

Research on Big Data-Driven Corporate Operation and Digital Ecology Construction

Wanxin Zhang^{1,a,*}

*¹School of accounting, The Capital University of Economic and business, Beijing, 100070, China
a. 18500127879@163.com*

**corresponding author*

Abstract: With the rapid development of information technology, the amount of global data is growing exponentially. According to statistics, the total amount of global data has reached 120 ZB in 2023, and is expected to exceed 180 ZB in 2025. The emergence of massive data and the application of advanced analytics are profoundly changing the logic of the company's economy and investment market. The application of big data technology is not only a technological innovation, but also a key driving force for the high-quality development of the corporate economy. In the future, there will be a need to deeply integrate data governance, algorithmic modeling, and company operations in order to fully exploit the potential of big data. The purpose of this paper is to discuss how the company economy, exemplified by media-based companies, can leverage the power of big data in the era of big data to promote the development of the company economy.

Keywords: Big data era, Company economy, Digital ecology, Algorithmic modelling, Data governance

1. Introduction

Big data is a buzzword that refers to data that does not fit into the traditional database structure. Its potential is enormous in a wide range of fields.

The core value of big data lies in its ability to empower company operations and drive profound economic change. By making sense of the logic behind it, companies can better manage their operations and maximize economic benefits. As Big Data tools and concepts become more widespread, they will change long-held perceptions of the value of experience, the nature of expertise, and management practices. Wise leaders across industries will recognize the essence of leveraging big data: a management revolution. But as with any other major business change, the challenges of becoming a Big Data-driven organization can be enormous, requiring leaders to be hands-on - and in some cases hands-off. Nevertheless, it's a transformation that executives need to start tackling immediately[1].

Big Data is playing a key role in shaping the global media network landscape in two main ways. Firstly, the datafication of media and the application of Big Data services to this data facilitates the digital realization of networks of competition and cooperation that previously existed in the form of joint ventures and trade in goods and services. Second, Big Data represents an emerging global paradigm, theoretically similar to the global distribution of television programmers [2][3]. Media

organizations around the world have adopted big data technologies, both to compete in a globalized media market and to use data-based decision-making to tailor content to local audiences.

This paper explores the trend and necessity for companies to conduct business operations and build a digital ecosystem driven by big data in the era of big data. The plan is to start with TikTok, and by analyzing the existing literature and the data information released by the company to the society, it will further provide theoretical and practical support for the necessity of linking big data and the enterprise economy, with the ultimate aim of promoting more enterprises to have a soft landing in the era of big data, and better leverage the power of big data to promote further development.

2. Literature Survey

Figure 1 shows the number of papers obtained on Google Scholar for the search term "Big Data and Corporate Economics" from year to year. From 2010 to 2024, the number of annual searches for the relevant literature shows significant fluctuations but an overall increasing trend. Specifically, the number of searches was 66,900 in 2010, and has been increasing year on year since then. Despite a brief decline between 2020 and 2023 (possibly related to the short-term impact of the global epidemic on academic research), the number of searches quickly rebounded to a peak of 141,000 in 2024, an increase of more than 110 per cent compared to 2010. This trend not only reflects the continued academic interest in the intersection of big data and the economics of the firm, but also reveals the profound impact of big data technologies on the development of media-based businesses[2][3].

In the early 2010s, the commercial application of Big Data technologies was still at an exploratory stage, with academic research focusing on building theoretical frameworks (e.g., the concept of "management revolution") [1]. With the maturity of cloud computing, artificial intelligence and 5G technologies, the focus of research has shifted to practical applications after 2015. For example, how media companies can optimize content distribution through user behavior data [4], or use real-time data analytics to improve the efficiency of advertisement placement [5].

The transition of traditional media to digital platforms has accelerated the reliance on big data technologies. After 2020, the new crown epidemic has significantly increased online content consumption, leading researchers to concentrate on the role of big data in user retention, personalized recommendations, and crisis management [6]. Despite a brief dip in literature volume in 2020-2023 (possibly due to disruption in data collection for empirical research as a result of the epidemic), the rebound in 2024 suggests that academia is rapidly adapting to the digital norm in the post-epidemic era.

