture the bidding strategies' trends in action. Additionally substantiated by other studies done to identify the specific aspects of the market environment that affect bidding strategies. By broadening the concept, the subsequent research can use such findings to enhance the precision and relevance of bidding structures in various domains.

References

- [1] Alvarez, R., & Nojournian, M. (2020). *Comprehensive survey on privacy-preserving protocols for sealed-bid auctions*. *Computers & Security*, 88, 101502.
- [2] Arai, K., & Morimoto, E. (2023). *Case study in Shikoku: changes in the bidding behaviour of businesses*. *International Journal of Construction Management*, 23(2), 225-233.
- [3] Ho, E., Rajagopalan, A., Skvortsov, A., Arulampalam, S., & Piraveenan, M. (2022). *Game Theory in defence applications: A review*. *Sensors*, 22(3), 1032.
- [4] Cabrerizo, F. J., Al-Hmouz, R., Morfeq, A., Martínez, M. Á., Pedrycz, W., & Herrera-Viedma, E. (2020). *Estimating incomplete information in group decision making: A framework of granular computing*. *Applied Soft Computing*, 86, 105930.
- [5] Ye, M., Han, Q. L., Ding, L., & Xu, S. (2023). *Distributed Nash equilibrium seeking in games with partial decision information: A survey*. *Proceedings of the IEEE*, 111(2), 140-157.
- [6] Kalan, D., & Ozbek, M. E. (2020). *Development of a construction project bidding decision-making tool*. *Practice Periodical on Structural Design and Construction*, 25(1), 04019032.
- [7] Milgrom, P. (2021). *Auction research evolving: Theorems and market designs*. *American Economic Review*, 111(5), 1383-1405.
- [8] Pop, C., Prata, M., Antal, M., Cioara, T., Anghel, I., & Salomie, I. (2020, September). *An Ethereum-based implementation of English, Dutch and First-price sealed-bid auctions*. In *2020 IEEE 16th International Conference on Intelligent Computer Communication and Processing (ICCP)* (pp. 491-497). IEEE.
- [9] Tyagi, N., Arun, A., Freitag, C., Wahby, R., Bonneau, J., & Mazières, D. (2023, November). *Riggs: Decentralized sealed-bid auctions*. In *Proceedings of the 2023 ACM SIGSAC Conference on Computer and Communications Security* (pp. 1227-1241).
- [10] Wang, E., Yang, Y., Wu, J., & Wang, H. (2019). *Multi-round Bidding Strategy Based on Game Theory for Crowdsensing Task*. In *Security, Privacy, and Anonymity in Computation, Communication, and Storage: 12th International Conference, SpaCCS 2019, Atlanta, GA, USA, July 14–17, 2019, Proceedings 12* (pp. 196-210). Springer International Publishing.
- [11] Xiao, J., Gao, Q., Yang, Z., Cao, Y., Wang, H., & Feng, Z. (2023). *Multi-round auction-based resource allocation for edge computing: Maximizing social welfare*. *Future Generation Computer Systems*, 140, 365-375.
- [12] Liu, Y., Yang, N., Dong, B., Wu, L., Yan, J., Shen, X., ... & Huang, Y. (2020). *Multi-lateral participants decision-making: A distribution system planning approach with incomplete information game*. *IEEE Access*, 8, 88933-88950.
- [13] Li, S., & Wei, C. (2020). *A two-stage dynamic influence model-achieving decision-making consensus within large scale groups operating with incomplete information*. *Knowledge-Based Systems*, 189, 105132.

Current Situation, Problems and Suggestions of Agricultural Futures Market in China

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Abstract: The agricultural futures market occupies a central position in China's financial landscape, wielding substantial influence over the sustainable development of the national economy. Apart from its core roles in price discovery and risk management for agricultural products, this market acts as a catalyst for efficient allocation of resources and continuous financial innovation. Furthermore, it enhances market liquidity and amplifies China's global economic impact. As China's financial sector matures, the agricultural futures market will continue its dual role of bolstering agricultural prosperity and financial dynamism, despite encountering various challenges. This study explores the present state of China's agricultural futures market, evaluating metrics such as total market turnover and penetration. Analysis identifies several critical issues, including inadequate liquidity, susceptibility to market manipulation, speculative activities, and uncertain economic policies. To address these challenges, the paper proposes targeted strategies. The research outcomes carry significant implications for nurturing the sustainable and resilient growth of China's agricultural futures market.

Keywords: Agricultural futures, China, futures markets.

1. Introduction

The agricultural futures market in China plays a crucial role in its economy, marked by its diverse significance and rapid evolution. Firstly, it functions as a crucial tool for managing risks associated with price fluctuations, benefiting both farmers and agribusinesses through futures contracts that secure future prices.

Additionally, the futures market promotes fair pricing mechanisms for agricultural commodities, supporting informed decision-making among producers, consumers, and governments. This process not only guides rational production and consumption strategies but also influences governmental agricultural policies.

Furthermore, amidst global population growth and increased food demand, the agricultural futures market has expanded significantly in size and trading volume. This growth has attracted a growing number of investors, supported by advances in electronic trading platforms, thereby enhancing market efficiency and accessibility and driving its globalization.

Thus, the agricultural futures market is not only a cornerstone of China's agricultural economy but also a crucial component of the global financial system. Addressing challenges within this market is essential for its sustainable development and broader societal benefits. This article aims to explore

the current landscape of the agricultural futures market in China, identify potential challenges, and propose practical solutions to these issues.

2. Current Situation

The dawn of China's agricultural futures market began in the late 1980s and early 1990s, aligning with the gradual shaping of the nation's market-driven economic system and the ongoing reforms spurred by the policy of openness. This era marked the debut of futures markets as an innovative financial tool within China. A crucial landmark arrived in 1990 with the founding of the Zhengzhou Commodity Exchange (ZZME), a pivotal juncture as the country's first futures exchange. This milestone officially set in motion the course of futures trading in China [1].

During subsequent years, China witnessed a significant expansion in its futures market. Successively, the Dalian Commodity Exchange and the Shanghai Futures Exchange were founded, accompanied by the gradual introduction of diverse agricultural futures contracts such as those for corn, soybean, and cotton. Throughout this era, the principal role of China's agricultural futures market evolved to encompass vital functions such as facilitating price discovery mechanisms and providing essential risk management tools tailored for farmers and enterprises alike [2].

Since the dawn of the 21st century, China's agricultural futures trading sector has experienced a gradual evolution, driven by improved regulatory frameworks and the optimization of market mechanisms. The strategic objective of "steady advancement of the futures market" was first outlined in the 2001 Tenth Five-Year Plan. The pivotal moment came with the issuance of the "Guidelines for Further Regulating the Futures Market" by the State Council in 2004. This policy directive not only provided substantial backing for the market's development but also established a robust framework of legal protections to bolster its growth. Consequently, this era saw a marked surge in trading volumes and participant numbers, coupled with significant strides in market liquidity and operational efficiency [3].

Currently, the agricultural futures market in China stands as the second largest globally, trailing only behind the United States. This market features a broad selection of over 30 agricultural futures and options, covering key products like corn, soybeans, wheat, and apples [4].

China's agricultural futures market plays a crucial role in functions such as discovering prices, hedging risks, and integrating markets. Studies indicate that despite shortcomings in price discovery, the market effectively tracks price fluctuations and serves as a robust risk management tool during significant events like trade disputes, climate crises, and the COVID-19 pandemic. Notably, the apple futures market, launched on the Zhengzhou Commodity Exchange in 2017, has become the leading global contract for fruit futures. Research shows its strong performance in price discovery, risk management, and integration with spot markets, despite occasional periods of high volatility, especially during outbreaks [1].

Regarding the overall turnover of the agricultural market, the combined annual turnover between 2019 and 2020 dropped significantly from 462.49 billion yuan to 4.72 trillion yuan due to the pandemic's impact. However, following the initial containment of the pandemic in 2020-2021, turnover quickly recovered to 1.12 trillion yuan, indicating a stabilization trend in the agricultural options market from 2021 to 2023 (See Figure 1).

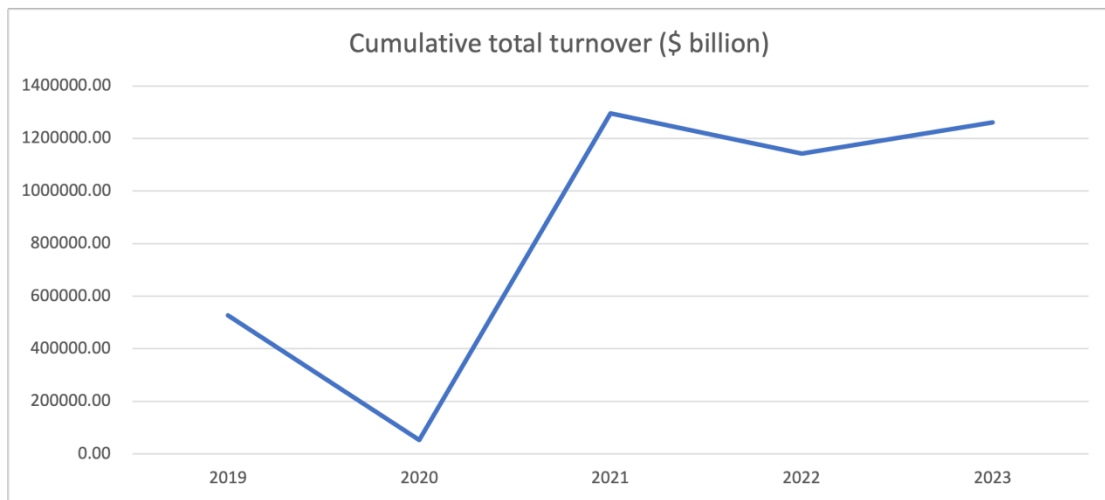


Figure 1: Agricultural futures market turnover

Meanwhile, in terms of market share, the share of the agricultural market in the total financial market is relatively high and stable at 15.91-23.23 percent in 2019-2023 (See Figure 2).

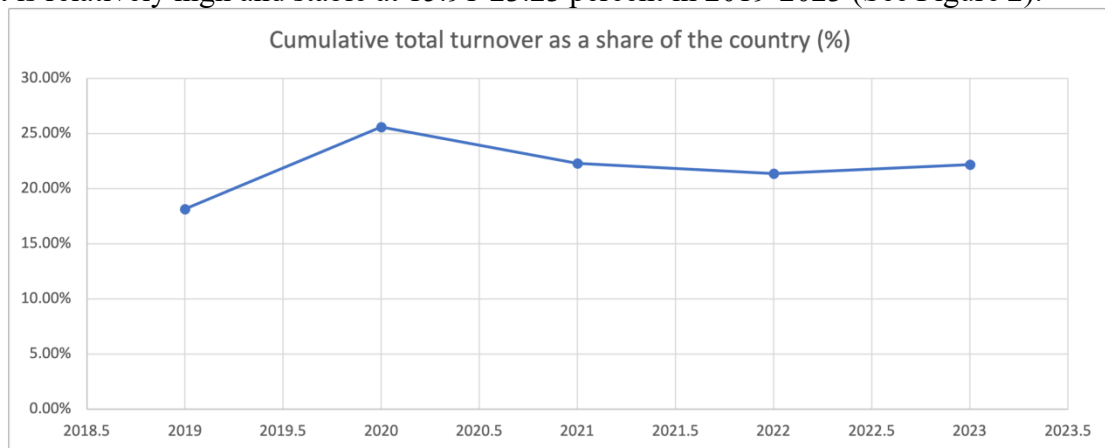


Figure 2: Agricultural markets as a share of financial markets

Furthermore, the Chinese authorities and pertinent regulatory bodies have consistently refined market regulations and policies to enhance market transparency and standardization. A notable example occurred in 2018 when the China Securities Regulatory Commission (CSRC) implemented the Measures for the Supervision and Administration of Futures Companies. These measures aimed to strengthen supervision over operations and management practices in the futures market, thereby protecting the interests of investors [5].

In conclusion, China's agricultural futures market has evolved significantly since its inception, progressively expanding to become a key player on the global agricultural futures platform. This market plays crucial roles in price discovery, risk management, and market integration. With ongoing improvements in market mechanisms and robust policy support, it is well-positioned to sustain strong and stable growth in the foreseeable future.

3. Problems

3.1. Market Illiquidity and Market Manipulation

Currently, China's agricultural futures market faces significant challenges with insufficient liquidity and frequent instances of market manipulation. The lack of liquidity severely limits the market's ability to accurately determine prices and manage risks, reducing its overall effectiveness and attractiveness. Academic research emphasizes a clear shortage of liquidity in China's agricultural futures market, particularly exacerbated during periods of financial market instability [6].

Furthermore, market manipulation is a recurring issue, especially when influential speculators exploit their financial leverage to manipulate prices, disrupting market order and causing considerable price volatility. Studies indicate that such manipulation seriously undermines market fairness, diminishes investor confidence, and increases market instability [7]. These issues not only hinder the market's healthy growth but also pose substantial risks and uncertainties for agricultural producers and consumers, potentially disrupting the efficient functioning of the agricultural supply chain.

Therefore, proactive steps are essential to improve market liquidity and strengthen regulations against market manipulation. These actions are crucial to promoting fair and stable market development.

3.2. Speculative Behaviour

In China's agricultural futures market, the intensification of speculative activities poses a significant challenge. The widespread prevalence of such practices has led to increased market price instability and heightened overall market risk. Extensive research highlights the pervasive nature of speculative behaviors within this market segment. These actions not only disrupt the customary trading dynamics but also amplify price instability [8]. This heightened instability adversely affects both agricultural producers and consumers, introducing uncertainty throughout the agricultural supply chain and escalating operational risks and expenses. Moreover, the surge in speculative activity has created artificial fluctuations in market supply and demand, thereby distorting price signals. This distortion complicates accurate assessments of market demand for agricultural producers, influencing their production decisions and resource allocation strategies. Consequently, the impacts extend well beyond mere financial volatility, influencing the operational and strategic aspects of agricultural businesses.

3.3. Uncertain Economic Policies

Undoubtedly, the unpredictability surrounding economic policies plays a crucial role in shaping the Chinese agricultural futures market. This uncertainty encompasses the impacts of both domestic policy changes and shifts in global economic policies, affecting market dynamics and potentially causing fluctuations in policy implementation. Studies show that such economic policy uncertainty distinctly weakens China's agricultural futures market, exacerbating market volatility and spreading risks throughout the sector [9]. This volatility becomes particularly evident during periods of trade tensions between China and the United States and adjustments in domestic economic strategies, highlighting how market risks are transmitted tangibly through agricultural futures trading. As a result, these developments not only disrupt market stability but also hinder agricultural product trade and influence price formation. For instance, during the mentioned trade conflicts, China's agricultural futures market saw significant turbulence, characterized by sharp price swings, reduced trading activity, and a notable decline in market confidence [10]. These economic uncertainties add layers of complexity and increase the market's risk profile, thereby further threatening its stability and sustainable growth prospects.

4. Recommendations

4.1. Improving Liquidity and Preventing Market Manipulation

Addressing the issues of liquidity and market manipulation in China's agricultural futures market requires strategic initiatives. Firstly, broadening participation by institutional and global investors is crucial to deepening market activity and reducing the impact of dominant market players. Research emphasizes that a diverse participant base enhances liquidity and stabilizes market dynamics.

Secondly, upgrading market infrastructure and advancing trading technologies are vital for robust and efficient operations. This includes improving trading platforms, speeding up transactions, cutting costs, and diversifying financial products to meet diverse investor demands. These improvements are essential for strengthening market resilience and responsiveness.

Additionally, enhancing market supervision is necessary to monitor large transactions and detect abnormal trading patterns to prevent manipulation. Key actions involve establishing strict regulations, enhancing transparency with real-time market data, and imposing severe penalties for manipulative behavior. These coordinated efforts aim not only to enhance liquidity but also to promote fair and stable market growth.

Implementing these comprehensive measures is expected to significantly enhance market liquidity, reduce manipulation, and reinforce overall market integrity and stability.

4.2. Curbing Speculative Behaviour

To combat the widespread issue of speculative activities in China's agricultural futures market, a set of specific actions can be enacted. Initially, bolstering market oversight is critical, necessitating the establishment and refinement of a robust regulatory framework to counter excessive speculation and market manipulation. Through the implementation of real-time monitoring of trading data, regulatory authorities can promptly detect and address abnormal trading patterns, thereby reducing speculative practices and maintaining orderly market conduct. Enhancing market supervision is crucial for effectively curbing speculative behavior and promoting a stable trading environment.

Furthermore, optimizing market mechanisms entails improving transparency and minimizing information asymmetry. This can be achieved by implementing comprehensive information disclosure protocols aimed at ensuring the accessibility and clarity of market data. Such measures empower investors to make well-informed decisions based on accurate market information, thereby lessening speculative behavior arising from information disparities. Additionally, prudent formulation of trading regulations, including the imposition of trading limits and increased margin requirements, helps to manage excessive speculation and safeguard sustainable market development.

Lastly, educating investors and enhancing their awareness of risks and investment strategies is essential. By promoting educational programs focused on improving risk management and fostering prudent investment practices, investors can gain a deeper understanding of the dynamics of the futures market and avoid uninformed speculation. Educational initiatives for investors play a crucial role in reducing speculative activities and strengthening market resilience in the long run.

4.3. Reducing Economic Policy Uncertainty

To mitigate the adverse effects of uncertainty in China's agricultural futures market due to economic policy, several strategies can be implemented. Firstly, the government ought to prioritize transparency in policy making, proactively disclosing changes and ensuring consistency and predictability. Regular updates on economic policies and market regulations will empower stakeholders to anticipate changes, preemptively strategize responses, and diminish market volatility and risk stemming from policy

uncertainties. Enhanced transparency is pivotal in curbing market fluctuations and bolstering confidence.

Secondly, effective communication channels between the government and market participants should be fortified. This facilitates timely understanding of market dynamics and needs, enabling swift adjustments to policies. Conducting policy hearings and market seminars to solicit feedback from stakeholders ensures that policy formulation remains informed and rational, thereby reducing uncertainties arising from policy shifts.

Moreover, bolstering macroeconomic oversight is crucial to maintaining a stable economic climate and mitigating external economic uncertainties' impact on the market. Particularly amidst global economic fluctuations and trade disputes, proactive governmental measures are imperative to stabilize domestic markets and shield the agricultural futures sector from external shocks. A stable macroeconomic environment is indispensable for fostering market health.

Lastly, fostering international cooperation is essential to stabilize trade relations and buffer against global market uncertainties affecting domestic markets. Strengthening ties with key trading partners will stabilize the agricultural trade landscape and ensure sustained market growth and stability.

5. Conclusion

Ultimately, addressing the challenges within China's agricultural futures market necessitates broad societal engagement and commitment. Effective resolution demands collaborative efforts involving governmental bodies, businesses, the public, and other stakeholders. By fostering such cooperation, we can effectively tackle the issues facing China's agricultural futures market and foster its sustained, robust growth. This, in turn, will bolster the steady advancement of China's agricultural economy. Our aspiration is that these endeavors will significantly bolster the development of China's agricultural futures market.

References

- [1] Hou, X., et al. (2022). *The trilogy of the Chinese apple futures market: Price discovery, risk-hedging and cointegration*. *Sustainability*, 14(19), 12864.
- [2] Yang, J., Li, Z., & Wang, T. (2020). *Price discovery in Chinese agricultural futures markets: A comprehensive look*. *Journal of Futures Markets*, 41(4), 536-555.
- [3] Li, J., & Zhang, J. (2015). *The current situation, problems, and countermeasures in the development of China's agricultural futures market*. *Financial Education Research*, (04), 74-80.
- [4] Chen, Z., Yan, B., & Kang, H. (2022). *Price bubbles of agricultural commodities: Evidence from China's futures market*. *Empirical Economics*, 64(1), 195-222.
- [5] Li, X., & Ma, W. (2023). *Analysis of the current situation, problems, and countermeasures in the development of China's agricultural futures market*. *Applied Economics and Policy Studies*, 804-814.
- [6] Xu, Y., et al. (2022). *Liquidity of China's agricultural futures market: Measurement and cross-market dependence*. *China Agricultural Economic Review*, 14(2), 443-463.
- [7] Cai, S. (2016). *Introduction to the development path of China's agricultural futures market*. *Social Sciences Academic Press*, 2016(03).
- [8] Hu, X., et al. (2024). *Extreme risk spillovers between US and Chinese agricultural futures markets in crises: A dependence-switching copula-covar model*. *PLOS ONE*, 19(3).
- [9] Lyu, Y., et al. (2021). *Economic uncertainty shocks and China's commodity futures returns: A time-varying perspective*. *Resources Policy*, 70, 101979.
- [10] Tan, Y., & Yang, S. (2024). *Challenges and countermeasures for China's food security under the background of risk superposition*. *Journal of South China Agricultural University*

The Impact of Tax Policy on the Attractiveness of Foreign Direct Investment (FDI): An Analysis of National Strategies and Economic Effects

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Abstract: In the context of globalization, the economic ties between countries are getting closer and closer, and capital flows are significantly stronger. Countries take measures to attract foreign direct investment (FDI), and among them, tax policy has a significant impact on the purpose of attracting foreign investment, as tax policy plays an important role in the country's macroeconomic policy. In this article, this paper will analyze the attractiveness of the tax policies adopted by FDI in recent years, and the impact of their tax policies on the economic effects of their respective countries, supported by the theories of internationalization, tax policy stability, and tax competition theory. Then, by summarizing and comparing the analysis, we can identify more attractive policies and analyze their reasons. Finally, it is concluded that tax policy plays a very important role in the development of the global economy, and countries can effectively attract foreign investment, promote economic growth and industrial upgrading by adjusting tax policies. However, due to the challenges of balancing attracting foreign investment with maintaining fair competition, tax base erosion and fiscal sustainability, countries need to improve policy transparency and stability, optimize the preferential tax structure, strengthen international tax cooperation and other measures to help their countries achieve higher quality development and bring higher economic benefits.

Keywords: Internationalization theory, Tax competition theory. Tax policy, Foreign direct investment, Comparative analysis.

1. Introduction

In the context of globalization, the economic ties between countries have become closer and closer, and the mobility of capital has been significantly enhanced. As a result, countries have begun to take measures to attract foreign direct investment (FDI), so that they can promote their own economic growth, increase employment, and promote technological advancement. Among them, tax policy has a significant impact on the purpose of attracting foreign investment, because tax policy plays an important role in the country's macroeconomic policy. Common tax policies include corporate income tax, value-added tax, capital gains tax, etc., and countries can attract foreign investment by adjusting the tax rates of different taxes, providing preferential tax regimes and exemption measures. The significance of the study can be illustrated in three aspects: first, the inflow of foreign investment can lead to an increase in total domestic investment, which can promote economic growth and

increase the employment rate and thus reduce unemployment. Second, there is competition between countries in tax policy, and the study of this competitive dynamics can provide theoretical support for international tax coordination. Third, understanding the differences in the effects of different tax policies on attracting foreign investment can help countries optimize their policies according to their own economic conditions and development goals, to better achieve reasonable and efficient resource allocation. In this article, I will analyze the tax measures they have adopted and how attractive they are to foreign direct investment, as well as their impact on economic growth, employment, and technological progress in their respective countries. Then, through summary and comparative analysis, we can identify more attractive policies and analyze their reasons. Finally, making a summary recommendation that can be given to international investors and the government.

2. The Impact of China's Tax Policy on FDI

Lower tax rates and preferential measures have effectively attracted a large amount of foreign investment and promoted the development of China's local economy [1]. The long-term and stable tax policy has enhanced the investment confidence of foreign-funded enterprises and reduced the negative impact of policy uncertainty on foreign direct investment. However, in the context of intensifying international tax competition, China still needs to continue to optimize its tax policy and improve its transparency and predictability.

2.1. Tax Policy

As of 2024, China's tax policy has undergone some important changes in the past five years, mainly focusing on optimizing the tax structure, supporting innovation-driven development, and improving the operating environment. These policy changes not only reduce the tax burden on enterprises and residents, promote innovation and green development, but also enhance China's competitiveness and influence in international tax governance.

2.1.1. Corporate Income Tax Optimization

Preferential Tax Policies for High-tech Enterprises: we will continue to promote the preferential corporate income tax rate of 15% for high-tech enterprises, and optimize the recognition standards and procedures, to better encourage enterprises to innovate. **R&D expenses are deducted:** starting in 2022, the additional deduction ratio for R&D expenses will be increased to 100%, which means that enterprises can deduct the actual R&D expenses by two times when calculating their taxable income.

These changes can encourage companies to increase R&D investment and improve their ability to innovate independently. By reducing the tax burden on high-tech enterprises and increasing the deduction of R&D expenses, the government hopes to play a role in promoting scientific and technological innovation and improving industrial competitiveness, which can not only enhance the competitiveness of Chinese enterprises in the global market but also promote the development of high-tech industries and the transformation and upgrading of the economic structure.

2.1.2. VAT Reform

VAT Rate Adjustments: since 2021, the VAT threshold for small-scale taxpayers has been raised to 150,000 yuan per month, further reducing the tax burden on small and micro enterprises. **VAT Credits are Refunded:** since 2023, China has implemented a larger-scale VAT refund policy, allowing eligible enterprises to apply for a refund of VAT credits.

The VAT reform is mainly aimed at the development of small and medium-sized enterprises [2]. The second change has greatly improved the cash flow situation of enterprises, reduced the financial

pressure on small and medium-sized enterprises, and helped these enterprises, especially the manufacturing industry, better cope with the challenges and problems encountered in their operations [3]. Overall, the changes in these measures will help promote stable economic growth, maintain mass employment, and enhance market vitality.

2.1.3. Individual Income Tax Reform

The content of the IIT reform is to deduct the special additional IIT, which is mainly reflected in the increase in the deduction standards for education, housing loan interest rates, and other aspects from 2022.

The expansion of this policy will help reduce the tax burden on residents, increase their disposable income, and enhance their spending power [3]. By increasing the number of special additional deductions, we will promote the growth of consumption, thereby stimulating domestic demand and promoting the steady development of the economy.

2.1.4. Green Tax Reform

(1) Environmental tax: Starting in 2020, the environmental tax will increase the requirements for emission standards. (2) Carbon tax pilots: From 2023, carbon tax pilots will be launched in some provinces and cities to encourage low-carbon production and green development.

This reform has boosted China's determination to go green, and the government intends to force companies to reduce their emissions and promote the green transformation of the industry. These measures focus on improving environmental quality and promoting sustainable economic development, which is in line with China's commitments and goals in global climate governance.

2.2. Changes in FDI flows

This paper will examine the changes in China's FDI flows from three periods, namely the early period of reform and opening, after China's accession to the WTO, and after the tax reform.

2.2.1. The Early Stage of Reform and Opening (1978-2000)

With the implementation of preferential tax policies, FDI has grown rapidly. Between 1983 and 2000, China's utilized foreign capital increased from US\$0.92 billion to US\$40.72 billion, with an average annual growth rate of 18.1 percent. The specific data was founded, as shown in Figure 1. (The data are from the official website of the National Bureau of Statistics)

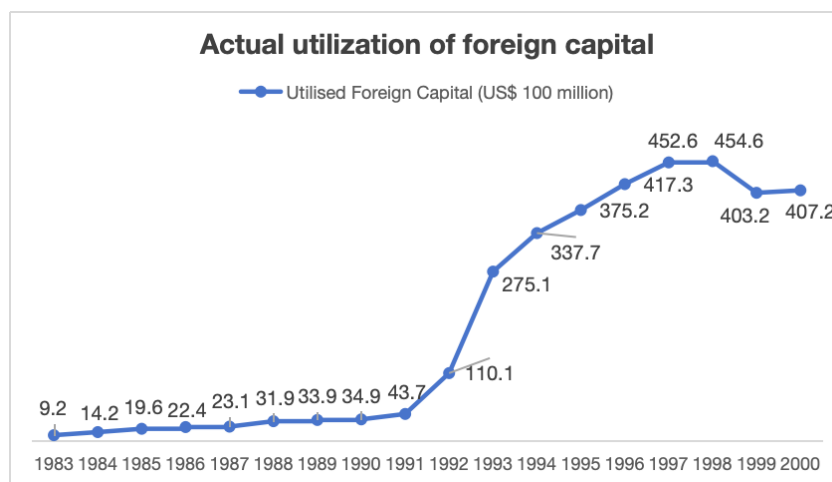


Figure 1: Actual utilization of FDI for China (1983-2000) (Photo credit: Original).

In the early days of China's reform and opening, China successfully attracted a large number of foreign enterprises by drastically reducing the corporate income tax rate and providing tax exemptions and rebates, which enabled foreign enterprises to fully enjoy the benefits when entering the Chinese market, which not only reduced operating costs but also increased investment returns.

2.2.2. After WTO Accession (2001-2010)

China's FDI inflow continued to increase, as shown in Figure 2.

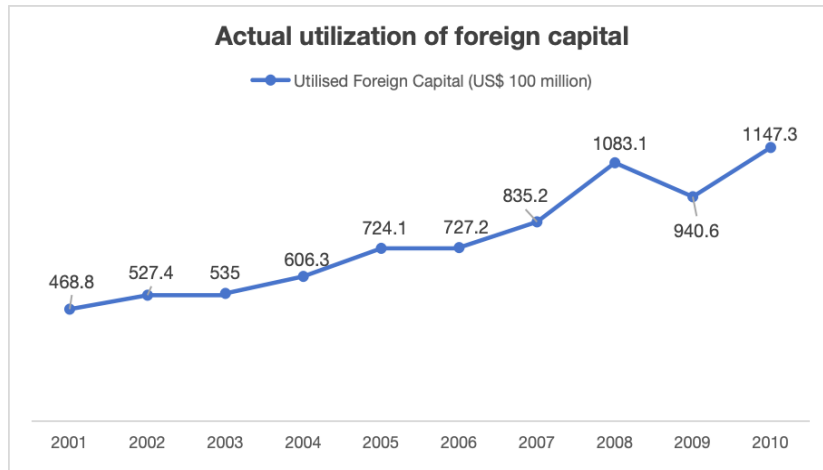


Figure 2: Actual utilization of FDI for China (2000-2010) (Photo credit: Original).

Reaching US\$46.88 billion in 2001 and US\$11.473 billion in 2010, with an average annual growth rate of 9.5%. (All data are from the official website of the National Bureau of Statistics)

2.2.3. Tax Reform (2011-Present)

FDI inflows from 2011 to 2024 will be visualized in this article, as shown in Figure 3. (All data are from the official website of the National Bureau of Statistics)

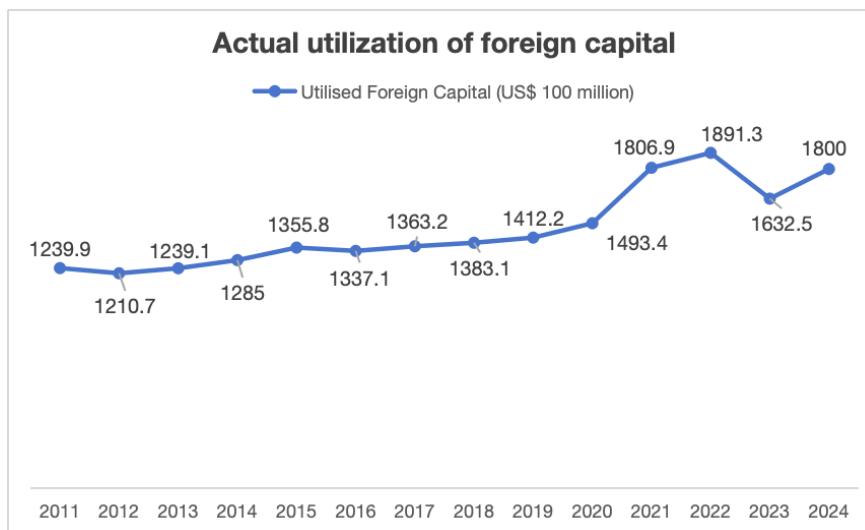


Figure 3: Actual utilization of FDI for China (2011-2024) (Photo credit: Original).

These data clearly show that despite the global economic fluctuations and trade frictions faced by China, FDI can still maintain stable growth.

2.3. The Economic Effects of Tax Policy on China

The economic effects of tax policy on China can be analyzed from economic growth, employment rate increase, technological upgrading and changes in tax revenue.

2.3.1. Changes in the Growth of the Economy

The inflow of foreign capital has greatly promoted the growth of China's economy because the capital, technology, and management experience brought by foreign-funded enterprises have improved China's productivity level and the transformation and upgrading of its industrial structure. In China's Guangdong Province, for example, the province's GDP has grown from 13.2 billion yuan in 1980 to 13 trillion yuan in 2024, with an average annual growth rate of more than 10% [4].

2.3.2. Growth in the Employment Rate

Foreign-funded enterprises create a great number of jobs, reduce the possibility of increasing the unemployment rate of the population, and at the same time increase the income level of the population, thereby contributing to social stability [5]. By 2024, foreign-funded enterprises will directly create more than 50 million jobs, which will indirectly lead to more employment possibilities. For example, foreign-funded enterprises in the manufacturing industry have driven the development of related supporting industries through the upstream and downstream of the industrial chain, such as raw material supply, logistics, and transportation.

2.3.3. Technological Innovation

Foreign-funded enterprises have brought advanced technology and management concepts to China, which has improved the technological progress and innovation ability of Chinese enterprises. For example, Shenzhen has gradually become an innovation hub in China by attracting R&D customer centers from foreign-funded high-tech companies.

2.3.4. Tax Revenues

Although there are many preferential tax policies, the introduction of foreign-funded enterprises has increased the tax base, which has increased the country's tax revenue as a whole. In 2024, foreign-funded enterprises will pay more than 20% of the country's total tax revenue. The economic growth effect brought by foreign-funded enterprises has also indirectly increased the tax revenue of other industries, including value-added tax and personal tax.

3. The Impact of U.S Tax Policy on FDI

3.1. Tax Policy

In August 2022, the Inflation Reduction Act (IRA) was signed into law. The law introduced certain reforms in terms of taxation. Broadly speaking, there are two aspects: the corporate minimum tax and the super fund tax.

The IRA introduces a new corporate minimum tax that applies to large companies with annual revenues of more than \$1 billion. These companies must pay a minimum tax rate of 15%. This policy is designed to ensure that high-profit companies do not avoid paying taxes altogether through tax avoidance strategies. The IRA reinstated taxes on crude oil and petroleum products to fund Superfunds. The levy is levied on crude oil received by U.S. refineries and imported petroleum products, which is levied at a rate of 9.7 cents per barrel of crude oil.

3.2. Changes in FDI Flows

Despite the implementation of tax policy changes in 2022 and 2023, overall FDI inflows maintained their growth trend, but at a slower pace. Here are the specific data on U.S. foreign direct investment (FDI) flows from 2021 to 2023, as shown in Table 1.

Table 1: The FDI changes for U.S. from 2021-2023.

Year	Total FDI inflows (USD billions)	Manufacturing FDI (USD billions)	Services FDI (USD billions)	Energy FDI (USD billions)
2021	211.2	68.5	105.3	37.4
2022	236.3	73.1	118.9	44.3
2023	240.5	70.2	122.4	47.9

In terms of manufacturing FDI, it will increase by about 6.7% in 2022 and decrease by about 4% in 2023. FDI in the manufacturing sector increased in 2022 but declined in 2023, likely reflecting the impact of tax policy changes on investment decisions in the sector [6]. As the superfund tax significantly increases the cost of manufacturing and importing chemicals, this may lead companies to reduce their investment in U.S. chemical manufacturing in 2023, which indirectly leads to a decline in manufacturing FDI.

3.3. The Economic Effects of Tax Policy on The United States

3.3.1. Economic Growth Impact

Positive impacts: First, the land after clearing the contaminated site can be reused for commercial and residential development, which will promote local economic development and increase the value of real estate. These clean-up projects can improve the quality of the community environment and attract new investment and residents [7]. Second, revenues from the Superfund tax can be used for other public investment projects, such as infrastructure and education, which can further boost economic growth.

Negative impacts: First, the increased tax burden may discourage investment in the chemical manufacturing industry, leading to the postponement or cancellation of certain projects, which can negatively impact overall economic activity. The American Chemical Association notes that such a tax could lead to a decrease in competitiveness within the industry, which in turn could affect economic growth. In addition to this, the increase in the cost of chemical manufacturing may lead to higher product prices, which in turn will affect downstream industries and consumers, leading to a slowdown in economic activity.

3.3.2. Employment Impact

Direct impact: The Superfund levy is designed to raise funds to clean up contaminated sites. These clean-up projects often require a lot of human resources, resulting in direct job creation. For example, there will be an increase in jobs involved in pollution assessment, monitoring, and physical clean-up work. The U.S. Environmental Protection Agency (EPA) estimates that every \$1 billion spent on environmental clean-up could create about 13,000 direct jobs.

Indirect impacts: Increased production costs in chemical manufacturing and other affected industries may lead to downsizing or investment, which in turn can lead to fewer jobs. According to

the American Chemical Society (ACC), higher operating costs could force companies to lay off employees or delay expansion plans, resulting in fewer jobs.

3.3.3. Technology Implications

The first elaboration is to promote the development of environmental protection technologies, which are manifested in the following ways: (1) The superfund tax encourages enterprises to adopt cleaner production technologies by increasing the cost of pollution to reduce pollution and related taxes and fees. This pressure is likely to drive the development of environmentally friendly technologies and innovations; (2) Investments in projects to clean up contaminated sites may also drive the adoption and development of new technologies. For example, the R&D and application of soil and water remediation technologies may be strengthened.

On the other hand, the impact is that the application of technology can be widely disseminated. As a result of tighter environmental regulations, companies are likely to adopt advanced pollution control technologies more widely, not only in the chemical manufacturing industry affected by the Superfund Tax but also in other related industries.

4. The impact of the Ireland's tax policy on FDI

4.1. Changes of Tax Policy

Ireland has introduced a series of tax policy changes in its 2024 budget, which cover several areas, including research and development tax credits, angel investor tax cuts, housing market support, carbon tax, and the minimum wage. These policies are implemented to promote economic growth, encourage innovation, support the stability of the housing market, and promote environmental sustainability.

4.1.1. R&D Tax Credit

Among the tax policy changes in 2024, the R&D Tax Credit is an important measure. Specifically, the proportion of this tax credit has been increased from 25% to 30%, effective January 1, 2024. The R&D tax credit applies to eligible R&D activities carried out by a company in Ireland, including systematic, investigative, and experimental work, with the aim of increasing scientific or technical knowledge or applying that knowledge through the development of new or improved materials, products, equipment, processes, systems, or services. The government hopes to attract more businesses to R&D activities by offering a higher percentage of tax credits. Businesses can use the tax credit to offset the corporate income tax (CT) payable and claim a refund if the tax credit exceeds the tax payable. This will not only help to enhance Ireland's competitiveness in global innovation and R&D but will also drive long-term economic growth.

4.1.2. Angel Investors are Tax-deducted

For eligible angel investors, the capital gains tax (CGT) has been reduced from 33% to 16%. The investment must meet certain conditions, including investing in an Enterprise Ireland-certified SME, and be held for at least three years. This measure is expected to attract more angel investors to the market and support the development of new ventures, which in turn will promote the diversification and vitality of the economy [8].

4.1.3. Carbon Tax

The carbon tax has also been raised in the 2024 tax policy changes. The carbon tax per ton of CO₂ emissions increased by 7.50 euros, from 48.50 euros to 56.00 euros. This change has been applied to motor fuels as of October 11, 2023, and to other fuels as of May 1, 2024. The increase in the carbon tax is to reduce carbon emissions and promote environmental sustainability [9]. By raising the cost of carbon emissions, the government hopes to encourage businesses and individuals to reduce carbon emissions and adopt more environmentally friendly energy sources and technologies.

4.2. Changes in FDI Flows

4.2.1. The Impact of R&D Tax Credits on FDI Flows

Ireland increased the R&D tax credit in 2024 from 25% to 30%.

First, the increased R&D tax credit will make Ireland more attractive to global competition, as businesses will be able to benefit from it by reducing R&D costs and thus improving profit margins [10]. FDI flows in Ireland are expected to rise as the R&D tax credit increases, particularly in R&D-intensive sectors such as high-tech and pharmaceuticals.

In terms of specific figures, Ireland attracted around 10 billion euros of FDI in 2019, a significant part of which went to R&D and high-tech industries. FDI inflows are expected to increase by about 10-15% in 2024 as the R&D tax credit increases. This not only reflects Ireland's strengths in attracting high-tech investment but also shows the trust and reliance of global businesses in Ireland's R&D environment.

4.2.2. The Impact of Angel Investor Tax Cuts on FDI Flows

With the angel investor tax cut reducing the capital gains tax (CGT) from 33% to 16%, we know angel investors play a key role in the development of start-ups, providing financial support and strategic guidance. From the perspective of FDI flows, this policy will attract more foreign investors to participate in Ireland's start-up ecosystem. As an important start-up hub in Europe, Ireland will attract more international angel investors and venture capital funds by providing a favorable tax environment. According to the Startup Ireland Report, Ireland attracted more than €2 billion in start-up investment in 2022, and this figure is expected to increase further with the implementation of tax policies.

4.2.3. The Impact of Carbon Tax on FDI Flows

An increase in carbon taxes is likely to discourage investment in high-carbon-emitting sectors and attract investment in low-carbon and environmentally friendly technologies.

High-carbon-emitting industries are likely to reassess their investments in Ireland due to increased operating costs. However, on the other hand, an increase in the carbon tax is likely to attract more investment in green technologies and renewable energy. According to the International Energy Agency (IEA), global investment in renewable energy reached a record US\$366 billion in 2022, and Ireland is expected to attract more green investment by raising the carbon tax.

In terms of specific figures, Ireland attracted around €1.5 billion in renewable energy investment in 2023 and is expected to increase green investment by about 20% in 2024 as carbon taxes increase. This reflects Ireland's efforts to promote the transition to a green economy through policy adjustments and shows the interest and support of global investors in sustainable development.

4.3. The Economic Effects of Tax Policy on Ireland

4.3.1. Economic Growth Impact

R&D investments typically bring a range of economic benefits, including the development of new products and technologies that can significantly improve productivity and competitiveness. According to research by the Organization for Economic Co-operation and Development (OECD), the contribution of R&D investment to GDP growth is generally high across countries. For example, data from Ireland's Central Statistics Office (CSO) suggests that every €1 invested in R&D can lead to about €1.5 in GDP growth. In addition, the establishment of R&D centers by multinational companies in Ireland not only brings direct capital investment, but also drives the technological progress and innovation capabilities of local enterprises through knowledge spillovers. This knowledge spillover effect will further boost economic growth and enhance Ireland's competitiveness in the global market.

The increase in angel investment is a direct driver of the growth and expansion of start-ups, which often have high growth potential and can enter the market quickly and create economic value. According to the Global Entrepreneurship Research Association (GERA). Start-ups can contribute 2% to 3% to GDP growth. By attracting more angel investment through tax cuts, Ireland is expected to see an increase in the number and quality of new ventures, which in turn will drive economic growth. The development of start-ups not only directly increases economic activity but also further promotes economic growth by driving the development of upstream and downstream industries. For example, tech startups often expand their reach quickly after receiving angel funding, increasing demand for related industries such as services and manufacturing. This knock-on effect will further boost economic growth.

An increase in carbon taxes will not only incentivize companies to adopt greener technologies and processes to reduce carbon emissions. It can also promote investment in renewable energy and environmental technologies. For example, the development and maintenance of solar and wind energy projects require many professional and technical personnel and advanced equipment, which will drive the development of related industrial chains and increase economic activities. In addition, the research and development of eco-friendly technologies will lead to new products and markets, further driving economic growth.

4.3.2. Employment Impact

According to IDA Ireland, every €1 billion invested in R&D can create about 1,000 direct high-skilled jobs. With the increase in R&D tax credits, it is expected that more multinationals will choose to set up or expand their R&D centers in Ireland. In the case of Pfizer and Johnson & Johnson, which have already set up large R&D centers in Ireland, the new tax credit may prompt these companies to further expand their R&D activities in Ireland and create more highly-skilled jobs.

In addition, the increase in the R&D tax credit will attract more technology and innovation companies to the Irish market. This will not only help to create jobs directly but will also indirectly create more jobs through technology spillovers to local businesses. According to the European Innovation Scoreboard, innovation activity is a significant driver of overall employment growth in the economy.

According to Enterprise Ireland, every €1 million invested in a start-up can create about 20 direct jobs. The increase in angel investment will directly promote the development and expansion of new ventures, which in turn will create more jobs.

