Article

Practical Experience in Data-Driven Product Transformation and Revenue Growth

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Abstract: In the wave of informatization, many companies promote product upgrading with the help of data analysis, aiming to promote revenue growth and enhance market competitiveness. This data-driven product transformation is not only a technical process, but also involves the in-depth mining of large-scale data, the integration of intelligent algorithms, and the strategic alignment of products with user needs. This paper aims to deeply study the theoretical basis of data-driven product transformation and the technical architecture of its implementation. By analyzing practical cases, it explains how data-driven transformation can help enterprises grow by relying on product upgrading, intelligent innovation, revenue growth model and other means, so as to enhance the competitiveness of enterprises in the market. Through the detailed interpretation of specific cases, this paper will explain how to improve user experience, enhance user stickiness and enhance the market competitive position of enterprises with the help of data analysis.

Keywords: data driven; product transformation; income growth; big data

1. Introduction

With the rapid progress of information technology and digital technology, enterprises are facing unprecedented market competition and challenges. The demand of customers shows a more diversified trend, and the fierce market competition intensifies day by day, forcing enterprises to explore new development power and transformation and upgrading strategies. Data driven product transformation has become an important way for many companies to seek breakthroughs. With the help of in-depth mining and analysis of big data, enterprises can not only accurately grasp the needs of customers, but also predict market trends and improve product quality, so as to maintain a steady growth trend in the unpredictable market tide. This paper aims to deeply discuss the theoretical basis of data-driven product transformation, and analyze the application of this model at the specific implementation level, focusing on the ways to promote income growth and strengthen market competitiveness, while providing practical cases and reference for the industry.

2. Theoretical Basis of Data Driven Product Transformation

2.1. Basic Framework of Data Driven Transformation

The basic framework of data-driven product transformation includes four key links: data collection, data processing, data analysis and decision optimization. The process of data-driven transformation is shown in Figure 1.
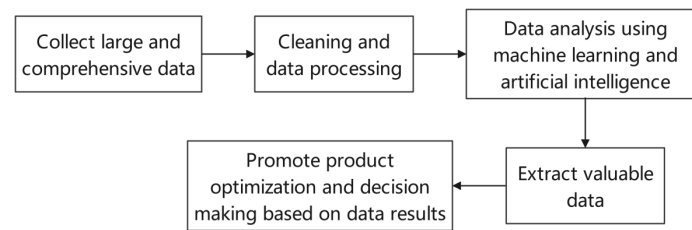
Figure 1. Data Driven Transformation Process.

Data collection marks the initial stage of enterprise transformation. Through various channels, such as user interaction, market response, social platforms, and Internet of things devices, enterprises have gathered huge amounts of data. These data not only reflect consumer behavior patterns and needs, but also encompass market dynamics, competitor status, and the latest industry developments. Processing the collected information is a key step to ensure the data quality, because the preliminary collected data is often accompanied by interference, omission or unnecessary repetition, and must be cleaned, de duplicated and formatted. The processed data will be more accurate and unified, providing a solid foundation for in-depth analysis. In the process of data-driven transformation, data analysis plays a crucial role. With the help of statistics, machine learning, artificial intelligence, and other technical methods, enterprises can extract valuable insights from massive datasets. This process helps to mine the rules of user behavior, predict the market development trend and fine adjust the product attributes. Relying on the insights provided by data analysis, enterprises can make more accurate decisions on product development, pricing policy and resource allocation [1]. Data driven decision-making process can significantly reduce the error caused by personal assumptions, and can quickly respond to market fluctuations. With the support of a comprehensive data feedback environment, enterprises can continuously upgrade and innovate their products, thereby completing the transformation from traditional operations to a data-driven operational model.

2.2. Core Technology of Data Driven Product Transformation

In the data-driven product transformation, the core technologies involved include big data technology, intelligent algorithm, data visualization technology, cloud computing technology and Internet of things technology. Among them, big data technology is responsible for the collection and preservation of data. Intelligent algorithms such as machine learning and artificial intelligence are crucial in data analysis. Enterprises use a variety of algorithms, such as deep learning, supervised learning, and unsupervised learning, to uncover underlying patterns within the data. These insights enable intelligent predictive analysis and personalized recommendations, guiding product optimization and marketing strategy formulation [2]. Data visualization technology transforms the complicated data information into intuitive visual elements, which is convenient for decision makers to quickly grasp the essence of data analysis. By leveraging a dynamic visual control platform, enterprises can monitor product usage and market feedback in near real time, allowing them to effectively adjust their strategies. With its powerful computing and storage capabilities, cloud computing technology enables enterprises to flexibly allocate resources based on real-time demands. This approach effectively reduces the economic burden of technological investment and daily maintenance, while enhancing the system's adaptability and scalability. The Internet of things technology realizes the real-time data collection by deploying sensors and intelligent devices, so as to promote the intelligent process of products. IOT technology can track the application status of products and users' usage habits in real time, and then provide accurate experience feedback information for optimizing users' feelings. The comprehensive application of the above technologies has promoted the realization of the data-driven transformation path, and has made significant progress in the highly intelligent and customized products [3].