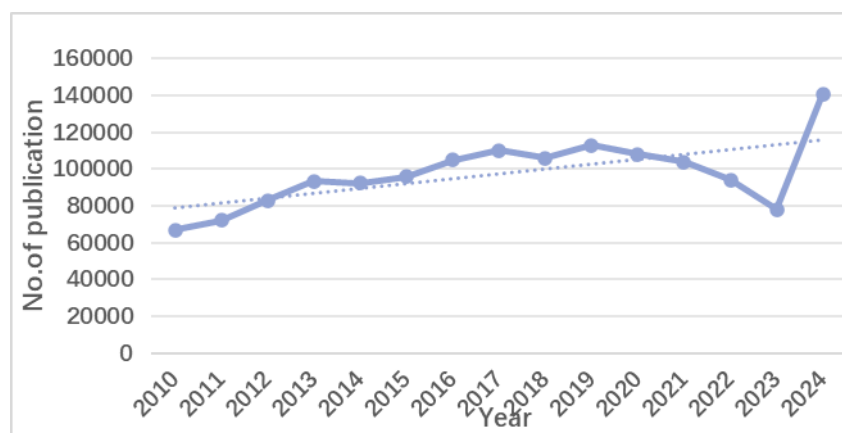


Figure 1: The number of papers searched using “Big Data and Corporate Economics” per year

3. The Application of Big Data and Digital Model in the Operation of Media Enterprises

3.1. Application of Big Data in Company Operations

For many applications, the speed of data generation is even more important than the volume of data. Real-time or near real-time information allows a company to be more flexible than its competitors. For example, Alex "Sandy" Pentland and his team at the MIT Media Lab used location data from mobile phones to extrapolate the number of people in the Macy's car park on Black Friday (the start of the Christmas shopping season in the US). This allowed Macy's to estimate its sales for the day before it had even recorded them itself. Quick insights like these can provide a clear competitive advantage to Wall Street analysts and managers of ordinary businesses[1].

Some Big Data environments, such as consumer sentiment analysis, are not designed to automate decision-making, but are more suited for real-time monitoring of the environment. Given the scale and velocity of Big Data, traditional, high-determinism approaches to decision-making are often inappropriate in such environments; by the time organizations have access to the information they need to make a decision, new data is often available, rendering previous decisions obsolete. In real-time monitoring situations, organizations need to adopt a more continuous approach to analysis and decision-making, based on a range of intuitions and assumptions[7].

It is very important for companies that make sales, especially media companies, to keep an eye on sales trends for the products they are casting streams for. This isn't possible with traditional analytics because the data is always changing, so you can't get to the most up-to-date information that way. In a big data environment, you need to analyze, decide, and act quickly and often.

3.2. Role of Big Data in User Behavior Analysis

In the traditional offline world, it is difficult for consumers to find substitutes. And in the digital world, the problem is that there are too many alternatives. Today, the search process generates digital data at every step of the process. Whereas in the past, a direct-to-consumer retailer would only record all items purchased, it now also keeps track of all the search activity on its website and shopping apps that lead to a purchase, such as a log of all activity on the site, including which items have been searched for, clicked on, added to the cart or wish list, abandoned, purchased, and so on. It also knows which search terms attracted prospects from search engines and whether those search terms were paid or natural search terms[5].

Media companies can then leverage consumers' search history to recommend products of interest to them in a targeted manner. For example, by analyzing users' search records, viewing behaviors and interaction data, TikTok is able to accurately recommend content and products that users may be interested in. Specifically, TikTok's recommendation system records every click, dwell time, like, comment and share on the platform, and analyses this data through machine learning algorithms to build user profiles. For example, if a user frequently searches for or watches "fitness"-related content, TikTok will infer that the user has a potential demand for fitness products or services, and recommend relevant advertisements or fitness courses to the user.