High-carbon-emitting industries, such as traditional manufacturing and fossil fuel industries, may scale back or reduce investment due to increased operating costs, resulting in fewer jobs. However,

an increase in carbon taxes will encourage companies to invest in energy-efficient and emission-reducing technologies and renewable energy, creating new jobs. According to the International Labor Organization (ILO), the transition to a green economy could create 24 million new jobs globally. Ireland is expected to boost green jobs by raising its carbon tax.

4.3.3. Technology Implications

When multinational companies set up R&D facilities in new markets, they usually bring advanced technology and knowledge, which will be further disseminated to the local market through cooperation and exchange with local enterprises and scientific research institutions. According to the Organization for Economic Co-operation and Development (OECD), R&D investment by multinational corporations is one of the main channels for technology transfer. TNCs' R&D centers in Ireland not only generate direct technology investment but also generate knowledge spillovers through a variety of channels. For example, through partnerships with local universities and research institutes, multinational companies can facilitate the dissemination of cutting-edge technologies and research results.

Angel investors often have extensive industry experience and extensive network resources, and in addition to financial support, they also help start-ups achieve technology transfer and innovation through mentoring and consulting. This policy will attract more international angel investors and venture capital funds to the Irish market and support the development of start-ups. For example, technology startups often accelerate the development and marketization of new technologies after receiving angel funding, and these technologies and innovations are quickly disseminated through a network of partners and customers, thereby enabling technology transfer.

The increase in carbon taxes will drive investment in environmental technologies and renewable energy, where technological innovation and application will be rapidly transferred. For example, the development and application of solar and wind energy projects in Ireland has not only promoted the transformation of the local energy industry but also the widespread application of environmentally friendly technologies through technical exchanges and cooperation with international partners.

5. The Role and Challenges of Tax Policy in Global Economic Integration

5.1. The Role of Global Economic Integration

Tax policy plays an important role in attracting foreign investment, promoting economic growth, optimizing the industrial structure, and enhancing international competitiveness.

5.1.1. Attracting Foreign Investment and Retaining Businesses

Countries can attract many multinational companies to establish overseas subsidiaries in their own countries through preferential tax policies, such as income tax exemption for high-tech enterprises, additional deductions for R&D expenses, and reductions in corporate income tax rates, and attract many foreign investments into high-tech, information technology, manufacturing, and other fields, which can also increase the attractiveness of local enterprises.

5.1.2. Promote Employment and Economic Growth

The inflow of foreign capital supported by tax policies has promoted the rapid economic growth of various countries, because the entry of foreign enterprises has brought a great number of jobs and economic growth momentum to the country, which can refer to the real cases of companies such as Apple, Google, and Facebook.

5.1.3. Innovation and Upgrading

The advanced technology and rich management experience brought by foreign-funded enterprises can help optimize and upgrade the industrial structures of various countries, thereby improving their overall competitiveness. For example, the R&D tax credit encourages enterprises to increase R&D investment and promote the development of scientific and technological innovation and high-value industries.

5.1.4. International Tax Cooperation

Actively participating in international tax cooperation and signing double taxation agreements can reduce tax barriers to cross-border investment. For example, the U.S. tax policy, combined with its extensive network of tax treaties, reduces the risk of double taxation and promotes cross-border investment.

5.2. Challenges

5.2.1. Policy Sustainability

Significant tax cuts could lead to an increase in the fiscal deficit, so finding a balance between boosting economic growth and maintaining fiscal sustainability is a worthy challenge. At the same time, attention should also be paid to the environment of global tax competition, such as the peace and attraction of foreign capital and fair competition by domestic enterprises.

5.2.2. Base Erosion

Multinational corporations take advantage of tax policy differences for profit shifting and tax avoidance, which can lead to base erosion and profit shifting (BEPS) problems.

5.2.3. Tax Dependence

A high dependence on the tax revenues of multinational corporations will have the serious consequence of a strong dependence of the economy and tax revenues on foreign investment.

5.2.4. Policy Transparency

The transparency and stability of tax policies still need to be improved to reduce the uncertainty of foreign enterprises.

6. Suggestions

6.1. Optimize Preferential Tax Policies

For specific industries and regions, we will continue to implement targeted preferential tax policies and continue to attract foreign investment in high-quality, high-tech, and high-value-added industries with low tax rates and high preferential treatment. In addition, while maintaining a low tax rate to attract foreign investment, it is necessary to ensure fiscal sustainability and balance the relationship between tax cuts and fiscal revenues. The specific measures include: (1) Establish a dynamic adjustment mechanism to adjust the tax policy according to the economic situation and ensure the sustainability of the tax reduction measures. and (2) providing R&D tax credits and other incentives to encourage long-term investment and innovation. For example, the tax incentives for high-tech enterprises will be increased, and the proportion of additional deductions for R&D expenses will be

further increased [10]. (3) Promote green tax policies and encourage enterprises to invest in clean energy and environmental protection technologies.

6.2. Strengthen International Cooperation in Taxation

In the context of global tax competition, it is necessary to strengthen tax cooperation with other countries, avoid vicious competition, promote fair and reasonable global tax rules, ensure their own interests and international reputation, and ensure that multinational enterprises pay taxes fairly, to achieve common development [11]. For example, in the case of China, it is necessary to prevent the problem of base erosion and profit shifting (BEPS) and safeguard the country's tax revenues. Specific measures include: (1) Actively participate in the discussion and rulemaking of tax reform in international organizations such as the OECD. (2) Strengthen the exchange and cooperation of tax information with other countries. (3) Sign or update double taxation agreements to clarify tax jurisdiction and benefit distribution and reduce unnecessary contradictions.

6.3. Maintain Policy Stability and Transparency

A long-term stable and transparent tax policy reduces the uncertainty of enterprises, which can help enterprises estimate their tax liabilities more accurately and enhance the investment confidence of foreign-funded enterprises [12, 13]. The measures that can be implemented are: (1) Regularly issue and update tax policy guidelines to clarify the scope of application of the policy and the specific implementation rules. (2) Strengthen the communication between the tax department and the enterprise to solve the problem in a timely manner.

6.4. Diversify the Economic Structure

While it is important to strengthen international tax cooperation, it is also necessary to appropriately reduce dependence on multinational enterprises, promote the development and diversification of local enterprises, and enhance economic resilience. The measures that can be implemented are: (1) promoting the development of local SMEs through tax incentives and financing support. (2) Promote the development of high-tech and other industries and reduce dependence on a single industry or foreign-funded enterprises [11].

7. Conclusion

Tax policy plays an important role in global economic integration, and by optimizing tax policy, countries can effectively attract foreign investment, promote economic growth and industrial upgrading. For example, lower tax rates and preferential measures have effectively attracted a large amount of foreign investment, or long-term stable tax policies have enhanced the investment confidence of foreign-funded enterprises and reduced the negative impact of policy uncertainty on investment. However, countries also face the challenge of balancing attracting FDI with maintaining a level playing field, reducing base erosion, and ensuring fiscal sustainability. Against the backdrop of intensifying global tax competition and changes in international tax rules, countries need to continuously optimize and adjust their tax policies, strengthen international tax cooperation, and jointly respond to complex issues in global economic integration. By adopting appropriate policy measures, enhancing the transparency and stability of tax policies, optimizing the preferential tax structure, and promoting scientific and technological innovation and sustainable development, countries can achieve higher-quality development in the context of global economic integration.

References

- [1] Zhou, Z. *Analysis of the impact of national preferential tax policies on the tax burden of enterprises under the background of epidemic prevention and control: from the perspective of fiscal and tax treatment*. *Contemporary Accounting*, (06),179-180, 2021.
- [2] Li, L., Liu, Y., Su, C. *R&D Expense Deduction Policy and Enterprise Capital Structure: Based on the Non-Debt Tax Shield Theory*. *Finance & Accounting Monthly*, 45(12), 35-42, 2024.
- [3] Yan, X., Liang, C. *Features and prospects of tax policy reforms across major countries in the world in 2020—Review of OECD's tax policy reforms 2020 report*. *Taxation Economic Research*, 25(06), 33-40, 2020.
- [4] *The official website of the Guangdong Government Bureau of Statistics*.
- [5] Song, F. *The role of fiscal taxation in the development of the market economy*. *Finance and accounting*, (36), 4-6, 2021.
- [6] *Organization for Economic Co-operation and Development (OECD)*.
- [7] Cai, D., Yao, S. *China's digital economy tax policy and regulatory design: Based on the comparison of digital economy tax policies in typical countries such as OECD, the United States, and India*. *Business Economics*, (01), 172-174, 2022.
- [8] Tan, R., Song, W. *Promote the legislation of angel investment industry and build a more complete preferential tax system for angel investment*. *Economics and Management Science*, 2024, (03).
- [9] Yuan, Y., Yu, X. *Experience and enlightenment of foreign carbon emission trading tax systems*. *Natural resource intelligence*, (06), 2024.
- [10] Jin, A. *Enlightenment of national tax incentive policies*. *Business culture*, (17), 130, 2014.
- [11] Zhu, Y. *A ten-year process of BEPS project: Transition to the multilateralization of international tax coordination mechanism*. *International Taxation*, (12), 13-20, 2023.
- [12] Sun, C. *The policy effects of interest rate marketization and LPR reform*. *Global Circulation Economy*, (17), 165-168, 2023.
- [13] Sun, T. *Technological diversification and innovative development of circulation enterprises under market competitive advantage*. *Business Economics Studies*, (11),164-167, 2024.

How Digital Nomad Communities Can Empower Rural Revitalisation

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Abstract: The potential of digital nomad communities to support sustainable development and rural revival is examined in this research. Digital nomads are remote workers who travel and work from different places using technology. They provide skills, creativity, and cross-cultural interchange to rural areas. The desire for flexible lifestyles and worldwide trends toward remote work are congruent with the emergence of digital nomadism. Conversely, rural rejuvenation tackles issues including depopulation and economic downturns in rural areas, which are frequently made worse by urbanization and globalization. Rural communities can benefit from the new technology, varied businesses, and cultural enrichment that digital nomads can bring. Nonetheless, issues like geographical limits and infrastructure shortcomings must be resolved. The effective integration of digital nomads into rural areas requires policy support, teamwork, and new approaches. Rural communities may support economic growth, cultural preservation, and sustainable development by utilizing the skills and resources of digital nomads.

Keywords: Digital Nomads, Rural Revitalization, Sustainable Development, Rural Tourism, Community Construction.

1. Introduction

1.1. Definition of digital nomads

A digital nomad is a remote worker that uses productivity and wireless Internet connectivity to travel for extended periods of time to several countries and locations. They earn money by working remotely, without being tied to a particular office, and with a great level of freedom and flexibility.

Makimoto[1] coined the phrase "digital nomad," which subsequently became acknowledged as a social phenomenon[2]. Professionals that operate remotely and digitally are known as "digital nomads" since they can live an expat lifestyle of perpetual travel[3]. Digital nomadism is a contemporary phenomenon of the network information-communication society that has arisen as a result of mobility and digitalization[4]. The rise in the mid-2000s in the number of digital nomads was attributed to the advancements in computers and mobile Internet, which facilitated remote work and freelance labor. Remote working has become more popular, partly due of the COVID-19 pandemic's enhanced lockdown from 2020 to 2023. Over this period, companies and the general

public have become more acclimated to remote work over the internet, which has resulted in a rise in the global population of digital nomads.

1.2. Definition of rural revitalization

The decade of the 1960s, which was characterised by the third Industrial Revolution, witnessed the rapid development of communications and transportation technology. Additionally, information highways were established all over the world, resulting in massive transnational flows of capital, technology, people, services, and goods. The process of globalisation advanced at a rapid pace during this time period[5]. Rural sustainability in developing nations has been impeded by emerging rural challenges such as out-migration, depopulation, and environmental contamination. These difficulties have arisen as a result of globalisation, industrialization, and urbanisation[6]. During the last several decades, China has seen a decline in the rural population, a lack of available labour, and a general decline in society. A number of factors, including mobility, poverty, technology, biased legislation, and bad land management, contribute to the abandonment of rural areas[7]. As a direct result of this, the capacity for rural development has deteriorated, which puts both sustainability and resilience in jeopardy.

The Chinese government has made efforts in the 21st century to reconcile the general growth of the nation with the rising aspirations of the Chinese people for a better living [8]. A new rural revitalization programme was implemented by the government with the intention of giving agricultural and rural regions more priority. It was in his report to the 19th CPC National Congress that General Secretary Xi Jinping presented the rural vitalization plan for the very first time. He also set out a roadmap for rural development that included "thriving industries, livable ecology, civilised local customs, effective governance, and rich life." In the annals of China's experience with rural development, the rural revitalization plan stands out as a significant strategic deployment. The rural revitalization approach encompasses a wide range of issues, including the economics, society, culture, environment, people's livelihoods, and social governance, with the ultimate goal of achieving comprehensive rural development [9]. It is a long-term strategic endeavour to develop a plan for rural revitalization. The strategy for rural revitalization is a methodical and comprehensive approach that necessitates close collaboration between all regions and departments in order to achieve synergy. The rural revitalization strategy places an emphasis on innovative development, encourages agricultural modernization, enhances the capacity of rural scientific and technological innovation, and cultivates a new classification of rural business operators [10].

Rural revitalization facing challenges such as declining business numbers, depopulation, and limited opportunities can be achieved through the adoption of digital nomadism. Technology combined with the desire for a more rural lifestyle opens up possibilities for those seeking new lifestyles as well as municipalities trying to find methods to come back to life. Rural communities can take advantage of supporting sustainable development, boosting local economies, and protecting cultural heritage by utilizing the talents, resources, and creative spirit of digital nomads.

2. Digital nomads

2.1. Group size of digital nomads

The number of people who are considered to be digital nomads is projected to be anywhere between 65 million and 100 million all over the world. It is expected that this number will climb by 20 to 30 percent annually for the next three to five years. A significant increase in the number of digital nomads has occurred over the course of the past three years as a direct result of the widespread proliferation of the coronavirus. Some of the aspects that have greatly contributed to the rise in the popularity of

nomadic ways of living throughout the world include the fact that they are able to function from remote regions and have the liberty to construct their own settings for working [11] .

A number of factors have contributed to the creation of the digital nomad community. These factors include the availability of co-working spaces and digital nomad centers, the increase of jobs that are ideal for working remotely, and the growing acceptance of remote work arrangements by employers. The appeal of discovery, the chance to learn about new cultures, and the ability to maintain a harmonic equilibrium between one's work and personal life are all factors that contribute to the widespread adoption of the digital nomad way of life.

2.2. Spatial distribution of digital nomads

The spatial distribution characteristics of digital nomads are influenced by a number of different factors, including infrastructure, the cost of living, the availability of facilities, and visa rules.

Individuals who are able to perform and dwell from nearly any area that is equipped with an internet connection are referred to as digital nomads. As a consequence of this, individuals have a propensity to be pulled to places that provide pleasant temperatures, a cost of living that is inexpensive, and a quality of life that is greater.

An approach known as "slow travel" is utilized by certain digital nomads. This method involves staying in a single area for a period of many months before moving on to the next available destination. It is possible that seasonal migratory patterns will emerge, in which remote laborers shift in reaction to favorable weather conditions or cultural happenings. A significant number of digital nomads, for example, relocate to countries of Southeast Asia or Latin America that have warmer winters in order to avoid the harsh winters.

The restrictions governing visas and the classification of nomad visas have a significant impact on the spatial distribution of digital nomads. Countries such as Thailand, Indonesia, and Portugal, which have visa regulations that are flexible, attract a significant number of remote workers; these countries include Portugal. There are certain countries that have introduced "digital nomad visas" or other alternatives to long-term residence with the specific purpose of attracting freelancers and remote workers.

Internet access that is dependable and infrastructure that is up to date are both necessities for digital nomads who want to work remotely. As a consequence of this, they have a preference for destinations that offer internet access that is both reasonable and fast, as well as coworking spaces, lodging that is designed to accommodate digital nomads, and comforts such as dining outlets, fitness facilities, and cafés [12] .

Locations that provide active expat communities, social activities, and networking events are typically the ones that digital nomads prefer to settle in with their families. As a result of these communities, possibilities for members who have similar interests to work together, show solidarity with one another, and provide assistance are made possible [13] . The cost of living is a key factor to take into account for digital nomads, particularly those who are on a limited budget or freelancers who are just starting out on their adventure of working remotely. It is particularly enticing for remote workers to relocate to regions that have a lower cost of living. These regions include parts of Eastern Europe and Southeast Asia.

In general, the spatial arrangement of digital nomads is characterized by adaptability, mobility, and a preference for areas that offer a harmonic balance of remote work infrastructure, affordability, and lifestyle comforts. This is the case since digital nomads like to work from various locations.

2.3. Digital nomads communities and evolution

The term "digital nomads community" refers to a geographical area, the community of digital nomads who live in a spontaneous or structured manner, and the relationships that exist between the individuals who make up the social entity known as the digital nomads community [14]. We will separate the current digital nomad community into two distinct groups: the first generation digital nomad community and the second generation digital nomad community. This division will be based on the genesis and organizational structure of the digital nomad community [15].

The first generation of digital nomads communities are frequently found in towns or areas that have a big number of digital nomads. These communities are developed spontaneously by digital nomads who are dispersed around the region. Living, working, and providing a sense of community are the primary functions that it serves for the community. The digital nomad community has a constraint in that its design is intended to cater to the requirements of conventional digital nomads in terms of their daily lives, their jobs, and their interactions with other people. Additionally, the design has limited contact with the local culture.

A "designed" digital nomads community is exactly what the second-generation digital nomads community is meant to be. Furthermore, the second-generation community not only fulfills the functions of the first-generation community, but it also strengthens the link between the community and the surrounding environment, therefore enhancing the connotation of the digital nomads community in rural areas. Its originality is in the fact that it permits communities that are in great circumstances to bring new blood; nevertheless, there are constraints in the selection of sites, and in general, it chooses villages that have a higher degree of development. It is the nomad business that is essential to the community industry sector.

3. Revitalization of rural areas and sustainable development

3.1. The Potential Contribution of Digital Nomads to Sustainable Rural Development Challenges

As a result of the rapid advancements in digitization and globalisation, the digital nomad community is progressively emerging as a significant catalyst for the rural economy's sustainable revitalization and progress. The dynamic growth of digital nomad communities and the proactive appeal of digital nomads are critical factors in rural economy revitalization and advancement.

To begin with, the existence of digital nomads will infuse rural regions with a surge of new technologies and skilled individuals. Digital nomads frequently possess advanced degrees and professional expertise; their advent will infuse rural regions with renewed vigour and innovation. Simultaneously, the work and way of life of digital nomads are inextricably linked to the assistance of modern technology, which will increase the level of technology in rural areas and promote the application and popularisation of information technology there [16].

Additionally, the establishment of digital nomad communities will foster the expansion of diversified industries in rural regions. Digital nomads are employed in numerous disciplines, including but not limited to design, programming, marketing, and education. Their existence will stimulate the growth of associated sectors, including rural tourism, the trade of unique agricultural products, cultural innovation, and more. This initiative is expected to generate additional employment prospects in rural regions, elevate the standard of living of local inhabitants, and bolster the growth of the rural economy.

Furthermore, the development of digital nomad communities will contribute to the augmentation of rural areas' cultural soft power. Digital nomads originate from various nations and regions, thereby contributing an abundance of cultural knowledge and intellectual dialogue. This will enhance the

cultural appeal and competitiveness of rural regions while also aiding in the expansion of the cultural horizons of rural residents.

A series of policy measures may be implemented by the government and relevant departments to entice more digital nomads to settle in rural regions. An illustration of this would be the provision of advantageous housing policies, tax incentives, and entrepreneurial support in order to mitigate the financial burdens associated with residing and working for digital nomads. Simultaneously, infrastructure development should be fortified to increase Internet access and transportation accessibility in rural regions, so as to provide digital nomads with a comfortable and expedient living and working environment [17].

Actively attracting digital nomads and vigorously developing digital nomad communities are crucial for promoting the rural economy's sustaining revitalization and growth. By enhancing cultural soft power, attracting talented individuals, and promoting industrial diversification, rural regions can attain sustained economic prosperity and overall social advancement.

3.2. Pertinence of infrastructure

Infrastructure development is essential for achieving sustainable development and efficient construction of digital traveller communities in rural regions. These amenities comprise a reliable and secure electricity supply, high-speed Internet connectivity, a comfortable and secure living environment, and an expedient transportation system. Nevertheless, some developing rural areas may be unable to afford the substantial financial investment and technical assistance that are frequently required for the construction of these infrastructures.

The Chinese government and its associated policies have significantly contributed to the advancement of rural infrastructure development. Government funding and strategic allocation of social capital can facilitate the acceleration of the digitization process in rural regions, thereby enhancing the scope and calibre of Internet connectivity. Government support measures, including land policies and tax incentives, can also be employed to encourage more digital nomads to establish residence and employment in rural regions [18].

Collaboration with private enterprises and civil society organisations is an essential means of advancing the digital nomad community, alongside government support. Innovative solutions and technical assistance from the private sector can aid rural regions in their digital transformation. Conversely, civil society organisations can leverage their proficiencies in social governance and community development to advocate for the advancement and assimilation of digital traveller communities within the host society.

Developing a digital traveller community is undoubtedly a lengthy undertaking that demands sustained investment and collaboration from civil society organisations, the private sector, and the government. Simultaneously, it is imperative to safeguard the indigenous cultural heritage and ecological environment to ensure that the development of the digital traveller community does not impede the sustainable progress of the local community. The digital traveller community can only genuinely emerge as a significant catalyst for rural development in this manner [19].

3.3. Business, industrial, and production systems associated with rural revitalization

3.3.1. Rural travel

The establishment of digital traveller communities has garnered significant global interest and implementation as an innovative model of development. Particularly within the domain of rural tourism, this model exhibits considerable promise and worth. This concept will be elaborated upon in greater detail in this paper via a number of concrete illustrations.

Case 1: Town in Provence, France

Numerous visitors are drawn to the town of Provence by its picturesque natural surroundings and rich cultural history. The establishment of a digital nomad community has rejuvenated this historic settlement. Numerous remote workers, artists, and creators choose to reside and work in this locale. In addition to generating a consistent influx of visitors, they disseminate the town's allure globally via social media and other platforms, thereby enticing a considerable number of tourists to partake in its experiences.

Case 2: The Tuscan Region of Italy

Prominent features of the Tuscan countryside include undulating hills, expansive vineyards, and mediaeval towns. The development of digital nomadic communities has elevated the status of rural living in this region. Numerous remote employees of multinational corporations opt to reside in this region, where they can actively engage in cultural exchanges and local tourism activities while appreciating the countryside's serenity; this contributes to the expansion of possibilities and opportunities within the rural tourism sector.

Third Case: Old Town of Lijiang, Yunnan, China

Lijiang Old Town is a popular tourist destination due to its distinctive Naxi culture and picturesque natural environment. With the development of the digital nomad community in recent years, an increasing number of remote workers and entrepreneurs have chosen to reside and operate in this region. By disseminating accounts of their personal journeys and cultural investigations in Lijiang via social media, blogs, and other online channels, they bolster the city's standing and impact while fostering consistent expansion in the regional tourism sector [20] .

These instances demonstrate that the formation of digital nomadic communities positively impacts rural tourism. It not only facilitates a consistent influx of individuals and financial resources to the villages, but also augments their prominence and sway by means of the dissemination and communication of digital nomads. Concurrently, the integration and participation of digital nomads provide rural tourism with additional opportunities for innovation and growth [21] .

3.3.2. Preservation and succession of traditional crafts and industries

Numerous invaluable traditional skills are subtly transmitted in the rural regions of China. These skills represent not only the cultural heritage of the rural areas but also the cultural foundations of the Chinese people. However, as a result of modernization and urbanisation, numerous traditional skills are threatened with extinction. To safeguard and transmit these abilities, the rapid proliferation of digital nomadic communities has emerged as a viable strategy.

The emergence of digital nomadic communities may offer an unprecedented avenue for the transmission of traditional expertise. By utilising digital technologies, comprehensive data regarding the historical context, technical attributes, and manufacturing procedures of traditional skills can be captured and transformed into a variety of formats, including instructional videos, interactive games, and virtual reality encounters. This facilitates broader accessibility and comprehension of these skills. This has the potential to not only garner increased public interest but also facilitate further transmission of traditional expertise .

Simultaneously, the digital nomad community may contribute financially to the preservation of traditional skills. By means of crowdfunding and community sponsorship, the organisation can furnish the inheritors of traditional skills with the essential financial assistance required to overcome economic challenges and enhance their standard of living. This can enhance safeguards for the transmission of traditional skills while also igniting the interest of the inheritors.

Furthermore, the digital nomad community may offer assistance in the preservation of traditional skills through talent support. Many digital nomads in the community are culturally literate and possess an innovative mindset; as a result, they are able to contribute novel approaches and concepts to the transmission of traditional skills. By fostering collaboration and exchanging ideas with the inheritors,

they can facilitate skill development and innovation while also promoting the preservation of traditional abilities.

In summary, the exponential growth of the digital nomadic community may furnish novel avenues and platforms through which traditional skills can be transmitted. By employing diverse strategies including financial assistance, talent development support, and digital initiatives, it is possible to safeguard and transmit these invaluable traditional skills while fostering the sustainable growth of the rural economy and culture. Concurrently, this necessitates our enduring determination and efforts to contribute to the preservation and transmission of traditional skills .

4. Restrictions and Prospects for the Future

Although the initiative to construct digital traveller communities in an effort to revitalise villages has numerous benefits, it is not universally applicable to rural regions. Primarily, the high demands placed on local transportation and natural conditions constitute its limitations.

The establishment of a digital traveller community begins with the presence of a picturesque natural environment. Not only does such an environment afford travellers comfortable living conditions, but it can also serve as a significant incentive for them to visit. Nevertheless, not every rural region possesses favourable natural circumstances. Due to issues such as inadequate resources and unfavourable environments, it may be impractical to establish a digital traveller community in certain regions.

Additionally, the establishment of digital traveller communities necessitates specific transportation conditions. Travellers must be able to readily enter and exit the community in order to communicate with the outside world. Consequently, areas that are geographically isolated and difficult to access may not be conducive to the formation of digital traveller communities. Even with the most desirable natural surroundings, such regions would be challenging to entice travellers to reside and conduct business [22] .

Undoubtedly, this does not preclude the implementation of alternative strategies to revitalise rural areas in these districts. One may investigate viable avenues for progress in accordance with their specific circumstances. One way to stimulate local economic growth and attract foreign investment and tourists is through the establishment of specialised agricultural and ecotourism sectors. Simultaneously, it is imperative that the government and all sectors of society bolster their backing for rural regions by offering policy, financial, and technological assistance, so as to advance the cause of rural revitalization across its entirety.

5. Conclusion

This article presents a comprehensive examination of the inception and development of the digital nomadic community. The paper then uses examples to illustrate the contribution of digital nomadic communities to rural revitalization and sustainable development. Nonetheless, the paper also identifies the causes and practical limitations of digital nomadic communities. In order to address these constraints, the paper additionally examined the outcomes of the alternative methodologies. As a novel form of community organisation, digital nomadic communities ultimately contribute significantly to rural revitalization and sustainable development. Nevertheless, in actuality, it is imperative to address the challenges it presents and advocate for its implementation and growth in rural regions via diverse strategies.

References

[1] Makimoto, T., & Manners, D. (1997). *Digital nomad*. Wiley.

- [2] Müller, A. (2016). *The digital nomad: Buzzword or research category?* *Transnational Social Review* 6(3), pp. 344–348. Available at: <http://dx.doi.org/10.1080/21931674.2016.1229930>.
- [3] Schlagwein, D. (2018). "Escaping the rat race": Justifications in digital nomadism.
- [4] Kuzheleva-Sagan, I. P., & Nosova, S. S. *Culture of Digital Nomads: Ontological, Anthropological, and Semiotic Aspects*. (2014). [Электронный ресурс]. In *World congress of the IASS/AIS* (Vol. 12).
- [5] Jerath, K. S. and K. G. Kushal, et al. (2021). *Globalization and the Third and Fourth Industrial Revolution* ER -. Switzerland, Springer International Publishing AG: 119-130.
- [6] Hedlund, M. and Lundholm, E. (2015). *Restructuring of rural Sweden – Employment transition and out-migration of three cohorts born 1945–1980*. *Journal of Rural Studies* 42, pp. 123–132. Available at: <http://dx.doi.org/10.1016/j.jrurstud.2015.10.006>.
- [7] Liu, Y. and Y. Li (2017). "Revitalize the world's countryside." *Nature (London)* 548 (7667): 275-277.
- [8] Zhang Huachun and Ji Jing (2018). *A Brief Analysis of Xi Jinping's thought on ecological Civilization in the New Era* .
- [9] Zhang, H. (2023). "Century-Long History and Basic Experience of the CPC in Leading China's Rural Development." *Frontiers of Economics in China* 18 (1): 21.
- [10] Zhang Haipeng and Gao Liangliang, et al. (2018). "" The theoretical origin of the rural revitalization strategic thought, the main innovation and realization path. "China's rural economy" 11 (2).
- [11] Hall, G., Sigala, M., Rentschler, R., & Boyle, S. (2019). *Motivations, mobility and work practices; the conceptual realities of digital nomads*. In *Information and Communication Technologies in Tourism 2019: Proceedings of the International Conference in Nicosia, Cyprus, January 30–February 1, 2019* (pp. 437-449). Springer International Publishing.
- [12] Orel, M. (2021). *Life is better in flip flops. Digital nomads and their transformational travels to Thailand*. *International Journal of Culture, Tourism and Hospitality Research*, 15(1), 3-9.
- [13] Hannonen, O. (2020). *In search of a digital nomad: defining the phenomenon*. *Information Technology & Tourism* 22(3), pp. 335–353. Available at: <http://dx.doi.org/10.1007/s40558-020-00177-z>.
- [14] Chevtava, E., & Denizci-Guillet, B. (2021). *Digital nomads' lifestyles and coworkation*. *Journal of Destination Marketing & Management*, 21, 100633.
- [15] Lee, A., Toombs, A. L., Erickson, I., Nemer, D., Ho, Y. S., Jo, E., & Guo, Z. (2019). *The social infrastructure of co-spaces: Home, work, and sociable places for digital nomads*. *Proceedings of the ACM on human-computer interaction*, 3(CSCW), 1-23.
- [16] LHAARD, P. (2022). *Destination City for Digital Nomad's in Thailand: A Case Study of Digital Nomad Community in Chiang Mai*. *Journal of Humanities and Social Sciences Studies* 4(1), pp. 178–188. Available at: <http://dx.doi.org/10.32996/jhss.2022.4.1.18>.
- [17] VINCEK, Z.L. (2023). *Trend of the Research on Digital Nomads*. *Communications of International Proceedings* 2023. Available at: <http://dx.doi.org/10.5171/2023.4131923>.
- [18] Green, P. (2020). *Disruptions of self, place and mobility: digital nomads in Chiang Mai, Thailand*. *Mobilities* 15(3), pp. 431–445. Available at: <http://dx.doi.org/10.1080/17450101.2020.1723253>.
- [19] Matos, P. and Ardévol, E. (2021). *The Potentiality to Move*. *Transfers* 11(3), pp. 62–79. Available at: <http://dx.doi.org/10.3167/trans.2021.110304>.
- [20] Nasirdinova, A. (2022). *Glocalizations of digital nomads*. *нроекм байкал* (71), pp. 100–103. Available at: <http://dx.doi.org/10.51461/projectbaikal.71.1947>.
- [21] Vagena, A. 2021. *Digital Nomads and Tourism Industry*. *Academia Letters* . Available at: <http://dx.doi.org/10.20935/al765>.
- [22] Müller, A. (2016). *The digital nomad: Buzzword or research category?* *Transnational Social Review* 6(3), pp. 344–348. Available at: <http://dx.doi.org/10.1080/21931674.2016.1229930>.

Central Bank Digital Currency Development Status and Future Challenges

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Abstract: The development and popularization of digital currency is the inevitable trend of the development of the digital era, and its development speed is relatively fast, and the development potential is large. This paper discusses the connotation and characteristics of digital currency, expounds the definition of digital currency, introduces the use of blockchain as the underlying technology of digital currency, studies the development status of digital currency, divides it into legal currency and non-legal currency and defines and discusses it, at the same time discusses the opportunities and challenges faced by digital currency, and analyzes the advantages and disadvantages of digital currency. Methods of developing digital currency are discussed at the level of legal protection, regulation, technology and commodity, and academic literature, research reports and policy documents related to digital currency at home and abroad are extensively collected and analyzed to understand the development process and theoretical basis of digital currency. Promote social change and financial innovation, and promote the promotion and dissemination of digital currency, so that digital currency has more development opportunities.

Keywords: Central bank, digital currency, challenges.

1. Introduction

Digital currency is an alternative to electronic money. Digital currency includes digital gold coins and cryptocurrencies, which can be considered a virtual currency based on node networks and digital encryption algorithms, usually issued and managed by developers. China's central bank has been actively exploring and promoting the research and development and pilot of digital currency and has launched digital currency electronic payment [1]. The issuance policy emphasizes strict supervision of the digital currency market to ensure its legal and compliant operation, and the issuance of the digital yuan aims to improve the efficiency and security of the payment system, reduce reliance on traditional payment intermediaries, and promote financial service inclusion and fintech innovation. China has taken strict regulatory measures on cryptocurrencies such as Bitcoin, in particular cracking down on illegal financial activities, and has made it clear that some cryptocurrencies are not protected by law. At the same time, China's policy does not prohibit the sale and purchase of all virtual currencies but emphasizes that investors must bear their own risk. In the context of economic globalization, the demand for cross-border payments is growing, and traditional payment systems are facing challenges in efficiency, cost and convenience. Digital currencies provide new ideas for improving cross-border payments. The traditional monetary system has some limitations, such as the

cost of currency issuance, and the precision of monetary regulation and control, and digital currency is expected to optimize the monetary system to a certain extent. This paper discusses the characteristics of digital currency, and shows the definition of digital currency[2].

2. Connotation Characteristics

At present, digital currency is considered to be a mechanism system that can realize decentralized payment transactions, wealth storage, accounting circulation and other functions through digital information technology [3]. It relies on blockchain technology, has anonymity and cannot be modified. It is found that the origin of digital currency is not long, and the initial digital currency needs the credibility of the government to achieve stability and play the function of a currency, which will have a certain impact on the normally issued currency. China gradually discovered the important nature of digital currency and set up a national digital currency research and development team in 2014, launched the central bank's research on digital currency, and in January 2017, the central Bank officially established the Digital Currency Research Institute. In September 2018, the National Data Currency Institute established a trade finance blockchain platform. By August 2019, the central bank said it would accelerate the pace of research and development of fiat digital currencies. On April 22nd, 2020, the Reform and Development Bureau of the Xiongan New Area Management Committee organized a pilot promotion meeting for the legal digital renminbi, and on August 14th, 2020, the Ministry of Commerce issued the Overall Plan for Comprehensively Deepening the Innovative Development of Trade in Services [4]. Both the 2017 document and the 2021 document define virtual currencies as those that have not acquired the same legal status as fiat currencies and cannot be circulated as money. Digital currencies make the economic cycle more convenient and rapid, achieve transparent and efficient fund transfer and settlement, simplify complex procedures in supply chain finance, and reduce related costs. However, in many judicial cases in our country, different courts have a legal nature of virtual digital currency. According to the "flower of money" conceptual model proposed by the Bank for International Settlements in 2017, digital goods are distinguished into four aspects.

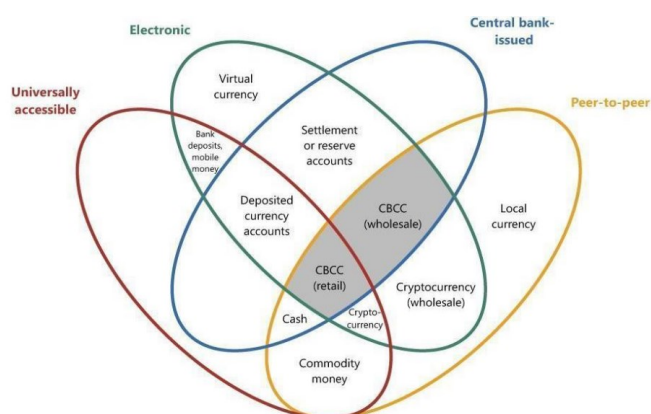


Figure 1: accessible class, digital form class, central bank-issued class, and token class [5]

As shown in Figure 1, it is classified into accessible class, digital form class, central bank-issued class, and token class. The shaded core represents a digital currency form: CB settlement account (universal), CB digital token (universal) and CB digital token (wholesale mode)[6]. From the perspective of payment methods, the money tree is divided into four levels, and five types of money are obtained: bank money, electronic money, investment money, central bank money and cryptocurrency[7]. If the above payment currency changes the centralized settlement to a decentralized settlement model based on the blockchain, it will get a series of currencies called

"stablecoins". From the perspective of payment and clearing method, it is divided into four parts from the type of ownership, the form of asset value, the guarantor and the technical attribute. It traces back the monetary hierarchy and better explains the payment and settlement structure under the modern monetary system.

3. Development Status

In recent years, with the popularity of the digital economy, digital currency has also received a lot of research, forming a new trend of future development. However, as a newly formed monetary system, digital currency does not constitute a complete system.

3.1. Fiat Digital Currency

Legal digital currency is issued by the state, has a certain legal status, issued by the People's Bank of China and managed by the state, subject to state supervision, sovereign, digital financial innovation can improve the level of financial services, become an important part of our country's digital construction, has a great impact on the economic and social order [8]. This kind of currency is decentralized management, which increases credibility, has traceability, is more convenient to track and capture illegal acts, almost avoids money laundering and other activities, and is more convenient and cheaper. The production process of paper currency is complex, the process is numerous, and the cost is lower. Therefore, it also improves stability and keeps the value of the currency stable in the long run. Centralized issuance and supervision mechanisms reduce potential risks, improve the security of the system, and provide the government with a new type of currency, policy tools and financial market supervision means to help promote financial innovation and economic development [9]. For the development of digital currency, money laundering methods emerge in an endless stream, and supervision is increasingly strict, but different courts have slightly different definitions of the legal nature of virtual digital currency, and by the end of 2020, China's central bank Digital currency Research Institute has applied for 84 patents for digital currency payment systems. At the same time, the People's Bank of China will also promote the cross-border project of "digital currency" with the Hong Kong Monetary Authority of China, and consider promoting cross-border transactions to achieve the integration of the global financial market and realize the development of the "token economy"[10], Digital currencies reduce issuance and circulation costs, making transactions more efficient. As a product of the rapid development of financial technology, the form of money has changed. Compared with paper money or WeChat Pay, it greatly saves the cost of issuance and circulation and does not need to use terminals and networks. The value of digital currency is stable for a long time and tends to be internationalized, and the value of the currency directly affects the exchange rate, national credit and international trade [11]. Therefore, the digital currency will also exist as an important factor in the market, and the legal digital currency will also be guaranteed by the national credit, which is legal and sovereign, and the value of the currency will be more stable. In the face of the reform of the international monetary system, the voice of China's legal digital currency will be increased.

3.2. Non-Legal Digital Currency

Non-fiat currencies, that is, cryptocurrencies, can also be called private digital currencies, private digital currencies, etc. This digital currency has no central issuance and regulatory authority, the currency adopts decentralized blockchain technology, and all transaction records are stored on the ledger, with anonymity but without monetary stability, and through special encryption algorithms, it can hide the identity information and transaction address of currency holders and traders, and transactions can be carried out in complete secrecy. Non-fiat digital currency transactions are global,

have no geographical restrictions, and can be completed in the case of cross-border transfer payments, making payments more efficient [12]. However, non-legal digital currencies are like storage items, like antiques, jewellery and other collectables, so in terms of pricing, they can only be used in the crypto ecosystem. At present, the highest acceptance of currency is Internet websites and their service providers. Private digital currencies are traded on a smaller scale and lack legal safeguards. In contrast, costs are high and the value of non-fiat digital currencies lacks universal recognition. As a collection item, non-fiat digital currency holders usually buy the collection and hold it for a long time, until the currency appreciates, which will lead to serious deflation. By 2017, China's regulatory attitude has changed to directly combat the hidden dangers of risk. By 2021, China's regulation of private digital currencies will extend to all types of token financing businesses at home and abroad [13].

4. The Opportunities and Challenges

4.1. Statutory Protection and Safety

The current digital currency policies and laws are not sound, and it is necessary to promote the legislative construction of legal digital currency, and its regulatory issues have become the focus of research in the industry. There are no clear guidance restrictions in the supervision and implementation of money laundering and other issues, but China's attitude toward financial supervision is increasingly strict, and private currency and legal currency are distinguished by the idea of distinguishing virtual currency and blockchain technology. And policy-based documents, so that many regulatory bodies cross responsibilities, power allocation is unclear [14]. As a newly developed new monetary system, currency types need to be further explored, it is suggested to clarify the legal status and use rules of digital currency, and build a complete monetary system.

4.2. Regulatory Issue

There are many types of digital currencies, but the nature and function are not clearly defined, the supervision involves multiple fields, and it is easy to appear unclear responsibilities, etc., and because of the different regulatory frameworks and laws in different regions, the difficulty of coordinating supervision will be greatly increased, and the emergence of counterfeit currency may also disrupt the market order. According to the provisions of Article 19 of the Law of the People's Republic of China on the People's Bank of China, the circulation method of counterfeit currency also difficult to play an effective regulatory role for digital currency. As for the problem of money laundering supervision, the special form of legal digital currency makes it impossible to be included in the scope of regulation of the current law. A kind of transfer of currency ownership through peer-to-peer transactions, which does not pass the bank settlement system, makes the money laundering crime of digital currency completely avoid supervision. It is suggested to launch a complete anti-money laundering system, strengthen the responsible departments of specialized agencies to crack down on illegal money laundering activities, and combat tax evasion. In view of the regulatory problems in counterfeit currency, money laundering, tax evasion and other aspects, a comprehensive inspection can be carried out by expanding the subject of regulatory obligations, establishing an information-sharing mechanism, and strengthening international cooperation [15].

4.3. Technical Characteristics

The main challenge lies in transaction and security. Although it has encryption technology, it faces threats such as network security loopholes. The People's Bank of China should establish a sound system security management system and operational norms, monitor and evaluate the security of the digital RMB system, and take necessary measures to improve and update it. It not only needs to meet

the protection of user privacy but also needs to have certain requirements for regulatory traceability, but also can design customized products according to the needs of different customer groups [16]. The Consensus algorithm is a distributed algorithm mainly used by blockchain technology, and the transaction performance and speed are mainly determined by the performance of each participating node in the network, requiring a large number of transactions [17]. At the same time, as technology continues to update, legal protection and regulation need to keep up with the pace of technological change.

4.4. Product Awareness

The awareness of digital currency is improving, but from the overall point of view, there are still some ordinary people's cognition of digital currency is extremely limited, and there are differences in public cognition in different regions, it is currently recommended that China's digital yuan be piloting at the wholesale end. Encouraging commercial banks to further promote digital RMB; The central bank's digital currency interest rate can be adjusted according to the needs of policy regulation, as an important supplement to the existing interest rate corridor, and even as a lower limit of the corridor to further optimize the transmission effect of monetary policy [18].

5. Conclusion

To sum up, digital currency has many advantages such as efficient transaction completion, decentralized management and low cost, but it should also pay more attention to regulatory issues. In contrast, having a complete financial system must be more helpful to the development of China's financial industry. This paper has extensively collected several domestic academic articles to explain the definition of legal digital currency and private digital currency and clarify the problems and challenges faced by digital currency. For the future research direction, the prediction includes but is not limited to the system, evaluation criteria, operation mode and other aspects of central bank digital currency. To develop China's financial industry, the digital technology industry should be improved. To determine the legal status and rules for the use of legal digital currency, technological progress will promote social change, and digital currency will be developed and disseminated [19], Product awareness will also increase. Driven by financial innovation, people continue to explore more efficient, safer and more convenient forms of payment and money. Make use of many advantages such as the high efficiency and low cost of digital currency, so that domestic digital currency can achieve greater development.

References

- [1] Guangmei Wan, *Research on Financial Risks and Prevention Strategies of Digital Currency*, *Financial news journal*, 2024-01-23, page185
- [2] Gang Di, *Digital Currency Analysis*, *Financial technology*, 1994-2023, page52
- [3] Ming Zhang ,Zhe Wang, Yinmo Chen, *Comparative analysis of three digital currencies: Bitcoin, Libra and digital Renminbi*, *International finance*, 2023-03-15, page54-55
- [4] Peijie Wang, *On the Inevitability and Future Trend of Digital currency Issuance*, *Shanxi finance and Taxation*, 2024-01-01, page47
- [5] Salomé Bernhart, *Applications of CBDCs and private stablecoins*, *Comparative analysis*, 2020-08-21, page:29
- [6] Gang Di, *Digital Currency Analysis*, *Financial technology*, 1994-2023, page52
- [7] Ziyu Ma , *Research on the Development path of new money under the Evolution of Monetary system classification*, *Prices in China* , 2021-09-13, page10
- [8] Jingxuan Jiang, *On the Regulatory Dilemma and Breakthrough of China's Legal Digital Currency*, *Northern Finance* , 2024-01-15, page64-65
- [9] Guangmei Wan, *Research on Financial Risks and Prevention Strategies of Digital Currency*, *Financial news journal*, 2024-01-23, page185

- [10] Ziyu Ma ,*Research on the Development path of new money under the Evolution of Monetary system classification*,*Prices in China* ,2021-09-13,page11-12
- [11] Jingxuan Jiang,*On the Regulatory Dilemma and Breakthrough of China's Legal Digital Currency*,*Northern Finance* ,2024-01-15,page67
- [12] Guangmei Wan,*Research on Financial Risks and Prevention Strategies of Digital Currency*,*Financial news journal*,2024-01-23,page187
- [13] Ziwei Dai, Hailong Guo ,*Research on China's Digital Currency Development from the Perspective of Jinping Xi Economic Thought*,Kunming, Yunnan Province 650000,*Institute of Party History and Literature of the CPC Central Committee (Central Compilation and Translation Bureau)*, Beijing ,2014-03-15,page6
- [14] Yating Zhang,Fanqi Zhou,*Regulatory reform of virtual digital currency*,*Investment and cooperation*, 2024-02-15,page11
- [15] Jingxuan Jiang,*On the Regulatory Dilemma and Breakthrough of China's Legal Digital Currency*,*Northern Finance*,2024-01-15,page67-69
- [16] Zhihui Shi, Minfeng Lu,*Study on the Influence Mechanism and Optimization Countermeasures of Digital RMB on the Development of Digital Financial Industry*,*Investment and cooperation* ,2024-02-15,page109
- [17] Yingying Guan,*Research on the Development of legal Digital Currency -- Taking Central Bank DCEP as an Example*,*Journal of HeiheCollege* ,2024-02-25,page64
- [18] Xiaolei Liu,Changzhou Ma,Bowen Dong, Xiaolin Xiao,*Research on Central Bank Digital Currency under the Interest Rate Corridor * -- A Discussion Based on the Theory of New Monetarism and the Reality of China*,*Manage world*,2024-03-25
- [19] Gang Di,*Digital Currency Analysis*,*Financial technology*,1994-2023,page54-55

Analysis of the Economic Factors Influencing Rural Tourism Based on the Grey Relational Method: A Case Study of Zhejiang Province

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Abstract: The development of rural tourism is a key task for the revitalisation of rural areas and is of great significance for narrowing the gap between urban and rural areas and achieving shared prosperity. Zhejiang Province is one of the first provinces in China to develop rural tourism. Studying the factors influencing the economic impact of rural tourism in recent years is a reference for other provinces and cities to develop rural tourism and achieve rural revitalisation. This paper selects the total number of rural tourism visitors, the total number of farmhouses, the total number of rural tourism employees and the total number of travel agencies as variables to study their relationship with the total output value of rural tourism. Based on the data from 2013 to 2023, the grey correlation method is used to conduct an empirical analysis. The results show that the total number of rural tourists and the total number of travel agencies have a stronger impact on the development of rural tourism economy.

Keywords: Rural tourism, Rural revitalisation, Grey relational analysis, Influencing factors.

1. Introduction

2023 Central Document No. 1 made a comprehensive deployment of the work of the "three rural areas" and the key work of rural revitalisation in the new era, which also put forward new requirements for rural tourism development. At the same time, it also puts forward new requirements for the development of rural tourism.

Since 2007, rural tourism has been included in the central government's No 1 document, which requires that priority be given to the development of horticulture, speciality agriculture and rural tourism. In the ten years since, almost every year's Central No 1 Document has stressed the importance of rural tourism in promoting the strategy of rural revitalisation. In China, the rapid development of tourism has opened up new areas for the rural economy, and it has increasingly become a pillar industry in some regions, playing an important role in achieving industrial revitalisation and urban-rural integration [1-3].

Since the 19th National Congress, the strategy of rural revitalisation has become an important national strategy, and rural tourism is an important driving force for China's rural revitalisation and an effective hand for rural development [4]. Domestic scholars also pay more attention to applied

research. In the new era, rural tourism still has huge development space, and rural tourism research still has great potential [5].

For the economic development of rural tourism in a region, there are various influencing factors, such as the number of tourists choosing rural tourism, the income of rural tourism, and the number of travel agencies doing rural tourism business. Among these factors, which factors play a more important role in the development of rural tourism economy is a key issue that needs to be quantitatively analysed, so that the countermeasures formulated to promote the development of rural tourism economy can be more targeted.

Zhejiang has rich landscape resources, unique rural scenery, high-quality ecological environment, from the evaluation of tourism resources, the development of rural tourism conditions is unique and has great potential. The development of rural tourism is crucial for Zhejiang Province to achieve rural revitalisation and promote rural economic development in Zhejiang. However, there are many factors affecting the rural tourism economy, and there is a lack of direct visible correlation between the factors. This paper adopts the grey scale correlation method to carry out specific empirical research and analysis work to provide a theoretical basis and strategic support for promoting the development of rural tourism in Zhejiang Province.

2. Grey Relational Calculation and Result Analysis of Economic Influencing Factors of Rural Tourism in Zhejiang Province

2.1. Grey Relational Analysis

The concept of grey correlation comes from grey system theory, which is based on the degree of similarity in the shape of the sequence curve of factors between two systems to determine the degree of correlation between the factors.

The advantage of grey correlation analysis is that the computational volume is small, and the sample capacity requirement is not high, even if there are only four samples, and it can also be applied to the data without regularity [6]. Its basic idea is: the raw data collected, if it needs to be pre-processed, it will be dimensionless. After calculating the correlation coefficient and correlation degree, then compare the size of the correlation degree, and rank the evaluation indices according to the size of the correlation degree [7].

2.2. Selection and Calculation of Indicators

In order to analyse the factors influencing the development of rural tourism in Zhejiang, the variables needed for the empirical study were first selected for the grey relational analysis model. For the development of rural tourism, the total output value of rural tourism was selected as the representative variable, and its size reflects the level of development of rural tourism. For the factors influencing the development of rural tourism, the total number of rural tourism visitors, the total number of rural tourism farms, the total number of rural tourism employees and the total number of travel agencies were selected as representative variables. The reasons for selecting these factors as variables in the grey relational analysis are based on two considerations:

A. These variables have been used in the literature, either individually or in combination, and their usefulness has been confirmed.

B. These variables can be quantified by data and are useful for grey relational analysis. Among them, the total number of rural tourism tourists reflects the customer base that the rural tourism economy can attract; the total number of rural homestays reflects the scale of rural accommodation, catering and entertainment facilities available to tourists; the total number of rural tourism employees reflects the scale of staff involved in rural tourism; and the total number of travel agencies reflects the scale of economic organisations that can provide rural tourism services.

In order to obtain the original data needed for empirical research and the availability of reference data, this paper collates data from the Zhejiang Statistical Yearbook, the China Tourism Industry Development Report and other survey reports on the five variables from 2016 to 2023. The specific results are presented in Table 1.

Table 1: Raw data on the influencing factors of rural tourism economic development in Zhejiang Province

Year	Total rural tourism output value (100 million yuan)	Total number of rural tourists (100 million)	Total number of farmhouses (10,000)	Total number of people employed in rural tourism (10,000)	Total number of travel agencies (households)
2016	291	2.8	1.9	16.6	2105
2017	353.8	3.4	2.04	16.7	2173
2018	427.7	4	2.2	16.9	2707
2019	522.2217	4.22	2.12	17	2769
2020	431.3	2.47	2.1	17	2885
2021	469.4	3.9	2.1	31.5	3014
2022	514.6	3.22	2.29	32	3181
2023	471	3.6	2	32.7	3497

The calculation of grey relational degrees is mainly concentrated in four steps [8]:

Step1. Based on the original data in Table 1, each sequence must be dimensionless and the initial value of each sequence must be calculated;

Step2. Find the absolute value sequence of the difference between the initial value image of the parent sequence and the corresponding component of each subsequence;

Step3. Find the maximum and minimum values of the absolute value sequence;

Step4. Calculate the correlation coefficient and the average of each correlation coefficient. The average of each correlation coefficient is the correlation coefficient.

In this paper, Spss Pro is used to import the original data and directly calculate the correlation between each sub-sequence and the parent sequence, as shown in Tables 2 and 3.

Table 2: Annual correlation between the sequence variables of each influencing factor and the variables of tourism economic development

	Total number of rural tourists	Total number of farmhouses	Total number of people employed in rural tourism	Total number of travel agencies
2016	1.000000	1.000000	1.000000	1.000000
2017	0.996065	0.730502	0.647437	0.677353
2018	0.903412	0.552629	0.460303	0.677031
2019	0.572700	0.362059	0.333333	0.445685
2020	0.391016	0.505493	0.456838	0.775405
2021	0.636296	0.431383	0.575181	0.680072
2022	0.383849	0.406216	0.707426	0.599632
2023	0.536484	0.405019	0.523024	0.900165

Table 3: Total correlation of the impact of each influencing factor on the development of rural tourism economy

Influencing Factor	Total Relevance	Rank
Total number of travel agencies	0.719	1
Total number of rural tourists	0.677	2
Total number of people employed in rural tourism	0.588	3
Total number of farmhouses	0.549	4

2.3. Grey Relational Calculation and Result Analysis

According to the results of the grey relational analysis given in Table 3, it can be seen that the factor that has the greatest impact on the development of rural tourism in Zhejiang Province is the total number of travel agencies, with a grey relational degree of 0.719; followed by the total number of rural tourism visitors, with a grey relational degree of 0.677; and then the total number of rural tourism employees, with a grey relational degree of 0.588; the weakest influence is the total number of farmhouses, with a grey relational degree of 0.549.

Empirical research also found that the grey relational method pays special attention to the measurability of variables in practical applications. If the variables are not measurable and cannot be quantified, the grey relational method cannot be applied. Therefore, when using the grey relational method to solve practical problems, it is necessary to consider the existence of this limitation.

3. Analysis and Suggestion

3.1. Establishment of Professional Rural Tourism Travel Agencies

According to the conclusions of the grey relation analysis, the total number of travel agencies ranks first in terms of its impact on the development of the rural tourism economy, indicating that the advertising and promotion, route design and full service of travel agencies are of great significance in attracting tourists to choose rural tourism projects and expanding the scale of the rural tourism economy. From the current situation, Zhejiang travel agencies are fully developed, providing both international and domestic tourism services, as well as scenic and rural tourism services. Relevant departments should take a series of effective measures to build professional rural tourism travel agencies and promote the upgrading of the rural tourism industry. Make good plans for the development of the rural tourism industry and try to avoid low-quality homogeneous industry development. Create a wide range of health and wellness tourism products, including farm experience, healthy eating and physical management, which can activate the use of rural resources, increase the added value of rural tourism, enhance the resilience of the industry and accelerate the iterative upgrading of traditional rural industries, thereby promoting overall regional development.

3.2. Adapting to Local Conditions to Increase Attractiveness

Although the total number of rural tourism visitors ranks second in terms of its impact on the development of the rural tourism economy, the number of rural tourism visitors is still an important factor affecting the development of the rural tourism economy. Affected by the epidemic, most tourists chose to travel within the city and province. Therefore, from 2020 to 2021, the total number of rural tourism visitors in Zhejiang Province increased rapidly. However, after the epidemic, although the number of rural tourism visitors in Zhejiang Province increased, the growth rate

slowed down, mainly due to the increase in the number of routes and scope of travel options for residents. China's traditional rural tourism industry does not have a distinctive personality, market competition is fierce and the industry is highly replicable. However, in order to form a core competitiveness and make rural tourism products unique and different from other products in the industry, they must have regional characteristics. Therefore, villages that have the prerequisites should be encouraged to develop local resources with local characteristics. Professional tourism planning agencies can help with creative ideas, and provincial organisations can explore, protect and promote rural cultural tourism areas. They can also establish relevant provincial rural cultural tourism demonstration zones to raise the social status of the project, increase its influence, enhance the attractiveness of rural tourism to tourists, stabilise the number of tourists, and prevent tourists from abandoning rural tourism and choosing other forms of tourism.

3.3. Improving the Quality of Rural Tourism Service Personnel

In rural tourism, the most important factor in attracting tourists is the quality of the staff providing services in various aspects such as catering, accommodation, guided tours and entertainment. The skills and quality of rural tourism employees affect the taste of rural tourism services and the attraction of tourists in all aspects. The quality of employees can be improved in two ways: first, by recruiting professionals to go to scenic spots and conduct various forms of training activities, including university scholars and experienced employees in the tourism industry. At the same time, employees should be organised to study at universities or rural tourism model areas to improve the theoretical knowledge and practical skills of service personnel.

Second, rural tourism areas can introduce high-quality professional high-end talent, including the following two aspects: first, directly introduce staff with high professional quality, such as hotel management, professional tour guides, professional cooks, etc.; second, introduce new investment units to attract high-quality talent to join, and some investors themselves are very professional and will also bring a lot of related resources.

3.4. Enriching the Service Content and Improving the Service Quality of Agritourism

Farm holidays are an important factor in attracting tourists to rural tourism, and the food, accommodation and folk entertainment they provide are important services in rural tourism. However, the results of this analysis show that their impact on the development of rural tourism is not commensurate with the role they should play. The reasons for this are related to the single service content of some farm stays, the poor food and accommodation environment and the vulgarity of the service items. Therefore, in order to increase the impact of farm stays on the development of rural tourism, it is necessary to further enrich the service content of farm stays so that tourists feel that they get value for money when they visit farm stays. At the same time, considering that most tourists who go to rural areas are urban citizens with relatively high quality and education, farm-stay must pay attention to service quality, food hygiene, clean accommodation environment, attitude in the service process and other issues.

4. Conclusion

Tourism is a wealth-creating industry, and in the context of common prosperity, rural tourism has huge room for development. Vigorously developing the rural tourism industry helps develop the rural economy, exploit rural natural and cultural resources, optimise the integration of rural industries, promote employment among farmers, drive up farmers' incomes, and inject vitality into rural economic development. The development of rural tourism in Zhejiang Province requires support from all sides. The government, tourism enterprises and local villagers should all recognise

the intrinsic connection between the rural tourism industry and rural revitalisation, do their own jobs well, improve the overall quality of rural tourism in Zhejiang Province by building specialised rural tourism travel agencies and designing multi-level tourism products to increase their appeal to tourists, and promote the sustainable development of the rural tourism industry to support the comprehensive promotion of the rural revitalisation strategy. This paper also lacks field visits and investigations into the local rural tourism situation. The above methods can be incorporated into future research to better collect local data.

References

- [1] Su Fei, Wang Zhonghua. *Rural tourism in China from the perspective of rural revitalisation: development model, driving mechanism and international experience*. *World Agriculture*, 2020(2): 115-119, 127.
- [2] Zhong Yiping, Tang Linren, Hu Pingbo. *The mechanism and empirical analysis of promoting the optimisation and upgrading of rural industrial structure by integrating agriculture and tourism: taking the national demonstration counties of leisure agriculture and rural tourism as an example*. *Chinese Rural Economy*, 2020(7): 80-98.
- [3] Yang Geyao, Zhou Changchun, Yang Guangming. *Analysis of the relationship between the integration of agriculture and tourism industries and the alleviation of rural poverty*. *Statistics and Decision*, 2020, 36(5): 81-86.
- [4] Shen Shizhan, Wang Pengfei. *The logical mechanism, practical dilemma and breakthrough way of rural tourism in promoting rural revitalisation [J]*. *Journal of Northwest A&F University (Social Science Edition)*, 2022 (5): 72.
- [5] Huang Zhenfang, Zhang Yuangang, Jia Wentong, et al. *Research history and development trends of rural tourism in China in the new era [J]*. *Journal of Natural Resources*, 2021 (10): 26
- [6] Ding Yidan. *Empirical analysis of the impact of population ageing on consumption structure in Huangshi City [D]*. Hubei Normal University, 2017.
- [7] Liu Sifeng, Xie Naiming, et al. *Grey system theory and its applications (6th edition) [M]*. Science Press. 2013 (03)
- [8] Liu Sifeng, Yang Yingjie, Wu Lifeng, et al. *Grey system theory and its applications (Seventh edition) [M]*. Science Press. 2014 (06).

The Transformation of Luxury Brands' Marketing Strategies in Social Media

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Abstract: The luxury industry is currently undergoing a significant transformation driven by digitalization. Consumer shopping behaviors are increasingly shifting towards online channels, while social media emerges as a key platform for interaction between luxury brands and consumers. The rise of emerging markets and the growing young consumer demographic are driving the trend of digital consumption. Luxury brands are actively expanding into the digital sphere, employing celebrity endorsements and social media marketing strategies. This paper utilizes a literature review and case analysis methodology. It finds that combining celebrity endorsements with social media marketing effectively enhances brand awareness and sales, creating a unique brand image and attracting more consumers. This trend has become a crucial transformation path for the luxury industry, albeit brands need to carefully consider celebrity selection and risk management. Future research could further explore best practices in celebrity endorsements and social media marketing, as well as their long-term impact on consumer behavior and brand benefits.

Keywords: luxury industry, digitalization, celebrity endorsements, social media marketing, brand awareness.

1. Introduction

The modern economy is causing consumer shopping habits to become more digital, with a rising number of people choosing to make their purchases online. Concurrently, social media's steady ascent has made it an essential conduit for communication and interaction between consumers and premium firms. The younger generation, who are more accustomed to internet consumption, is gradually becoming the majority of luxury buyers as new markets arise. Given this, luxury businesses are steadily entering the digital space, and data-driven marketing is playing a big role in this transformation [1].

The purpose of this essay is to investigate the history, rationale, and outcomes of luxury firms' use of social media and celebrity endorsements in digital marketing. The study focuses on examining how social media marketing and celebrity endorsements work together to affect sales, brand awareness, and brand image remodelling. Case analyses and literature reviews are part of the methodology used. A thorough examination of pertinent literature provides insights into the history and current trends of luxury firms that choose digital marketing [2]. In addition, case studies of luxury brands that

successfully integrate social media marketing with celebrity endorsements are looked at in order to assess the influence of these strategies on luxury brands.

According to the study, social media marketing in conjunction with celebrity endorsements by premium firms, can effectively enhance brand recognition and attractiveness, increase brand visibility, create more exposure opportunities, and generate unique brand stories and interactive content, shaping a profound brand impression, increasing interaction with consumers, attracting more consumers, and increasing consumer spending and market share. In the digital age, luxury brands choosing to use celebrity endorsements and social media for digital marketing have become a trend. Through collaborations with celebrities and integration with social media marketing, luxury brands can better enhance brand awareness, sales, and brand image. However, brands need to carefully consider the match between celebrity image and brand positioning when choosing celebrity endorsements, while also paying attention to the risks and challenges they may face in social media marketing. Through this research, it is hoped that suitable operating methods for integrating celebrities and social media between luxury brands can be explored, bringing about long-term stable positive effects.

2. Transformation of the Luxury Industry

2.1. Brand Reshaping

The modern economy is causing consumer shopping habits to become more digital, with a rising number of people choosing to make their purchases online. Concurrently, social media's steady ascent has made it an essential conduit for communication and interaction between consumers and premium firms. The younger generation, who are more accustomed to internet consumption, is gradually becoming the majority of luxury buyers as new markets arise. Given this, luxury businesses are steadily entering the digital space, and data-driven marketing is playing a big role in this transformation [3].

The purpose of this essay is to investigate the history, rationale, and outcomes of luxury firms' use of social media and celebrity endorsements in digital marketing.

The research focuses on analyzing the combined impact of celebrity endorsements and social media marketing on brand awareness, sales, and brand image reshaping. The methodology employed includes literature reviews and case analyses. Through comprehensive analysis of relevant literature, insights into the background and trends of luxury brands choosing digital marketing are obtained. Furthermore, through case analysis, successful practices of luxury brands combining celebrity endorsements and social media marketing are examined, aiming to analyze the impact of celebrity endorsements and social media marketing on luxury brands.

The research reveals that luxury brands collaborating with celebrities for endorsements, combined with social media marketing, can effectively enhance brand recognition and attractiveness, increase brand visibility, create more exposure opportunities, and generate unique brand stories and interactive content, shaping a profound brand impression, increasing interaction with consumers, attracting more consumers, and increasing consumer spending and market share. In the digital age, luxury brands choosing to use celebrity endorsements and social media for digital marketing have become a trend. Luxury brands can better enhance brand awareness, sales, and brand image through collaborations with celebrities and integration with social media marketing. However, brands need to carefully consider the match between celebrity image and brand positioning when choosing celebrity endorsements, while also paying attention to the risks and challenges they may face in social media marketing. Through this research, it is hoped that suitable operating methods for integrating celebrities and social media between luxury brands can be explored, bringing about long-term stable positive effects [4].

In the past, the luxury industry heavily relied on offline and travel retail. However, the sales volume was significantly impacted by the COVID-19 pandemic, prompting luxury brands to seek a more reliable sales strategy. In recent years, luxury brands have transformed by continuously integrating into the fields of new media and digitalization, redefining their brand image in conjunction with traditional models.

With the development of the market and the change in consumer mindset, brands aim to stand out in the market, leaving a rapid brand impression on the public. Major luxury brands are innovating continuously, particularly through visual innovation and social media marketing, which is currently an effective and rapid method to enter the public's view.

"Firstly, in terms of brand visual reshaping, it is a dynamic and continuous process critical to brand communication. A successful luxury brand visual symbol not only represents the brand's connotation and characteristics but also carries the cultural value and historical heritage of the brand. It not only has high recognition and artistic sense but also embodies the historical value of the brand. Brand visual reshaping should always meet the needs of brand competitive strategies, considering both the brand's own history and cultural background, maintaining brand consistency, and also considering the feelings of consumers with different cultural backgrounds and behaviors, making the brand more modern, fashionable, valuable, and dynamic, continually enhancing consumers' sense of brand identity and belonging" [1].

China is not a big producer of luxury goods, but a big consumer of luxury goods. According to the statistics of Bain Consulting Company, China's total luxury consumption has been growing year by year, the fastest growth rate in 2010, reaching 36.25%, the first three quarters of 2011, continued this growth momentum, but the growth rate slowed down in the fourth quarter, down to 13.33% in 2012. The reasons for the slowdown in luxury consumption are both political and economic. Economic: China's economic growth slowdown and European debt crisis; Political: On July 9, 2012, The State Council issued the Regulations on the Administration of Government Office Affairs, which clearly stipulates that the government cannot purchase luxury goods. The economic downturn has made consumer expectations less optimistic, and government policies have weakened the wind of luxury gifts, which has led to a lack of demand in the luxury market.

China Luxury Association also releases a luxury goods market consumption report every year, mainly studying China's domestic luxury goods consumption, which is divided into luxury goods according to the consumption level of our people, including: cosmetics, diamonds, luggage and clothing, alcohol, top-brand tea, high-end luxury real estate and so on. Many of these brands are not internationally recognized. In 2011, the total consumption of luxury goods in China was 1,392 billion yuan, and the growth rate was 1,836.5 billion yuan in 2012. There are many reasons for the rapid growth of the total consumption of luxury goods in China: the improvement of people's income level, the improvement of life quality, unhealthy consumer psychology... It is worth mentioning that the arrival of the era of generalized virtual economy has weakened the consumption of some luxury goods and increased the investment. For example, wine, jewelry, antiques, etc., many consumers buy not for consumption, but for investment and preservation, and the real economy turns to the virtual economy, which is also one of the reasons for the rapid growth of luxury consumption.

Chinese consumers are much more enthusiastic about buying luxury goods abroad than in China. From the beginning of February 2010 to the end of March 2011, the total consumption of China's luxury goods market has reached 10.7 billion US dollars (excluding private jets, yachts and luxury cars), while in almost the same period, the total consumption of Chinese luxury goods in the European market has reached nearly 50 billion US dollars, which is four times that of the domestic market. The peak of overseas consumption is mainly concentrated in Chinese holidays. From 2010 to 2012, the total amount and growth rate of Chinese people's overseas consumption during the Spring Festival continued to rise.

2.2. Exploring the Potential of the Chinese Market

Luxury brands have realized the enormous consumption potential of the Chinese market and have been continuously combining with traditional Chinese culture for long-term sustainable development. Digitalization has also been assisting luxury brands in further expanding into the Chinese market. In recent years, with the support of various factors, the luxury industry has gradually rebounded. For example, according to Burberry's preliminary performance data, the robust growth in the Chinese market has driven an 18% year-on-year increase in sales [2]. The characteristics of the Chinese luxury market lie in its large and diverse consumer groups. Heavy consumers remain the most stable backbone force, accounting for 40% of consumption with only 11% of consumer proportions. Additionally, the consumption momentum of young consumers under 30 and consumers from second-tier and below cities is strengthening, becoming emerging forces and future growth drivers in the luxury goods market. Among them, Chinese luxury consumers' buying habits formed during the epidemic are gradually stabilizing. Although epidemic prevention and control policies have been relaxed, the Chinese mainland market is expected to continue to account for over 80% of the overall market size.

2.3. Diversification of Channels

In practice, it can be observed that luxury brands currently employ marketing strategies tailored to brand characteristics and audience groups, conducting personalized and differentiated marketing, and combining online and offline models through integrated media for more accurate promotion modes. Online, platforms with significant traffic such as Weibo, Douyin, and Xiaohongshu are utilized for advertising and commercial promotion, quickly gaining traffic and increasing brand exposure. Collaboration with top bloggers and celebrities, utilizing their traffic and alignment with the brand's image, for cooperative marketing, can also rapidly gain traffic and reshape or enhance brand image. Traditional offline channels also require attention. For instance, physical stores, press conferences, brand banquets, fashion shows, and exhibitions provide emotional value to consumers, such as a sense of achievement, experience, joy, and social status symbolism, strengthening consumer identity and belonging [3].

3. The Uniqueness of Traditional Marketing Model

Using the upscale jewellery and watch company M as an example, their strategy for developing new goods is to introduce them once a year, with an emphasis on distinctive craftsmanship and ultra-thin movement production technology. In the jewellery business, M offers inventive and collectible jewellery with fresh features and distinctive designs, frequently fusing traditional Chinese culture, particularly during particular holiday seasons [5].

4. Opportunities Brought by the Digital Field to the Luxury Industry

4.1. Limitations of Traditional Marketing Models

The 4P framework (Product, Price, Promotion, Place) analysis of traditional marketing methods reveal some weaknesses. Using the upscale jewellery and watch company M as an example, their strategy for developing new goods is to introduce them once a year, with an emphasis on distinctive craftsmanship and ultra-thin movement production technology. In the jewelry segment, M introduces collectible and innovative jewelry with novel elements and unique designs, often incorporating traditional Chinese culture, especially during specific festive periods [6].

4.2. Diversity Brought by Digital Marketing Models

The advent of digital marketing has introduced a diverse range of approaches for luxury brands to engage with consumers. Unlike traditional marketing channels, digital platforms offer unparalleled opportunities for direct engagement and interaction with consumers. Luxury brands can utilize various digital marketing strategies such as influencer partnerships, content marketing, and targeted advertising to reach their desired audience segments. By leveraging data analytics and consumer insights, brands can tailor their marketing efforts to effectively resonate with their target demographics.

4.3. Impact of Network Symbolic Consumption

Network symbolic consumption, facilitated by digital platforms, has profoundly influenced consumer behaviour in the luxury industry. Social media platforms serve as a space for individuals to showcase their status, lifestyle, and identity through conspicuous consumption of luxury goods. The phenomenon of "Instagrammable" luxury experiences and products has led to increased demand for visually appealing and aspirational products [7]. Luxury brands must carefully navigate this landscape to ensure that their marketing efforts align with the values and aspirations of their target audience while maintaining authenticity and exclusivity.

5. Precision Marketing through Social Media

5.1. Marketing Models on Social Platforms

Social media platforms offer luxury brands a unique opportunity to engage with consumers in a more personalized and targeted manner. Through platforms such as Instagram, Facebook, and TikTok, brands can create tailored content that resonates with specific audience segments. Influencer marketing has emerged as a particularly effective strategy, allowing brands to leverage the influence and reach of social media personalities to promote their products to a broader audience. By partnering with influencers whose personal brand aligns with the values and aesthetics of the luxury brand, companies can enhance their brand image and reach new consumers[8].

5.2. Reinforcement and Diminishing of Segmentation

While social media allows luxury brands to reach a broader audience, it also presents challenges in maintaining exclusivity and segmentation. The democratization of luxury through social media platforms has led to a blurring of traditional boundaries between luxury and mass-market brands. Additionally, the rise of micro-influencers and user-generated content has further fragmented the market, making it increasingly difficult for brands to differentiate themselves. To address this challenge, luxury brands must carefully curate their online presence to maintain a sense of exclusivity and desirability while still engaging with a diverse range of consumers.

5.3. Consumer Attitudes

Consumer attitudes towards luxury consumption have evolved in response to the digitalization of the industry. Millennials and Gen Z consumers, in particular, exhibit different purchasing behaviors and preferences compared to previous generations. These digital-native consumers place a high value on authenticity, sustainability, and social responsibility when making purchasing decisions. Luxury brands must adapt their marketing strategies to appeal to these changing consumer preferences, emphasizing transparency, ethical practices, and meaningful brand storytelling [9].

6. Issues with Digital Marketing

6.1. Risk Management in Marketing Content

One of the primary challenges faced by luxury brands in digital marketing is risk management in content creation and distribution. Social media platforms present opportunities for brands to engage with consumers in real time, but they also pose risks in terms of brand reputation and integrity. Missteps in content creation or influencer partnerships can quickly escalate into public relations crises, damaging brand credibility and trust. To mitigate these risks, luxury brands must establish clear guidelines and protocols for content creation and partner selection, ensuring that their marketing efforts align with their brand values and objectives.

6.2. Integration Management Issues between Platforms

Another significant challenge in digital marketing for luxury brands revolves around the integration of marketing efforts across numerous platforms. As consumers engage with brands through various digital touchpoints, including social media, e-commerce websites, and mobile apps, it becomes imperative for luxury brands to maintain consistency and coherence in their messaging and branding. To achieve this, luxury brands must adopt an omnichannel marketing approach, which involves seamlessly integrating their marketing efforts across platforms to offer consumers a unified and cohesive brand experience. This requires effective coordination and collaboration between marketing teams, as well as the implementation of robust analytics and tracking systems to monitor performance and optimize strategies [10].

6.3. Avoiding Over-Marketing and Overindulgence in Hedonism

In the digital era, luxury brands must delicately balance the maintenance of exclusivity and desirability with the avoidance of over-marketing and the perpetuation of hedonistic consumer behaviors. The incessant flood of marketing messages and promotions on social media can lead to consumer fatigue and cynicism, ultimately diminishing the perceived value of the brand. Therefore, luxury brands must adopt a more restrained and selective marketing approach, prioritizing quality over quantity and focusing on creating meaningful brand experiences rather than superficial indulgence. By cultivating a sense of scarcity and exclusivity, luxury brands can enhance their allure and appeal to discerning consumers who value craftsmanship, heritage, and authenticity. This approach not only preserves the integrity of the brand but also fosters deeper connections with its target audience.

6.4. Balancing Brand Value with Consumer Personalization

In the realm of digital marketing for luxury brands, a delicate balance must be struck between preserving brand value and catering to consumer personalization. As consumers increasingly demand customization and personalization, luxury brands are faced with the challenge of aligning these initiatives with their core brand identity and positioning. Mass customization strategies, while seemingly attractive in their potential to cater to individual preferences, can inadvertently dilute the exclusivity and prestige that are integral to the luxury brand experience. It is essential for luxury brands to delicately manoeuvre the customization space, ensuring that personalized experiences resonate with individual consumers while simultaneously upholding the aura of exclusivity and craftsmanship that defines the luxury segment.

6.5. Balancing Use Value and Symbolic Value

Furthermore, luxury brands must navigate the intricate tension between use value and symbolic value in their digital marketing endeavors. While luxury products inherently possess a certain level of functional utility, their appeal often transcends mere practicality, encompassing deeper symbolic and aspirational qualities. In the digital era, consumers are increasingly drawn to brands that offer experiences and narratives that go beyond the mere product. Therefore, luxury brands must harness the power of digital channels to effectively communicate their brand stories, emphasizing the emotional and symbolic significance of their products while consistently delivering superior quality and craftsmanship. This balanced approach will ensure that luxury brands maintain their esteemed position in the market, while also connecting deeply with their target audience.

7. Conclusion

In conclusion, a new era of marketing potential and difficulties has been brought about by the digitalization of the luxury sector. The way luxury businesses interact with customers has been completely transformed by the incorporation of digital technologies and social media platforms, which present previously unheard-of possibilities for customisation, interaction, and narrative. These chances do, however, come with hazards, such as dilution of the brand, weariness among consumers, and harm to reputation. Luxury businesses need to take a strategic and sophisticated approach to digital marketing in order to compete in the modern day. They need to strike a balance between the technological draw and the classic principles of authenticity, exclusivity, and fine craftsmanship.

References

- [1] Zhang, Y. (2019). *Research on Luxury Brand Visual System Reshaping*. Beijing Fashion Institute. DOI:10.26932/d.cnki.gbifc.2019.000223.
- [2] Qi, L. (2023). *Digitalization Assisting Luxury Brands in Deepening the Chinese Market*. *China Foreign Trade*, 44-45.
- [3] Chevalier, M., & Mazzalovo, G. (2012). *Luxury Brand Management: A World of Privilege*. Wiley.
- [4] Kapferer, J. N., & Bastien, V. (2009). *The Luxury Strategy: Break the Rules of Marketing to Build Luxury Brands*. Kogan Page.
- [5] Okonkwo, U. (2010). *Luxury Fashion Branding: Trends, Tactics, Techniques*. Palgrave Macmillan.
- [6] Vel, K., & Vargas, P. (2018). *Luxury Branding in Higher Education: Lessons from the Luxury Brand Market*. Palgrave Macmillan.
- [7] Kern, L. (2016). *Luxury Online: Styles, Systems, Strategies*. Springer.
- [8] Atwal, G., & Williams, A. (2017). *Luxury Brand Marketing: The Experience Is Everything*. John Wiley & Sons.
- [9] Dubois, B., & Laurent, G. (1994). *Attitudes Toward the Concept of Luxury: An Exploratory Analysis*. *Asia Pacific Advances in Consumer Research*, 1(1), 273-279.
- [10] Swaminathan, V., & Bawa, K. (2018). *The Relationship Between Brand Loyalty and Price Sensitivity: A Study of Packaged Coffee Buyers*. *Journal of Retailing*, 74(2), 223-245.

Analysis of Key Events to Economic Growth in Thailand's History

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Abstract: In recent decades, Thailand has made a lot of efforts to achieve a rapid economy increase, and completed the transition from agricultural production to industrialization. Thailand's economic journey has seen significant reforms, challenges, and changes, closely intertwined with global economic changes and domestic policies. This article examines Thailand's economic trajectory from the 1960s to the present day, focusing on pivotal events such as the economic reforms of the 1960s, the Asian financial crisis in 1997, and the growth of the tourism sector since the 1980s. By examining these key historical moments, it aims to uncover the fundamental principles and trends that have influenced Thailand's economic development trajectory. Through an analysis of their impacts on economic growth, this study identifies lessons gleaned from both successes and setbacks. It highlights the significance of adaptive economic policies, resilience in the face of external shocks, and the role of sectoral diversification in fostering sustainable growth.

Keywords: Thailand Economy, Thailand History, Industrialization, Asian Financial Crisis, Economic Growth.

1. Introduction

Since the early 1960s, Thailand's per capita GDP has just reached three digits, and before the outbreak of COVID-19, Thailand's per capita GDP had reached a peak of US\$7,629. In these decades, the per capita GDP has increased by more than US\$7,000 [1]. Thailand has made a lot of efforts to achieve this achievement. In the early 20th century, Thailand's economy was mainly agricultural-dominated and relied on agricultural product exports, such as rice, rubber, and timber. Thailand's early economic structure was an agricultural society, with most of the population engaged in agricultural production.

At the beginning of the 20th century, Thailand's economy was mainly based on agriculture. From 1867 to 1937, Thailand's annual rice exports amounted to more than 65% of its total production [2]. The focus after World War II was on rapid industrialization to achieve huge economic growth through a structural shift from low-productivity agriculture to high-productivity industry. In these 60 years, Thailand's economy has achieved a huge leap and completed the transition from agricultural production to industrialization. This article analyzes the economic reforms in the 1960s, the Asian financial crisis in 1997, and the development of the tourism sector since the 1980s, it also analyzes the key events in Thailand's history that have affected economic growth to understand the laws, and trends of economic development, and identify the lessons learned from success and failure.

2. Thailand's Economics Reforms in the 1960s

In the early 20th century, Thailand's economy was mainly based on agriculture. This period was the starting stage of Thailand's economic development. The economy at that time mainly relied on agriculture, especially rice cultivation. Rice is Thailand's main food crop and one of its important export commodities. Many Thai people are engaged in agricultural labor, which reflects the basic nature of the economic structure at that time. Thailand began to export agricultural products to the international market in the early 20th century, mainly rice and natural rubber. These exports brought foreign exchange income to the country and promoted economic growth to a certain extent.

Thailand is a country in Southeast Asia that is free from direct colonial rule. However, colonial forces are very influential. At that time, Thailand signed some unequal treaties on trade with other countries, which stimulated the growth of trade. From 1857 to 1859, the average annual export of rice was about 49.5 million kilograms, and it doubled from 1860 to 1864. It reached 556.5 million kilograms from 1900 to 1904 and 1.289 billion kilograms from 1930 to 1934 [2]. The emphasis on exports in agriculture is reflected in the overall economy, and the overall economy is highly dependent on agriculture, which is the result of the stagnation of the domestic market. This is because a large part of the profits is not used for local reinvestment but are transferred overseas. This loss of profits is partly due to the repatriation of profits by foreign companies. The dramatic social changes during World War II helped the Thai economy truly begin to develop. After the end of the Korean War in 1953, the international market demand for rubber, rice, and tin dropped sharply, and prices plummeted, resulting in a serious "foreign exchange crisis" in Thailand in 1954 [3]. This made Thailand realize the importance of industrialization, and Thailand officially decided to promote industrialization.

After World War II, western powers increased their investment in Thailand, and the Thai economy recovered and developed. The United States' economic assistance to Thailand began with the Agreement on Economic and Technical Assistance and Cooperation and the Educational Exchange Program signed in 1950 [4]. The United States helped Thailand build roads. Thailand used US funding to open up the main transportation routes from Bangkok to the northern and northeastern mountainous areas, allowing the government to strengthen control and transportation in various places. The United States also helped Thailand repair bridges and build airports. It also helped Thailand in education, improving the teaching ability of local teachers and improving methods to give Thai children better educational opportunities. The construction of road transportation makes it easier for resources and goods to flow, improves productivity, reduces transportation costs, promotes the development of the market economy, and accelerates the urbanization process. The improvement of the education system improves the education level and skills of talents, adapts to the needs of the modern economy, promotes industrialization and technological progress, and improves the overall social and economic level of the country.

In 1959, Thailand restructured the Office of the National Economic Development Board (NEDB) and began formulating the nation's Economic Development Plan. The *First Six-Year Plan* (1961-1966) and the *Second Five-Year Plan* (1967-1971) were initial development plans formulated by the Thai government to diversify the economy and reduce reliance on agriculture. The goal of First Six-Year Plan was to achieve rapid economic growth, during which a large amount of money, about 21.26 billion baht, was invested. Thailand focuses on the development of infrastructure, including the construction of roads, bridges, ports, and power facilities. To develop industrial production that can replace imported consumer goods, the plan focuses on promoting the development of the industrial sector, especially light industry and processing manufacturing. In these six years, Thailand has achieved better results than expected. The original planned annual economic growth was 5.5%, the actual annual growth was 8.1%, the agricultural plan was to increase by 4.5%, the actual annual

growth was 5%, the actual annual growth of the manufacturing industry was 10.5%, the annual export growth was 14%, and the per capita GDP increased from 2,100 baht in 1961. Increased to 2,787 baht in 1966 [5]. The First Six-Year Plan was a critical stage in its modernization and industrialization process, and Thailand's economic growth rate increased significantly. The success of the first Six-Year Plan was to promote many aspects of the country's modernization, including infrastructure, industrialization, and agricultural modernization. These achievements have laid a solid foundation for economic development in the coming decades.

In the second five-year national economic and social development plan, Thailand not only continues to build infrastructure but also pays more attention to social development and the development of human resources. It continued to promote the industrialization process, especially strengthening the development of heavy industry and basic industry. In the process of promoting industrialization, Thailand has not forgotten the development of agricultural convenience. The plan includes agricultural modernization and rural development policies to improve farmers' productivity and living standards. The second five-year plan did not reach its original target due to a reduction in foreign loans, but the ratio of domestic investment to gross national product still increased to 23.6% from 21.4% in the previous six-year plan. Thailand's Second Five-Year Plan further promoted Thailand's modernization and industrialization process from the late 1960s to the early 1970s. In the 1960s, the two plans jointly promoted the modernization and industrialization processes of Thailand's economy, improved the country's economic growth rate and overall economic strength, and laid an important foundation for future economic development.

3. Asian Financial Crisis in Thailand

Thailand is a member of the Association of Southeast Asian Nations and implements a liberal economic policy. Before the outbreak of the financial crisis in 1997, various economic indicators soared, and GDP continued to grow. Thailand experienced rapid economic growth in the early 1990s. The per capita GDP soared from more than US\$700 in 1980 to US\$3,000 in 1996. During the period 1980-1994, the proportion of Thailand's manufacturing industry in GDP increased from 22% to 29%, and manufacturing exports grew by 30% annually. During the same period, the proportion of agricultural exports decreased from 47.7% to 13.9%, and the proportion of agricultural output value in GDP decreased from 21% to 11% [6]. The proportion of Thailand's total domestic fixed investment in GDP has also increased year by year, and the proportion of foreign direct investment has also increased year by year. Thailand's economy has successfully transformed and is no longer an economy that relies on agriculture. Despite rapid economic growth, Thailand also has structural problems, including a widening gap between the rich and the poor, uneven regional development, and the risk of an over-expansion of the financial sector. The Thai economy is highly dependent on external financing, especially short-term foreign debt and foreign direct investment. This makes Thailand more sensitive to fluctuations in the international financial market.

In July 1997, Thailand's capital outflow and exchange rate depreciation sparked panic among the public. Everyone went to the bank to exchange dollars. The banking industry was hit hard, forcing Thailand to abandon the fixed exchange rate system, triggering a sharp depreciation of the Thai baht. This incident shocked the international market and triggered a chain reaction of financial crises in other Asian countries. At the end of 1997, the stock markets of Thailand, Indonesia, Malaysia, the Philippines, and Singapore fell by 75.9%, 73.7%, 69.1%, 61.7%, and 43.1%, respectively [7]. Due to problems such as excessive short-term foreign debt, insufficient foreign exchange reserves, and rising non-performing loan rates, Thailand's financial institutions experienced large-scale closures and bankruptcies. This led to the collapse of the entire financial system, investors losing confidence, and capital outflows. Thailand's economy fell sharply after the outbreak of the crisis. In 1997, Thailand's economic growth rate plummeted from the high level of previous years and even experienced a

serious economic contraction. The Thai exchange rate reached as low as 32.6 baht per US dollar, with a depreciation of more than 30%. GDP experienced negative growth for the first time, the unemployment rate rose, the poverty rate increased, and social unrest intensified.

Faced with the financial crisis, the Thai government was forced to seek assistance from the International Monetary Fund (IMF) and accept a series of emergency fiscal and monetary policy adjustments. The Thai government implemented fiscal and monetary tightening policies to control inflation and fiscal deficits and stabilize the domestic economic environment. Thailand restructured and rebuilt its financial system, including strengthening bank supervision and auditing, cleaning up and restructuring non-performing assets, and improving financial transparency and management capabilities. The government also supported weak financial institutions through capital injections and other measures. On August 14, 1998, the Thai government announced the "8-14" financial restructuring plan, which lasted until the end of 2000. A total of 13 financial institutions received 73.734 billion baht in capital injections [8].