In addition, TikTok also analyses the amount of time a user spends on advertisements. Dwell time is an important behavioral indicator that reflects the user's level of interest in the ad content. If a user stays on an advert for a long time, TikTok will consider the advert content to be highly compatible with the user's needs, and thus increase the exposure frequency of similar adverts in future recommendations. For example, if a user spends more than the average amount of time on a particular advert for sports shoes, TikTok may push more adverts or content related to sports shoes in subsequent recommendations[8]. This recommendation mechanism based on user behavior analysis not only improves the conversion rate of advertisements, but also optimizes the user experience.

According to the 2023 TikTok E-commerce Annual Report, TikTok's advertisement click-through rate has increased by 35% and product conversion rate by 20% through the big data-driven personalized recommendation algorithm. This ability to make accurate recommendations has enabled TikTok to take a significant position in the advertising market, while also providing brands with an efficient marketing channel.

4. Case Study: Big Data-Driven Operation and Digital Ecology Construction of TikTok (Byte Dance)

The success of TikTok, the world's leading short video platform, is largely attributed to the in-depth application of big data technology. Through accurate user behavior analysis, intelligent recommendation algorithms and efficient advertising strategies, TikTok not only optimizes user experience, but also maximizes business value. The following is an analysis of how TikTok uses big data to empower its operations from three aspects: user behavior analysis, recommendation algorithms and advertisement placement.

4.1. User Behavior Analysis and Accurate Recommendation

The core competitiveness of TikTok is its powerful user behavior analysis. The platform builds a detailed user profile by recording every click, watch duration, like, comment and share behavior of users. For example, if a user frequently watches content related to "fitness", TikTok will infer that the user has a potential demand for fitness products or services, and thus recommend relevant advertisements or fitness courses to the user [4].

In addition, TikTok optimizes the recommendation strategy by analyzing the user's dwell time on the advertisement. Dwell time is an important behavioral indicator that reflects the user's level of interest in the ad content. If a user stays on an advertisement for a long time, TikTok will consider the content of the advertisement to be highly compatible with the user's needs, thus increasing the exposure frequency of similar advertisements in future recommendations [8].

4.2. Optimization of Intelligent Recommendation Algorithm

TikTok's recommendation algorithm is the core driver of its user experience. The platform adopts machine learning technology to adjust its content recommendation strategy in real time by analyzing massive user data. For example, TikTok's recommendation system not only considers users' explicit behaviors (e.g. likes and comments), but also analyses implicit behaviors (e.g. viewing completion rate and the number of repeat viewings) in order to more accurately capture user interests[6].

This recommendation mechanism based on big data enables TikTok to provide users with highly personalized content, thus increasing user stickiness. According to TikTok's official data, the average daily usage time of users has reached 90 minutes, and the user retention rate has increased by 30%. This efficient content distribution model not only improves user experience, but also attracts a large number of advertisements for the platform.

4.3. Advertisement Placement and Commercialization Expansion

TikTok has optimized its advertisement placement strategy through big data technology to maximize its commercial value. Based on user profiles and behavioral data, the platform accurately locates the target audience and improves the efficiency of advertisement placement. For example, TikTok's "interest tag" system analyses users' content preferences and pushes advertisements to user groups that are most likely to generate conversions [5].

In addition, TikTok is also expanding its commercialization path through live e-commerce. The platform uses big data to analyze user buying behaviour and optimize product recommendation and inventory management. According to the 2023 TikTok Annual Report, the GMV (gross merchandise volume) of TikTok exceeded 1.5 trillion yuan, showing its strong commercialization capability.

4.4. Data Governance and Privacy Protection

Although TikTok has achieved remarkable results in the application of big data, it also faces the challenges of data governance and privacy protection. The platform needs to ensure data security and compliance while avoiding algorithmic discrimination and bias issues. For example, TikTok has adopted differential privacy techniques to achieve efficient use of data while protecting user privacy [1].

All in all, TikTok has achieved comprehensive optimization of user behavior analysis, intelligent recommendation and advertisement placement through big data technology, which has promoted the high-quality development of the company's economy. Its successful experience shows that big data is not only a technical tool, but also a core driving force for company operation and business innovation. In the future, with the further deepening of data governance and algorithm transparency, TikTok is expected to play a greater role in the digital ecosystem and create more value for global users and advertisers.