The Asian financial crisis had a profound impact on Thailand's long-term economic growth. During the crisis, Thailand's economy suffered a heavy blow, and its gross domestic product (GDP) fell sharply. Despite the recovery after the crisis, the economic growth rate has not returned to the pre-crisis level for a long time. Investor confidence has been seriously damaged. This lack of confidence may lead to the obstruction of long-term capital inflows, affecting the country's long-term economic development. Thailand's implementation of structural adjustments and reforms is beneficial to long-term economic growth, but its implementation process may cause certain obstacles and discomfort to the short-term economy.

4. Development of the Tourism Sector in Thailand

Since the 1980s, the Thai government has actively promoted the development of tourism. In 1979, the Thai government proposed the *National Tourism Draft Act* and the *Tourism Industry Self-Employment Draft Act*. After passing the vote of the National Legislative Assembly of Thailand, the two draft acts were declared Thai law, and the Tourism Authority of Thailand was also decided to be established [9]. The government hopes to promote the natural beauty of Thailand, attract tourists to travel to Thailand, provide tourists with convenient and safe services, and promote friendly relations between countries. In the 1990s and early 2000s, Thailand's tourism industry grew rapidly and became one of the important pillars of the national economy. A series of tourism-related laws and regulations have been formulated, including legal frameworks for protecting tourists' rights and interests, managing the tourism industry, and promoting the development of tourism. The Thai government has invested heavily in tourism infrastructure, including the construction and improvement of roads, airports, ports, hotels, and tourist facilities. The contribution of Thailand's tourism industry to economic growth is very significant. Tourism directly supports a large number of employment opportunities and also drives the development of related industries, such as agriculture, handicrafts, culture and art, etc., thereby promoting national economic growth.

To attract more foreign tourists, the Thai government has introduced convenient measures, such as visa-free or electronic visa policies, simplified entry procedures, etc., to improve the convenience and comfort of tourists. Tourism has become one of Thailand's important sources of foreign exchange. Millions of international tourists each year bring in substantial foreign exchange earnings, supporting the country's trade balance and exchange rate stability. Thailand's tourism resources are widely distributed, and all regions can benefit from them. After the financial crisis in 1997, the tourism services trade became the key to Thailand's solution to the economic crisis. In the past 10 years, Thailand's international tourism revenue has tripled from US\$121 trillion in 2005 to US\$481.04 trillion in 2015 [10]. The long-term development of Thailand's tourism industry provides a solid

foundation and driving force for economic growth, not only increasing the GDP but also improving the quality of life and social welfare.

5. Conclusion

From the 1960s to the present, Thailand's economic journey has seen significant reforms, challenges, and changes, closely intertwined with global economic changes and domestic policies. The foundations for industrialization and export-led growth were laid, laying the foundation for Thailand to become one of Southeast Asia's economic powerhouses. However, the Asian financial crisis in 1997 exposed the fragility of the financial sector and highlighted the risks of rapid economic expansion without adequate safeguards. Amid these challenges, tourism has emerged as a resilient pillar of the Thai economy since the 1980s, contributing significantly to employment, foreign exchange earnings, and regional development. The growth of the sector highlights Thailand's ability to diversify its economic base and leverage its cultural and natural assets on the global stage.

Throughout its economic history, Thailand has experienced complex development dynamics, learning valuable lessons from both successes and adversities. Looking ahead, maintaining inclusive growth, building resilience to external shocks, and promoting sustainable development will remain key priorities for Thailand's continued economic prosperity. Thailand's experience provides a nuanced understanding of economic development, illustrating the importance of adaptive policies, strategic foresight, and a diversified economic base in navigating the complexities of a globalized world.

References

- [1] Macrotrends. (2024) *Thailand GDP 1960-2024*. <https://www.macrotrends.net/global-metrics/countries/THA/thailand/gdp-gross-domestic-product>
- [2] Shuangwei Chen. (2021) *Research on the history of rice industry in Thailand after World War II* [D] Guizhou Normal University.
- [3] Jian Yang. (1989) *Historical Analysis of Industrializations in Thailand*. World Economic Research.
- [4] Lingling Duan. (2022) *American aid policy to Thailand during the Nixon-Carter Administration* [D] Jilin University.
- [5] Ziren Li. (1992) *Thailand's Economic and Social Development Plan*. Studies on the South Ocean.
- [6] Wen Long. (2009) *Comparative analysis of cause of Financial Crisis between Japan and Thailand*. Entrepreneur World.
- [7] Lingyue Di. (2017) *1997: Financial turmoil sweeps through Asia*. Dynamic Analysis of Stock Market.
- [8] Feng Li. (2009) *Financial sector reform in Thailand since the Asian Financial Crisis*. Southeast Asian Studies.
- [9] Li Ai. (2014) *On the development of Tourism in Thailand and its influence in Thai Economy* [D] Jilin University.
- [10] Shishan Fu. (2017) *Analysis of the impact of international tourism service trade on Thai Economy*. Technology and Industry.

Analysis of Financial Performance for Tesla: Based on Comparison with General Motors, Ford, and Toyota

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Abstract: As a matter of fact, the emergence of electric cars and new state-of-the-art technologies is changing the face of the automobile industry. This study compares the financial performance of Tesla with that of Toyota, General as well as Ford. To be specific, the critical financial variables compared are revenue, profitability, and market share over five years: 2019–2023. According to the numbers, Tesla revenues increased by 18.8% yearly, from \$24.58 billion in 2019 to \$96.77 billion in 2023. However, also in this very regard, Tesla appears to have way higher volatility in profitability than rivals, showing net income that is highly variable. General Motors and Ford both showed slower growth but are accompanied by Toyota, which still indicates good free cash flow margins and less overall volatility in results. This report highlights top automakers' competitive dynamics and strategic positioning, which benefit industry stakeholders and investors. Indeed, with an understanding of these financial trajectories, one can make wise investment decisions and spot future market trends.

Keywords: Financial performance, automotive industry, comparative analysis, Tesla, market Share.

1. Introduction

Over the past few decades, there have been tremendous changes in the automobile world, influenced by technological developments, changing consumer tastes, and stringent environmental restrictions. Internal combustion engine (ICE) vehicles have been particularly hurt, forcing automakers to defend their technologies and business models [1]. Tesla has pioneered EV development and commercialization since 2003. The company leads the EV market with its strong R&D strategy and direct-to-consumer sales model [2]. General Motors, founded in 1908, and Ford Motor Company, founded in 1903, are notable automakers. Both have extensive auto industry experience and plan to integrate electric vehicle technology into their product lines [3]. Toyota Motor Corporation, founded in 1937, pioneered hybrid technology worldwide. Since consumer preferences and legal requirements are changing, it focuses more on electric and hydrogen fuel cell cars [4].

However, for all these changes, the shift towards electric vehicles in the industry has remained uniform. As entrenched as ever are the older car manufacturers (e.g., Ford and GM), keeping their significant portfolios of ICE cars while heavily investing in EV technologies. The plan Toyota develops, which emphasizes hydrogen and hybrid technologies in addition to electric vehicles, is part of a multi-faceted approach toward sustainable mobility [4]. These different approaches only show

the complexity of the industry and the other ways businesses will grow and sustain in this environment [3].

Tesla's growth within the auto industry is said to come from its innovative business model and timely investments in technology. The success of this company has been mainly due to its focus on vertical integration, from software development to battery making. This made Tesla's revenues leap from \$24.58 billion in 2019 to \$96.77 billion in 2023, thanks to the expanding market and customers' acceptance of EVs [5]. Due to increased R&D expenditure and spending on production scale-up, profitability is quite volatile for Tesla; hence, even with impressive sales, the net income fluctuated a lot [6]. Ford and General Motors respond equally to changing market conditions. Compared to Tesla, General Motors' revenue rose from \$137.24 billion in 2019 to \$171.84 billion in 2023 due to investments in electric vehicles and autonomous driving [7]. General Motors has balanced innovation and financial management to grow net income more consistently [8]. Ford struggled financially despite its electric vehicle technology. It earned \$176.19 billion in 2023 from Mustang Mach-E and F-150 Lightning. Toyota experienced stable economic performance, earning ¥4.94 trillion (\$36.83 billion) in the current year to support hybrid and electric vehicle technology [9]. Previous research suggests that Toyota's strong free cash flow and competitiveness justify further investment in sustainable transport.

This study compares Tesla's financial performance and strategic platform to General, Ford Motor, and Toyota. The motivation behind the research is that the automobile industry has substantially changed, primarily driven by the new trend of electric vehicles. For instance, how Tesla will differ from these big automakers can help explain their strategies and financial needs to survive such a market change. The thesis aims to gain insight into how these businesses accommodate changes in the automotive scenario, especially towards electric cars. Key financial metrics are fully compared in Sec. 2. Sec. 3 discusses the findings and implications. This study's conclusions are summarized in Sec. 4 eventually.

2. Data and Method

The public financial accounts of four selected companies provided the information needed for this research. Financial statements of public companies provide in-depth information on the economic performance of the respective company within the stated period. The data include revenue, net income, operational income, gross profit, and several other financial measures, which will be necessary for this comparative analysis. Context and further data were also supplied from publications about the industry and market analyses. Tesla, Inc. was chosen as the study's main subject because the company's reputation as the world's number one electric vehicle (EV) manufacturer is well known. Tesla is an exciting domain for research on financial performance because of its proactive approach and high leverage in the market [2]. The firms used for comparative benchmarks include other three giants mentioned above since they define a clear market share within the automotive industry and have distinctive ways of embracing the electric vehicle transition.

Due to the different policies, these companies were chosen to provide a range of potential outcomes in the automobile industry. General Motors and Ford are old-fashioned car companies involved in the electric car business. Tesla is the leader in that new class of EVs. Toyota is the leader in commercializing hybrid technology and represents multiple aspects within the niche of environment-friendly transportation solutions. This option allows different strategic postures and their impact on financial performance to be investigated over a similar sector. The data goes from 2019 to 2023, which is five years. Over this period, crucial shifts have occurred in the automobile industry as electric vehicle popularity, technological advancements, and the world economic situation directly influenced the automobile market. The selection period allows analysis of patterns and

financial results over a sufficiently large amount of time, which could offer insights into the development and strategic orientation of selected businesses.

Several comparison parameters and indicators are utilized as following:

- Revenue Growth. This measures the increase in revenues over the period, which indicates the company's ability to grow its market presence with formula $(\text{Revenue, CY} - \text{Revenue, PY}) / \text{Revenue, PY}$.
- Net Income. The revenue collected at the end reflects an aggregated outlook of a company's profitability with formula $\text{Total Revenue} - \text{Total Expenses}$.
- Gross Margin. The percentage of money from total revenue remaining after subtracting the cost of goods sold, indicating the efficiency of production by a company with formula $(\text{Total Revenue} - \text{COGS}) / \text{Total Revenue}$.
- Operating Margin. This indicates the percentage of revenue left after subtracting all operating expenses and portrays how a business is efficiently run with formula $\text{Operating Income} / \text{Total Revenue}$.
- Market Capitalization. The market value of a company's shares indicates what investors perceive about a company and, at the same time, represents the company's size, with formula $\text{Share Price} \times \text{Total Outstanding Shares}$.
- Free Cash Flow. Cash that a company generates after considering its capital expenditures, indicative of how much revenue it can develop with formula $\text{Operating Cash Flow} - \text{Capital Expenditure}$.
- EBITDA. General measure of a company's financial performance with formula $\text{Net Income} + \text{Interest} + \text{Taxes} + \text{Depreciation} + \text{Amortization}$.
- EBITDA Margin. It indicates the efficiency with which a company can generate EBITDA compared to its total revenue with formula $\text{EBITDA} / \text{Total Revenue}$.

For calculation and interpretation of ratios:

- Revenue Growth Rate. This shows how well the firm has done in ramping up its sales revenues from the customers or clients over time. High rates could be a result of high demand in the market as well as good business strategies.
- Net Income. This forms one of the essential values in determining a company's profitability; this is the profit that remains after taking all expenses into account. The growth of the company's net income for the year is reasonable and thus portrays sound financial stability.
- Gross Margin. To stay profitable, a company is required to handle well the production costs and the income, which is indicated by a higher gross margin.
- Operating Margin. Higher operating margins indicate efficiency. After non-operational expenses, the operating margin measures the operating profit of a company.
- Market Capitalization. This provides all the necessary information for comparing company sizes and presence among investors; it provides investors with a snapshot of the company's market value.
- Free Cash Flow. This becomes the need of the hour for a business entity, as in this way, management can reinvest in expansion opportunities without considering outside financing options.
- EBITDA. The most frequently applied measure to calculate the profitability of a company is EBITDA. It removes non-operating expenses from the income statement, like interest and taxation, and thus shows operations' profit.
- EBITDA Margin. A measure of operating efficiency and profitability; higher EBITDA margin means better cost control and more profit.

Table 1: Tesla Income Statement [4].

Year	2023	2022	2021	2020	2019
Revenue	96,773	81,462	53,823	31,536	24,578
Cost of Revenue	79,113	60,609	40,217	24,906	20,509
Gross Profit	17,660	20,853	13,606	6,630	4,069
Operating Income	8,891	13,656	6,523	1,994	-69
Pretax Income	9,996	13,688	6,218	1,013	-752
Net Income	14,997	12,556	5,519	721	-862
Shares Outstanding (Diluted)	3,174	3,130	2,959	2,798	2,661
EPS (Diluted)	4.30	3.62	1.63	0.21	-0.33
Free Cash Flow	4,357	7,561	4,983	2,711	973
Gross Margin	18.25%	25.60%	25.28%	21.02%	16.56%
Operating Margin	9.19%	16.76%	12.12%	6.32%	-0.28%
EBITDA	14,819	17,626	9,500	4,083	2,087
EBIT	10,152	13,879	6,589	1,761	-67

Table 2: Ford Motor Company Income Statement [10].

Year	2023	2022	2021	2020	2019
Revenue	176,191	158,057	136,341	127,144	155,900
Cost of Revenue	160,031	140,893	119,903	121,359	144,165
Gross Profit	16,160	17,164	16,438	5,785	11,735
Operating Expenses	10,702	10,888	11,915	10,193	11,161
Operating Income	5,458	6,276	4,523	-4,408	574
Interest Expense / Income	1,302	1,259	1,803	1,649	1,020
Other Expenses / Income	171	7,862	-15,087	-4,938	231
Pretax Income	3,985	-2,845	17,807	-1,119	-677
Income Tax	-362	-864	-130	160	-724
Net Income	4,347	-1,981	17,937	-1,279	47
Shares Outstanding (Diluted)	4,041	4,014	4,034	3,973	4,004
Shares Change	0.67%	-0.50%	1.54%	-0.77%	0.15%
EPS (Basic)	1.09	-0.49	4.49	-0.32	0.01
EPS (Diluted)	1.08	-0.49	4.45	-0.32	0.01
EPS Growth	-	-	-	-	-98.91%
Free Cash Flow	6,682	-13	9,560	18,527	10,007
Free Cash Flow Per Share	1.67	-0.00	2.40	4.66	2.52
Dividend Per Share	1.250	0.500	0.100	0.150	0.600
Dividend Growth	150.00%	400.00%	-33.33%	-75.00%	-17.81%
Gross Margin	9.17%	10.86%	12.06%	4.55%	7.53%
Operating Margin	3.10%	3.97%	3.32%	-3.47%	0.37%
Free Cash Flow Margin	3.79%	-0.01%	7.01%	14.57%	6.42%
Effective Tax Rate	-9.08%	-	-0.73%	-	-
EBITDA	12,977	6,056	26,928	9,281	10,032
EBITDA Margin	7.37%	3.83%	19.75%	7.30%	6.43%
Depreciation & Amortization	7,690	7,642	7,318	8,751	9,689
EBIT	5,287	-1,586	19,610	530	343
EBIT Margin	3.00%	-1.00%	14.38%	0.42%	0.22%

3. Results and Discussion

3.1. Comparison Analysis

This section compares the financial performance from 2019 to 2023 between the four selected companies. Some vital financial indicators analyzed are revenue growth, net income, growth in gross and operating margins, market capitalization, free cash flow, and EBITDA margin. Seen from Table 1, the amount of money that Tesla has been able to generate in revenues over the five years is immense; the \$24.58 billion earned in 2019 has grown to \$96.77 billion in the year 2023. This means an increase of 18.80% in 2023 over the year prior, coming after enormous growth rates in the previous years. In comparison (given in Table 2 [10]), GM experienced far more tepid revenue growth, rising from \$137.24 billion last year to \$171.84 billion in 2023, or up 9.64% in 2023 compared to 2022. Ford's revenue increased by 11.47% year over year in 2023, from \$155.90 billion in 2019 to \$176.19 billion. For consistency, Toyota's net income increases and shows a notable jump, showing a solid performance in the Japanese yen environment. The company's revenue growth data is shown in JPY.

Table 3: General Motors Income Statement [11]

Year	2023	2022	2021	2020	2019
Revenue	171,842	156,735	127,004	122,485	137,237
Cost of Revenue	152,704	135,754	109,126	108,813	123,265
Gross Profit	19,138	20,981	17,878	13,672	13,972
Operating Expenses	9,840	10,667	8,554	7,038	8,491
Operating Income	9,298	10,314	9,324	6,634	5,481
Other Expenses / Income	-2,303	-2,495	-4,416	-2,665	-2,802
Pretax Income	10,690	11,822	12,790	8,201	7,501
Income Tax	563	1,888	2,771	1,774	769
Net Income	10,127	9,934	10,019	6,427	6,732
Net Income Common	10,022	8,915	9,837	6,247	6,581
EPS (Basic)	7.35	6.17	6.78	4.36	4.62
EPS (Diluted)	7.32	6.13	6.70	4.33	4.57
EPS Growth	19.41%	-8.51%	54.73%	-5.25%	-17.36%
Free Cash Flow	9,353	9,090	7,470	9,536	4,327
Dividend Per Share	0.360	0.180	-	0.380	1.520
Dividend Growth	100.00%	-	-	-75.00%	0%
Gross Margin	11.14%	13.39%	14.08%	11.16%	10.18%
Operating Margin	5.41%	6.58%	7.34%	5.42%	3.99%
EBITDA	23,489	24,099	25,791	22,114	22,401
EBITDA Margin	13.67%	15.38%	20.31%	18.05%	16.32%
Depreciation & Amortization	11,888	11,290	12,051	12,815	14,118
EBIT	11,601	12,809	13,740	9,299	8,283
EBIT Margin	6.75%	8.17%	10.82%	7.59%	6.04%

Although it has experienced significant fluctuations, Tesla's net income has generally increased in 2023. This volatility reflects Tesla's substantial R&D expenditures and rapid growth. According to Table 3, GM's net income grew steadily, rising from \$6.732 billion in 2019 to \$10.127 billion in 2023 [11]. Ford's net income showed a significant upturn from a meager \$47 million profit in 2019 to a hefty \$4.347 billion profit in 2023. Toyota's net income increased dramatically due to its steady performance, preserving its sound financial position [1].

Table 4: Toyota Motor Corporation Income Statement [4]

Year	2023	2022	2021	2020	2019
Net Income	4,944,933	2,451,318	2,850,110	2,245,261	2,036,140
Depreciation & Amortization	2,087,066	2,039,904	1,821,880	1,644,290	1,595,347
Other Operating Activities	-2,825,626	-1,536,146	-949,375	-1,162,389	-1,232,991
Operating Cash Flow	4,206,373	2,955,076	3,722,615	2,727,162	2,398,496
Operating Cash Flow Growth	42.34%	-20.62%	36.50%	13.70%	-36.32%
Capital Expenditures	-2,550,488	-1,641,955	-1,904,278	-2,077,257	-2,002,442
Change in Investments	-2,113,976	391,344	1,672,869	-2,328,471	182,784
Other Investing Activities	-334,287	-348,279	-346,087	-278,447	-304,992
Investing Cash Flow	-4,998,751	-1,598,890	-577,496	-4,684,175	-2,124,650
Dividends Paid	-880,197	-727,980	-709,872	-625,514	-618,801
Share Issuance / Repurchase	-231,069	-431,099	-404,718	199,884	-476,128
Debt Issued / Paid	3,706,760	1,163,574	-1,300,203	3,201,402	1,512,689
Other Financing Activities	-97,936	-60,675	-51,723	-36,598	-54,955
Financing Cash Flow	2,497,558	-56,180	-2,466,516	2,739,174	362,805
Exchange Rate Effect	189,914	103,305	334,195	220,245	-141,007
Net Cash Flow	1,895,094	1,403,311	1,012,798	1,002,406	495,645
Free Cash Flow	1,655,885	1,313,121	1,818,337	649,905	396,054
Free Cash Flow Growth	26.10%	-27.78%	179.79%	64.10%	-73.21%
Free Cash Flow Margin	3.67%	3.53%	5.79%	2.39%	1.33%
Free Cash Flow Per Share	1227.87	964.40	1315.85	464.89	275.08

Although it varied, Tesla's gross margin stayed strong, rising to 18.25% in 2023 [2]. Additionally, it improved its operating margin over time, going from -0.28% in 2019 to 9.19% in 2023, indicating increased operational efficiency. With an operating margin of 5.41% in 2023, GM's gross margin stayed steady at 11.14%. According to Table 2, in 2023, Ford's operating margin was 3.10%, and its gross margin was 9.17%. Toyota demonstrated good operational efficiency, as seen by its sizeable free cash flow and steady net income growth. However, its margin percentages are not directly comparable because of different accounting rules.

Due to its dominant position in the EV market, Tesla's market value has increased dramatically, showing high levels of investor trust and market expectations. Although significant, GM and Ford have dramatically risen differently than Tesla. According to Table 4, Toyota is still a formidable competitor, largely thanks to its diverse approach to sustainable transportation, robust market presence, and investor trust [4].

Tesla's free cash flow increased dramatically from \$973 million in 2019 to \$4.357 billion in 2023, demonstrating improved cash management and operational effectiveness [2]. General Motors' free

cash flow increased from \$4.327 billion in 2019 to \$9.353 billion in 2023. Ford's free cash flow in 2023 was \$6.682 billion, but it fluctuated significantly due to the recent difficulties the company has faced [3]. Its continuously high free cash flow margin demonstrates Toyota's strong cash generation capabilities.

3.2. Explanation and Implications

The financial analysis's findings shed light on several important aspects of the chosen organization's economic health and strategic posture. Tesla's strong brand presence and innovative EV technology drive the company's rapid revenue growth and rising market value. However, the substantial risk involved in its ambitious expansion plan is reflected in its operating margins and net profit volatility. As Tesla expands its business and makes significant investments in cutting-edge technology, investors should be prepared for the possibility of substantial swings in profitability.

Although the sales growth in these companies is smaller than in Tesla, General Motors and Ford have demonstrated better financial performance stability; in other words, they have been able to balance their acts in maintaining the profitability of their traditional automobile business versus investing in new technologies as shown through sustained growth of net income, gross, and operating margins. On the other hand, Ford has been modernizing its product portfolio and catching up with EV technologies, leading to considerable increases in revenue and returning to net profitability. Both firms have lower risk profiles than Tesla, are less aspirational growth markets, and have sturdier finances.

Toyota showed extreme operational efficiency and a diversified approach to mobility and sustainability in the market through sustained financial performance and sizeable free cash flow. It has a great potential to adapt to changing market requirements and regulatory environments since it focuses on hybrid technology apart from electric vehicles and hydrogen fuel cells. From an investor's perspective, Toyota can be visualized as a safe investment concerning the heterogeneity of risk in the automobile sector.

3.3. Limitations and Prospects

This study's several limitations should be considered while interpreting the results. The information is pulled from public records in financial documents, which are only sometimes representative of the subtleties in strategic objectives and business's economic standing. In addition, the automotive industry is significantly exposed to rapid changes in technology, changes in regulations, and fluctuations in market dynamics, all of which can highly determine changes in financial performance. These elements introduce uncertainty that could affect the future performance of the companies under study. However, one can hope that further research will be conducted. Subsequent research may include a broader set of financial indicators considering environmental, social, and governance issues to represent the company's performance more fully. Additionally, incorporating qualitative data related to expert interviews and market studies may provide more transparency about competition dynamics and strategic positioning.

4. Conclusion

To sum up, this research work has detailed comparative results of the finances of four selected companies from vehicle industry. Based on the data, Tesla has massive growth in revenues and significant improvements in market capitalization due to its innovative electric vehicle technology. This paper also finds that Tesla experiences higher earnings volatility than its well-established competitors. Ford and General Motors have shown consistent financial performances, with revenue growth and stability in profitability over time—very indicative of these companies being well-

rounded in their approaches to the regular automobile business and innovation. Financially, Toyota is a significant force, solid in operations and diversified in approach toward sustainable mobility. Sustainable technology and electric vehicles will shape the coming competitive landscape in the automobile industry. This stresses the importance of strategic innovation and agility in maintaining financial stability and market position in a quickly evolving sector.

References

- [1] Rahman, A., and Acharya, P. (2020) *A comparative study on the financial performance of Tata Motors and Toyota Motor Corporation cars*. SRRN 4173857.
- [2] Johnson, A.E. (2020). *Tesla financial ratios for analysis 2009-2024*. Retrieved from: https://www.macrotrends.net/stocks/charts/TSLA/tesla/financial-ratios#google_vignette
- [3] Sanci, E., Daskin, M.S., Hong, Y.C., Roesch, S., and Zhang, D. (2021). *Mitigation strategies against supply disruption risk: A case study at the Ford Motor Company*. *International Journal of Production Research*, 60(19), 1–21.
- [4] Toyota Motor (TM) Cash Flow Statement 2024. Retrieved from: <https://stockanalysis.com/stocks/tm/financials/cash-flow-statement/>
- [5] Ackerman, R.P. (2018). *Regulating Autonomous Vehicles in the United States*. *Jscholarship.library.jhu.edu*, 3(7).
- [6] Ritchie, H., and Roser, M. (2020). *Fossil Fuels*. *Our World in Data*, 3(6).
- [7] Gryta, T., and Mann, T. (2020). *Lights out: Pride, delusion, and the fall of general electric*. In *Google Books*. Houghton Mifflin Harcourt.
- [8] Bloomberg. (2020). *Bloomberg - Are you a robot?* Retrieved from: <https://www.bloomberg.com/opinion/articles/2021-01-06/tesla-kept-busy-in-2020>
- [9] Bhattacharya, S. (2021). *Multinational working capital management: A study on Toyota Motor Company*. *International Journal of Finance & Economics*, 28(1).
- [10] Ford Motor Company (F) Financial Statements: Income 2024. Retrieved from: <https://stockanalysis.com/stocks/f/financials/>
- [11] General Motors Company (GM) Financial Statements: Income 2024. Retrieved from: <https://stockanalysis.com/stocks/gm/financials/>

The Impact of Education on Chinese Economic Growth

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Abstract: Chinese traditional culture has consistently exerted a profound influence on everyday life in China and its educational system. Despite significant advancements in technology, the Chinese continue to employ traditional cognitive approaches in acquiring advanced knowledge. This traditional mindset has notable implications for the Chinese economy. This paper will explore the historical development and current state of the Chinese educational system. Through an analysis of the Chinese educational landscape, this paper will discuss its present impact on the Chinese economy. Additionally, this paper will examine its future implications, focusing particularly on the training of creative individuals and the related industries such as artificial intelligence (AI). A comparative analysis between China and the United States will be conducted to shed light on these areas.

Keywords: Chinese economy, Chinese educational system, artificial intelligence.

1. Introduction

The current discourse surrounding the interplay between education and economic growth has yielded numerous structured explanations. This article endeavors to delineate the landscape of Chinese education over the past few years and elucidate its predominant influence on economic development within China. Readers can attain a foundational comprehension of the nexus between education and China's economic trajectory through this exploratio. Furthermore, the narrative prompts deeper reflection on necessary reforms within the educational sphere to optimize its impact on economic progress.

Since A.D. 587, under Emperor Wen of the Sui Dynasty, a significant shift occurred in the method of selecting governing individuals. The traditional reliance on recommendations or hereditary positions gave way to rigorous examinations testing proficiency in the Four Books and Five Classics . However, during the Ming and Qing Dynasties, particularly through the eight-part essay format, examinations imposed constraints on candidates' freedom and creativity [1]. Consequently, traditional Chinese beliefs uphold academic pursuit as the primary pathway for social advancement, epitomized by the adage: "The worst of all things is to be without knowledge, and the best of all things is to be well-read." This essay examines the impact of China's educational system on its economy.

2. Contemporary Chinese Education System

In contemporary China, the landscape of education has taken a peculiar turn. The competitive fervor begins as early as kindergarten, where parents initiate a relentless push for their children to acquire an array of skills and interest, often neglecting the child's individual preferences. More importantly,

the cost of education skyrocketed in recent decades. The cost of educating a child can be divided into two parts: implicit cost and explicit cost. This pressure to excel is often accompanied by explicit costs, wherein parents invest heavily in various activities. While some opt for conventional pursuits like piano, painting, or chess, a segment of the emerging middle class steers towards less mainstream activities such as horse riding or golf, wishing their children will one day puncture the social class boundary and coming a members of upper class. In the year 2018, a majority of students, constituting over 60% of the demographic, engaged in extracurricular activities. These activities incurred an average cost of 9211 RMB, representing approximately 12.84% of their annual income [2].

Conversely, there exists a subset of parents who veer towards unconventional choices. Most of these parents are what this paper calls “upstart”, because they come from an era of rapid economic growth in China, leveraging the trends of the time to amass significant wealth. However, they often lack a deeper understanding of society and have not received higher education. In a notable instance from 2019, an extracurricular institution claimed to teach a skill dubbed "Quantum Wave Speed Reading," promising children the ability to absorb hundreds of thousands of words in minutes through heightened perception known as "HSP high perception." However, this endeavor was later exposed as a scam. The fees associated with these activities vary significantly, ranging from 6 thousand RMB for a half-year duration to thirty thousand RMB for lifelong participation. Through a private channel, it was learned that an undisclosed parent had once expended seventy thousand RMB [3].

After children enter primary school, an additional hidden cost arises the expenditure on housing within specific school districts, if parents seek to ensure their children receive a better education in junior high schools. Purchasing a residence within the boundaries of a desired school district grants residents' children admission to the associated school. An empirical investigation from Hangzhou, China figured out that as one-level of quality of educational facilities increased, the price of second-hand houses increased by 817 yuan per square meter and the price of low-priced and small house will increased by 1000 yuan per square meter, because of more obvious value-added effect[4]. This decision places children under the weight of expectations and subjects them to the pressures stemming from intense competition among classmates.

During junior high school studies, students primarily focus on academic pursuits in preparation for the Senior High School Entrance Examinations (SHSEE), which are crucial for admission to prestigious local senior high schools. Parents emphasize the importance of securing enrollment in these schools for future university admissions prospects, motivating students to dedicate themselves fully to their studies. Those who do not pursue this path may opt for vocational schools to acquire technical skills like hairstyling or nursing. Chinese parents, particularly those with higher education, struggle to accept the possibility of their children failing to gain university admission or lacking upward social mobility. The average extracurricular tuition fee is RMB 120,000, with some households spending up to RMB 300,000, significantly impacting their socio-economic status [5]. The effectiveness of these expenditures depends on the cognitive abilities of parents, who must make informed decisions about advantageous educational investments for their children.

Upon entering senior high school, students encounter various challenges. Firstly, there are limited subject choices available. Despite recent reforms in the college entrance examination system, allowing candidates to choose from five out of nine subjects, the selection remains narrower compared to education systems in the United States and the United Kingdom. Secondly, competition is intense, especially in provinces like Henan, which has the highest proportion of senior students nationally [6]. The demanding schedule persists for nearly three years, prompting many students to supplement their education with extracurricular tuition classes during breaks. In 2018, the extracurricular academic tutoring has been risen to 455 billion and it was forecasted to reach 611.1 billions in 2022 [7]. Wealthier families often invest in their children's education by enrolling them in international schools, where the annual cost can exceed one hundred thousand RMB per student,

excluding extracurricular fees. Even among talented students admitted to prestigious universities, the primary motivation is often securing certification for employment opportunities rather than pursuing personal interests. This leads to a significant disparity in the number of students opting for majors perceived to enhance job prospects versus less popular disciplines.

3. The Effect of Education on Chinese Economic Growth

The impact of Chinese education is significant, raising questions regarding its capacity to sustain economic growth currently and in the future. In 2023, education expenses accounted for 17.1% of the average annual income in China, totalling 8464 RMB per year, against an average household income of 39218 RMB. China allocates the largest proportion of its total annual expenditure to education, accounting for 7.9%. In contrast, most other countries typically allocate only 1-2% of household expenditure to education. Even South Korea, which ranks second in educational spending, allocates only 5.3% of its total annual expenditure to education. Disparities are notable: top quartile families spend 10.6% of their income on education, while bottom-quartile families allocate 56.8%. As education expenses rise, disposable income decreases, affecting living standards and domestic consumption[8]. This may lead to surplus supply, prompting the need to export excess production, leveraging China's pricing advantage. However, if China's population advantage diminishes, so too will its pricing edge. Thus, incentivizing domestic consumption becomes crucial for bolstering consumer purchasing power. Moreover, another side effect of this educational emphasis is the creation of an economic bubble due to overinvestment in the real estate sector. A considerable portion of funds is directed towards real estate instead of being allocated to improving education systems that foster not only knowledge acquisition but also creativity and other essential qualities for individual development.

The influence of China's educational system on the nation's economic prospects is both enduring and significant. These seemingly education-induced side effects and excessive competitive pressures have led to an increasing number of children losing their motivation to learn. A pertinent example of societal educational neglect is evident in the phenomenon of aimless youth, epitomized by individuals residing in LongHua District, Shenzhen, colloquially referred to as "SanHeDaShen," who predominantly spend their time in cyber cafes. Engaged in a cycle of part-time work in factories when finances are low, followed by returns to cybercafes, these individuals find themselves trapped in a purposeless cycle, squandering their time and potential. If individuals adhere to the traditional mindset of securing a regular job, purchasing a house with a mortgage, marrying, raising children, and similarly educating them, they may find themselves trapped in a cycle. However, should they encounter any crisis such as illness or economic downturn, this delicate balance could collapse, leading to the dissolution of the family unit.

The People's Republic of China was established in 1949 amid a backdrop of numerous challenges, including economic restructuring and recovery from prolonged conflicts. Until 1978, China operated primarily under a planned economy, focusing on industrialization and striving to catch up with the industrialized nations of that era. The pivotal year of 1978 marked the beginning of China's reform and opening-up policy, a transformative phase that opened the doors to substantial foreign investment and collaboration. During this period, China's primary objectives were twofold: to elevate the living standards of its population and to stimulate its domestic economy. As a result, the immediate focus was on rapid economic development and infrastructural growth. Consequently, many college graduates possessed technical expertise in fields such as applied physics and chemistry, thereby significantly contributing to China's economic advancement.

4. The Lag of AI and Creativity

However, following nearly two decades of prosperity, the advent of the artificial intelligence (AI) era has supplanted the digital technology era. Following the experience of the pandemic, it was anticipated that the global economy would plunge into recession. Contrarily, the US economy has exhibited a trajectory of recovery. Several factors can elucidate this phenomenon. Apart from economic growth driven by robust domestic consumption and supply increases, investment in AI has also played a pivotal role. After decades of leveraging digital technology, the global economy was in dire need of another innovative breakthrough. AI emerges as the most promising avenue for significant technological advancement that can bolster the economy. Notably, in 2016, about 90% of commercial investments in AI were allocated to R&D and deployment of AI technologies [9]. Within the US stock market, the so-called "Magnificent Seven," including companies like NVIDIA, Microsoft, and Meta Platforms, commanded a substantial portion of market capitalization. A common thread among these seven companies is their strong focus on AI as a core component of their business operations. In 2023, the stock of these "Magnificent Seven" surged by 71%, while the remaining stocks in the S&P 500 index grew by a mere 6%, contributing to an overall 19% increase in the S&P 500 index [10]. Historically, rapid economic growth has consistently been accompanied by significant technological advancements. Conversely, in China, Kweichow Moutai, a prominent liquor manufacturer, holds the largest market share. The stark disparity in AI adoption and focus between Chinese and US technology companies is becoming increasingly evident.

5. The Hardware Disparity in the AI Field Between China and the United States

To elucidate the disparities between Chinese AI capabilities and global standards, it is instructive to examine both hardware and research dimensions. On the hardware front, AI infrastructure primarily consists of GPUs (Graphics Processing Units), TPUs (Tensor Processing Units), and NPUs (Neural Processing Units). In China, Huawei stands as the leading company producing these components and can design chips up to 7 nm. However, due to technology restrictions imposed by the US, Huawei faces limitations in chip manufacturing capabilities. In contrast, NVIDIA, the foremost US-based company, leads in the production of AI-related hardware components. A critical factor in chip production is lithography, which determines the intricacy and efficiency of semiconductor manufacturing. The technological gap between China and other leading nations is evident in the limitations of their lithography machinery. Sanctions from the US and restrictions by ASML, a Dutch company that supplies lithography machines, have constrained Chinese technology firms to produce chips with a minimum lithography size of 7nm. In contrast, the most advanced chips globally are now being manufactured at 3nm lithography size. Despite efforts by Chinese technology companies to reverse-engineer and understand the intricacies of lithography machinery, doing so entails substantial economic and time investments. Thus, the technological gap in lithography machinery serves as a significant barrier to China's AI hardware development [11].

The historical economic strategies provide a rationale for China's relative shortcomings in AI hardware development when compared to technologically advanced Western countries. The emphasis during the early stages of reform was largely on economic growth and infrastructure, with less attention directed towards cutting-edge technological advancements. Consequently, there has been a prevailing inclination towards industrialized approaches in talent development, causing China's AI hardware capabilities to face challenges in keeping pace with those of developed Western nations.

6. The Research Disparity in the AI Field Between China and the United States

From an AI research perspective, studies indicate a relatively smaller disparity and a comparable research structure between China and the US. Metrics such as research volume, citation impact, and

sources of citations support this observation. However, when evaluating research quality, differences become evident in metrics like PP-top20% values and the proportion of publications in top-tier venues. While the US maintains a lead in these quality indicators, China has been proactive in addressing this disparity and has shown efforts to narrow the gap. Over time, these efforts have begun to yield positive results, indicating China's commitment to enhancing the quality of its AI research output. As for students who pursuing knowledge in robotics and AI, there remains a palpable gap between Chinese AI capabilities and those of Western counterparts[12]. The duration and manner in which China will engage with the technological advancements driven by AI remains uncertain. The core issue is Chinese individuals may not be able to ask probing questions, thinking creatively. Under the current education system, most of students lack creativity. One explanation is the limited emphasis on exploring creative subjects such as the arts. In China, art students are evaluated primarily through examinations that assess their technical skills rather than encouraging them to demonstrate creativity through original works of art. Non-art students have very limited access to art at all. The Chinese education system lacks emphasis on arts education, especially at the secondary level, making arts subjects least prioritized. Despite this, arts are vital for fostering creativity, offering avenues to express ideas and emotions. Artistic pursuits, whether in painting, music, literature, or dance, inspire imagination and diverse perspectives, enhancing creative skills. Engaging with art cultivates aesthetic sensibilities and an appreciation for detail, which can further stimulate creative thinking in daily life and work. Additionally, arts intersect with disciplines like STEM, promoting interdisciplinary thinking and creative problem-solving. Art also serves as a platform for free expression, helping individuals find their voice and fostering confidence, which in turn enhances creative thinking. The overall lack of emphasis on arts education in China's educational system significantly constrains the innovative potential of its citizens. Without exposure to arts education, individuals may lean towards linear, logical, and traditional modes of thinking, often lacking the diversity, non-linearity, and creativity inherent in artistic and interdisciplinary approaches. It is obvious that the Chinese education system effectively identifies students with strong academic abilities, facilitating their study and research based on a solid foundation. However, it falls short of fostering creativity, an essential quality for generating innovative ideas.

7. Conclusion

In conclusion, the Chinese educational system bears significant implications for both present and future economic growth in China. A primary concern arises from the potential scarcity of innovators equipped with the creative acumen necessary to generate novel ideas crucial for stimulating economic progress. Moreover, the considerable investment in education-related expenditures, including extracurricular tuition, poses a risk of diminishing consumption levels within the economy. Additionally, the inflated housing market observed in proximity to prestigious school districts, largely fueled by parental aspirations for their children's education, has engendered economic distortions reminiscent of a housing bubble. These intertwined factors necessitate a nuanced examination of the Chinese educational landscape to discern its multifaceted impact on both current economic dynamics and future growth prospects. However, there are notable challenges stemming from governmental restrictions that limit access to crucial data necessary for comprehensive research. This obstacle underscores the necessity for further examination of the tangible impact of education on economic development, particularly in the coming decade. Such investigations must grapple with the uncertainty surrounding the applicability of existing theories to future scenarios. It is imperative to determine whether current frameworks adequately explain forthcoming trends, or if adjustments are required to comprehend the evolving relationship between education and the economy.

References

- [1] Ko, K.H(2017). *A Brief History of Imperial Examination and Its Influences*. Soc 54, 272–278
- [2] Tan, M., Cai, L., & Bodovski, K. (2021). *An active investment in cultural capital: structured extracurricular activities and educational success in China*. *Journal of Youth Studies*, 25(8), 1072–1087.
- [3] Zheng, Guiling (2019). *Why does the “Quantum Wave Speed Reading Succeed*. Sina. Available at: <https://baby.sina.com.cn/news/2019-10-18/doc-iicezzrr2897371.shtml>
- [4] Peng,Tian & Wen (2021). *How does school district adjustment affect housing prices:An emprical investigation from hangzhou, China*. *China Economic review*,69(2021).
- [5] VEROT. Claire (2020). *Chinese parents spend up to \$43500 a year on their children’s extracurricular classes*. Chinese tourist agency. Available at: <https://chinesetouristagency.com/chinese-parents-spend-up-to-43500-a-year-on-their-childrens-extracurricular-classes/>
- [6] Knoema (2023). *Education-Basic Statistic on Regular Senior Secondary Schools, by province, China*. Available at: https://knoema.com/NBSCN_P_A_A0M05/education-basic-statistics-on-regular-senior-secondary-schools-by-province-china?region=1000140-shandong
- [7] Hamid, M. O., Khan, A., & Islam, M. M. (2017). *The spread of private tutoring in English in developing societies: exploring students’ perceptions*. *Discourse: Studies in the Cultural Politics of Education*, 39(6), 868–886.
- [8] Hu, Dezhuang and Li, Hongbin and Li, Tang and Meng, Lingsheng and Nguyen, Binh Thai, *The Burden of Education Costs in China: A Struggle for All, but Heavier for Lower-Income Families* (August 31, 2023). Available at SSRN: <https://ssrn.com/abstract=4558282> or <http://dx.doi.org/10.2139/ssrn.4558282>Vijayakumar, H. (2021).
- [9] *The Impact of AI-Innovations and Private AI-Investment on U.S. Economic Growth: An Empirical Analysis*. *Reviews of Contemporary Business Analytics*, 4(1), 14–32.
- [10] Goldman Sachs (2023). *2024 US Equity Outlook: “ All You Had To Do Was Stay”*. Available at: <https://www.goldmansachs.com/intelligence/pages/2024-us-equity-outlook-all-you-had-to-do-was-stay.html>
- [11] Cohan, P. (2024). *Generative AI Hardware*. Apress, Berkeley, CA, 2024,p234-279
- [12] Min, Chao & Zhao, Yi &Bu, Yi &Ding, Ying & Wagner, Caroline S. *Has China caught up to the US in AI research? An exploration of mimetic isomorphism as a model for late industrializers*. P19-35

A Review of the Impact of AIGC on User Behavior in Digital Marketing

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Abstract: As an important means for modern enterprises to promote their products and services, the effect of digital marketing is affected by a variety of factors, and the emergence of AIGC technology brings new possibilities for digital marketing, which not only improves the efficiency of marketing but also brings a more personalized and intelligent experience for users. This study will focus on “the impact of AIGC on user behavior in digital marketing” to explore how AIGC technology affects users' purchase decisions, information search behavior, interactive participation, etc. and analyze the mechanism behind it. This study adopts the method of literature review to collect and analyze academic papers, case studies and industry reports in related fields at home and abroad. By combing and summarizing these literatures, this paper will distil the main ideas and conclusions of AIGC's influence on user behavior in digital marketing, and construct the corresponding theoretical framework.

Keywords: aigc, digital marketing, user behavior.