5. Future Directions

The application of big data in the company's economy is deepening, and in the future its development can not be separated from the optimization of algorithmic models, the construction of the digital ecosystem, as well as data analysis in real time, decision-making automation and service personalization and customization. Optimized algorithmic models will more accurately predict user needs and enhance the user experience. Big data helps companies increase productivity, and more productive companies will invest more and scale up to generate more data, creating a "data feedback loop"[9]. Moreover, real-time data analysis will become the key to enterprise competitiveness, especially for media enterprises, real-time monitoring and analysis of data to achieve rapid response to market changes or will determine the survival of enterprises. Simple decision-making is also something that AI can do after further learning and progress, which will largely improve operational efficiency and decision-making accuracy[10][11]. In addition, through the analysis of user behavioral data, enterprises can provide customers with more accurate products and services to meet their personalized needs, such as media companies can customize exclusive content recommendations and advertisements according to user interests and preferences, to enhance user stickiness and satisfaction. Of course, the development of big data must consider the balance between data governance and privacy protection, as this will be a critical area for future development. With the improvement of global privacy regulations (such as GDPR, etc.), enterprises need to find a balance between data utilization and user privacy[12].

6. Conclusion

The application of big data technology is profoundly changing the operating logic of the company's economy and driving the evolution of the digital ecology. Big data has significantly improved the operational efficiency and economic benefits of companies through precision marketing, user behavior analysis and real-time decision-making. For example, TikTok has achieved a significant increase in the click rate of advertisements and the conversion rate of goods through its big data-driven recommendation algorithm. The use of big data is irreplaceable and cannot be ignored in the future development of enterprises, from building models to analyze user behavior, optimizing

algorithmic models to personalize services, to automating decision-making and analysis, it can be said that the future of big data technology is bright.

Although big data technology brings great opportunities, its application also faces challenges such as data quality, algorithmic bias and privacy protection. Enterprises need to overcome these challenges through technological innovation and institutional improvement to fully realize the potential of big data. What we need to understand is that big data is not only a technological revolution, but also a management revolution. Business leaders need to shift their thinking to embrace a data-driven decision-making model and drive organizational culture change.

References

- [1] Andrew McAfee, Erik Brynjolfsson. (2012). *Big Data: The Management Revolution*. Harvard Business Review.
- [2] Waisbord. (2004). *Media and the reinvention of the nation*.
- [3] Oren and Shahaf. (2013). *Introduction: Television formats—a global framework for TV Studies*.
- [4] Michael D. Smith, Rahul Telang. (2016). *Understanding User Behavior Through Big Data: The Case of Online Video Platforms*. Journal of Marketing Research.
- [5] Eric T. Bradlow, et al. (2017). *Big Data and Consumer Behavior: Immediate Opportunities and Longer-Term Challenges*. Journal of Consumer Psychology.
- [6] Taina Bucher. (2017). *Algorithmic Media and the Politics of Recommendation*. Social Media + Society.
- [7] Paul Barth, Randy Bean. (2013). *How Big Data is Different*. MIT Sloan Management Review.
- [8] Hongliang Yu, Dongdong Zheng, Ben Y. Zhao, Weimin Zheng. (2006). *Understanding User Behavior in Large-Scale Video-on-Demand Systems*. ACM SIGOPS Operating Systems Review.
- [9] Ajay Agrawal, Joshua Gans, Avi Goldfarb. (2018). *Big Data and Firm Dynamics*. AEA Papers and Proceedings.
- [10] Lucy Kuing. (2017). *The Impact of Big Data on Media Industries*. Media Industries Journal.
- [11] Annabelle Gawer. (2020). *Big Data and the Platform Economy*. Research Policy.
- [12] Sanjay Kumar Singh , Abdul-Nasser El-Kassar. (2018). *Role of big data analytics in developing sustainable capabilities*. Journal of Cleaner Production.