1. Introduction

With the rapid development of science and technology, artificial intelligence has become a powerful driving force for social progress. Among them, Artificial Intelligence Generated Content (AIGC), as a branch in the field of AI, is gradually changing the face of digital marketing. AIGC can automate the generation of high-quality content through deep learning, natural language processing and other technologies, providing unprecedented opportunities and challenges for digital marketing. However, despite the increasing application of AIGC in digital marketing, research on how it influences user behaviour is still in its infancy and there are many research gaps.

Currently, some studies have begun to explore the application of AIGC in digital marketing and its impact on user behavior. These studies mainly focus on how AIGC improves marketing efficiency, optimizes user experience and promotes user engagement. However, these studies are often limited to specific scenarios or cases and lack systematic summarization and in-depth exploration. In addition, there is a lack of comprehensive and in-depth research on how AIGC influences specific user behaviors (e.g., purchase decision, information search, interactive participation, etc.) and the mechanisms behind these influences.

Therefore, the purpose of this paper is to review the current state of research on the impact of AIGC on user behavior in digital marketing, and to fill the gaps in the existing research. This paper will focus on the core theme of “the impact of AIGC on user behavior in digital marketing”, and discuss in depth how AIGC affects users' purchasing decisions, information searching behavior, and

interactive participation, etc. Meanwhile, this paper will also analyze the impact of AIGC on user behavior. At the same time, this paper will also analyze the mechanism behind these influences, such as personalized recommendation, emotional marketing and so on [1].

In the specific research process, this paper will adopt the method of literature review to extensively collect and analyze academic papers, case studies and industry reports in related fields at home and abroad. By combining and summarizing these literatures, this paper will distill the main viewpoints and conclusions of AIGC's influence on user behavior in digital marketing, and construct the corresponding theoretical framework.

The significance of this study is that it will provide valuable references and insights for related enterprises and researchers. By gaining a deeper understanding of the current situation and development trend of the application of AIGC in digital marketing, enterprises can formulate more accurate and effective digital marketing strategies to improve marketing effectiveness and user satisfaction. At the same time, this study will provide new research directions and ideas for the academic community and promote the in-depth development of related fields. For the future development, this paper predicts that AIGC will play an increasingly important role in digital marketing, but at the same time, it will face more challenges and problems. Therefore, this paper suggests that future research should pay more attention to the ethical, legal, and data security aspects of AIGC to ensure its healthy and sustainable development [2].

2. Literature Review

In recent years, the application of Artificial Intelligence Generated Content (AIGC) technology in the field of digital marketing has attracted a lot of attention. AIGC technology provides a new type of authoring method for enterprises to generate and optimize marketing content through Artificial intelligence-generated content. This technology has achieved remarkable results in the fields of e-commerce, finance, insurance, industry, etc., and has pushed digital marketing to leapfrog to digital intelligence. However, the development of AIGC also faces technical, ethical, and legal challenges [3].

The application of AIGC technology is regarded as an emerging momentum in the development of digital marketing approaches. AIGC technology can autonomously and intelligently generate communication content according to marketing scenarios to enhance marketing efficiency. For example, AIGC can generate 3D models and textures of goods to provide a near-physical online shopping experience, or create virtual anchors to provide users with uninterrupted recommendations of goods and online services.

While AIGC technology shows great potential in digital marketing, it also poses some challenges. First, privacy and security risks are a major concern, as the effective operation of AIGC relies on the collection and processing of large amounts of data. Companies need to ensure the quality and security of data and comply with data laws and regulations and ethical principles. In addition, bias and discrimination risks are also issues that AIGC technology needs to face. Due to the imbalance of training data, large models and algorithms may have bias and discrimination amplification problems, which need to be mitigated by enterprises taking appropriate measures in data collection and algorithm design [4].

The exploration of the application of AIGC technology in the media field has also demonstrated its potential in journalism, advertising, and film and television. AIGC technology can enhance news discovery, realize human-computer symbiotic communication in advertising, and activate creative output in film and television. However, these applications are also accompanied by potential risks, such as knowledge bias, rumor proliferation, privacy security issues, and copyright infringement. In order to ensure the safe and reliable application of AIGC technology, effective coping strategies need

to be proposed from the perspectives of dissemination subject, dissemination content, and technology regulation.

In terms of agricultural e-commerce content marketing, the application of AIGC technology brings new opportunities for agricultural e-commerce, such as reducing costs, improving efficiency, and expanding the influence of content [5]. At the same time, AIGC technology also faces some challenges, including the difficulty of guaranteeing content stability, the risk of user privacy leakage, and copyright issues. In order to cope with these challenges, it is necessary for technology providers to improve the generation technology, platforms to strengthen the management mode, and the state to introduce corresponding legal norms.

It can be seen that the application of AIGC technology is promising. It can automatically generate various forms of content, including text, audio, images and video, etc., providing a constant stream of ideas and materials for digital marketing. This automated content generation not only enriches the marketing means, but also makes the marketing content more diversified and personalized. Through big data analysis and machine learning, AIGC technology can provide in-depth insight into user needs, realize personalized marketing strategies, and provide users with customized content and recommendations, thus effectively improving user satisfaction and loyalty. In addition, AIGC technology can also improve the production efficiency of marketing content, shorten the content production cycle, reduce costs, and make marketing more efficient and flexible [6]. At the same time, AIGC technology also has the ability of cross-modal conversion, which can convert different forms of content such as text and audio to each other, providing more diversified choices and richer expressions for brand communication. Finally, AIGC technology can also help brands automate the publication and distribution of content on multiple channels, realizing omni-channel linkage and enhancing brand exposure and user coverage.

However, AIGC technology also faces some challenges in digital marketing. First of all, privacy and security risk an issue that can't be ignored; AIGC technology may face the risk of data leakage, misuse and tampering when it collects and processes a large amount of user data. Therefore, strengthening data protection and management is the key to ensuring the safe application of AIGC technology. Second, AIGC technology may replicate and amplify biases in training data when generating content, leading to unfair or discriminatory phenomena. This requires that when using AIGC technology, this paper need to strictly audit and regulate the content it generates to avoid its negative impact. In addition, the content generated by AIGC technology may contain false or misleading information, which requires us to establish a content audit and supervision mechanism to ensure the authenticity and quality of the content. At the same time, AIGC technology may involve copyright infringement in the process of content creation, which also requires us to clarify copyright attribution and legal use to avoid legal disputes [6]. Finally, in digital marketing, the collaboration between AIGC technology and human beings may have inconsistencies in goal setting and task allocation, which requires us to optimize the human-computer collaboration mode to ensure that both parties can work together efficiently.

3. The Impact of AIGC on User Behavior in Digital Marketing

3.1. Influence Mechanism

The introduction of AIGC technology makes content personalization possible. Through deep learning and big data analysis, AIGC can accurately capture users' interests, consumption habits and psychological needs to generate highly personalized content. This customized content not only meets users' tastes, but also resonates with them, increasing their engagement and satisfaction. For example, on social media, AIGC can recommend customized advertisements and promotional content for users

based on their browsing history, likes and comments, making advertisements no longer intrusive but a source of information of interest to users [7].

AIGC technology greatly enhances the interaction between brands and users. With tools such as chatbots and virtual assistants, brands can provide instant response services to users, answer their questions and collect their feedback at any time. This real-time interaction not only improves user satisfaction, but also allows brands to better understand user needs and optimize their products and services. At the same time, AIGC is also able to provide users with a more natural and smooth communication experience through intelligent Q&A and voice interaction, further bridging the distance between brands and users [8].

AIGC technology plays an important role in data-driven decision support. It is able to process and analyze a large amount of user data to provide marketers with accurate user profiles and marketing strategy suggestions. Through in-depth understanding of user behaviour and preferences, AIGC helps marketers develop more precise marketing strategies and improve marketing effectiveness. For example, AIGC can analyze information such as users' browsing behaviors, purchase records and search terms on websites to predict users' needs and points of interest, so as to recommend products or services to users that they may be interested in. This data-based marketing strategy not only improves marketing efficiency but also reduces marketing costs.

In terms of content innovation, AIGC technology has demonstrated strong capabilities. It can automatically generate various forms of content, such as articles, videos, images, etc., providing brands with diverse marketing tools. These novel contents are not only highly creative and interesting, but also capable of delivering brand messages in a more vivid and intuitive way [8]. AIGC technology can also automatically create content related to users according to their preferences and behaviors, such as recommending articles based on their reading preferences and videos based on their viewing habits. This kind of personalized content recommendation not only improves user satisfaction, but also increases users' stickiness to the brand.

In addition, AIGC technology has the ability to generate cross-modal content. It can convert textual content into forms such as images, video or audio to provide users with a richer experience. This cross-modal content not only increases the attractiveness of the content but also improves its dissemination. For example, AIGC can convert an interesting article into video format, allowing users to experience the content through both visual and auditory stimulation. This diversified form of content not only meets the diverse needs of users but also improves user engagement and loyalty.

AIGC technology also has the ability to predict and adapt to user behavior [9]. It can predict the future behavior of users based on their historical behavior and preferences, thus providing more personalized services and content. This capability not only increases user satisfaction and loyalty, but also brings more business opportunities for brands. For example, AIGC can analyze a user's purchase history and online behavior to predict new products or services that the user may be interested in and recommend them to the user. This kind of recommendation system based on user behavior not only improves marketing effectiveness, but also brings users a more convenient shopping experience.

3.2. The Effect of the Role

AIGC technology is able to accurately capture users' personalized needs through deep learning and big data analysis, and generate highly customized marketing content accordingly. This personalized content is no longer a static template but can be dynamically adjusted according to users' real-time needs and interests. For example, on e-commerce platforms, AIGC can analyze a user's browsing history, and purchase history and search keywords to recommend products and offers that highly match their interests [10]. This kind of precision marketing not only improves user engagement and satisfaction but also enhances users' loyalty and stickiness to the brand by meeting their personalized needs. In addition, AIGC can generate ad copy and visual designs that match users' interests and

values based on their social media interaction data. This kind of content not only better attracts users' attention, but also resonates with them emotionally and promotes an emotional connection between users and brands. By gaining a deeper understanding of the user's inner world, AIGC provides brands with the opportunity to establish a deep connection with the user, thus realizing a new level of precision marketing.

AIGC technology has significant advantages in improving marketing efficiency and reducing costs, and the application of AIGC technology makes the content generation process efficient and convenient. Compared with traditional manual content generation, AIGC can generate a large amount of high-quality content in a short period of time to meet the needs of different marketing channels. This efficient content generation capability not only reduces labor costs, but also makes marketing activities more flexible and efficient. Brands can respond faster to market changes and adjust their marketing strategies to meet the diversified needs of users. AIGC is also able to automate the updating and optimization of content. Through real-time analysis of user feedback data, AIGC can continuously optimize marketing content to improve user experience and satisfaction. This user-centric optimization strategy can better meet user needs and increase user loyalty and satisfaction, thus creating greater business value for the brand.

Despite its significant advantages in digital marketing, AIGC faces the challenges of algorithmic bias and ethical issues. If the training data is biased or insufficient, AIGC-generated content may be biased or discriminatory in some way, which may have a negative impact on brand image and user behavior. In addition, AIGC may unconsciously reinforce certain stereotypes or discriminate against certain groups of people during the content generation process, which may also raise social and ethical issues. At the same time, AIGC-generated content may involve the risk of copyright infringement, especially when using copyrighted material. Brands need to ensure that the content used has legitimate copyright and intellectual property rights to avoid possible legal disputes and brand image damage. In addition, brands need to be concerned about the originality issues that may arise from AIGC technology in the content generation process to ensure that the content generated is uniquely creative and valuable.

4. Research Discussion

Among the commonalities of numerous studies, AIGC's superior ability to generate personalized content has been mentioned several times. This was highlighted by several pieces of literature, which pointed out that this personalized content generation has a significant effect on enhancing user experience and driving conversions. In addition, data-driven decision-making is one of the consensus of the research. Several literatures explicitly mention that AIGC is able to provide scientific support for the development of marketing strategies through the analysis of massive user data, thus improving the accuracy of marketing. Further, several research reports have noted the unique advantages of AIGC in cross-modal content generation, which can easily transform text into video or images, greatly enriching the presentation and attractiveness of content. Finally, user behavior prediction is also seen as an important commonality of AIGC, a predictive capability that helps companies gain a deeper understanding of customer needs and market trends [10].

Despite the many commonalities, the studies also present some notable differences when exploring AIGC. In particular, on the issue of privacy and ethics, some of these literatures specifically emphasize the privacy and ethical boundaries that AIGC may touch when processing user data, which contrasts with other studies that focus primarily on the application and effectiveness of the technology. In addition, the breadth of AIGC technology applications is one of the points of difference between the studies. Some studies focus on applications in specific industries such as healthcare and education, while others broadly explore the applicability of AIGC in multiple domains. At the same time, the

research methodologies adopted by different literatures are also distinctive, with experimental design, survey research and case study analysis all represented.

In the process of in-depth research, the author also found some problems and shortcomings. Some of the studies may rely too much on a particular type of data or research method, such as over-reliance on the results of questionnaire surveys or small-scale experiments, which may limit the generalizability and applicability of the findings to a certain extent. Meanwhile, in terms of data collection, with increasingly stringent privacy regulations, how to legally and compliantly collect and use user data for AIGC training and testing has become a major legal and ethical challenge for researchers. In addition, the transparency and interpretability of the technology has been pointed out by some studies as a glaring shortcoming of current AIGCs, which may affect users' trust in AIGC-generated content.

5. Conclusion

In the new era of digital marketing, the rise of AIGC technology has revolutionized the industry. Its application not only significantly influences user behavior by generating highly personalized and diversified content, but also greatly enhances user engagement and brand loyalty by accurately capturing users' interests and needs. AIGC technology, with its powerful data analytics, is able to predict user behaviors and provide strong support for enterprises to formulate their marketing strategies, thus ensuring the accuracy and effectiveness of their marketing campaigns. In addition, AIGC's ability in content innovation should not be underestimated, it can automatically generate articles, videos, images and other diversified forms of content, bringing users an unprecedented interactive experience. These advantages not only enhance user experience, but also bring higher conversion rate and market competitiveness for enterprises, making AIGC an indispensable part of digital marketing.

After in-depth research, it is not difficult to find that AIGC technology shows great potential and value in digital marketing. It can not only significantly improve the effect of content marketing and change the way of interaction between users and brands, but also bring considerable business value to enterprises. However, with the wide application of AIGC technology, this paper must also face up to the challenges it brings, such as user privacy protection, ethical standards and content transparency. Therefore, while utilizing AIGC technology to promote digital marketing, this paper must always pay attention to these issues to ensure that user rights and interests are fully protected.

Further to the future research direction, the author believes that interdisciplinary research will become an important trend. Combining the knowledge of psychology, sociology, data science and other fields will help us understand the multi-dimensional role of AIGC in digital marketing in a more comprehensive and in-depth way. Meanwhile, with the continuous improvement of privacy protection regulations, exploring new privacy protection technologies to ensure the security and privacy of user data will be an important direction for future research. In addition, improving the transparency and explanatory nature of AIGC to help users better understand its workings and decision-making process is likewise an indispensable research topic for the future. Finally, focusing on the long-term impact of AIGC in digital marketing, including the impact on user behavior, brand trust, and even social culture, as well as the development of multimodal and interactive AIGC, will provide rich topics and broad space for future research.

References

- [1] YG Wang, SQ Zhang. *Research on Digital Marketing Based on Interactive Perspective: Integration Framework and Future Prospect*[J]. *Collected Essays on Finance and Economics*, 2024(5)
- [2] Belém Barbosa, José Ramón Saura. *Defining content marketing and its influence on online user behavior: a data-driven prescriptive analytics method*[J]. *Annals of Operations Research*, 2023

- [3] GY Han,K Zhang.*AIGC marketing: the man-machine symbiosis marketing model promotes the leap from digital marketing to digital intelligence*[J].*Enterprise economy*,2024,(02)
- [4] LY Zhu,J He,Y Tian.*Exploration and potential risks of AIGC in the field of media*[J].*Media*,2024,(1)
- [5] QN Wang,CC Zhang,ZX Li,YY Wei.*Opportunities and Challenges of Agricultural E-commerce Content Marketing under AIGC Mode*[J].*China Collective Economy*,2024,7(3)
- [6] JQ Zhu.*AI Empowers the Demand Side of Advertising — A New Mission of Artificial Intelligence in Digital Marketing*[J].*International brand observation*. 2021(05)
- [7] Chen ZY,Ren XX,Qiu C.*Bi-Meta: Bi-Alternating Resource Provisioning and Heterogeneous Auction for Mobile Metaverse*,*IEEE Global Communications Conference*.Kuala Lumpur, MALAYSIA,2023.5481-5486
- [8] Filipe Oliveira, António Santos, Bruno Aguiar, João Sousa*.*GameFoundry: Social Gaming Platform for Digital Marketing, User Profiling and Collective Behavior*[J].*Social and Behavioral Sciences*.2014,58-66
- [9] Shahab Saquib Sohail,Faiza Farhat,Yassine Himeur.*Decoding ChatGPT: A taxonomy of existing research, current challenges, and possible future directions*[J].*Journal of King Saud University--Computer and Information Sciences* 35,2023
- [10] MY Hu,HW Xia.*Research on Digital Marketing Strategy of Agricultural Products Live E-commerce Based on 5A Model — Taking Oriental Selection as an Example*[J].*Modern agricultural science and technology*,2024(09)

Problems and Countermeasures of China's Foreign Exchange Derivatives Market

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Abstract: China's foreign exchange derivatives market continues to develop, but some problems remain. This essay predominantly analyzes the shortcomings in China's foreign exchange derivatives market and proposes corresponding countermeasures. This essay mainly focuses on the following four issues in China's foreign exchange derivatives market. They are trading scale and liquidity problems, insufficient product innovation, market participant structure problems, and insufficient market trust and risk awareness. Four corresponding countermeasures are proposed, which are proposed from four angles: appropriately lowering the threshold for foreign exchange derivatives business of small and medium-sized financial institutions, promoting innovation of market derivatives, strengthening market diversification, and foreign exchange derivatives supervision. This article aims to analyze China's derivatives market from multiple angles and put forward appropriate suggestions for optimizing China's foreign exchange derivatives market structure.

Keywords: Foreign exchange derivatives, liquidity, product innovation, risk awareness, market participants.

1. Introduction

The foreign exchange market plays an important role in the national economy. It supports international economic development and trade activities to a certain extent. It also plays an indispensable role in the global financial system and has a profound impact on the stability and development of the economies of various countries. The foreign exchange market is a bridge for international trade and investment, providing a platform for enterprises and individuals to conduct cross-border transactions and capital flows. In the foreign exchange market, countries can buy and sell goods and services, promoting the interaction and development of the global economy. The foreign exchange market is also an important transmission mechanism for the country's macroeconomic policies. The stability and fluctuation of the exchange rate directly affect the country's economic growth, inflation level, and international competitiveness. The central bank intervenes in the foreign exchange market to adjust the exchange rate level, achieve the goals of monetary policy, and maintain economic stability. The foreign exchange market is also an important part of the financial market, playing a key role in the risk management and asset allocation of financial institutions and investors. A large number of foreign exchange transactions provide market participants with diversified investment opportunities and enhance the liquidity and efficiency of the market.

As the world's second-largest economy, China has a significant impact on the development of the world economy. China's foreign exchange market plays a vital role in China's economic development. Through the foreign exchange market, Chinese companies can trade goods and services across borders, which has promoted the export-oriented growth of China's economy. The stability and development of China's foreign exchange market directly support the Chinese government's macroeconomic management. China's foreign exchange reserves are large in scale, providing an important guarantee for the risk resistance of the Chinese economy. These foreign exchange reserves not only support the liquidity and stability of the domestic market but also play an important role in times of global economic instability, laying a solid foundation for the continued growth of China's economy.

This article focuses on China's foreign exchange derivatives market. This article deeply analyzes the market size and liquidity, lack of product innovation, market participant structure, and market trust and risk awareness. In response to these issues, relevant policy recommendations are put forward, including: lowering the threshold for foreign exchange derivatives business of small and medium-sized financial institutions, thereby promoting the diversification and activity of market participation; actively promoting the innovation and development of market derivatives, stimulating the market's momentum and competitiveness; optimizing the structure of market participants, improving the efficiency and stability of market operations; strengthening the supervision of the foreign exchange derivatives market, and improving the market's trust and risk management awareness.

2. Overview

2.1. Market Size and Structure

At present, China's foreign exchange derivatives trading products include forwards, foreign exchange swaps, currency swaps, ordinary European options and their combinations. In recent years, the trading volume of China's foreign exchange derivatives business has continued to increase. In April 2024, China's foreign exchange market had a total turnover of RMB 23.04 trillion, equivalent to US\$3.24 trillion. Among them, the derivatives market had a cumulative turnover of RMB 15.65 trillion, equivalent to US\$2.20 trillion. From January to April 2024, China's foreign exchange market had a cumulative turnover of RMB 89.21 trillion, equivalent to US\$12.56 trillion [1].

2.2. Market Development History

The development of China's foreign exchange market can be roughly summarized into three parts, namely the initial growth stage, the mature and perfect stage, and the activeness improvement stage. In the initial growth stage, China launched foreign exchange derivatives in 1997, but the exchange rate was relatively stable at that time, and foreign exchange derivative transactions were not active. In 2005, China's interbank market launched the RMB-foreign currency forward foreign exchange business for the first time, marking the official launch of China's foreign exchange derivatives market. In the mature and perfect stage, with the normalized two-way fluctuations of the RMB exchange rate, the transaction demand of the domestic foreign exchange derivatives markets gradually stabilized, and the system gradually matured and improved. In 2017, among the transactions in China's interbank foreign exchange market, the transaction volume of foreign exchange spot transactions and foreign exchange derivatives accounted for 31.5% and 68.5% respectively. In the activeness improvement stage, since 2021, China's import and export trade has shown a good situation of sustained growth, and foreign exchange transactions and investments have also become more active. The annual transaction volume of the foreign exchange derivatives market has increased to 22.65 trillion US dollars, a year-on-year increase of 25.87%. In 2022, affected by the strong US dollar, the bilateral fluctuation of the RMB exchange rate increased. Foreign exchange derivatives were widely used in

foreign investment and foreign trade transactions between financial and real enterprises, effectively reducing exchange rate risks [2].

3. Problems

3.1. Transaction Size and Liquidity

To measure whether a country's foreign exchange derivatives market is consistent with its economic development level, two types of evaluation indicators are usually used. One is the ratio of foreign exchange derivatives trading volume to foreign exchange spot trading volume, and the other is the ratio of foreign exchange derivatives trading volume to foreign trade scale and GDP. In recent years, China's foreign exchange derivatives market has developed, but it is still not in line with the economy that maintains medium-to-high-speed development. Compared with other developed countries, China's foreign exchange derivatives coverage is still relatively low. It can be seen that the volume of China's foreign exchange derivatives is far smaller than the scale of economic development [3].

Compared with the international foreign exchange market, the trading volume is relatively low. In terms of the ratio of over the counter and on-exchange derivatives, in major developed markets, the scale of the over-the-counter derivatives market is generally larger than the scale of the on-exchange derivatives market, while the total nominal amount of China's over-the-counter derivatives transactions is less than half of that of on-exchange derivatives [4]. China's foreign exchange derivatives market transactions are homogeneous, which prevents the expansion of derivatives transactions, resulting in a loss of trading activity, which leads to the problem of low liquidity of China's foreign exchange derivatives.

3.2. Insufficient Product Innovation

The variety of derivatives directly affects the enthusiasm of market participants and the liquidity of the market. China's foreign exchange derivatives are few in variety and have a lower trading volume than the international foreign exchange market. Compared with mature markets, the domestic derivatives market has weak innovation capabilities, and the product homogeneity of various institutions is serious, lacking cross-product portfolio innovation. In response to the widespread lack of foreign exchange futures and options in the international market, the Chinese market has not yet launched foreign exchange futures contracts, and the existing trading types are far from meeting the requirements of risk avoidance [5]. This is not conducive to the optimization of price discovery and the improvement of market liquidity.

3.3. Market Participant Structure

At present, China's foreign exchange derivatives market is dominated by commercial banks. Many large institutional investors or large enterprises involved in foreign exchange transactions want to enter the foreign exchange derivatives market to avoid exchange rate risks, but they are not qualified to enter due to the system. This leads to the inactivity of the foreign exchange derivatives market and the singleness of the trading subjects. Since the main types of foreign exchange derivative contracts in China are traded over the counter, the over-the-counter market has the characteristics of low transparency and strict market access. Therefore, China's foreign exchange derivatives trading has a low utilization rate and insufficient market participation.

The relatively single participants and trading strategies affect the supply and demand balance of products and reduce market liquidity. For example, most of the participants in the over-the-counter derivatives market are commercial banks. Their trading purposes and strategies are similar, resulting in a lack of counterparties for opposite transactions in the market. These market structure

characteristics are because my country's derivatives market is still subject to strict regulatory restrictions, including strict approval for product listing, the inability of certain institutions to participate in specific derivatives trading markets, and the real need principle and short selling transactions being restricted.

Many investors and enterprises have a low degree of acceptance of foreign exchange derivatives. China's foreign exchange derivatives trading is mainly concentrated between banks. For other markets, the participation level is low, and trading is not active. The development of option trading and swaps is relatively slow, and they are mainly concentrated in forward contract trading, and their trading volume is far lower than that of spot business. In addition, investors of different sizes have different understandings of foreign exchange derivative trading. Large-scale enterprises are more likely to use foreign exchange derivatives than small-scale enterprises, and the larger the scale of foreign exchange derivative transactions, the lower the average transaction cost and the greater the economic benefits. These factors have limited the demand for product diversification and the improvement of market liquidity [6].

3.4. Market Trust and Risk Awareness

There are various risks in China's foreign exchange derivatives market. The first is market risk, which refers to the uncertainty loss caused by changes in interest rates and exchange rates. Foreign exchange derivatives are based on exchange rates, and the risk of exchange rate fluctuations is its market risk.

Secondly, counterparty risk is also a very common risk. When the contract expires, the two parties to the transaction have no or cannot avoid the risks brought by the transaction. The trading system and regulatory mechanism of China's foreign exchange derivatives market are not perfect, which increases the possibility of risk. In addition, although only a low margin is required to fulfill its obligations to control risks and improve efficiency, this cannot guarantee the control of market risks that may be faced during the trading period. The margin system also makes transactions have a higher leverage ratio, and the gains and losses are correspondingly magnified, which is more risky. Thirdly, liquidity risk is the main risk faced by investors. It refers to the risk that the holder of the product contract cannot find an opportunity to sell or close the position in the market. The size of the risk depends on the standardization of the product contract, the size of the market, and changes in the market environment. Due to the difficulty of trading in the foreign exchange derivatives market, its liquidity risk will increase [6].

Operational risk should not be ignored. It refers to the risk of loss due to management errors, failure of the trading system or clearing system, or human error. China's foreign exchange derivatives market is in its infancy and lacks a large number of high-quality professional talents and professional equipment. In particular, there is a gap in product design and research and development, which increases the possibility of operational risks [7].

4. Countermeasures

4.1. Lower the Threshold

Related departments should continue to expand the market players of small and medium-sized financial institutions, continue to promote financial institutions to actively participate in the domestic foreign exchange derivatives market, and expand the development channels for foreign institutions to participate in the onshore market. At the same time, market should simplify the market access of foreign exchange derivatives, implement unified one-time market access centralized management for domestic and foreign derivatives businesses, and continue to lower the market access threshold for small and medium-sized financial institutions in foreign exchange options and other related businesses. All banking institutions must emancipate their minds, actively seek support from their

superiors, and strive to change the situation where bank credit products are single, and the threshold is relatively high and launch more financial innovation products. The government should actively guide and increase the training of enterprise management, actively organize enterprises to go abroad, learn from experience, and strengthen corporate governance. In this regard, banks can also exert external forces on China's foreign exchange derivatives through relevant supporting systems, forcing enterprises to continuously improve their management level. The government should do a good job in delegating management authority, simplifying and optimizing the access management of small and medium-sized financial institutions, vigorously promoting the government's efforts to streamline administration and delegate power, and lowering the participation threshold of small and medium-sized financial institutions [8].

4.2. Promoting Innovation

According to the current development status of China's foreign exchange derivatives market, to build a more multi-layered and diversified financial market system, China should increase the types of foreign exchange derivative transactions and enhance the influence of the domestic foreign exchange market. At present, China's existing foreign exchange derivatives transactions are all over-the-counter contracts, and compared with mature international markets, there are no on-site market contracts. Therefore, the construction of the on-site foreign exchange derivatives market will become a focus. And at the right time, it is possible to consider launching futures trading of foreign exchange derivatives [3].

Related departments can strengthen product research and development and gradually innovate products to promote the development of the foreign exchange derivatives market. In recent years, China's foreign exchange products have shown a trend of diversification. On this basis, related departments can appropriately relax the foreign exchange products of banks and further promote the development of foreign exchange futures. The government can consider appropriately relaxing the control of foreign exchange derivatives investment, reducing some unnecessary procedures, and promoting corporate innovation; it can also strengthen the management of offshore products and promote the development of option trading, to better solve the problems of domestic and foreign market development. In addition, China can also join other countries to continuously increase and expand the variety and scale of transactions and establish a comprehensive real economy [8].

4.3. Strengthen Market Diversification

More commercial banks and other institutions should be encouraged to participate in transactions, conduct transactions with investors, and allow more non-bank financial institutions to participate, to continuously enrich the trading entities in the market. This requires the adoption of effective measures: the trading mechanism of enterprises needs to be improved in advance so that investors can actively participate in the trading process; commercial banks should give full play to their intermediary role, help enterprises reduce transaction costs, find institutional investors to trade with, provide them with high-quality services, and reduce the volatility of the foreign exchange market; in combination with the different needs of investors, more trading varieties and products should be innovated for investors to meet the development needs of the real economy. For example, foreign exchange-related enterprises, financial leasing companies, trust investment companies and other entities should be allowed to enter the foreign exchange derivatives market. By drawing on international experience, innovative research and development of domestic foreign exchange products, and vigorously introducing foreign exchange mutual funds, ETFs, and other foreign exchange derivatives [9]. It is necessary to meet the personalized needs of investors in the domestic market and to improve the enthusiasm of the entire market for investment [10].

4.4. Foreign Exchange Derivatives Regulation

A good foreign exchange derivatives market cannot do without government participation, and government supervision is also the key to solving these problems. Government supervision first needs to improve legislation, establish and improve the regulatory system of the foreign exchange derivatives market, clearly define the powers of each regulatory agency, divide the responsibilities of each regulatory agency, and ensure that there is a law to follow. The introduction of a series of relevant laws will greatly improve the disorder of the derivatives market, make transaction requirements clearer, fully improve transaction efficiency, and reduce losses. Secondly, it is necessary to enhance market effectiveness and improve market transparency [6].

Firstly, there are currently few laws in China related to the foreign exchange derivatives market, which has led to a regulatory vacuum. A sound regulatory system should be based on a solid legal foundation. The introduction of a law specifically targeting the foreign exchange derivatives market will help form an integrated financial regulatory framework.

Secondly, Regulatory authorities should ensure that market players are transparent about foreign exchange derivative transactions and try to avoid losses caused by factors that cannot be fully disclosed during the transaction process.

Thirdly, Crackdown on excessive speculation. Although speculation is common in derivatives trading, and the degree of speculation is positively correlated with the size of corporate assets, the proportion of export revenue, and corporate solvency, many transactions for speculative purposes are not conducive to the healthy development of the financial market. If inadequate supervision leads to excessive speculation and thus creates risks, it will disrupt market order and affect the normal operation of the market. Therefore, regulatory authorities should strictly control possible excessive speculation [3].

5. Conclusion

At present, China's foreign exchange derivatives market is in a stage of rapid development, however, the market still faces many challenges. This article deeply analyzes the core issues such as market size and liquidity, insufficient product innovation, market participant structure, and market trust and risk awareness. In response to these challenges, a series of corresponding countermeasures are proposed: lowering the threshold for foreign exchange derivatives business of small and medium-sized financial institutions, thereby promoting the diversification and activity of market participation; actively promoting the innovation and development of market derivatives, stimulating the market's momentum and competitiveness; optimizing the structure of market participants, improving the efficiency and stability of market operations; strengthening the supervision of the foreign exchange derivatives market, and improving the market's trust and risk management awareness. These analytical countermeasures aim to provide useful strategic guidance and suggestions for the healthy development and structural optimization of China's foreign exchange derivatives market.

References

- [1] State Administration of Foreign Exchange. State Administration of Foreign Exchange released data on China's foreign exchange market transactions in April 2024
- [2] Zhou Jingtong, Wu Dan. (2023). New developments, significance and impact of RMB foreign exchange derivatives market. *Financial Market Research* (10), 58-71.
- [3] Xu Yiwen. (2021). Research on the development and countermeasures of China's foreign exchange derivatives market. *Management and Technology of Small and Medium Enterprises (first half of the month)* (10), 91-93.
- [4] He Yulin, Chen Xian, Jiang Yile. (2023). The development and challenges of China's derivatives market from the perspective of open economy. *Shanghai Economic Review* (03), 83-93.

- [5] Si Wen. (2015). *Research on the country's foreign exchange derivatives market. (PhD Dissertation) Shanghai Academy of Social Sciences.*
- [6] Shen Zhaoyan. (2021). *Problems and solutions in the development of China's foreign exchange derivatives market. China Management Informationization (22), 175-176.*
- [7] Hao Xiangchao, Liang Qi. (2019). *Can foreign exchange risk hedging promote innovation among Chinese listed companies. World Economy (09), 151-172.*
- [8] Mao Jian. (2023). *Analysis of the problems and countermeasures of the development of China's foreign exchange derivatives market. China Market (32), 75-78.*
- [9] Zhang Xilin. (2022). *Research on the Problems and Countermeasures of Foreign Exchange Derivatives Trading of Commercial Banks. China Market (23), 49-51.*
- [10] Wang Yueying. (2021). *Research on the problems and countermeasures of the development of China's foreign exchange derivatives market. Management and Technology of Small and Medium Enterprises (first half of the month) (04), 172-173.*

Analysis of Financial Performances for Walt Disney: Based on Comparison with Netflix, Warner Bros and SONY

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Abstract: As the COVID-19 ended, the global entertainment economy began to recover. On this occasion, the global film and television industry is also beginning to recover. This study will discuss the company background, main industry, main products, stock situation, financial data, future development and competition of several major film and television companies. Through financial data and market analysis, comparing and selecting target companies, and analyze the advantages and risk factors of investment. By comparing the financial data of the four companies, Disney became the target investment company. The risk factors are analyzed in detail. At the same time, by calculating and chart statistical analysis, the financial situation, competitive relations, advantages and disadvantages and development prospects of the four major companies are comprehensively analyzed. These results are conducive to the basic research of film and television industry under the recovery of entertainment economy and the correct investment choice. It is also helpful for investors to learn the basic methods and main thinking aspects of investment selection.

Keywords: Financial analysis, Walt Disney, Netflix, Warner Bros, SONY.

1. Introduction

The Disney Company is one of the largest entertainment and media companies in the world, and its industry development history and current situation reflect the process of transformation from traditional entertainment to digital [1-3]. Walt Disney Company's history dates back to the early 20th century, when it was founded by Walt Disney and initially focused on the production of animated films [4]. With the passing of time, Disney gradually expanded its business scope to cover movies, theme parks, toys, games and other fields, becoming a leader in the global entertainment industry [5-8]. Entering the 21st century, the Disney Company faced huge changes in the industry, especially the rise of digitalization and streaming services. Disney's streaming service, Disney+, reached 73.7 million subscribers, showing the potential of the company in its digital transformation [9]. This year, Disney was saved by the huge growth of its streaming business, which grew 80% year-over-year, making direct-to-consumer and international business the second-largest source of revenue for Disney [10].

In order to address financial challenges and seize the opportunities of digital transformation, Disney has taken a series of measures, including issuing bonds and adjusting its business structure [11-15]. Although the streaming service is still burning through cash, Disney's cash reserves and liabilities show that the company remains financially strong. In addition, Disney has adjusted the way

the business is aggregated in its financial results to better reflect the revenue of its important businesses such as derivatives licensing and content licensing.

It was founded by founder Walt Disney in 1923. Disney has many brands, some of them have worked with award-winning filmmaker Jerry Bruckheimer more than 10 times. Disney has a distribution partnership with Ghibli. Moreover, the Walt Disney Company owns Disneyland Resort, Walt Disney World, and licenses in many countries. On February 2, 2024, the Walt Disney Company announced that Disney+ would launch on Apple's Apple Vision Pro on the same day. Buffett's comments about Disney in the 1930s and 1940s focused largely on the uniqueness of its animation offering, arguing that Disney was unique in providing animation, which was very good. However, he also pointed out that times are different now, and the number of viewers and duration of viewing will not increase as dramatically as in the past. This shows that Buffett's view of Disney has changed over time, and although he initially gave high marks to Disney's animation capabilities, he also recognized the changing market environment.

In order to make people's competitive relations and investment choices in the film and television industry more smooth, this research is very necessary. In the second section that follows, the source of the data, the companies selected, the reasons for selecting these comparison companies, the time frame of the data selected, and the calculation method are described. The third section will use the data for financial analysis, resulting in an explanation and some investment implications. At the same time, it will also explain the research limitations and prospects of this paper. The fourth section will summarize the whole paper.

2. Data and Method

All data is from <https://www.nasdaq.com> and <https://www.estimize.com>. And the three competing companies are Netflix, Warner Bros and SONY. All relevant data was selected on June 10, 2024. The reasons for choosing these comparison companies are as follows. For DIS and NFLX:

- Market positioning and business model. Disney+ is launched as a "happy dream maker" and a "family streaming media platform". Moreover, Disney recently surpassed 100 million media subscriptions, indicating its initial success in expanding into the now-hot industry of streaming media. By contrast, Netflix is a full-fledged movie platform with high-quality drama aimed at adults.
- IP and brand effect. Disney owns the Marvel Universe, Star Wars, Disney Princess series and other well-known IP, forming an ecosystem including media networks, park resorts, film and television, as well as consumer and interactive entertainment. While Netflix isn't as good as Disney in terms of IP and branding.
- Long-term investment appeal: Based on long-term growth, revenue and net income estimates, Netflix is less undervalued than Disney. The average analyst price target for Netflix is higher than its current share price, indicating optimism about its future growth. Disney's streaming business is expected to add to the company's net income by the end of 2024, thereby increasing earnings per share, making it seem more attractive to long-term investment.

For traditional film Industry competition:

- Film and Television. Disney, through its subsidiaries such as Disney Pictures and Lucasfilm, has well-known IP, as well as strong animation production capabilities. Warner Bros. owns "Harry Potter," "DC" and other well-known IP. SONY Pictures is known for IP for characters in the Spider-Man series and the Avengers, which are also well known in the film industry.
- Game field. Disney and Warner Bros. have launched games based on their respective movie and TV IP (Star Wars series and 'Harry Potter series). SONY has produced franchises such as Final Fantasy and Uncharted, and competes with Microsoft's Xbox in the console space.

- Theme Park Disney has several theme parks around the world, which feature Disney movies and animated characters.
- Brand value and market influence. The three companies have a broad market and IP effect.

As the COVID-19 ended, the global entertainment economy began to recover. As one of the top film and television companies in the world, Disney has a wide audience and a relatively perfect corporate management system. Also, Disney recently surpassed 100 million media subscriptions, indicating its success in expanding into streaming media, with low-cost advantages. The upside for Disney stock is its superior economic moat, long history of profitability. The media company Netflix, classic film studios Warner Bros and SONY have all released big hits in recent years. In addition, SONY and Disney have had changes in senior leadership. So, one can pick out these three competitors from a variety of perspectives. The four companies' basic information are given in Table 1.

Table 1: Four companies' basic information.

Company	DIS	NFLX	WBD	SONY
Market Cap (in Billion)	185.1	276.4	20.3	104.3
Industry	Entertainment programming, Theme parks, Toys, Books, Video games and Media networks	Movies, Entertainment videos, and Video games	Film and television entertainment production	Production and distribution of films and television programs and digital entertainment programs
Main Products	Cartoon, film and television, theme parks and their derivatives	Online movie rental services, self-made online dramas and exclusive peripheral clothing related to the works released on the platform	Movies, TV dramas, and related consumer goods and peripheral products	TV series, movies, TV variety shows, franchise products, digital production, animated films, online games, digital products
Other Competing Factors	Amazon; Comcast Corporation; Universal Picture; Paramount Picture			

The calculation evaluation metrics are listed as follow: $EPS = \text{Net Income} / \text{Shares Outstanding}$, $TTM = \text{sum most recent four quarter}$, $NTM = \text{sum next four quarter}$. The higher the value of this index, the more profit can be obtained per share, the better the investment efficiency of shareholders, and the worse it is. Therefore, there is no fixed standard of "normal" data, as it will vary based on the specific financial situation of the company and the industry average. It means the rate of after-tax profit to total share capital or the corporate net profit or net loss that common shareholders can enjoy for each share held. The calculation formulae are given as follows: $\text{Growth rate} = (\text{NTM EPS} - \text{TTM EPS}) / \text{TTM EPS}$. To test the growth of individual stocks, the valuation is given as: $P/E \text{ Ratio} = \text{Market Capitalization} / \text{Net Income} = \text{Share Price} / \text{Earnings per share}$. In a word, the P/E ratio is as follows: <0: indicates that the company's profit is negative; 0-13: undervalued; 14-20: Normal level; 21-28: The value is overvalued; 28: indicates a speculative bubble in the stock investment. It's the ratio of the stock price divided by the earnings per share. $\text{Gross profit Margin} = \text{Gross Profit} / \text{Total Revenue}$. The general range of gross profit margin varies due to various factors such as industry, company size,

product type and so on, and there is no uniform standard. It reflects the conversion of internal systems and value of a product after production as follows: $GP/A = \text{Gross Profit} / \text{Total Assets}$ and $PEG = \text{TTM P/E} / (100 * \text{EPS growth rate})$. A PEG equal to 1 indicates that the market has assigned a valuation to the stock that completely reflects the growth of future performance. If the $PEG > 1$, the share may be overestimated, or the market may believe that the one's performance will grow faster than the market expects. When the $PEG < 1$, the market is underestimating the value of the stock, or the market believes that its growth may be worse. PEG ties the current value of a stock to its future growth. $\text{Net Margin} = \text{Total Assets} / \text{Total Revenue}$. The corporate income tax rate is statutory, the higher the income tax rate, the less the net profit. Net profit from operations as a percent of net sales or invested capital.

3. Results and Discussion

3.1. Comparison Analysis

On February 7, The Walt Disney Company (NYSE: DIS) released its fiscal 2024 first quarter report for the year ended December 30, 2023. Financial data show that in the first quarter, Disney's total revenue was about 23.549 billion US dollars, an increase of 0.16%. Net income attributable to the parent was approximately US \$1.911 billion, up 49.41% year-on-year. From the perspective of revenue composition, Disney's entertainment segment revenue was about 9.981 billion US dollars in the first quarter, down 6.5% year on year; Sports segment revenue of approximately \$4.835 billion, an increase of 4.2%; Experience segment revenue was approximately \$9.132 billion, an increase of 6.87%. In the entertainment sector, Disney + had approximately 46.1 million domestic users (U.S. and Canada) in the first quarter, an increase of 1% sequentially; The number of international users was about 65.12 million, an increase of 1%. Disney expects a net addition of 5.5 to 6 million Disney + main subscribers. In terms of revenue composition, linear network revenue of the entertainment segment was approximately \$2.803 billion, a decrease of 12%. Direct-to-consumer revenue of approximately \$5,546 million, up 15% year-over-year; Content sales/licensing and other revenue was approximately \$1.632 billion, down 38% year-over-year. In the sports segment, ESPN's revenue was about \$4.073 billion, up 1% year over year. In the experience segment, Disney's domestic (US) parks and experiences revenue was approximately \$6.297 billion in the first quarter, up 4% year on year. Disney noted that the Experiences segment set year records for revenue, operating income and margin in the first quarter of fiscal 2024.

Netflix Inc.'s (NASDAQ: NFLX) financial report for the second quarter of fiscal 2023 showed operating income of \$8.187 billion, up 2.72% year-over-year, although below analyst expectations of \$8.30 billion. Operating income was \$1.827 billion, with an operating margin of 22.3%, roughly in line with guidance given last quarter and up from 21% growth in the previous quarter. Net income attributable to common shareholders was \$1.488 billion, an increase of 3.24%, and net profit margin was 18.2%, both higher than the same period last year. Going into the third quarter, Netflix's performance was more optimistic. Revenue was \$8.542 billion, up 7%, and net income was \$1.677 billion, up 16%. Adjusted earnings per share were \$3.73, up 17% continuously. For the fourth quarter, the company expects revenue of \$8.692 billion, up 10.7% from a year ago, and earnings per share of \$2.15. The highest operating margin for fiscal 2023 is 20%. Exploration (WBD) reported a 6.93% year-over-year decrease in revenue and a 9.91% decrease in net loss in the first fiscal quarter of 2024. The typical results are shown in Fig. 1 and Fig. 2.

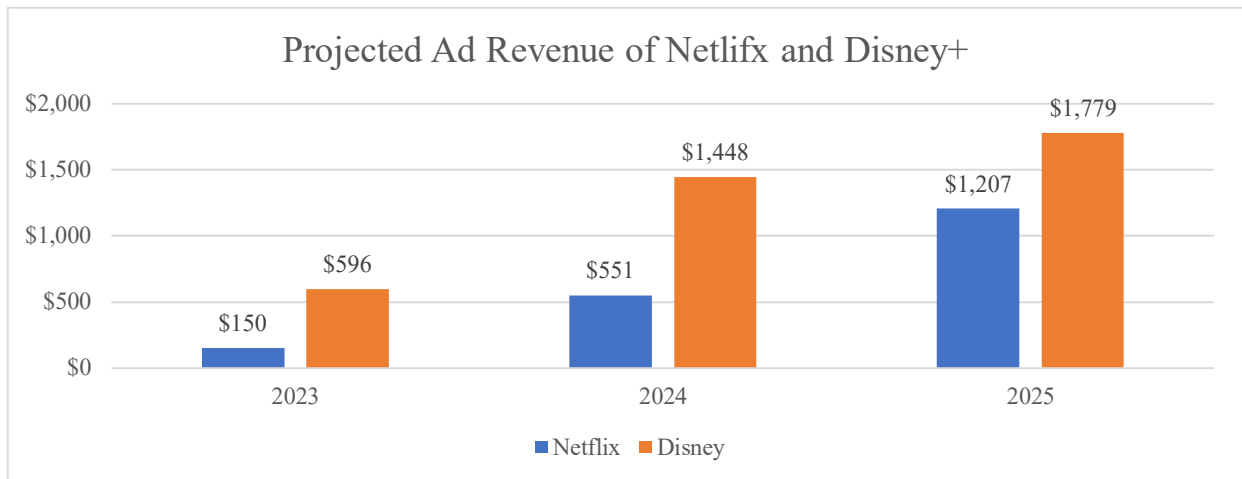


Figure 1: The revenue of Netflix and Disney+.

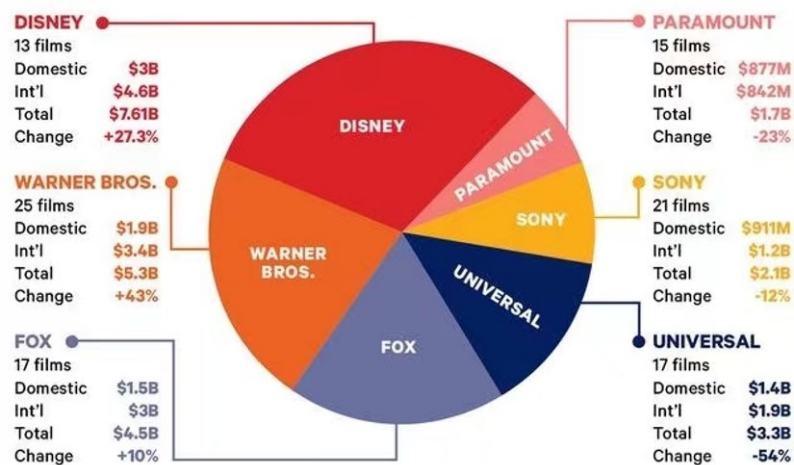


Figure 2: The competition among DIS, WBD and SONY.

Summary of the results are listed in Table 2. Warner Bros. Exploration (WBD) recently released its fiscal 2024 first quarter earnings report showing that total revenue for the quarter was \$9.958 billion, down 6.93% from \$10.700 billion in the same times last year. In addition, the net loss for the quarter was \$955 million, compared to a net loss of \$1,060 million in the same times last year, which narrowed by 9.91%. Basic earnings per share were minus \$0.40, compared to minus \$0.44 in the same period last year. SONY Pictures' overall results for the 2023 fiscal year show that its sales revenue reached 1,493.1 billion yen, an increase of 9% over the previous year, which was mainly driven by an increase in theatrical releases and the growth of paid Crunchyroll subscribers. Operating profit was essentially flat at 117.7 billion yen from a year earlier, indicating that SONY Pictures was able to maintain solid profitability in the face of challenges such as a decline in TV production deliveries due to the Hollywood strike and higher marketing costs for film releases. In the first quarter of fiscal 2022, SONY Pictures' sales revenue jumped 67% year on year to 341.4 billion yen. In the case of positive EPS and revenue growth rate, DIS's PEG is lower than NFLX which makes it a more attractive investment target. Besides, DIS's TTM and NTM P/E is much lower than NFLX's, which makes it a more potential investment target. Compared to NFLX, DIS's stock price is much lower. WBD has a large decrease in P/E which indicates the company's operating condition is not good, the future

profitability is weak. SONY's growth rate of total revenue and EPS is negative which means it's lack of impetus for development. DIS has the highest net profit margin.

Table 2: The table with specific financial data.

	DIS	NFLX	WBD	SONY
Share Price	\$101.54	\$641.47	\$8.27	\$85.45
EPS Growth Rate	17.8%	32.8%	-66.1%	-2.7%
Revenue Growth Rate	5.3%	14.3%	1.3%	-7.3%
TTM P/E	23.72	44.52	-6.67	16.82
NTM P/E	20.15	33.53	-19.69	16.72
PEG	1.34	1.36	0.10	-6.10
GP/A	14.4%	28.7%	13.7%	9.8%
Gross margin	33.4%	41.5%	40.6%	27.2%
Net profit margin	2.6%	16.0%	-7.6%	8.2%

3.2. Explanation and Implications

It is through the preliminary comparison of financial data that one can basically determine that the two main investment competitors are Disney and Netflix. Disney owns well-known brands such as "Star Wars" and "Marvel Universe," which have a broad fan base around the world, giving Disney several blockbuster movie franchises that have swept the world. Disney is transiting to a platform-as-a-service (PaaS) business model that generates subscription revenue through streaming services such as Disney+, marking a shift from traditional content production to a broader range of digital media services. For sales and earnings growth, Disney's sales increased from \$55.1 billion to \$69.6 billion by two years, showing the annual growth rate of 9.8%. Its group has acquired a number of film and television companies. As the COVID-19 ended, the global entertainment economy began to recover. Bob Iger is returning to Disney as CEO and will retire again in 2026. In addition, the second Zootopia movie will be released in the next two years. It closes to a historically rare buying opportunity. Regarding risk factors for DIS, the uncertain sale of the ABC television network (relate to debts); the warnings that the COVID-19 outbreak and repeat; ESPN struggled with a lack of sports programming during the pandemic. Fewer live sports programs have made it difficult for ESPN to Disney's trend of losing cable subscribers.

With reason of rejection, NFLX has High GP/A, EPS, TTM P/E, NTM P/E, Stock Price. The market is concerned about its profitability: the reported earnings assumptions are considered too optimistic, which can cause the share price to fall because the market reacts when the earnings requirements of the stock are not met. Although earnings per share nearly doubled from the prior fiscal year, revenue, cash flow, and free cash flow failed to confirm this progress. Cash flow barely increased from the first quarter of fiscal 2023, which may indicate that expenses for development projects once again exceeded long-term management expectations. It also has low free cash flow yield. Netflix promises to generate a lot of cash flow, but the free cash flow yield is extremely low for the market value of the stock. In addition, free cash flow has only recently turned positive, which is not what the company expected when it first went public. For shaky dominance in the streaming market, Netflix doesn't have a franchise like Disney or Warner Bros. Discovery to ensure the success of its programming investments. That means Netflix relies on creating hit product after hit product "from scratch," a company with no franchise that doesn't have a deep moat, and the market attitude may be "so far, so good," but that uncertainty increases the risk for the stock. Moreover, it has the highest stock price.

3.3. Limitation and Prospects

Limited by my own understanding ability, this study also has limitations in the research process: one is the timeliness of data. Due to the flexibility of the market, the data selected in this article may differ from the data at the time of reading. The other is the research algorithm. The limitation of PEG valuation method mainly includes the limitation of its application scope and the dependence on the forecast of future performance growth. The PE ratio may not be appropriate for companies with volatile or loss-making earnings, as these companies' earnings data do not accurately reflect their true profitability and investment value. So, although this study collected information as possible as one can and tried to use the learned knowledge to write the paper and develop the system, there are still many deficiencies in the paper, and the system functions are not perfect enough to be improved. Please criticize and correct, so that one can learn more.

To solve the shortages of this study, the future development direction is proposed. First, one needs to expand data sources, ensure the objectivity, and try to make more deeper research, so that the research results more realistic. Second, add the practical on market investment. Third, deepen the research under the world investment theory. It is hoped that the future research can continue to in-depth analysis of financial data, and improve the shortcomings and limitations of this research. Through more comprehensive professional knowledge to make a more in-depth forecast of the development of the entire international film and television industry, so as to better serve the investment activities and market development.

4. Conclusion

To sum up, this study is mainly about analysis of Financial performances for Walt Disney based on Comparison with Netflix, Warner Bros and SONY. Through research and analysis, one finally selected Walt Disney Company as my investment target. The upside for Disney stock is its superior economic moat, long history of profitability, and the fact that the direct-to-consumer business has become more profitable over time. Additionally, according to the study of the company's general situation and the calculation and analysis of financial data, the study deeply studies the investment advantage and risk factors of Disney Company and the competitive relationship with the three rival companies. At the same time, the research and application of the algorithm is further. It is hoped that one can continue to study and make progress in venture capital and financial data analysis in the future. This research is helpful to cultivate discipline thinking and research ability, and has certain reference significance for investment practice, which also enhances the knowledge and theory of researchers.

References

- [1] Moon, S. (2020) *Effects of COVID-19 on the Entertainment Industry*. *IDOSR Journal of Experimental Sciences*, 5(1), 8-12.
- [2] DeWaard, A. (2020) *Financialized Hollywood*. *Journal of Cinema and Media Studies*, 59(4), 54-84.
- [3] Ashton, D. (2015) *Making media workers: contesting film and television industry career pathways*. *Television & New Media*, 16(3), 275-294.
- [4] Gabler, N. (2006) *Walt Disney*. *Vintage*.
- [5] Iger, R. (2019) *The ride of a lifetime: Lessons learned from 15 years as CEO of the Walt Disney Company*. *Random House*.
- [6] Rojek, C. (1993) *Disney culture*. *Leisure studies*, 12(2), 121-135.
- [7] Jenner, M. (2018) *Netflix and the Re-invention of Television*. *Springer*.
- [8] Glancy, H.M. (1995) *Warner Bros film grosses, 1921–51: The William Schaefer ledger*. *Historical Journal of Film, Radio and Television*, 15(1), 55-73.
- [9] Ismail, M. (2017) *Sony pictures and the US federal government: a case study analysis of the sony pictures entertainment hack crisis using normal accidents theory*.

- [10] Havard, C.T. (2021) *Disney, Netflix, and Amazon oh my! An analysis of streaming brand competition and the impact on the future of consumer entertainment. Findings in Sport, Hospitality, Entertainment, and Event Management*, 1(1), 7.
- [11] Martínez-Sánchez, M. E., Nicolas-Sans, R. and Díaz, J.B. (2021) *Analysis of the social media strategy of audio-visual OTTs in Spain: The case study of Netflix, HBO and Amazon Prime during the implementation of Disney+.* *Technological Forecasting and Social Change*, 173, 121178.
- [12] Eklund, O. (2023) *Streaming Platforms and the Frontiers of Digital Distribution: 'Unique Content Regions' on Netflix, Amazon Prime Video, and Disney.* *The SAGE Handbook of the Digital Media Economy*, 197-222.
- [13] Li, W.Y. (2018) *Can Netflix Beat Disney in Business Operation-Evidence from the Streaming Media.*
- [14] Alcacer, J., Collis, D.J. and Furey, M. (2010) *The Walt Disney Company and Pixar Inc.: To Acquire or Not to Acquire?*. *Harvard Business School Case*, 709-462.
- [15] Lu, J. (2024) *Explore the Risk Factors and Market Performance of American Animation Companies Represented by Walt Disney.* *Highlights in Business, Economics and Management*, 24, 1648-1652.

Predicting CSI 300 Index and NASDAQ Index by Simple RNN and LSTM

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Abstract: Stocks are an important part of the financial market, and their prices can reflect the economic level of a country. It is significant to predict the trends of stocks. With high noise, non-linearity and other complex features, stock systems are hard to be predicted accurately by traditional statistics models and deep learning methods are suitable to be used for stock predictions. In this study, CSI 300 index and NASDAQ index are selected as research targets in this study. Considering one model cannot fit all of the stocks, Simple Recurrent Neural Networks (RNNs) model and its variant model, Long-Short Term Memory (LSTM) model are chosen as two main methods for forecasting these data, and their prediction results will be compared to determine which model fits better. For assessment indicators, graphs and root mean square error (RMSE) can evaluate the accuracy both visually and numerically of prediction results. Experimental results show that simple RNN and LSTM predicts better for CSI 300 index than NASDAQ index. Both simple RNN and LSTM cannot perform well in the test set of NASDAQ index. High discreteness and sudden changes of NASDAQ index may be potential reasons.

Keywords: Stocks predictions, RNN, LSTM.

1. Introduction

Stock companies issue stocks to gather funds, and investors buy stocks to earn returns. It is significant for investors and governments to predict the trends of stock prices to forecast economic trends and changes. Statistical methods like Vector Autoregression (VAR) [1] or ARIMA [2] can be used to analyze the laws and characteristics of stock price trends. However, stock markets are complex and chaotic, statistical methods cannot get good results. At the same time, advances in machine learning enable the data-processing methods to be applied to stock data [3]. Nowadays there are a lot of deep learning models on financial time series forecasting [4]. RNN, (Convolutional Neural Network) CNN and LSTM [5] are common models used for prediction. Besides, a bidirectional long short-term memory neural network (BiLSTM) model, which consists of two layers of LSTMs in opposite directions, was proposed by Graves et al. [6]. Stock price can also be predicted by combined models like CNN-GRU model or CNN-LSTM model to get higher accuracy [7-8]. However, there are still a lack of applied research of complex prediction methods. China and the US are the world's two largest economies. Considering the interactivity [9] and differentiation of stock market between China and USA, CSI 300 index and NASDAQ index are selected as research objects. They are predicted by simple RNN and LSTM in this study to find out which model can fit them better.

2. Data and Methods

2.1. Data

This study chooses CSI 300 index and NASDAQ index from 12/08/2014 to 06/11/2024 as datasets and forecasts their closing price. Additionally, CSI 300 index comes from JoinQuant and NASDAQ index comes from MSN. Figure 1 shows the trends of CSI 300 index and NASDAQ index. The CSI 300 index is in a state of fluctuation, while the NASDAQ index is generally on an upward trend. And their descriptive statistics are displayed in Table 1.

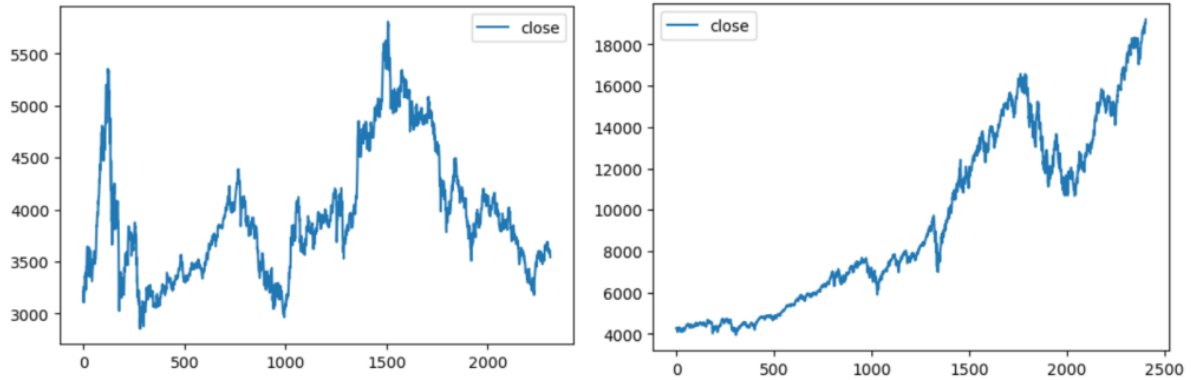


Figure 1: Data Frame of CSI 300 Index(left) and NASDAQ Index(right)

Table 1: Descriptive Statistics of CSI 300 Index and NASDAQ Index

index(close)	count	mean	std	min	max
CSI 300	2311.00	3933.56	599.43	2853.76	5807.72
NASDAQ	2403.00	9368.18	4271.92	3947.80	19210.18

Each data is divided into 2 parts, the first part (1200) is used as training set while the subsequent data is the test set.

2.2. Data Normalization

In this study, normalization is used to bring both the phase space domain dataset and the original chaotic time series dataset to the range of (0, 1). On the one hand, normalization can make the data the same scale to reduce the impact of data on prediction. On the other hand, it can improve prediction accuracy and enhance the convergence speed. The normalization function:

$$x' = \frac{x - \min}{\max - \min} \quad (1)$$

2.3. RNN

Recurrent Neural Networks (RNNs) are a common type of neural network, which can identify patterns in data sequences, time series for example. Different from these traditional neural networks, whose inputs and outputs are assumed to be independent of each other, RNNs leverage their internal states (memories) to process series of inputs. There is a type of RNN operation principle shown in Figure 2 [10].

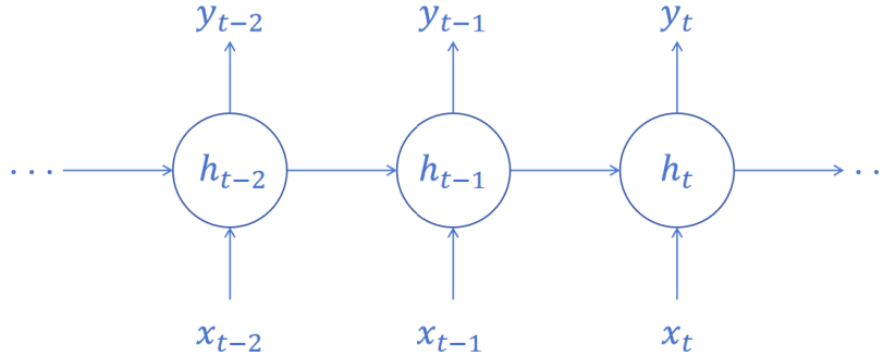


Figure 2: Operation Principle of RNN

Ability to keep a hidden state that catches information from previous time steps is the most outstanding feature of RNNs. This hidden state is updated along the time steps according to hidden state stored in previous cells and the input at present. At time step t , hidden state h_t is:

$$h_t = \sigma(W_h x_t + U_h h_{t-1} + b_h) \quad (2)$$

Here, x_t is the input, h_{t-1} is the hidden state from the previous time step, W_h and U_h are weight matrices, b_h is a bias term, and σ is the activation function (typically tanh or ReLU). And output y_t is:

$$y_t = \sigma(W_y h_t + b_y) \quad (3)$$

Here, W_y is the weight matrix of the output layer, and b_y is a bias term.

2.4. LSTM

As a variant type of RNN architectures, LSTM is without the defect of long-term dependencies, which is a limitation found in the traditional RNN. LSTMs store information in memory cells which enables them to maintain long-term states and control the changes of information. LSTMs are effective in data-processing. Besides, LSTMs include 3 types of gates, Forget Gate, Input Gate and Output Gate (See Figure 3). This mechanism helps the network handle more complex patterns and structures. The details of gates' functions are as follows.

Forget Gate f_t : Select useless information and discard it from the cell state.

Input Gate i_t : Determines what new information will be reserved in the cell state.

Output Gate o_t : Determines the next hidden state, which contains information that will be passed to the next time step.

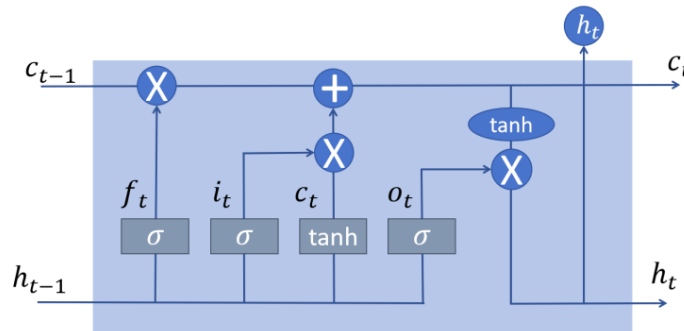


Figure 3: Operation Principle of LSTM

Where:

$$f_t = \sigma_g(U_f h_{t-1} + W_f x_t + b_f) \quad (4)$$

$$i_t = \sigma_g(U_i h_{t-1} + W_i x_t + b_i) \quad (5)$$

$$o_t = \sigma_g(U_o h_{t-1} + W_o x_t + b_o) \quad (6)$$

$$c_t = f_t \odot c_{t-1} + i_t \odot \tilde{c}_t \quad (7)$$

$$\tilde{c}_t = \sigma_c(W_c x_t + U_c h_{t-1} + b_c) \quad (8)$$

$$h_t = o_t \odot \sigma_h(C_t) \quad (9)$$

Here, $x_t \in \mathbb{R}^d$ is input vector, f_t is the activation vector of the forget gate, i_t is the activation vector of the input or update gate, o_t is activation vector of output gate, h_t means hidden state, it is LSTM unit's output vector, $\tilde{c}_t$ is the activation vector of the cell input, $c_t \in \mathbb{R}^h$ is a vector containing information in cell state, $W \in \mathbb{R}^{h \times d}$, $U \in \mathbb{R}^{h \times h}$ are weight matrices and $b \in \mathbb{R}^h$ is bias vector parameters. Additionally, σ_g and σ_c are sigmoid function and hyperbolic tangent function.

2.5. RMSE

For a statistical model, RMSE shows the average difference between its predicted values and actual observed values. RMSE is used to assess the amount of deviation in regression analysis or other statistical models. In this study, RMSE is a standard of models' quality levels. The smaller RMSE means better prediction. For a sample with N observations, its RSME is as follows:

$$RSME = \sqrt{\frac{\sum (y_i - \hat{y}_i)^2}{N}} \quad (10)$$

3. Result

This study predicts CSI 300 index and NASDAQ index (12/08/2024 to 06/11/2024) by simple RNN and LSTM to find out which model fits index better. Each data is divided into 2 parts, the first 1200 data of the index is seen as training set while the subsequent data is the test set. The result of prediction will be presented in both image and RMSE. The better one will be chosen by their comparison. Here the neural network models utilize the stock price from the previous day to forecast the stock price for the following day, leveraging patterns and trends identified in historical data. MSE and ADAM are chosen as loss function and optimizer.

3.1. Simple RNN

Simple RNN model is built to predict CSI 300 index and NASDAQ index separately. As Figure 4 shows, simple RNN predicts really well both for CSI 300 and NASDAQ. However, when it comes to RMSE, their differences are apparent (See Table 2).

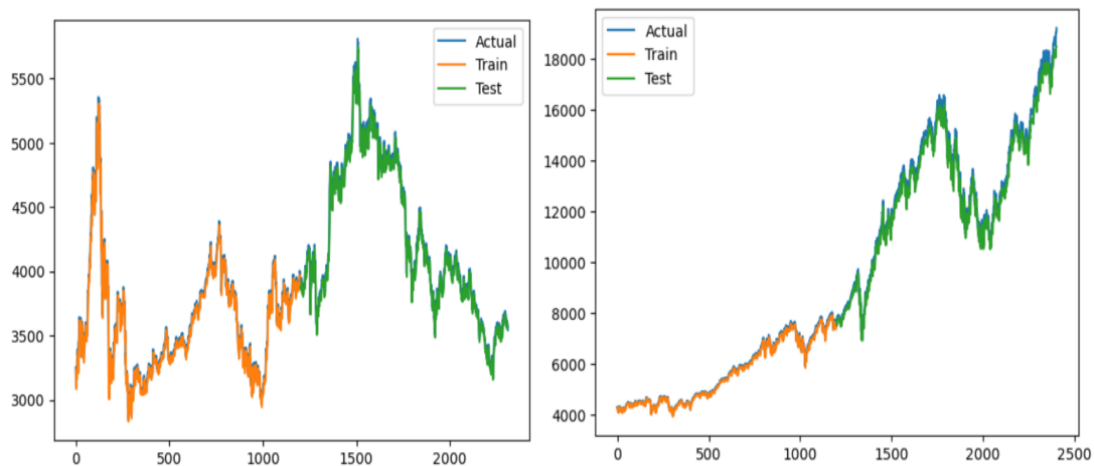


Figure 4: Simple RNN Predicts CSI 300 Index(left) and NASDAQ Index(right)

Table 2: Comparison Results (Simple RNN)

index	Training score (RMSE)	Test score (RMSE)
CSI 300	64.52	60.01
NASDAQ	93.10	341.43

It is clear that simple RNN predicts better for CSI300 index than NASDAQ index. Their training scores are close but test scores are not as that close. At the same time, NASDAQ' test score is much bigger than its training score, which means simple RNN can't predict NASDAQ index well. It may because there is a sudden downward trend after a continuous upward trend for NADAQ index, simple RNN did not anticipate this situation. And there is a relatively obvious rule for CSI 300 index, so this model can fit better.

3.2. LSTM

Then LSTM model is used to forecast both CSI300 index and NASDAQ index. Similar to RNN, LSTM also performs well in prediction (See Figure 5 and Table 3).

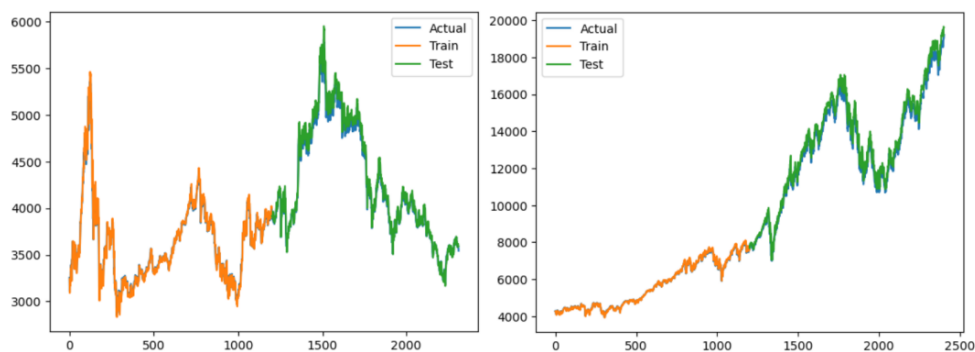


Figure 5: LSTM Predicts CSI300 index(left) and NASDAQ index(right)

Table 3: Comparison Results (LSTM)

index	Training score (RMSE)	Test score (RMSE)
CSI 300	63.94	72.91
NASDAQ	72.42	377.58

Like simple RNN, LSTM predicts CSI300 index better than NASDAQ. For both CSI 300 index and NASDAQ index, simple RNN predicts better in test set and LSTM is a little better in train set.

4. Conclusion

Though simple RNN and LSTM are good models for prediction, it can be found that both simple RNN and LSTM are better at forecasting CSI300 index than NASDAQ index. This study still has some disadvantages. The models cannot predict sudden changes in data. To handle this problem, it may be effective to try to make models more complex to deal with the changes of data. For example, attention mechanisms can be introduced attention mechanisms in the LSTM model, allowing the network to focus on different degrees of input information at different time steps. Models can also be combined with others to get more precise predictions.

References

- [1] Yan XY. (2024). *Analysis of CITIC Securities stock returns based on ARMA-GARCH and VAR models*. *Business Exhibition Economy* (11), 98-101.
- [2] Wu YX & Wen X. (2016). *Short-term stock price forecasting based on ARIMA model*. *Statistics and Decision* (23), 83-86.
- [3] Sezer, O.B., Gudelek, M.U., & Ozbayoglu, A.M. (2019). *Financial Time Series Forecasting with Deep Learning: A Systematic Literature Review: 2005-2019*.
- [4] Nabipour, M., Nayyeri, P., Jabani, H., & Mosavi, A.H. (2020). *Deep Learning for Stock Market Prediction*. *Entropy*, 22.
- [5] Graves, A., & Jürgen Schmidhuber. (2005). *Framewise phoneme classification with bidirectional lstm and other neural network architectures*. *Neural Networks*, 18(5–6), 602-610.
- [6] Chen WJ, Jiang WH & Jia XB. (2021). *Stock index price prediction based on CNN-GRU joint model*. *Information Technology and Informatization* (09), 87-91.
- [7] Geng JJ, Liu YM, Li Y & Zhao ZY. (2021). *Stock index prediction model based on CNN-LSTM*. *Statistics and Decision* (05), 134-138.
- [8] Cui, ZH. (2007). *Research on the linkage between Chinese and US stock markets*. PhD (Dissertation, Zhejiang University).
- [9] Géron, A. (2019). *Hands-on machine learning with Scikit-Learn, Keras and TensorFlow: concepts, tools, and techniques to build intelligent systems (2nd ed.)*. O'Reilly.
- [10] Yin, W., Kann, K., Yu, M., & Schütze, H. (2017). *Comparative study of CNN and RNN for natural language processing*. *arXiv preprint arXiv:1702.01923*.

The Impact of Advancing AI Industry on Economic Growth

-- Taking China's Economy as an Example

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Abstract: The AI industry has become increasingly significant in the economy. The paper tries to explore the effect of AI industry development on China's economic growth. It studies aggregate supply (AS) and aggregate demand (AD) sides. For the AS side, the paper analyzes how the AI industry increases the productivity of factors of production. And how the increase in productivity will increase economic growth, according to the production function. Then it cites the Solow paradox and restructuring lags to analyze the time-lag of the effect of AI on economic growth. For the AD side, the paper points out that the AI industry development may boost low consumer confidence and therefore increase aggregate demand, which might be helpful to the current China's economy. Finally, this paper provides policies for developing China's AI industries to encourage economic growth. The policies include continuing to subsidize firms that buy chips and providing "AI career subsidies".

Keywords: AI, Economic Growth, Aggregate supply and demand.

1. Introduction

Artificial intelligence (AI) is the technology that enables computers and machines to simulate human intelligence and problem-solving capabilities. Nowadays, almost all cutting-edge companies in all industries are interested in AI technology. For example, in education, there is a growing number of AI teachers. And in the car industry, the proportion of autonomous (smart) vehicles is increasing. AI technology will affect every aspect of people's lives, having huge economic potential.

From 2019 on, the China's AI industry has grown rapidly. However, the rate of growth tends to decline. This is caused by COVID-19 and the lack of confidence of consumers. In 2021, the year-on-year growth rate was 33.3%. In 2022, the year-on-year growth rate decreased to 18%; in 2023, the year-on-year growth rate decreased to 13.9% [1]. But still, it experienced rapid growth in the China's economy. With its growing scale, it takes up a higher proportion of GDP and has an increasing impact on the economy. So it is also of increasing importance to analyze how it will affect economic growth.

Mark Purdy et al. found that artificial intelligence not only improves labor productivity, but also becomes a new factor of production, with the characteristics of both capital and labor, creating a new impetus for economic growth [2]. Seth G. Benzell and his partners call AI growth as "immiserating growth", which means that although the economy will grow and the price level fall, the falling employment and income may reduce the welfare of consumers [3]. However, this paper does not focus on the welfare that AI economic growth brings or AI as a new factor of production that can

generate more GDP, but it concentrates on components of aggregate supply (AS) (for example, factors of production) and aggregate demand (AD) to analyse how they influences China's economic growth. In the end, the paper provides some policies to deal with the problems of AI growth.

2. Aggregate supply analysis

AI technology increases the quality of factors of production (FOPs). This increases the productive potential and makes the PPC curve right shift. In general, the adoption of AI technology will increase the productivity, causing a high economic growth. Cao Jing and Zhou Yalin collated different documents and confirmed this point [4]. Specifically, FOPs will be influenced by AI in different ways.

2.1. AI as a substitute of labor

AI provides automation, which, like any technological advancement, will certainly replace and create job opportunities at the same time. Acemoglu and Restrepo investigated the issue by using data from the US labor market from 1990 to 2007. The result showed that as the proportion between robots and workers increases by 0.1%, the job vacancy reduces by 0.18%-0.34% and income declines by 0.25%-0.5% [5]. Frey and Osborne studied 702 job positions, and they estimated that around 47% of total US employment is in the high risk category (being replaced over the next decade or two)[6]. Yong Chen used the method of Frey and Osborne to estimate the job replacement rate in China. The result shows that in the next 20 years, 76.76% of the total employed people will receive a shock from AI [7].

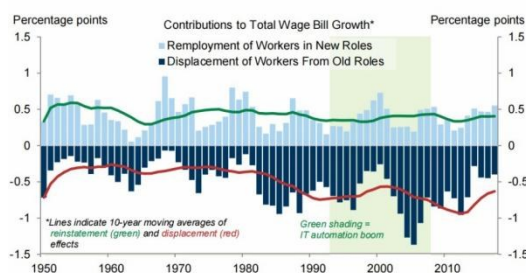


Figure 1: Effects of AI on job positions [8]

The Goldman Sachs' graph (Figure 1), cited data from Daren Acemoglu and Pascual Restrepo, confirmed the aforesaid opinions. From 1980 on, the jobs replaced by new technology were greater than those it created. The greatest job replacement happened during the period of the IT automation boom. If the boom of generative AI is like the IT automation boom, it may lead to a similar employment result.

2.2. AI as a compliment of labor

A doctor can use an expert system to help him do the basic checkout. It shows that AI can help raise labor productivity. Considering the increase of labor productivity in China has decreased in recent 20 years, AI may help maintain the increase in productivity. Not only does AI take on the role of an assistant, but it also improves the area of education. A virtual teacher improves the efficiency of study. So companies find it easier and more cost-effective to train their employees. However, the accurate rate of labor productivity growth caused by AI is not clear.

2.2.1. Capital and knowledge

AI increases the productivity of capital. Through big data and AI, capital is able to produce higher quality and quantity of goods, satisfy more tailored requirements, and adapt to complicated environments. Together with the increasing competitiveness compared to labor, this may lead to a huge investment. Investment increases the capital stock, leading to future economic growth. Meanwhile, AI (especially generative AI) has the potential to engage in creative work and apply knowledge. It can combine knowledge to invent products and make plans according to individual demand, which is quite different from previous technological advancements. If AI can replace humans to apply knowledge to tasks, there is no reason why it can't lead to an economic singularity. Interest will increase in the future, as the method of production will be more capital-intensive.

2.2.2. Land and enterprise

AI can help supervise the land and use automated systems to accomplish work. Taking agriculture as an example, it is estimated that automation can generate 200-800 dollars per acre, raising the productivity of land. It also increases the efficiency of pesticides and chemical fertilizers, which reduce the cost of production[9]. Higher quality land increases both supply and demand, so the price of rent depends. Finally, as AI provides better education, more people will be capable of being entrepreneurs. The quality of enterprise will increase. Meanwhile, as the AI develops, the return on capital increases. Profit may increase, so the quantity of entrepreneurs may increase.

2.2.3. Implementation and restructuring lags (retaining)

Solow Paradox argues that the advancement of computers and the internet does not have a relevant impact on the productivity of economic growth, based on the data he observed. But Brynjolfsson et al. did provide the idea of "implementation and restructuring lags", which they held was the reason why the Solow Paradox was generated by the data at the time [10]. AI is in the same situation. The investment of infrastructure, the training for workers, the adaptation to commercial purposes, and the emerging of accessory industries take time and cause time-lag.

3. Aggregate demand analysis

After COVID-19, China's demand has shown a slack status. Although it is expected that the economy will recover, the current situation seems not optimistic. The consumer confidence index and spending ratio are lower than before the pandemic.

3.1. Consumption

From 2017 to 2023, although consumption increases, the proportion of consumption to income decreases (Table 1). The demand for housing market declines from 2021 to 2023, which decreases the price of house and therefore the value of asset decreases. This reduces the wealth of people and in return reduces spending.

Table 1: Proportion of consumption from income (unit:Yuan)

Year	2023	2022	2021	2020	2019	2018	2017
Average consumption (AC)	26796	24538	24100	21210	21559	19853	18322
Average income (AI)	39218	36883	35128	32189	30733	28228	25974
AC/AI	0.68	0.67	0.69	0.66	0.70	0.70	0.71
CPI (last year = 100)	100.2	102	100.9	102.5	102.9	102.1	101.6
After adjustment for inflation							
Real average consumption	26742.51	24056.87	23885.03	20692.68	20951.41	19444.67	18033.46
Real average income	39139.72	36159.80	34814.67	31403.90	29866.86	27647.40	25564.96
Real AC/AI	0.68	0.67	0.69	0.66	0.70	0.70	0.70

In 2022, consumers' confidence index saw a cliff-like decline (more than 30 points). It definitely accounts for one reason for the declining consumption. In 2022, the unemployment rate reached 5.6%. This is because firms made redundant labors to lower costs in response to low demand. The high cyclical unemployment also reduces income, confidence, and consumption. It is true that the deposit reserve rate decreased from 2018 to 2024 to increase money supply, but it seems that the lowered interest rates and opening market operations may have an insufficient impact on stimulating consumption when confidence is low. China has also enforced an expansionary fiscal policy by lowering taxation, increasing spending and issuing national debt.

However, AI can provide new and higher quality products that attract consumers' attention and encourage consumption, like the new versions of phones, earphones, cars, and fashion clothes. It can be proved by the recent rocketing demand for automated cars and ChatGPT. According to the *White Paper on the Internet of Vehicles*, it is estimated that in 2025, the automated car industry will reach one thousand billion yuan [11].

But for the influence of AI, as mentioned in 2.1, the rate of job replacement is high and the income will be lower. Increased unemployment will cause greater uneven distribution of income, which leads to unfairness and in turn reduces consumption.

3.2. Investment

The China's return on capital has a declining tendency because of the law of diminishing marginal revenue of capital and perishing demographic dividends. However, AI raises the return on invested capital. AI decreases the cost of production and increases efficiency. Let's take two examples. Firms can take greater advantage of economies of scale, as the managerial problems, conflicts, and poor relationships between workers and managers will be perished by AI. The adoption of AI models helps firms market. They can collect consumers' information and enforce price discrimination to further increase their profit.

In recent years, the profitability of AI incentives investment in the US. The leading AI technology companies in the US have had increasing funds and revenue. However, that is not the case in China. Baidu, as the greatest and most well-known company in the IT area in China, has experienced almost the opposite direction in the stock market. The reason for this may be the time-lag of AI influences and the poorer condition of AI development. China's economy need time to start the boom of AI technology. Generally, the boom of the stock market increases the wealth of the share holders, making them more confident about the future. If AI development can cause a stock market boom in China,

both consumers' and investors confidence and wealth may increase, which may increase AD. Currently, China's economy is facing the problem of a lack of confidence. The consequent slack in demand makes it non-profitable to invest (in all area, as well as in AI). Firms are seeking for survive rather than invest for the future, which lowers the investment. Also, the prices of stocks in the stock market are irrationally low, because of the doubtful emotions that exist in the investment environment. The AI industry is underestimated, whose price cannot totally reflect its potential profit.

3.3. International competitiveness

On February 16, 2023, the CHIP4 alliance formed by the United States and Japan, South Korea and China Taiwan, held its first formal meeting, and the U.S. sanctions against China entered a new stage. According to IC insight data, the chip production capacity of the CHIP4 Alliance accounted for 70% of the world in 2021, while the China's mainland accounted for only 15% [12]. Having considered the increasing demand for computing power (an index explosion), China has to invest in the chips to switch from imports.

However, the population advantage of China may be expressed in another way in AI. The huge population provides a bigger data set, which helps train AI models. Since the network's availability is high in China, data collection is relatively easy. The China's AI model may be more comprehensive, which increases its international competitiveness.

4. Policy suggestions dealing with problems of AI growth

In the short-run, the shortage of computing power cannot be overcome; still, China's companies have to buy chips from the main chip export countries at a high price. However, the government can continue to subsidize those who buy chips to encourage the production. Brain drain is also a problem, a large proportion of people with doctorates in the US choose to stay there instead of coming back to China. So the government can set up an "AI career subsidy" to encourage AI experts to stay in China. It also encourages domestic laborers to choose an AI career. The parameters needed to calculate the amount of subsidy can be: (1) wage; (2) degree; (3) experience. The reason for using wages is to consider the market force. Companies will examine the worker's performance and determine which worker is worth a high salary. However, this may discourage start-up firms, for profit-making and mature AI firms tend to pay higher salaries for workers, whereas start-up small firms' positions are generally low-paid, because the revenue has to cover the cost. In the end, start-up small firms become increasingly less competitive for workers and find it harder to survive. This may cause a monopoly in the AI market and lead to unfairness. So it also considers degrees and experience to solve the problem.

5. Conclusion

This paper discusses the AD and AS sides of how the AI industries will affect the China's economy. AI has global economic potential, not only in China. And indeed, some countries, like the US, have received huge rewards from the advancement of the AI industry. China is still on the way. The AI may boost China's consumer confidence and stimulate consumption and investment. The productivity of FOPs will increase in the future, but they will experience a time lag. The most urgent "bottleneck" problem has been chips recently, but technological breakthroughs take time, so now the chips still rely on imports, and the government can continue to subsidize the firms using chips. The paper also suggests AI career subsidy. However, the analysis in this paper is descriptive rather than further statistical. Also, all the data is derived from the website, there is no field trip data collection. In the future, the author hopes that there are more statistical studies relating AI influences on economic growth and there are further models.

References

- [1] Prospective Industry Research Institute. (2024) *Foreseeing 2024: Panorama of Chinese AI industry in 2024 (with market size, competitive pattern and development prospects, etc.)* <https://new.qq.com/rain/a/20240102A0778T00>
- [2] Mark Purdy Qiu Jing, Xiaobing Chen. *Accenture: Artificial intelligence helps China's economic growth*[J]. *Robotics Industry*, 2017(04):80-91.
- [3] Seth G. Benzell, Laurence J. Kotlikoff, Guillermo LaGarda, Jeffrey D. Sachs. (2015) *Robots are us: Some economics of human replacement*. NBER WORKING PAPER SERIES, NATIONAL BUREAU OF ECONOMIC RESEARCH, pp.1-57.
- [4] Cao Jing, Zhou Yalin. *Economic Perspectives*, 2018(01):103-115.
- [5] Daron Acemoglu, Pascual Restrepo. (2017) *Robots and jobs: Evidence from us labor markets*, NBER WORKING PAPER SERIES, NATIONAL BUREAU OF ECONOMIC RESEARCH, pp. 1-91.
- [6] Carl Benedikt Frey, Michael A. Osborne. (2013) *The future of employment: How susceptible are jobs to computerisation?* *The Oxford Martin Programme on the Impacts of Future Technology*. September 17, pp.1-72.
- [7] Yongwei Chen. (2018) *Artificial intelligence and economics: A review of recent literature*. *Economic Review*, March 21.
- [8] Goldman Sachs. (2023) *The Potentially Large Effects of Artificial Intelligence on Economic Growth Picture name Globally, 18% of Work Could be Automated by AI, with Larger Effects in DMs than EMs Time*, March 26. http://inews.gtimg.com/newsapp_bt/0/15788429836/641
- [9] Sheng Hong, Rob Bland, Vasanth Ganesan, Julia Kalanik. (2024) *From field to future: Global implications for agricultural automation transformation*. McKinsey & company. <https://www.mckinsey.com.cn/%E4%BB%8E%E7%94%B0%E9%97%B4%E5%88%B0%E6%9C%AA%E6%9D%A5%E7%BC%9A%E5%85%A8%E7%90%83%E5%90%AF%E7%A4%BA%E5%8A%A9%E5%8A%9B%E5%86%9C%E4%B8%9A%E8%87%AA%E5%8A%A8%E5%8C%96%E8%BD%AC%E5%9E%8B/>
- [10] Erik Brynjolfsson, Daniel Rock, Chad Syverson. (2017) *Artificial intelligence and the modern productivity Paradox: A Clash of Expectations and Statistics*, National bureau of economic research, pp.8. DOI 10.3386/w24001
- [11] China academy of Information and Communications Technology. (2023) *White Paper on Internet of Vehicles*, January.
- [12] Fei Jiang. (2023) *AI has started a wave of technology, and the competition between China and the United States has become more intense*. <https://www.eeo.com.cn/2023/0425/588130.shtml>

Game Theory Analysis of Competitive Dynamics in the Streaming Industry: A Comparative Study of Netflix and Disney+

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Abstract: In the contemporary digital age, streaming platforms have significantly transformed the entertainment industry by providing unparalleled convenience and enjoyment. This paper employs game theory concepts in the competitive dynamics between two prominent streaming services, Netflix and Disney+. The primary objective is to understand how these platforms interact competitively, focusing on pricing, marketing, and content acquisition. Key concepts from game theory, such as mixed strategies, grim-trigger, and the end-game effect, are applied to identify marketing niches where both companies might stabilize their strategies. Additionally, the study explores how exclusive content and strategic collaborations shape their competitive landscape, impacting their market positions and profitability. This paper aims to offer insights into the potential outcomes of their competition and suggest strategic actions to enhance their market advantage. Furthermore, the study examines consumer behavior trends and their influence on platform loyalty and subscription decisions, offering a comprehensive view of the streaming market's dynamics.

Keywords: Disney+, Netflix, Game Theory, Content Acquisition.

1. Introduction

With the rapid development of technology, the medium of social media and live-streaming platforms have become vital resources for entertainment and information acquisition, reshaping the entertainment industry. Nowadays, more and more companies are developing and customizing different strategies to attract users to become their subscribers. Among these competitors, Netflix and Disney+ are two oligopolies that have significantly affected the way content is distributed, completely changing the entertainment industry.

Netflix was first established in 1997 as a DVD rental service company at the beginning, then transformed into streaming in 2007. Consumers prefer it for its worldwide streaming service, which excels in content, global coverage, personalized content, multi-device support, advertisement service, and original productions, such as “Stranger Things” and “The Crown”.

The Walt Disney Company owns Disney+, a subscription-based streaming platform. It was established in November 2019 and quickly became a competitive video provider because of its classics, original Disney series, Marvel movies, and Star Wars franchises. A representative example

was the exclusive streaming of Taylor Swift's movie "The Eras Tour" on Disney+ on October 13th, 2023, which highlights the fierce competition for exclusive content.

2. Objectives

The primary purpose of this essay is to analyse the competitive interactions between Disney+ and Netflix using game theory concepts based on their recent actions. Understanding the competitive actions between Disney+ and Netflix is facilitated by employing game theory concepts such as grim-trigger and end-game effects. This helps clarify how each platform's decisions regarding pricing, marketing, and content offerings impact their respective market positions and profitability. Through game theory analysis, the study aims to give suggestions to streaming platforms like Disney+ and Netflix.

The second objective is to understand how Disney+ and Netflix acquire content and secure resources by monopolizing or cooperating. Content acquisition and exclusivity are two critical factors that influence their competitive strategies. The study will investigate the content acquisition strategies of both platforms, particularly their bidding behaviors for popular shows and movies.

3. Literature Review

The fierce competition among streaming giants like Netflix and Disney+ for acquiring content and securing exclusive streaming rights is an intricate matter that can be efficiently dissected through game theory, especially by utilizing mixed strategy methods. This review comprehensively consolidates existing research on the rivalry among streaming services, content strategies, and the application of game theory to offer a comprehensive perspective for grasping the intricate competitive interplay between these two platforms.

3.1. Streaming Service Competition

The research conducted by Gonçalves-Dos Santos, Martinez, and Sánchez-Soriano deeply delves into revenue distribution mechanisms on streaming platforms. It underscores how these platforms deliberately allocate resources to maximize their content offerings and entice subscribers. This study underscores the crucial need to comprehend revenue models and competitive strategies within a multi-platform competition [1].

The Congressional Research Service report on video streaming service competition offers a comprehensive insight into the industry's competitive background, highlighting the emergence of key players such as Netflix and Disney+ and the regulatory hurdles they encounter. This report emphasizes the crucial role of market dynamics and strategic content acquisition in maintaining a competitive advantage [2].

3.2. Content Strategy and Exclusive Rights

Netflix's strategic focus on original content, mentioned in its 2023 Annual Report [3], clearly demonstrates its dedication to reducing dependency on external content by investing significantly in original productions. This action enables Netflix to establish a unique brand identity and maintain complete control over its content library. Similarly, Disney's 2023 Annual Financial Report underscores its extensive utilization of its existing catalog and strategic acquisitions of exclusive rights to bolster its competitive edge [4].

Li and Yu directly delve into the cooperation and competition dynamics within duopoly online video websites, offering valuable insights into how platforms such as Netflix and Disney+ skillfully navigate content acquisition and competitive strategy. Their comprehensive analysis of strategic

interactions firmly establishes a solid foundation for applying game theory to deeply understand platform behavior [5].

3.3. Game Theory Applications

Game theory, particularly its focus on mixed strategies, serves as a highly effective framework for comprehending competitive behaviors within streaming platforms. The in-depth study conducted by Andreoni and Varian in 1999[6], exploring pre-play contracting in the prisoner's dilemma, aptly demonstrates how players can employ mixed strategies to navigate through challenging decision-making landscapes and compete with utmost efficiency.

Maihami, Ghalehkhondabi, and Ahmadi directly apply game theory to pricing challenges in the entertainment supply chain, clearly showing how platforms utilize mixed strategies to strike a balance between pricing and competitive maneuvers [7]. This straightforward method offers a profound understanding of how streaming services could flexibly adjust their pricing and content acquisition strategies in response to changing market conditions.

Li and Li undertake an exhaustive analysis of revenue management within network video platforms using game theory as the theoretical framework [8]. They strongly recommend the implementation of mixed strategies in order to gain a profound understanding of how platforms such as Netflix and Disney+ meticulously orchestrate their content acquisitions and exclusivity agreements. Their study provides a meticulous breakdown of the probabilistic decision-making mechanisms that constitute the foundation of strategic content management.

3.4. Platformization and Market Dynamics

AuColbjørnsen directly examines the instances of Joe Rogan and Spotify to clearly demonstrate wider concepts related to platformization and strategic content acquisition [9]. This study explicitly shows how platforms handle content rights and exclusivity, drawing parallels to the competitive strategies utilized by Netflix and Disney+ in their market interactions.

Zhihong Li's research on duopoly online video website strategies enhances our comprehension of competitive techniques by thoroughly examining how cooperation and competition jointly influence platform strategies in content acquisition and exclusivity [10].

4. Analysis of Problem

4.1. Main concepts in game theory

Zero-sum game and non-zero-sum game are two fundamental concepts in the field of game theory. In a zero-sum game, the total payoff for all players sums up to zero, while in a non-zero-sum game is that where the collective gains and losses of interacting parties can exceed or fall short of zero. Within this specific context, two competing entities engage in decision-making processes concerning whether to bid higher or lower prices for content; these choices exert influence not only on their individual profitability but also on that of their adversary.

A mixed strategy allows each pure strategy to have the same probability, meaning a player can randomly choose any of the pure strategies. Due to the continuous nature of possibility, a player can use an endless number of mixed strategies, even if their strategy set is finite. According to applied game theory, defining the strategy sets is a crucial aspect of making a game that can be solved and has value simultaneously. Game theorists can reduce potential strategies and help to solve the problem.

4.2. Overall conditions

According to the Netflix 2023 Annual Report [3], the total revenue was \$33,723,297 thousand, with a net income of \$5,407,990 thousand, which was a significant increase compared with the 2022 total revenue of \$31,615,550 thousand and a net income of \$4,491,924 thousand. In 2023, Netflix spent \$21,713,349 thousand for total content obligations.

In the Walt Disney Company fiscal year 2023 annual financial report, from Disney's direct-to-consumer segment, Disney+'s total revenue was \$19,886 million (\$19,886,000 thousand), and its subscription fees were \$16,420 million (\$16,420,000 thousand) [4]. Disney+ reported an operating loss of \$2.496 billion(\$2,496,000thousand) due to increased operating expenses, decreased advertising revenue, and a significant drop in Disney+ Hotstar subscribers.

It is not likely that the managers of the two companies have complete information concerning the properties of the other platforms. The costs and revenues of the competitor are not perfectly known. The mixed strategy frequencies are, however, observed. Each company continuously observes the frequency of the other companies' actions. The expected marginal profits are predicted based on this information.

4.3. Application of Mixed Strategies in Subscription and Pricing Models

All these make sure that Netflix and Disney+ are competitive with their diverse user groups, which in turn augments users and grows revenue with multi-tiered subscription models, dynamic pricing strategies, free trial periods, promotional activities, bundled packages, and personalized recommendations and pricing.

4.3.1. Multi-tiered Subscription Models

Netflix offers a variety of tiered subscriptions to its customers: Basic, Standard, and Premium. These tiers cater to users with different paying capabilities and needs. Essential is ad-supported and costs \$6.99 monthly; Standard is ad-free and costs \$15.49 monthly, supporting HD streaming; Premium supports 4K Ultra HD streaming at \$22.99 monthly and supports multiple device downloads. With such a multi-tier subscription model, Netflix can attract price-sensitive users, but on the other hand, it can offer premium options for the best viewing experience for the users; in other words, it increases both user numbers and revenue.

4.3.2. Dynamic Pricing Strategies

Netflix and Disney+ can adjust prices for subscribed customers based on market demand and user behavior. For instance, they can increase subscription prices temporarily when launching popular series or during holidays to capitalize on high demand and increase the revenues realized. In addition, they can also create personalized pricing plans for customers who log in more often or tend to watch a specific type of content genre.

4.3.3. Free Trial Periods and Promotional Strategies

Free trial periods and promotion activities during some holidays can attract new users to the platforms and make them paid subscribers. For example, in a free one-month trial, Netflix or Disney+ would allow customers to experience its premium content. Additionally, launching subscription discounts for Black Friday or Christmas will give room for more users.

4.3.4. Bundled Offers

Disney+ has offered its service bundled with Hulu and ESPN+ to increase users by value-providing a one-stop-shop subscription package. Netflix could also bundle the services with internet service providers or mobile carriers for users, creating more volume. The bundling approach not only increases the number of users and thus enhances stickiness but also significantly improves subscription revenues.

4.3.5. Personalized Recommendations and Pricing

In this manner, the use of big data and AI technologies by Netflix and Disney+ for personalization in the nature of content recommendations and corresponding subscription pricing can be offered to individual users according to their viewing history and preferences. For example, Netflix uses its powerful content recommendation algorithms to suggest relevant premium subscription options based on users' viewing habits and offers personalized discounts.

4.4. Exclusive and Collaborative Strategies in the Streaming Industry

The exclusivity of content investments has been achieved by both Netflix and Disney+, with an exponential increase in stickiness for their respective platforms. For example, Netflix, with its exclusive streaming rights for Sony films and many others that it acquires at regular intervals, can ramp up its original content with blockbuster favorites such as the Marvel series, thus decreasing dependence on third-party content while increasing subscribers. The company, for instance, closed a deal to get exclusive streaming rights to "Spider-Man: Far from Home," gaining almost 5 million subscribers in the quarter and increasing total revenue by nearly 10% [11]. Total revenues for the company are \$33.7 billion as of 2023, with a net income of \$5.4 billion [12].

On the other hand, Disney+ made its service more appealing to viewers by purchasing exclusive rights to the "The Eras Tour" concert film, which set records by reaching a viewership of 4.6 million and being watched for 16.2 million hours during just the opening weekend [13]. This exclusivity strategy skyrocketed Disney+'s subscription base by an estimated 2 million new sign-ups, and its overall revenue increased by roughly 8% [14]. By acquiring exclusive rights to the movie for \$75 million, Disney+ managed to secure new users and increase its audience numbers [15].

4.4.1. Zero-Sum Game

The competition for exclusive content between Netflix and Disney+ becomes a zero-sum game. If one of them has the exclusive right to a top-rated series, it directly diminishes the attractiveness of the other. For instance, with the purchase by Netflix of exclusive streaming rights to the "Spider-Man" franchise, Netflix should expect to experience more user engagement and, hence, a more significant competitive advantage in that particular field [11]. On the other hand, competitive pressure was set by the exclusive rights that Disney+ had.

4.4.2. Collaborative Streaming Strategies

Besides having exclusive content, the two platforms add collaborative strategies to extend their accessibility in the market. Co-production by Netflix with BBC on "The Night Manager" brought in about 2 million subscribers and grew total revenue by almost 5% [12]. In this way, Netflix provides variety in content without much rise in costs. Disney+ has implemented this type of approach by teaming up with both Hulu and ESPN+ to deliver entertainment in unison, thereby increasing the scope of services that Disney+ offers in the market and thereby expanding user growth [6].

4.4.3. Non-Zero-Sum Game

In a cooperative streaming strategy, it is a non-zero-sum game where both players benefit from cooperation. With the help of bundling and access to other platforms, costs can be reduced for Disney+, and market power can also be gained, while both companies are also looking for large-market-level benefits rather than fighting for the market share of one another [16].

4.4.4. Long-term Collaboration and Market Signaling

After a couple of interactions that result in favorable outcomes, Netflix and Disney+ can have long-term collaborative relations based on trust. Signaling games play an essential role in their strategic choices, where large-scale investments by Netflix give out strategic signals to the market about investing in original content, thereby putting in place responses for Disney+ and taking a competitive advantage [12].

4.5. Case Description

The global Video-on-Demand (VoD) market grew significantly in 2023, with Netflix and Disney+ leading the market. Netflix expanded its library of original content, while Disney+ strengthened its position with exclusive content and strategic acquisitions in the figure 1 and figure 2.

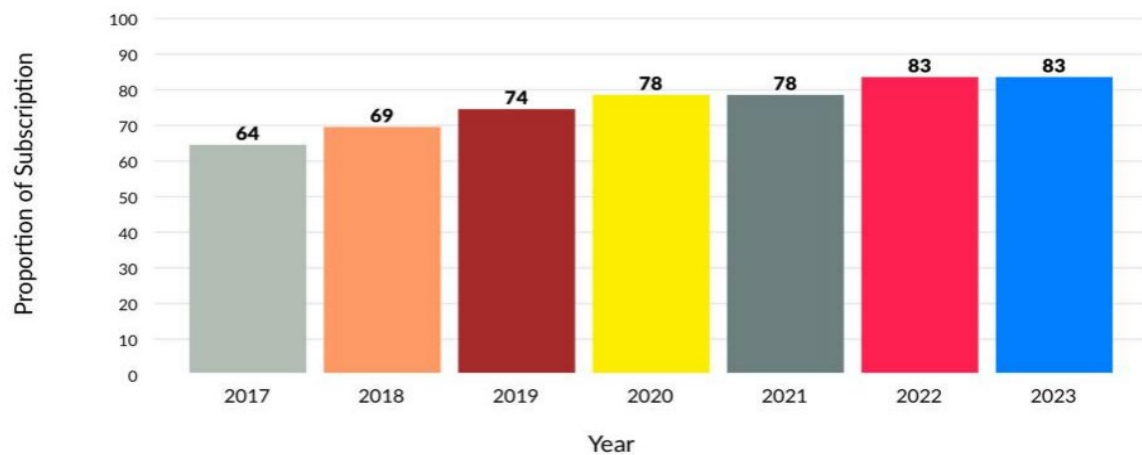


Figure 1: Video Streaming Subscriptions Growth [17]

Market share in Video-on-Demand

Netflix had the highest share

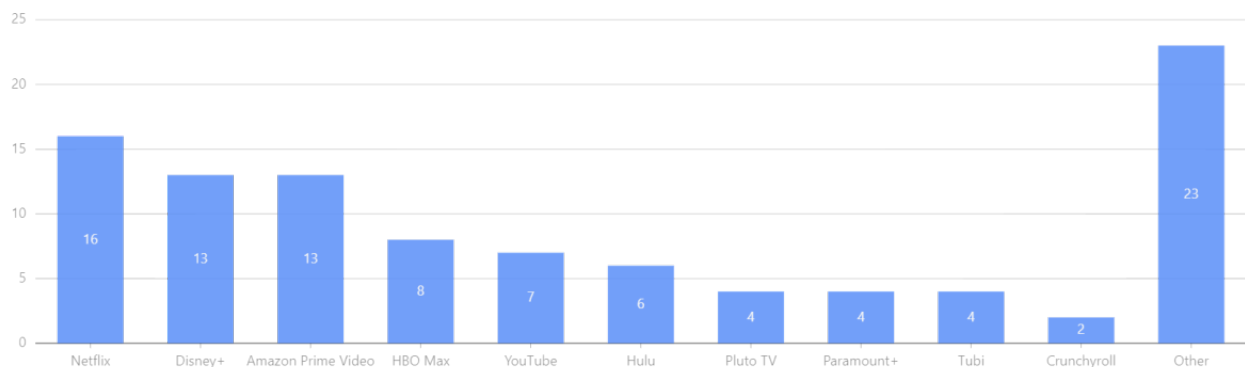


Figure 2: Video Streaming Market Share in 2023 [18]

Disney+'s content acquisition strategy has been distinguished by significant milestones over the years. Disney's 2019 purchase of 21st Century Fox for \$71 billion resulted in a significant increase in its entertainment and media resources. This contained a wide range of renowned films like X-Men, The Simpsons, and Avatar, which dramatically enhanced the programming availability on Disney+. Additionally, Disney+ has obtained exclusive streaming privileges for Marvel Studios, the Star Wars franchise, and Disney and Pixar movies..... This includes original series like Vendetta Vision, The Falcon and the Winter Soldier, Rocky, and The Mandalorian, which guarantees the distinctiveness and attractiveness of the platform's content. Disney allocates significant funds to develop unique content in order to consistently engage new members and maintain current subscribers by producing top-notch episodes and movies. Disney+ offers a complete entertainment package by combining memberships with Hulu and ESPN+ to reach a larger audience. Additionally, it introduced the Star brand to overseas regions to deliver more material targeted at adult consumers. In addition, Disney+ employs a Premier Access strategy that allows users to pay an extra fee to watch new movies in theaters at the same time and maintains long-term subscription interest by updating episodes weekly. Marvel's content has significantly increased on Disney+ through cooperation and licensing arrangements with Sony. This collaboration allows for the inclusion of upcoming movies and other massive successes from Sony. These actions have not only improved Disney+'s content catalog but also strengthened its competitive advantage in the streaming sector, establishing it as the preferred platform for numerous popular movies and TV shows.

In recent years, Netflix has made significant progress in several key aspects of its content acquisition strategy. In comparison to Disney+, Netflix has constantly been building its international content library by developing and releasing locally made original works, like "Money Heist," "Squid Game," and "Dark." For instance, Netflix ensured the constant supply of high-quality content by signing long-term collaboration contracts with leading producers and directors such as Shonda Rhimes and Ryan Murphy. Also, Netflix bought rights for popular IPs to transform them into long-running series, such as "The Stranger Things" series and "The Three-Body Problem." Furthermore, Netflix enhances user engagement and satisfaction by making data-driven content decisions that accurately capture audience preferences. Netflix continuously enhances its streaming technology to deliver exceptional user experience, offering features such as 4K HDR video and efficient content recommendation algorithms. Netflix has also introduced a dedicated low-cost mobile package to cater to different market demands, thereby further expanding its user base. These strategies have not only enriched Netflix's content library but also solidified its leading position in the global streaming industry, allowing it to maintain an advantage in the world streaming industry.

5. Theoretical Applications and Extensions

In analyzing the cooperative strategic choices of Netflix and Disney+, three important concepts called “End-Game Effect,” “Grim Trigger,” and “Shadow of the Future” may affect the collaboration. These theories can explain the behavioral patterns of two platforms in long-term collaboration.

5.1. End-Game Effect: Last-Round Betrayal

Definition: If the number of games is definite, the player may deviate in the last cooperation in order to maximize his payoff, as the last betrayal will not affect future cooperation.

5.1.1.Applications:Expiration of the Contract

Suppose Netflix and Disney make a 3-year agreement on content sharing. In the final cooperation, both competitors may consider shifting their choice in exclusive broadcast rights to maximize the market share and subscriber growth rate.

5.1.2.Applications:Market exit strategy

If one of them decides to exit the market, it is profitable for it to adopt an aggressive strategy to get a larger payoff quickly. The optimal solution for the other company is to reduce dependence on another platform during the cooperative process by investing in original content, which is powerful enough to counteract the effect.

5.2. Grim Trigger

Definition: In an infinite game, if a player is betrayed by another player, they will permanently withdraw from collaborating and will not work together forever to punish the betrayer and maintain the stability of cooperation.

5.2.1.Applications: Long-term cooperation maintenance

The long-term cooperation of Netflix and Disney+ on content acquisition can be maintained by harsh grim trigger strategies. For example, if either of them chooses to betray, the other player would stop the cooperation forever and switch to intense cooperation status (e.g., permanent exclusive broadcast rights). Any betrayal will lead to serious long-term consequences, thus maintaining the willingness of both parties to continue working together. If any rival chooses strategies that are not in keeping with the cooperation strategy (default the contract), the total revenue will reach a lower point. Then, the other party may decide to withdraw all content on its platform permanently.

5.3. Shadow of the Future

Definition: “Shadow of the Future” refers to the fact that potential future interaction and forecast will have an impact on current behavior. In infinite repeated games or long-term cooperative relationships, current decisions will affect not only current gains but also future interactions and payoffs. Therefore, competitors will take future opportunities into account when making current strategy choices.

Due to the presence and anticipation of future interactions, players are more likely to choose cooperation rather than betrayal to ensure that future long-term gains are maximized. This typically prevents betrayal in the short term, as cooperation helps to maintain future payoff streams.

5.3.1.Applications:Incentives for long-term cooperation: Future Market Potential

When analyzing the partnership and considering the potential for future growth in streaming subscribers, maintaining the partnership will help the two companies realize greater revenue by sharing market share and content resources.

Netflix and Disney+ expect the streaming market to continue to grow in the future. Therefore, they will choose to keep the partnership in order to share a bigger market popularization and revenue. The potential for future market expansion makes the current partnership even more secure.

Collaboration analysis should include potential new collaborative projects and technology development, emphasizing the long-term mutual benefits of maintaining the relationship.

5.3.2.Applications:Risks of short-term betrayal- Reputational damage

A current betrayal (e.g., early withdrawal of content or non-renewal of the update) may damage the reputation of the company and jeopardize future opportunities for collaboration with each other or other potential partners. Both parties prefer to maintain cooperation in the present to ensure long-term future benefits.

Collaboration analysis should consider the possible reactions of users and the market to a break in the collaboration and show that maintaining the collaboration will help ensure user satisfaction and market stability, thus supporting long-term gains for both parties.

6. Suggestions

In digital media and streaming industries like Netflix and Disney+, long-term partnerships and strategic stability are critical. Therefore, future practitioners are advised to not only focus on short-term gains but also consider building and maintaining long-term partnerships. By adopting a strategy similar to the "Grim Trigger," which includes strict collaboration guidelines and limits with partners, they can ensure continuity and long-term mutual benefit. Short-term defections can seriously affect a company's reputation and future cooperation opportunities. Future practitioners are, therefore, advised to consider long-term consequences when developing strategies to avoid short-sighted actions. Maintaining a good industry reputation and partnerships is essential for long-term growth. Given the rapid evolution of the digital media industry, investing in technology and innovation is critical to staying competitive. Future professionals are advised to constantly monitor the technological progress of the industry, actively invest in content innovation, and enhance user experience to ensure their company's leading position in the market. In addition, when it comes to contract design, competitors can consider designing contract terms to avoid last-minute defections, such as setting up automatic renewals or extending partnerships. In addition, by establishing a clear punishment mechanism and cooperation incentive mechanism, the possibility of betrayal can be reduced, and long-term stable market cooperation can be ensured.

7. Conclusion

In conclusion, the fierce competition strate between Netflix and Disney+ within the streaming industry have been thoroughly analyzed through the lens of game theory. This study has underscored how these two giants strategically navigate content acquisition and exclusive streaming rights to gain market dominance and sustain subscriber loyalty.

Game theory, particularly concepts like Nash equilibrium and mixed strategies, has provided a robust framework for understanding the complex interactions between Netflix and Disney+. Netflix, with its extensive library of original content and global reach, has capitalized on its first-mover advantage in streaming technology to continuously expand its subscriber base and solidify its market

leadership. Conversely, Disney+ has leveraged its rich catalog of classic Disney, Marvel, and Star Wars content to quickly establish itself as a formidable competitor, attracting a loyal fan base and expanding its content offerings through strategic acquisitions.

The paper also delved into the critical role of exclusive content in shaping competitive strategies. Both Netflix and Disney+ have invested heavily in securing exclusive rights to popular movies, series, and franchises, using these assets not only to differentiate themselves but also to retain subscribers amid intensifying competition. This strategy highlights their recognition of content as a key driver of subscriber acquisition and retention in the streaming landscape.

Furthermore, the study explored theoretical extensions such as the End-Game Effect, Grim Trigger, and Shadow of the Future, which illuminate the long-term strategic behaviors of Netflix and Disney+. These concepts underscore the importance of maintaining cooperative relationships and avoiding short-term defections that could damage the reputation and future prospects for collaboration.

Looking forward, the digital media and streaming industry is poised for continued evolution and disruption. Both Netflix and Disney+ must remain agile in responding to shifting consumer preferences, technological advancements, and competitive maneuvers from emerging players. Strategies focused on innovation in content creation, enhancing user experience through advanced streaming technologies, and forging strategic partnerships will be crucial for sustaining growth and retaining leadership in the highly competitive streaming market.

In conclusion, while Netflix and Disney+ continue to vie for market supremacy, their strategic interplay, as depicted through game theory concepts, provides valuable insights for industry practitioners and scholars alike. Understanding these theories not only sheds light on their competitive strategies but also offers lessons for navigating complex market environments in the digital age. As the streaming landscape evolves, leveraging insights from game theory will be essential for shaping future strategies that drive sustained success and innovation in the dynamic world of digital entertainment.

References

- [1] Gonçalves-Dosantos, J. C., Martinez, R., & Sánchez-Soriano, J. (2024). Revenue distribution in streaming platforms. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4762536>
- [2] Congressional Research Service. (2020). *Competition Among Video Streaming Services*. (No. R46545). Retrieved June 17, 2024, from <https://crsreports.congress.gov/product/pdf/R/R46545>
- [3] Netflix. 2023 Annual Report. (n.d.). Retrieved June 18, 2024, from https://s22.q4cdn.com/959853165/files/doc_financials/2023/ar/Netflix-10-K-01262024.pdf
- [4] The Walt Disney Company. *THE WALT DISNEY COMPANY FISCAL YEAR 2023 ANNUAL FINANCIAL REPORT*. (n.d.). Retrieved June 18, 2024, from <https://thewaltdisneycompany.com/app/uploads/2024/02/2023-Annual-Report.pdf>
- [5] Li, Z., Yu, C., & Wu, Y. (2015). Cooperation and Competition: The Analysis of Strategy in Duopoly Online Video Websites. *Science Journal of Business Management*, 3, 109.
- [6] Andreoni, J., & Varian, H. (1999). Preplay contracting in the prisoners' dilemma. *Proceedings of the National Academy of Sciences*, 96(19), 10933–10938. <https://doi.org/10.1073/pnas.96.19.10933>
- [7] Maihami, R., Ghalekhondabi, I., & Ahmadi, E. (2020). Game Theory Approach for Pricing Problem in Entertainment Supply Chain. In *IIE Annual Conference. Proceedings*(pp. 550-555). Institute of Industrial and Systems Engineers (IISE).
- [8] Li, B., & Li, H. (2022). Research on the Revenue Management of network video platform based on Game Theory. *Mathematical Problems in Engineering*, 2022, 1–16. <https://doi.org/10.1155/2022/8516961>
- [9] Colbjørnsen, T. (2024). Joe Rogan v. Spotify: Platformization and worlds colliding. *Convergence: The International Journal of Research into New Media Technologies*. <https://doi.org/10.1177/13548565241253909>
- [10] Zhihong, L. (2015). Cooperation and competition: The analysis of strategy in duopoly online video websites. *Science Journal of Business and Management*, 3(4), 109. <https://doi.org/10.11648/j.sjbm.20150304.13>
- [11] Engadget. (2021). Netflix will get exclusive streaming rights to future Sony films. Retrieved from www.engadget.com
- [12] Investopedia Team. (2023). How Netflix Is Changing the TV Industry. Retrieved from www.investopedia.com

- [13] *The Wrap*. (2024). *Taylor Swift's 'Eras Tour' Movie Sets Disney+ Record With 16.2 Million Hours Viewed in First Weekend*. Retrieved from www.thewrap.com
- [14] *The Walt Disney Company*. (2024). *Taylor Swift | The Eras Tour (Taylor's Version) to Debut Exclusively on Disney+ on March 15*. Retrieved from <https://thewaltdisneycompany.com/taylor-swift-eras-tour-film-disney/>
- [15] *The Wrap*. (2024). *Disney Paid Taylor Swift \$75 Million to Stream 'The Eras Tour': Bob Iger Wanted 'Big Announcement' for Earnings Call*. Retrieved from www.thewrap.com
- [16] *Business of Apps*. (2024). *Disney Plus Revenue and Usage Statistics*. Retrieved from www.businessofapps.com
- [17] Duarte, F. (2024b, June 6). *Video Streaming Services Stats (2024)*. *Exploding Topics*. <https://explodingtopics.com/blog/video-streaming-stats>
- [18] *Video-on-Demand: market data & analysis*. (2023). In *Statista*. *statista*. Retrieved June 25, 2024, from <https://www.statista.com/study/68959/global-video-streaming-market/>

Construction of Multiple Type Assets Portfolio Based on Stocks, Options, Futures, ETFs, Bonds and Cryptocurrencies

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Abstract: The development of portfolio theory has mainly been through 3 stages to become a mature system contemporarily. This theory is a practical approach in choosing and managing investments to maximize general returns within an acceptable level of risks. The topic in this study is a discussion about the Construction of multiple type assets portfolio based on Stocks, Options, Futures, ETFs, Bonds and Cryptocurrencies. The objective is to find out in what quantities and proportions can these assets be combined to realize the maximum returns. According to the analysis, the result suggests that under 3 different optimal situations, the optimal weight of each asset will be different depend on their individual return and variance, based on the application of modern portfolio theory and mean variance model. This study can not only make investors understand how to practice the portfolio theory to enlarge the return for a portfolio, but also fill the gap of investment-related research.

Keywords: Portfolio theory, returns, risks, multiple type assets portfolio.

1. Introduction

From the generation of portfolio theory in the late 1960s to the current ingrained, systematic and practical investment theory framework has not been a very long time [1]. Before the concept of portfolio occurred, the views in The Theory of Investment Value by John Burr Williams in 1938 is the dominator of investment methodology. The book captured the idea of the time: the dividend discount model. The goal of most investors is to find a good stock and buy it at the best price [2].

The pace of portfolio research never stops. There are three historical stages that the development of the portfolio theory has gone through, including Traditional Portfolio Theory (TPT), Modern Portfolio Theory (MPT), and Post-modern Portfolio Theory (PMPT) [3]. Among the 3 stages, TPT is originated from the which focus more on analyzing a single security, which is not systematic, objective, and adequate to form an optimal investment portfolio [3]. Additionally, MPT is created by Markowitz in 1959, which depends more on the feature of the portfolio, especially the assets class and the securities diversification. MPT is considered as a progress in the financial theory and investment practices since it mathematically optimizes the relationship between expected return and risk taking [4]. The development of PMPT is due to the incompatibility of MPT assumptions with market realities. Therefore, PMPT build up a more robust and precise framework for designing an optimal portfolio to correct the existing shortcomings in MPT [5]. The research of portfolio theory is necessary because it can improve the investment guidance in building a portfolio that maximizes

return and minimizes risk through the measurement of the risk of assets and their correlation to each other [6].

As the core of assets management and wealth allocation, the portfolio theory is the method that the investors and portfolio managers use when providing analysis and selection of securities, to achieve the best returns in line with investment objectives [2]. An assets portfolio is a collection of financial assets that mix different asset classes, which can ensure the overall benefit when one asset performs poorly and reduce the risk taking by investment diversification [7]. In recent years, researchers mainly focus on the improvement of modern portfolio theory and the expansion of its related practice. The MPT suggest that the risk and return characteristics of any given investment should not be viewed in isolation, instead, it should be evaluated in terms of how it affects the risk and return of the overall portfolio [8]. Based on the assets the pitfalls of mean-variance portfolio optimization that investigated by Review of Financial Studies, a new approach, the "Galton" strategy was developed by Sam van de Schootbrugge to correct the changing relationship between Actual (realized) means and assets deviate from forecasts using out-of-sample prediction errors [9]. In practice, modern portfolio theory suggests investors to consider the whole existing portfolio instead of a single stock and encourage the combination of the risk tolerance and return expectations when making investment decisions [10]. Portfolio theory is also found out to be very useful in the U.S. stock market as it is an efficient tool for resource allocation and wealth generation [11].

The motivation of the research is to find out in what way can futures, ETFs, bonds and cryptocurrencies are combined as a portfolio to realize the maximization of the return on investment. This research is expected to provide new insights and progress in financial analysis fields regarding to the portfolio investment and the design of new multi-asset portfolios. Besides, the application of the research method is desired to provide references to the other researchers about how to use these models to solve relevant issues. The results of data analysis can also be their research foundation. This article is divided into four parts that covering four different topics. The Sec. 2 involve the introduction of data collection and the portfolio model. The Sec. 3 are the discussion of the data analysis results, the research limitations and recommendations. The Sec. 4 is a conclusion of the study.

Table 1: Information of selected assets

Assets Name	Symbol	Asset Types	Industry
Apple Inc.	AAPL	Stock	Electronics Software Services
NVIDIA	NVDA	Option	Computer Hardware
Lean Hogs	HEQ	Futures	Agriculture
Vanguard S&P 500 ETF	VOO	ETF	Assets Management
iShares U.S. Treasury Bond	GOVT	Bond	Finance
Bitcoin	BTC	Cryptocurrency	Telecommunications

2. Data and Method

2.1. Data

The resource of data collected is in stock exchanges including Nasdaq, Trading View and Tip Rank because of their large scale, reliability and availability, and the samples are all in Table 1, they are all top performed assets in each kind of them. The data collected method is simple random sampling. The range of time is from July 2019 to July 2024, in which the weekly data has been collected. The sufficient time span and short statistical period can ensure the accurate reflection of the data trend. The indicator of the market return is 14.61% and the risk-free rate is 4.26%, which is the historical U.S stock market average return in the past 5 years until May 2024. Table 1 includes the information

of the names and symbols of each type of assets and the industry that they are in. Table 2 is the descriptive analysis of these assets, in which GOVT is the least profitable but most stable, NVDA and BTC have the largest amount of return but also riskier than the others.

Table 2: Descriptive Statistics for the Return of All Types of Assets

Descriptive Analysis								
Assets	Observation	Maximum	Minimum	Mean	Standard Deviation	Cumulative Return	Skewness	Kurtosis
AAPL	240	0.147	-0.175	0.006	0.040	1.396	-0.292	2.191
NVDA	240	0.333	-0.238	0.013	0.075	3.112	0.124	1.446
HEQ	240	0.385	-0.312	0.003	0.070	0.768	0.201	5.272
VOO	240	0.121	-0.149	0.003	0.028	0.607	-0.523	5.659
GOVT	240	0.028	-0.024	0.000	0.008	-0.104	0.032	0.697
BTC	240	0.308	-0.420	0.012	0.096	2.951	-0.067	2.509

2.2. Methods

In the previous research, the mean-variance model for portfolio optimization based on Harry Markowitz's "Portfolio Selection" of applying probability theory and solving quadratic programming has been used to solve portfolio problems [12]. Assume that an investor wants to invest in a portfolio of a number of n risky assets, 'r' is the expected return rate of Asset i , then the expected yield is:

$$E(r_p) = \sum_{i=1}^n x_i E(r_i) \quad (1)$$

Using σ_i^2 to represent the variance of the i -th asset, the equation of variance of the combination of n assets is:

$$\sigma_p^2 = \sum_{i=1}^n x_i x_j \text{cov}(r_i, r_j) = \sum_{i=1}^n x_i^2 \sigma_i^2 + \sum_{i=1}^n \sum_{j=1}^n x_i x_j \rho_{ij} \sigma_i \sigma_j \quad (2)$$

where i and j stand for different types of assets. ρ_{ij} refers to the coefficient of Asset i and Asset j , which reflects their correlation and can be used to compare the magnitude between them. From this formula, the portfolio risk is affected by the investment weight of each asset, the correlation between different assets and the standard deviation of each asset. So, it is more recommended to choose the assets with smaller variance and correlation coefficient between each of them to reduce risk. The sample mean and the sample variance of the past earnings data can be used to predict the future return and risk in practice. The portfolio volatility is:

$$\sigma_p = \sqrt{(\sum_{i=1}^n w_i \sigma_i)^2} \quad (3)$$

where w_i is the proportion of the portfolio invested in Asset i and σ_i is Asset i 's standard deviation of return.

If all possible combinations in the portfolio can constitute a feasible set, the shape of this set is similar to a left convex solid area. The feasible set can be equally divided into 2 parts by the center of minimum variance portfolio point that is considered as the frontier or the boundary. Portfolios above the efficient frontier satisfy the highest expected return at a certain level of risk or provide the lowest risk for a given level of expected return, which is below the efficient frontier is considered suboptimal [13].

The Sharpe ratio is used to measure investment performance by adjusting for risk. The higher the Sharpe ratio, the greater the return on the investment relative to the risk taken, the more optional the investment. This ratio can be used to evaluate individual stocks or investments, or it can be used to evaluate an entire portfolio [14]. Therefore, this ratio is suitable to this research. The formula is:

$$\text{Sharpe Ratio} = \frac{[E(R_p) - R_f]}{\sigma_p} \quad (4)$$

where the $E(R_p)$ stands for the expected rate of return for the portfolio, R_f is the risk-free interest rate, and σ_p refers to the standard deviation of the portfolio. To reach a higher Sharpe Ratio, the portfolio should be a combination of assets with larger expected rate of return, smaller risk-free rate and standard variation, so that the investment can consider to be good [15].

3. Results and Discussion

3.1. Model Performance and Explanation

According to modern investment theory, companies should use logic and reason to invest, that is, to diversify their portfolios to achieve better overall returns without taking on more risk. To achieve diversification, a portfolio investment weight constraint can be the maximum proportion of one asset is restricted to 30% ($0 \leq w_i \leq 30\%$), where w_i is the weight of each asset, and the optimal weight of each of them will be produced by using Mean-variance portfolio optimization. The 3 optimal condition is considered, including Maximum Sharpe Ratio Portfolio (MSRP), Global Minimum Variance Portfolio (GMVP), and Maximum Return Portfolio (MRP). Under each strategy the distribution of optimal portfolio composition will be different.

Table 3: Correlation of the Assets

	AAPL	NVDA	HEQ	VOO	GOVT	BTC
AAPL	1.000	0.139	0.019	0.069	0.005	0.070
NVDA	0.139	1.000	0.055	-0.051	0.097	-0.134
HEQ	0.019	0.055	1.000	0.003	0.048	-0.047
VOO	0.069	-0.051	0.003	1.000	-0.111	-0.037
GOVT	0.005	0.097	0.048	-0.111	1.000	-0.040
BTC	0.070	-0.134	-0.047	-0.037	-0.040	1.000

Table 4: Covariance Matrix of all assets

	AAPL	NVDA	HEQ	VOO	GOVT	BTC
AAPL	0.002	0.000	0.000	0.000	0.000	0.000
NVDA	0.000	0.006	0.000	0.000	0.000	-0.001
HEQ	0.000	0.000	0.005	0.000	0.000	0.000
VOO	0.000	0.000	0.000	0.001	0.000	0.000
GOVT	0.000	0.000	0.000	0.000	0.000	0.000
BTC	0.000	-0.001	0.000	0.000	0.000	0.009

Table 3 and 4 has shown the correlation and covariance between every two assets, which is used in computing the portfolio variance. Figure 1 is the trend of weekly return of these kinds of assets during July, 2019 to July, 2024, from which the returns of BTC NVDA and HEQ are the most fluctuated especially during the following 3 periods including week 31 to 41, week 71 to 91 and week

171to 181.And the NVDA and HEQ involve the maximum weekly return in the portfolio and the BTC has the lowest weekly return that appeared in week 34.

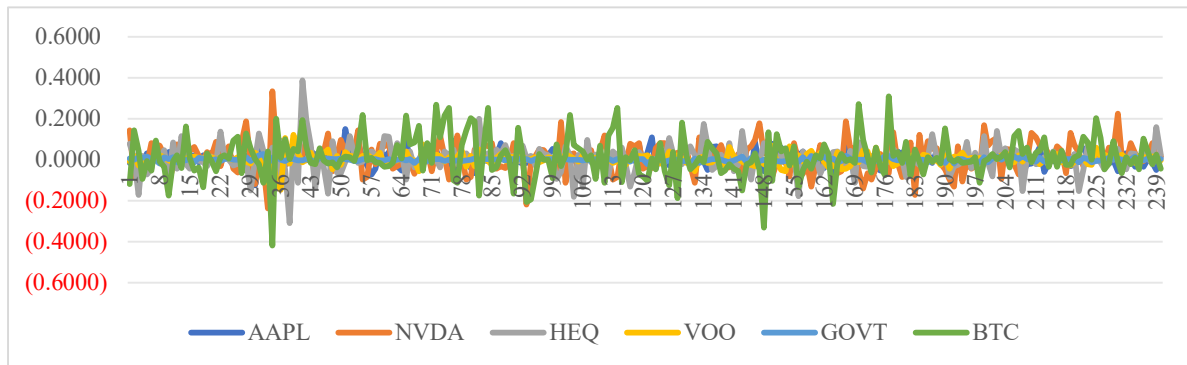


Figure 1: Weekly return trends of 6 kinds of assets for the period Jul.2019 to Jul.2024

Portfolio Optimization

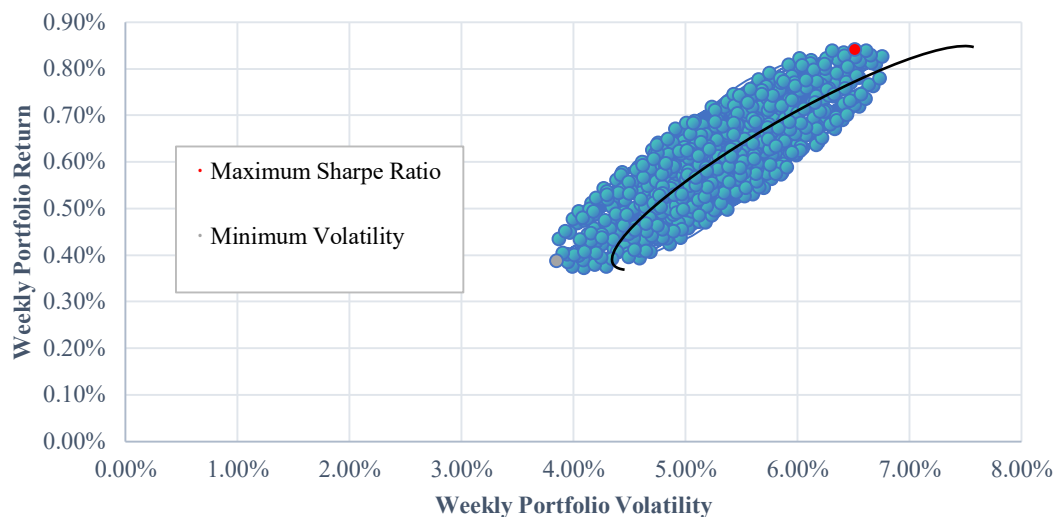


Figure 2: Portfolio Optimization based on Efficient Frontier

Table 5: Optimal Portfolio Composition under 3 Different Optimal Situation

Profile Constitute	Optimal Composition in Maximum Sharpe Ratio Portfolio (MSRP) (%)	Optimal Composition in Global Minimum Variance Portfolio (GMVP) (%)	Optimal Composition in Maximum Return Portfolio (MRP) (%)
AAPL	19.0%	23.8%	30%
NVDA	28.6%	9.5%	30%
HEQ	14.3%	14.3%	0%
VOO	9.5%	19.0%	0%
GOVT	4.8%	28.6%	0%
BTC	23.8%	4.8%	30%

The result got from the application of mean-variance model is in Table 5 and the point of all weekly portfolio return and volatility has formed the scatter diagram in Figure 2, in which the efficient frontier, MSRP point and GMVP points are highlighted. In Table5, under the Maximum Sharpe Ratio situation, NVDA, AAPL and BTC have the largest optimal portion of 28.6% ,23.8% and 19.0%, and the VOO and GOVT has the least percentage of 9.5% and 4.8% because their outstanding profitability while their risk is also relatively high. Under the Minimum Volatility situating has the largest weight in the portfolio because of its minimum variance, BTC has the smallest portion because it is the most fluctuated one among all six assets. To reach the Maximum Return condition, the most profitable assets should take the highest proportion, including APPL, NVDA and BTC. Since the maximum of weight of each kind of assets is 30%, so this weight will be given to these 3 assets.

According to the Figure 1, it shows how to construct a portfolio with the goal of maximizing the expected return under certain risk level and connects the MSRP and GMVP points. The GMVP point (3.90%, 0.40%) contain the optimal portfolio that satisfy the lowest volatility, and the points above it are more profitable but riskier, and the point below it are riskier and less profitable portfolios than itself. The MSRP point (6.51%, 0.84%) is the asset combination that realizes the best trade-off of return and risk, the points in its left side are alternatives that are have less risk but also smaller return, and the points on the right side are alternatives are not only less profitable but also riskier. The results can help investors to analyze the potential risks and benefits, so as to choose the best investment strategy. Decision depends on whether the investor is more profit-oriented or risk-averse.

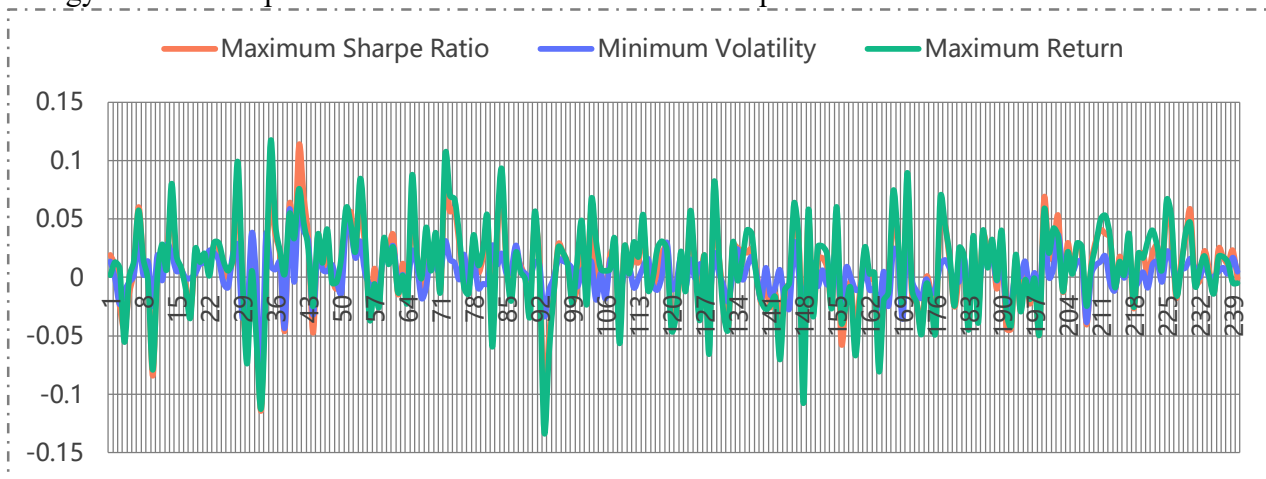


Figure 3: Weekly Portfolio Return Trend under Different Optimal Situation

The weekly portfolio return trend during July,2019 to July,2024 under 3 optimal situations: MSRP, GMVP and MRP is shown in Figure 3. According to the trends, it can be suggested that investors those who have a strong risk-taking ability and are committed to pursuing high returns can choose the maximum return strategy. Investors who are willing to take a certain risk and seek a certain return can choose the maximum Sharpe ratio strategy. The minimum volatility investment strategy is more suitable to the investors having relatively weak risk tolerance, and pay more attention to the long-term benefits of investment. Therefore, these strategies cannot be defined as better or worse, only suitable or not to the investment goal and desire.

3.2. Limitation and Prospects

Although this study explores the optimal portfolio multi-assets investment and make some valuable discoveries, but the result still exist some limitations that should be considered. First, the study did not adequately control some potential variables like the price level of each kind of assets. The prices

of all these assets are not at the same level and have a large difference between each other, which lead to the failure in providing the graph to make comparison of the price trend of each asset during July, 2019 to July, 2024. Second, the universality of results cannot be ensured since the sample amount is relatively small as only one target was selected for each kind of asset, and the research scope is only restricted in the U.S. So, it may exist some difficulty in generalizing findings from one study to other settings. Based on the above limitations, future research can be improved and expanded from the following aspects. Firstly, future studies should focus more on controlling and exploring potential confounding variables by choosing assets that have smaller price to ease the comparison and analysis, and it can also pay attention to the effect of industry, market capitalization and the asset's nature. And this can be done through designing more rigorous experimental studies, or by using advanced statistical methods. In addition, the future study can widen the research scope to study more countries' situation and selected more samples for different assets to enhance the generalization of the consequence.

4. Conclusion

This paper studies the modern portfolio theory and its application to multi-asset portfolios, where 6 common trading assets, i.e., stocks, options, futures, ETFs, bonds, and cryptocurrencies are considered and analysed. The result shows that MPT is a practical tool of portfolio selection, either for investors who pursue high return and for those who mitigate risk when investing. Besides, under different optimal situation involving maximum Sharpe ratio, minimum volatility and the maximum return, the optimal weight of each asset is different, which depended on the asset's return rate, their correlation, covariance and variance. Based on this finding, the investors can choose among the alternatives to reach their investment goal. The future study is expected to expand the research scope, pay more attention to the control variables and even use more advanced statistical methods. The study is expected to provide investors a better understanding of how to practice the portfolio theory to enlarge the return for a portfolio at a certain risk level some reference to future study.

References

- [1] Roche, C. O. (2016) *Understanding modern portfolio construction*. SSRN Electronic Journal, 274, 27.
- [2] Bhardwa, D. (2016) *Traditional and modern portfolio analysis*. Your Article Library, 82677.
- [3] Lekovic, M. (2021, January) *historical development of portfolio theory*. ResearchGate. Retrieved from: https://www.researchgate.net/publication/351398319_Historical_development_of_portfolio_theory
- [4] Elton, E.J., Gruber, M.J. and Blake, C. R. (2008) *Modern portfolio theory, 1950 to date*. SSRN, 1295211.
- [5] Rom, B.M. and Ferguson, K.W. (1994) *Post-modern portfolio theory comes of age*. *The Journal of Investing*, 3(3), 11–17.
- [6] Jacquier, E. (2013) *Modern portfolio theory*. *Portfolio Theory and Management*, 23–45.
- [7] Wood, K. (2024, March 18) *What's a financial portfolio?* Northwestern Mutual. Retrieved from: <https://www.northwesternmutual.com/life-and-money/what-is-a-financial-portfolio/>
- [8] Scott, G. (2023, August 29) *Modern portfolio theory: What MPT is and how investors use it*. Investopedia. Retrieved from: <https://www.investopedia.com/terms/m/modernportfoliotheory.asp>
- [9] Hafeez, B. (2023, July 5) *Modern portfolio theory is still relevant today*. LinkedIn. Retrieved from: <https://www.linkedin.com/pulse/modern-portfolio-theory-still-relevant-today-bilal-hafeez>
- [10] Elton, E. and Gruber, M. (1998) *Modern portfolio theory, 1950 to date*. *Journal of Banking & Finance*, 484
- [11] Hu, J. (2022) *Application of modern portfolio theory in stock market based on empirical analysis*. *Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022)*.
- [12] Zhang, A. (2023) *Portfolio optimization of stocks – python-based stock analysis*. *International Journal of Education and Humanities*, 9(2), 32–38.
- [13] Calvo, C., Ivorra, C. and Liern, V. (2012) *On the computation of the efficient frontier of the portfolio selection problem*. *Journal of Applied Mathematics*, 2012, 1.
- [14] Ma, Z. (2023) *Maximizing returns and minimizing risk: A data-driven portfolio optimization analysis using Markowitz's theory and Sharpe ratio*. *Academic Journal of Business & Management*, 5(9), 3–4.

- [15] *Qu, J. and Zhang, L. (2023) Application of maximum sharpe ratio and minimum variance portfolio optimization for industries. Highlights in Business, Economics and Management, 5, 205–213.*

Research on Supply Chain Optimization at Amazon

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Abstract: In today's era of globalization and digitization, supply chain management is critical to the success of globalized companies. Amazon, one of the world's largest e-commerce platforms, has a particularly complex and important supply chain management. Despite many studies on supply chain management, there is still a lack of research on how Amazon uses operations research and data analytics to optimize its supply chain. The purpose of this paper is to explore how Amazon can improve the efficiency of its supply chain through operations research and data analytics techniques (e.g., linear programming, inventory control, and transportation modeling) to cope with increasing market demand. Through literature analysis and case studies, this paper examines in detail the optimization practices and technology applications of Amazon's supply chain management. The study uses data collected from Amazon as well as relevant academic articles and industry reports. The results of the study show that Amazon effectively uses advanced operations research models, such as linear programming, inventory control, and transportation models, to optimize various aspects of its supply chain. These models help reduce costs, manage inventory levels, and improve delivery efficiency. The analysis shows significant improvements in supply chain performance metrics, confirming Amazon's strategic use of data-driven decision-making.

Keywords: Amazon, Supply Chain Management, Operations Research, Optimization.

1. Introduction

In the current era of globalization and digitalization, Supply Chain Management (SCM) is critical to the success of a globalized business. Supply chain management simply involves not only procurement and production but also logistics and inventory management. A good example is Amazon, one of the world's largest e-commerce platforms, where the complexity and importance of supply chain management is particularly prominent. Amazon's supply chain network covers the entire process from suppliers to consumers, ensuring that goods reach customers around the world in an efficient and timely manner.

Although there are a large number of studies on supply chain management, there is still a lack of research on how Amazon uses operations research and data analytics to optimize its supply chain. The purpose of this paper is to explore how Amazon can improve the efficiency of its supply chain through operations research and data analytics techniques, such as linear programming, inventory control, and transportation modeling, to cope with the increasing market demand.

2. Basic Concepts and Models of Supply Chain Management and Operations Research

2.1. Basic Concepts of Supply Chain Management and Operations Research

The administration of the entire process, from obtaining raw materials to producing goods to delivering finished goods to customers, is referred to as supply chain management. A company's operational efficiency is increased by effective supply chain management, which also lowers expenses and raises customer satisfaction. Supply chain management has gained significant importance in the era of globalization and digitization due to its intricate networks spanning numerous nations and regions. In contrast, operations research—also referred to as management science or decision science—is the study of using statistics, math, and algorithms to solve difficult decision-making issues. Operations research offers a variety of models and techniques in supply chain management, including inventory control, network flow problem solving, and linear programming. These tools enable managers to make better decisions and enhance operational procedures, which raises overall effectiveness. Organizations can address complex supply chain issues like material requirements planning (MRP), enterprise resource planning (ERP), and customer relationship management (CRM) in a scientific manner by combining supply chain management with operations research. Businesses may efficiently distribute resources, maximize service levels, optimize inventory levels, cut down on scrap and excess, and ultimately minimize costs by using operations research approaches. In today's corporate world, multidisciplinary approaches hold great significance, particularly when dealing with global competition and unpredictable markets. They can offer a sustainable competitive edge. For instance, operations research models have been used by Amazon and other e-commerce behemoths to optimize their supply chains. This has allowed for quick order processing and customer support, two essential components of their commercial success.

2.2. Basic Models of Supply Chain Management and Operations Research

2.2.1. Linear Programming (LP)

A popular mathematical technique for optimizing (maximizing or minimizing) a linear objective function under specific restrictions is called linear programming. Linear programming can be used in supply chain management to address issues with resource allocation, productivity maximization, and cost minimization. For instance, to maximize cost-effectiveness, a business may utilize linear programming to decide which items to produce, in what quantities, and how to distribute raw materials.

2.2.2. Inventory Control (Inventory Control)

Determining the ideal amount of inventory to meet production demands while minimizing holding costs is the basis of inventory control, a significant application field in operations research. Safeguard stock levels and the Economic Order Quantity (EOQ) model are two efficient inventory control techniques that can help businesses lessen the cost of excess inventory while guaranteeing that market demand is satisfied on time.

2.2.3. Transportation Models

Transportation models are used to optimize the problem of transporting goods from multiple sources to multiple destinations. These models take into account factors such as transportation costs, time, and route selection with the goal of minimizing logistics costs while meeting customer needs. Transportation models play an important role in assigning routes and selecting the most economical mode of transportation, especially in globalized supply chain networks.

These models not only help companies to effectively manage their supply chains, but also provide decision makers with data-supported insights that enable them to make more informed decisions in the ever-changing market environment. By utilizing these operations research models, companies are able to achieve greater operational and cost efficiencies to remain competitive in a highly competitive marketplace.

3. Characteristics of Amazon's Supply Chain Management

Amazon's supply chain management is one of the key success factors of its business, which is optimized through highly automated and technology-driven strategies. To gain a deeper understanding of Amazon's supply chain management characteristics, this section will cite other research papers to demonstrate its strategies and practices.

3.1. Highly Integrated Technology Systems

Amazon uses advanced information technology systems that integrate order processing, inventory management, shipping and customer service. These systems enable real-time tracking and data analysis to improve operational efficiency and optimize inventory levels and distribution efficiency. These systems facilitate collaboration and integration in the supply chain through data collection, sharing, and process optimization [1]. Additionally, enterprise Application Integration (EAI) technologies help to unify supply chain management components across organizations and enhance processes within and outside the organization [2]. These integrated systems enable Amazon to maintain accurate inventories, ensure quick deliveries, and efficiently manage global operations.

3.2. Innovative Logistics and Distribution Network

Amazon's "Fulfillment by Amazon" (FBA) model revolutionized its logistics and distribution network by allowing third-party sellers to store items in Amazon's warehouses. Amazon is responsible for picking, packing, and shipping these items, greatly expanding its storage and distribution capabilities while increasing efficiency and customer satisfaction throughout the supply chain. Innovations in logistics, especially in distribution centers, are designed to remain competitive and meet complex customer needs [3]. Furthermore, DHL utilizes a network of innovations to dynamically manage and coordinate logistics activities, similar to Amazon's FBA model [4]. This model not only speeds up order processing, but also reduces operational costs and complexity, demonstrating Amazon's strategy to maintain competitive advantage through innovative logistics solutions.

4. Amazon's Specific Practices in Supply Chain Optimization

4.1. Amazon's Challenges in Supply Chain Optimization

Amazon faces a complex set of challenges in optimizing its supply chain, which focus on the complexity of a globalized supply chain, demand volatility and inventory management, workforce management and health and safety, and information visibility and supply chain transparency. First, Amazon's supply chain has a global reach, which increases the complexity of logistics and coordination, and the vulnerability of the global supply chain was exposed especially during the COVID-19 outbreak, when about 95% of Fortune 1000 companies had global supply chain operations in China, and when embargo measures and factory closures as a result of the outbreak directly interfered with the flow of products and inventories, triggering a global supply chain risk regarding the new discussions. Secondly, demand uncertainty is one of the main challenges facing Amazon's supply chain; fluctuating market demand requires Amazon to flexibly adjust its inventory to avoid

overstocking or out-of-stock issues, which requires complex forecasting and real-time adjustment strategies to ensure that inventory levels can satisfy customer demand while optimizing the cost of inventory holding [5-6]. Additionally, Amazon faced workforce management and employee health and safety issues during the epidemic, with Amazon and other companies receiving widespread public criticism for poor working conditions, consumers becoming more concerned about the management of upstream supply chain activities, and the government's role in overseeing the health and safety of supply chain workers becoming more important [6]. Finally, information visibility is key to effective supply chain management, but traditionally, upstream supply chain information is often not disclosed to consumers; during the epidemic, product shortages triggered consumer demand for supply chain transparency, such as the desire to know when the next shipment will be made and the status of production, and this demand prompted firms to adopt technologies, such as blockchain and transportation tracking platforms, in order to improve supply chain transparency and responsiveness [6]. By addressing these challenges, Amazon has not only improved the resilience and responsiveness of its supply chain, but also enhanced its competitive advantage in the global marketplace.

4.2. Solutions

Amazon has adopted a variety of innovative solutions in supply chain optimization to cope with its complex global supply chain system and improve overall operational efficiency. First, Amazon optimizes its e-commerce supply chain by integrating advanced information technologies, such as the Internet of Things (IoT) and cloud computing, to monitor each product in real time and rationally manage its logistics system. IoT technology not only helps Amazon predict product information at each stage of the supply chain, but also improves the quality of information transmission through data analysis and reduces the risk of information asymmetry, thus enhancing market competitiveness [7]. Secondly, Amazon considers the balance between environmental protection and economic benefits in supply chain optimization by optimizing the total delivery time, transportation cost and production cost, while reducing environmental pollution and improving product quality, and adopts the mixed integer linear programming (MILP) model and improved genetic algorithm (GA) for supply chain scheduling to ensure the dual optimization of economic benefits and environmental protection [8]. In addition, to cope with the complexity of dynamic supply chains, Amazon used a multi-objective optimization model to improve inventory strategies and service levels, which optimized each operational link in the supply chain through simulation models and non-dominated sorting genetic algorithms (NSGA2), resulting in better supply chain management in terms of inventory costs and service levels [9]. Finally, Amazon uses advanced optimization tools such as Ant Colony Optimization (ACO) to promote information sharing and collaboration among nodes in the supply chain, and through this distributed optimization approach, Amazon is able to manage the various operational segments in the supply chain more efficiently and improve overall operational efficiency [10]. The implementation of these solutions has enabled Amazon to not only improve the responsiveness and efficiency of its supply chain, but also maintain a leading competitive position in the market.

5. Conclusion

The optimization of Amazon's supply chain using data analytics and operations research is the main topic of this study. The study comes to the conclusion that Amazon optimizes every part of its supply chain by using sophisticated operations research models like inventory control, transportation models, and linear programming. These approaches facilitate cost savings, inventory control, and more effective delivery. The investigation confirmed Amazon's strategic application of data-driven decision-making by demonstrating a notable improvement in supply chain performance

measures. Deeper exploration of Amazon's supply chain's real-time data analytics, which is essential for dynamic decision-making, could enhance the report, nevertheless. Furthermore, the study does not include several cutting-edge techniques that could provide more reliable optimization results, such machine learning algorithms for predictive analytics. To improve the supply chain's responsiveness, future research can concentrate on fusing traditional operations research models with real-time data analytics. Furthermore, investigating the use of artificial intelligence and machine learning in predictive analytics might lead to additional optimization by improving demand forecasting and inventory control. Given the growing significance of green logistics, examining the environmental and sustainability aspects of Amazon's supply chain could potentially be a worthwhile field for future research.

References

- [1] Neubert, G., Ouzrout, Y., & Bouras, A. (2004). *Collaboration and integration through information technologies in supply chains*. *Int. J. Technol. Manag.*, 28, 259-273. <https://doi.org/10.1504/IJTM.2004.005065>.
- [2] Themistocleous, M., Irani, Z., & Love, P. (2004). *Evaluating the integration of supply chain information systems: A case study*. *Eur. J. Oper. Res.*, 159, 393-405. <https://doi.org/10.1016/j.ejor.2003.08.023>.
- [3] Soosay, C., & Hyland, P. (2004). *Driving Innovation in Logistics: Case Studies in Distribution Centres*. Wiley-Blackwell: Creativity & Innovation Management. <https://doi.org/10.1111/J.1467-8691.2004.00292.X>.
- [4] Wirtz, H. (2011). *Innovation Networks in Logistics-Management and Competitive Advantages*. *International Journal of Innovation Science*, 3, 177-192. <https://doi.org/10.1260/1757-2223.3.4.177>.
- [5] Ross, D. (2015). *Managing Supply Chain Inventories*. , 309-356. https://doi.org/10.1007/978-1-4899-7578-2_7.
- [6] Esper, T. (2021). *Supply Chain Management Amid the Coronavirus Pandemic*. *Journal of Public Policy & Marketing*, 40, 101 - 102. <https://doi.org/10.1177/0743915620932150>.
- [7] Zhu, L. (2020). *Optimization and Simulation for E-Commerce Supply Chain in the Internet of Things Environment*. *Complex.*, 2020, 8821128:1-8821128:11. <https://doi.org/10.1155/2020/8821128>.
- [8] Beheshtinia, M., Feizollahy, P., & Fathi, M. (2021). *Supply Chain Optimization Considering Sustainability Aspects*. *Sustainability*. <https://doi.org/10.3390/su132111873>.
- [9] Amodeo, L., Chen, H., & Hadji, A. (2009). *Multi-objective Supply Chain Optimization: An Industrial Case Study*. , 732-741. https://doi.org/10.1007/978-3-540-71805-5_79.
- [10] Silva, C., Sousa, J., Runkler, T., & Costa, J. (2009). *Distributed supply chain management using ant colony optimization*. *Eur. J. Oper. Res.*, 199, 349-358. <https://doi.org/10.1016/j.ejor.2008.11.021>.

Analysis of Digital Finance Transformation for the Haier Group

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Abstract: With the development of the Internet economy today, the business scope of large enterprises has gradually expanded to cross-regional areas, and the development advantages of cross-regional enterprises have gradually become apparent, but at the same time, a series of management and decision-making problems have also arisen. To change the situation of increased costs and reduced efficiency in financial management and decision-making due to the expansion of enterprise scale and the establishment of additional branches, many large Chinese enterprises have begun to try digital finance transformation. Solving the current unclear path of digital finance transformation will help digital finance transformation to be rapidly promoted and implemented in more Chinese enterprises. This study analyzes the features of financial sharing service center (FSSC) in the stage of intelligent and the essence of digital finance transformation. Combined with the development history, organizational framework, operating mechanism and financial data analysis of the management model of Haier Group's FFSC, this research explains the path and future trend of digital finance transformation based on the financial sharing service model, shedding light on offering reference and lessons for the digital finance transformation of enterprises contemporarily..

Keywords: Digital finance transformation, financial sharing service center, transformation path.

1. Introduction

Finance serves as an extremely necessary role in enterprises. It controls the economic lifeline and core data of enterprises and leads the construction of enterprise informatization. It should serve as a crucial engine for the digital transformation of enterprises. As an important tool and strategic support platform for the digital transformation of enterprises, the application of financial shared service centers in China has become stable. The professional efficiency improvement and financial value creation brought by them have been recognized by many entrepreneurs [1]. The application of technologies and 5G has opened the prelude to the digital finance era. The core of digital finance is to use big data technology to model and analyze and use artificial intelligence technology to optimize the process from business end to financial end and then to management decision-making end, and improve management and decision-making efficiency, and promote the application of digital finance from the three levels of perception ability, computing ability and cognitive ability [2]. Accordingly, the digital financial shared service center uses big data to focus on empowering individuals and

implementing efficient decision support, forming an end-to-end intelligent sharing, value sharing, and value-added sharing model for the entire business process [3].

After systematically combing through the existing literature, this paper found that scholars have achieved certain research results in the digital transformation of corporate finance, and these literatures offer hints for the research of this paper. The existing research progress mainly reflects three research directions. With the deepening of research on corporate finance digitalization, scholars have gradually realized that corporate digital finance transformation is not just a technical development. Its core is the non-technical enterprise full process reengineering, which reshapes the business model, organizational structure, corporate culture and corporate strategy of the enterprise around the existing digital technology [4]. This research understanding has led more scholars to focus on the integration and reengineering of different digital technologies and different organizations. Theoretical basis of corporate digital finance transformation. Previous literature introduced the resource-based view (RBV), dynamic capability theory and stakeholder theory to study corporate digital finance transformation. The RBV believes that digital technology resources can bring competitive advantages to enterprises and create value and added value for enterprises [5]. Dynamic capability refers to "the ability to build, integrate and reorganize and allocate resources" [6]. Enterprises ensure the implementation of digital finance transformation by establishing dynamic capabilities, which is the key to enterprise digital transformation. Stakeholder theory, considering the scope and impact of it, the participation of external and internal stakeholders can promote the implementation of digital finance transformation of enterprises and benefit from it [7]. One can also place digital finance transformation in the larger framework of enterprise digital transformation for research [8]. Some scholars have proposed digital finance transformation paths from the perspective of financial sharing and service digitization, such as FSSC as the starting point of digital finance transformation, and the application of intelligent FSSC and intelligent financial management tools as the end point of digital finance transformation [9]. However, it is further emphasized that the application of new technologies does not represent the whole of digital finance transformation. Digital finance transformation should start from the overall situation and apply profound organizational changes [10].

In addition, according to the query of CNKI database, there are 236 articles studying "digital finance transformation path", but most of them analyze and study the implementation path of digital finance transformation from a specific industry. This article consults a large number of literature and collects typical enterprise practice case analysis, combines the research results of predecessors, and analyzes the specific digital finance transformation path and future development trend, in order to provide more specific reference and lessons for the enterprises in various industries. This article describes the digital finance transformation and analyzes the digital finance transformation of Haier Group's FSSC to provide inspiration and suggestions for subsequent digital finance transformation of enterprises.

2. Description of Digital Finance Transformation

Digital finance transformation is based on the FSSC and uses technology to achieve financial automation and intelligence. According to the three-stage model of enterprise digital transformation proposed by Verhoef et al. [11], and based on the professionalism of the enterprise's financial function, this study believes that the basic strategy of enterprise digital finance transformation should be: to meet business needs according to the business essence of the enterprise, integrate technical characteristics and reshape enterprise value. This strategy determines that the path of digital finance transformation is divided into three layers as follows. According to business essences and needs, establish the enterprise's financial shared service center and establish financial process reengineering to better serve each functional department of the enterprise. On the basis of the FFSC, use

technologies such as A (artificial intelligence), B (blockchain), C (Cloud computing), D (big data), E (Internet-of-Everything) and 5G to achieve financial automation and intelligence, that is, digital finance. The enterprise's financial department is transformed into the central nervous system of the enterprise, and by collecting small data from various departments of them and transforming it into the big data center, it will eventually achieve the digital transformation of the entire enterprise.

Digital finance transformation is a complex and systematic project. Its implementation steps and methods generally need to be promoted from the consciousness level, strategic level and execution level [12]:

- **Consciousness level.** First of all, the concept of platform, connection, sharing and collaboration should be possessed at the consciousness level. The management and decision-making level of the enterprise should believe that through the collaborative platform, real-time data exchange can be achieved, data can be accurately collected, customer needs can be accurately understood, supplier dynamics can be mastered, a digital supply chain can be established, stakeholders can be better served, and business data can be realized.
- **Strategic level.** The digital finance transformation strategy is a complex systematic project. Enterprises need to build an exclusive digital ecosystem based on the essences and pain points of their business. At the same time, enterprises need to open internal and external boundaries, connect and share, and jointly establish standardized data with employees, partners and customers to provide real-time intelligent decision-making and analysis, and build core competitiveness.
- **Execution level.** Enterprises need to restructure their financial structure and establish a flat front-end, middle-end and back-end model (depicted in Fig. 1). The flat financial structure can break boundaries and achieve end-to-end links. This architecture can achieve agile response and rapid response at the front end; business source triggering and automatic data sharing at the middle end; data collection modeling at the back end and business decision support at the front end [13]. On the other hand, robotic process automation is applied to replace large-scale manual operations, strengthen the deep integration of business and finance, and create an intelligent digital financial shared service center. Furthermore, in terms of talent training and management, enterprises need to focus on cultivating cross-border talents with digital knowledge reserves, establish flat and interconnected job channels within the enterprise, promote the comprehensive improvement of employees, and then deeply empower digital finance transformation. At the same time, it is necessary to keep the enterprise's digital finance ecosystem in an open, connected and symbiotic state always to better respond to uncertain internal and external needs of the enterprise.

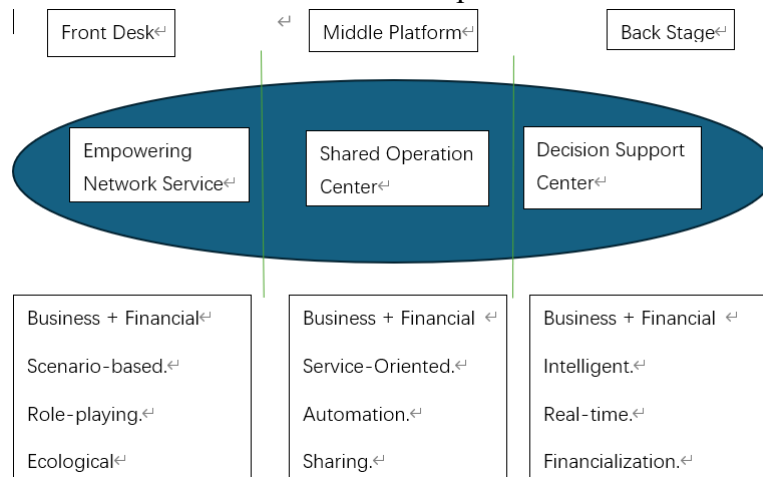


Figure 1: Flat front, middle and back pattern.

3. Case Background

Haier Group is one of the first enterprises in China to implement the financial sharing model. Founded in 1984, it is a giant home appliance brand. Haier Group's business consists of five major sectors: white appliance platform, service investment incubation platform, financial holding platform, real estate platform and cultural industry platform [14]. In the era of Internet economy, digitization and globalization are inevitable trends. For this reason, Haier Group took the lead in establishing a corporate FSSC. The establishment of the FSSC ensures the agreement of corporate financial reporting standards, saves the financial costs of different branches of the enterprise, and significantly reduces the operating costs of the enterprise, reducing the burden on the enterprise and creating a scale effect. In addition, through the establishment of a FSSC, the financial management process and service standards are reconstructed, and a new financial management model is formed, that is, the optimization and unification of financial management processes and financial service standards, the standardization and Process processing improves work efficiency and service quality, thereby enhancing the overall strength of the enterprise [15].

Through the review and analysis of previous literature, it was found that the digital finance transformation problems of enterprises usually appear in three aspects. In terms of personnel, most corporate executives usually do not have the ability to judge changes in digital finance transformation needs and to move digital strategies from high-level plans to specific actions. This requires the enterprise's top managers to make role changes based on the needs of digital finance transformation, strengthen collaboration among managers, design the power distribution of the top management team, and then start or change the digital transformation process. In terms of organizational, with the application and development of digital technology, most companies are unable to change their organizational forms in a timely manner, causing digital finance transformation to stagnate and fail to work. Digital finance transformation is a rebalancing action. Enterprises should adjust or rebuild the enterprise's organizational structure accordingly based on the current digital finance transformation strategy and current enterprise resources, thereby promoting the process of enterprise digital finance transformation. In terms of industry, digital finance transformation has changed the original business model and value chain structure of each industry. In the sharing economy model, the inherent business model thinking of enterprises limits the innovation of business models and the reconstruction of value chains, thereby restricting the development of digital finance transformation of enterprises. Enterprises should use digital technology to unify and improve data standards, carry out cross-industry and cross-platform business model innovation, and create a value chain beyond products and services, thereby improving the transformation of enterprise digital finance [16].

4. Analysis

4.1. Process

As a home appliance manufacturing enterprise, Haier Group, based on its own business essences and supply chain characteristics, first proposed the "employees and orders are one" model in 2005. This model transformed Haier Group from the traditional enterprise-paid salary model to the customer-paid salary model. Through the "employees and orders are one" model, the enterprise, employees and customers are connected to maximize the interests of the three parties [17]. In 2007, Haier Group took "SPORTS" (i.e., site selection, process, organization, regulations, technology and service level agreement) as the strategic path and began to implement the financial shared service center model in Qingdao, China. Under the FSSC model, Haier Group transferred the financial departments and financial functions of each branch to the Financial Shared Service Center, as shown in Figure 2 [18]. In 2015, under the trend of digital development, Haier took the creation of an "ecosystem" platform

as its strategic orientation and created the "1+7" interconnected factory platform. The "1" represents the smart life platform, which provides smart solutions based on user needs; the "7" represents interactive customization, open innovation, virtual marketing, modular procurement, smart manufacturing, smart logistics, and smart connection services.

Haier's interconnected factory integrates different digital technologies, pushing the enterprise's production supply chain to lean and flexible, greatly improving the enterprise's manufacturing capabilities, promoting the digital transformation of the enterprise's business activities, and improving the enterprise's digital finance capabilities. In 2017, Haier further upgraded its "ecosystem" platform and created the "COSMOPlat" industrial Internet platform. Based on the "employees and orders are one" and "1+7" models, the platform further breaks the boundaries between Haier's internal departments and between Haier and external stakeholders. The platform is divided into four levels: resource layer, platform layer, application layer, and model layer. The platform further strengthens the enterprise's smart manufacturing capabilities and strengthens the value sharing capabilities of the enterprise, customers, and employees. The application of this platform further strengthens Haier's digital finance upgrade and processing capabilities.

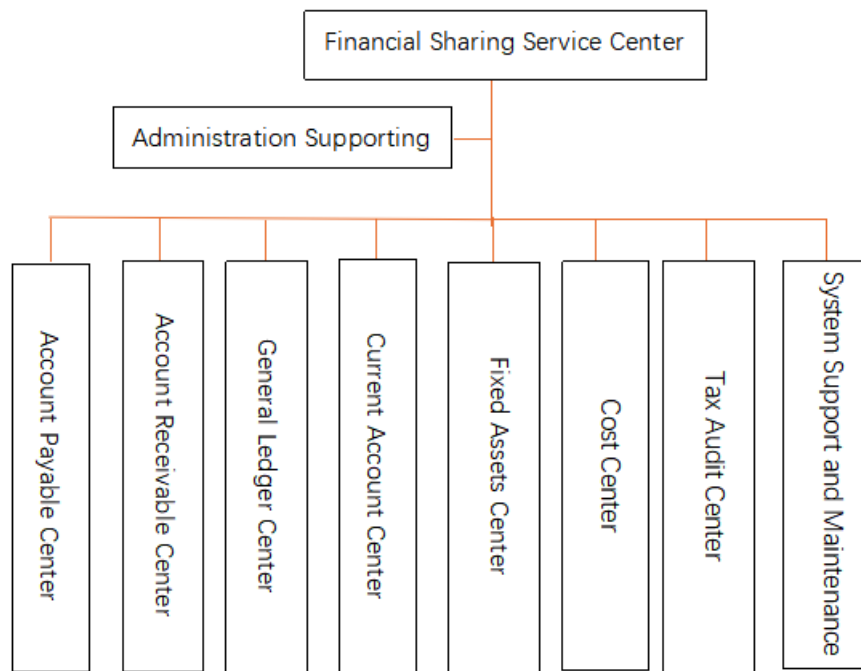


Figure 2: Shared Financial Service Center Structure.

4.2. Performance Analysis

In the process of implementing digital transformation, Haier Group established a FSSC and eliminated the financial departments and financial business of each branch. This move improved the efficiency of Haier Group's financial work processing and reduced Haier's labor costs [15]. With the evolution and application of digital information technology, the information and data processing capabilities of Haier Group's Financial Shared Service Center have been greatly improved. Compared with manual processing, it reduces information and data errors and ensures the accuracy of financial data and the real-time nature of information [15].

The establishment of Haier Group's Financial Shared Service Center has strengthened the enterprise's financial risk control and supervision capabilities. By formulating unified business

standards for the group, eliminating communication and process differences between the enterprise and its branches, unifying financial data and information, and strengthening the ability to control financial risks and implement financial adjustments and improvements [16]. The establishment of Haier Group's Financial Shared Service Center laid the foundation for the enterprise's comprehensive digital transformation. As a result, Haier Group was able to successfully implement the "7+1" ecosystem platform and the "COSMOPlat" industrial Internet platform, improving overall operational efficiency, which was significantly reflected in the increase in total operating income and attributable net profit, as shown in Figure 3 [17].

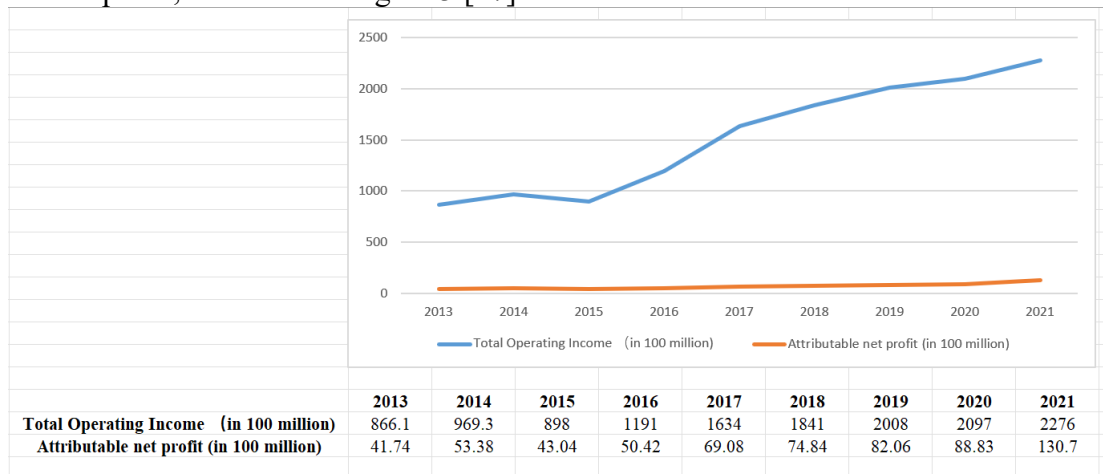


Figure 3: 2013-2021 Operating income and net profit.

4.3. Problems Encountered in Digital Transformation

The main problems encountered by Haier Group in the process of digital finance transformation are as follows:

- Organizational structure problems. The establishment of the FSSC changed the original communication mechanism between departments within the enterprise. At the same time, due to the unreasonable adjustment of the organizational structure and system, communication between departments was not smooth and conflicts of interest occurred between departments [18].
- Personnel problems. On account of the misunderstanding of the FSSC by senior managers of Haier Group, they failed to establish a management system and process that truly adapted to the FSSC model, which triggered Haier employees' confusion about work processes and career advancement paths, resulting in a high employee turnover rate [18].
- Information security issues. When Haier Group implemented the FSSC, due to insufficient information and digital technology application design, the financial management information system was unreasonable and imperfect, which threatened the enterprise's information and data security [18].

5. Suggestions and Implications

By analyzing the corporate background of Haier Group, the general path of digital transformation and the problems encountered during the transformation process, this article believes that the digital transformation can bring enterprises the ability to diversify their operations, and with the development and application of the technology, it can help enterprises strengthen their diversified operation advantages and reduce overall operating risks. The digital transformation of enterprises enhances the information collection ability of enterprises, reduces the organizational level and shortens the

management chain, and improves the information dissemination and work coordination efficiency within and between enterprise organizations. These advantages provide favorable conditions for the diversified operation of enterprises.

With the development of the Internet economy today, competition among enterprises is becoming increasingly fierce. Enterprises should focus on the adjustment and change of the business operation model. The business operation model should be customer-oriented, link the interests of customers, employees and enterprises, and use this model as a strategic guide for the enterprises. In view of the role and status of finance in enterprises, the digital finance transformation leads the overall process. Enterprises should first carry out digital finance transformation, establish a shared financial service center, and promote the comprehensive digital transformation of enterprises with digital finance transformation as the center. Digital finance transformation is a cross-domain project. When carrying out digital finance transformation, enterprises should focus on cultivating compound talents. Compound talents should have internet and digital knowledge reserves, as well as financial management expertise. On this basis, they should strengthen the service awareness of talents, full give to the role of shared financial service centers, promote the reconstruction of various business processes of enterprises, strengthen the application and design of digital and information technology, and promote the smooth progress of digital transformation of enterprises. By implementation of the internet and digital technology, the boundaries between internal organizations of enterprises are constantly being broken, and the communication methods between organizations are constantly changing. Enterprises need to continuously reorganize and optimize their organizational structures, and continuously adjust the management systems of enterprises to adapt to the application of new technologies, and enhance the internal control of enterprises to ensure the security of digital and information. To ensure the strategic direction of digital transformation, senior managers of enterprises should improve their digital knowledge and strengthen their understanding of the needs of digital finance transformation of enterprises, so that managers can accurately judge all the resources required for digital finance transformation of enterprises.

6. Conclusion

The digital finance transformation and enterprise digital transformation of Haier Group are successful and representative. This paper reviews the previous literature and takes the digital transformation of Haier Group as a case to deeply understand the main problems encountered by Haier Group at each stage of digital transformation, and finally analyses the specific transformation path and suggestions of Haier Group. Therefore, the digital background and management model innovation ability of enterprise managers and financial managers are very important for the digital finance transformation, and play a very critical role in the overall process. The success of Haier Group's digital finance transformation has enabled Haier Group to adapt to the trend of global development in advance, and will provide complete research materials for Chinese enterprises to carry out digital finance transformation and overall digital transformation in the future. Based on the analysis of the Haier Group case, this paper provides relatively specific suggestions for subsequent enterprises to carry out digital finance transformation and overall digital transformation from the perspective of enterprise business model, personnel, organizational framework, management system and technology application management, to provide examples and lessons for the digital finance transformation of enterprises in the era of intelligent.

References

- [1] Fang, J.N. (2023) *Exploration of the transformation of corporate financial management in the digital economy era. International Economics and Management*, 4(5), 85-87.

- [2] Lv, W., He, R.R. and Liu Y. (2017) *A brief discussion on the transformation of financial management of administrative institutions under the background of digitalization*. *Zhejiang Finance and Taxation and Accounting*: 42-43.
- [3] Qin, R. (2018) *A brief analysis of the digital transformation of financial companies under the background of big data*
Retrieved from:
<https://www.cnafc.org/cnafc/front/detail.action?id=BFB494B281B349B6B6BDFF4909125375>
- [4] Zhou, J. (2020) *Exploration of the digital transformation of financial management of traditional enterprises - taking PV company as an example*, *Accounting Monthly, First Series*, 6-11.
- [5] Alam, K., Ali, M.A., Erdiaw-Kwasie, M.O., Murraray, P.A. and Wiesner, R. (2022) *Digital transformation among SMEs: does gender matter?*, *Sustainability*, 14(1), 535.
- [6] Adner, R. and Helfat, C.E. (2003) *Corporate effects and dynamic managerial capabilities*. *Strategic Management Journal*, 24(10), 1011-1025.
- [7] Prebanic, K.R. and Vukomanovic, M. (2021) *Realizing the Need for Digital Transformation of Stakeholder Management: A Systematic Review in the Construction Industry*". *Sustainability*, 13(22), 12690.
- [8] Abou-Foul, M., Ruiz-Alba, J.L. and Soares, A. (2021) *The impact of digitalization and servitization o the financial performance of a firm: an empirical analysis*. *Production Planning & Control*, 32(12), 975-989.
- [9] Chen, H, Zhao, Y. and Dang, M. (2015) *ZTE's global financial sharing informationization practice*. *Finance and Accounting*, 15, 24-26.
- [10] He, X., Sun, J. and Liang, L. (2021) *Digital transformation empowers financial transformation and upgrading - a case study based on Sinopec Northwest Oilfield Branch*, *Management Accounting Research*, 1, 27-34.
- [11] Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J.Q., Fabian, N., and Haenlein, M. (2021) *Digital transformation: A multidisciplinary reflection and research agenda*, *Journal of Business Research*, 122, 889-901.
- [12] Yu, J. (2020) *Research on the path of financial digital transformation based on sharing model in the intelligent era*. *Academic Forum*, 7, 21-25.
- [13] Zhang, Z.L. (2020) *Analysis of the transformation trend of group financial organizational structure under the background of digital economy*. *Accounting Monthly*, 14, 10-14.
- [14] Dong, X. (2017), *Haier Group: Global Financial Shared Services under "People-Order Integration" | FSSC Typical Cases*. *Finance China | China Fashion*, 17.
- [15] Zhang, S. (2020) *Research on the Impact of Haier Group's Financial Shared Center Model on Enterprises*, *Finance and Market*, 18.
- [16] Zeng, D.L., Cai, J.W. and Ouyang, T.H. (2021) *Research on Digital Transformation: Integration Framework and Future Prospects*. *Foreign Economics and Management*, 43(5), 63-76.
- [17] Guo, X.Y. and Ma, Q.H. (2022). *Enterprise Digital Transformation - A Case Study Based on Haier Smart Home*, *Finance and Market*, 188-189.
- [18] Li, X. (2022) *Research on Enterprise Internal Control under the Financial Sharing Model - Taking Haier Group as an Example*, *Finance and Taxation Research*, 1, 151-153.