3. Practice of Data Driven Product Transformation and Income Growth

3.1. Product Iteration and Optimization Based on Data Analysis

Based on data analysis results, enterprises continuously upgrade and improve their products. This process involves enterprises collecting user information, studying market reactions and user behavior patterns, and then correcting and improving the performance, appearance and user interaction experience of the product. Taking Netflix's recommendation system as an example, the company has demonstrated the power of its data analysis in digging deep into the large-scale data of users' viewing habits. By collecting and carefully studying users' viewing behavior on the platform, such as session length, skipped segments, and user ratings, Netflix can gain insight into users' movie viewing preferences. Relying on these in-depth data insights, Netflix continues to iterate and optimize its services, especially in its personalized recommendation algorithm. After the user finishes watching a work, the system will intelligently recommend the relevant film and television content according to the user's viewing tendency, and optimize the accuracy of the recommendation algorithm by relying on the continuous analysis of the user's interactive data. In the process of upgrading Netflix's products, its recommendation algorithm has been further enhanced and a new dimension of social behavior analysis has been introduced, that is, the user's social network and their friends' movie preferences. With the in-depth mining of these social data, Netflix can not only customize the recommended content based on the user's personal movie viewing history, but also provide personalized movie recommendations based on the user's movie viewing behavior in the social circle. These improvements have contributed to longer user engagement times and a stronger sense of loyalty to the platform. With the help of continuous data tracking, Netflix can instantly grasp the response of users to recommended content, and then quickly optimize and adjust. It is this rapid iteration strategy relying on data feedback that keeps Netflix in the lead among many video service providers [4].

3.2. Intelligent Products and Data Driven Innovation

During the product design and development stage, enterprises rely on data collection and intelligent analysis to promote product intelligence and innovation. This process is intelligent product and data-driven innovation. Taking Tesla's automatic navigation technology as an example, it significantly demonstrates the practical application of this innovative model. Tesla's autonomous driving technology is based on real-time driving data collected from sensors, cameras, radars, and other hardware installed in the vehicle. The system then performs in-depth learning and continuous refinement based on these data. The various traffic conditions, driving habits, road conditions and other data collected by the system during vehicle driving help Tesla continuously refine its automatic driving algorithm, so as to enhance the safety and accuracy of driving. Whenever the automatic driving mode is activated, Tesla vehicles will immediately send the driving data to the company's remote server. By studying these data, Tesla not only upgraded the automatic driving algorithm, but also personalized adjusted the response mechanism of the system according to the characteristics of different regions and driving environments. In the changeable urban traffic environment, the automatic driving system often emphasizes the ability to quickly respond to emergencies, while in the high-speed section, it is more inclined to automatically control the vehicle spacing and speed. Tesla uses over-the-air updates to allow vehicles to receive the latest autonomous driving software without requiring manual intervention from the user. Such updates rely on vast amounts of driving data to continuously optimize the algorithm, thereby enhancing the system's performance and decision-making capabilities. This approach of Tesla not only realizes the continuous upgrading and improvement of product functions, but also reduces the cost and time consumption caused by traditional car manufacturers' having to rely on hardware updates through wireless upgrades, so as to meet the needs of consumers and market dynamics more quickly.

3.3. Revenue Growth Model Based on Big Data

Using the revenue growth model built by big data, through refined market situation, user activities and product performance analysis, help enterprises accurately lock in the active area of revenue growth, and then formulate appropriate business models accordingly. Taking Amazon's flexible price adjustment strategy as an example, Amazon successfully implemented the dynamic pricing strategy through in-depth mining of massive data, which significantly improved its overall profitability. The pricing mechanism takes into account market demand, competitor pricing, past sales performance, inventory levels, and other relevant factors to enable real-time price adjustments. These data sources cover Amazon's own platform data, and also extend to other retailers' data and market dynamics. In the actual operation process, Amazon uses advanced machine learning technology to track the sales dynamics of goods in real time and predict the fluctuation of demand in the short term [5]. When the sales volume of a commodity suddenly rises, the system will raise the price accordingly; On the contrary, when sales decline, prices will fall. For goods with good sales volume, Amazon will seize the opportunity to raise prices to maximize revenue; For goods with slow sales, the rapid turnover of inventory is promoted by means of price reduction. Amazon has implemented personalized pricing strategies for different consumer segments through in-depth mining and analysis of large-scale data. Based on multi-dimensional information such as customers' shopping history, online browsing behavior, and general regional market conditions, the platform customizes special offers and promotions for individual users. With the big data-driven real-time pricing mechanism, Amazon has maintained a steady increase in revenue in the competitive e-commerce field. Relying on the pricing strategy guided by data, Amazon has successfully improved the market competitiveness of its products and achieved higher profitability and sales volume growth.

4. Practical Case Analysis of Data Driven Product Transformation and Income Growth

With its vast consumer base and global network of physical stores, Starbucks is committed to transforming its products and services through data analysis and artificial intelligence technologies. Starbucks has collected a large amount of user data through its mobile client and membership system, covering diversified information such as customers' consumption habits, purchase frequency, commodity preferences and location. Using these rich data resources, Starbucks has successfully refined its product recommendation system, inventory management, price strategy and customized marketing activities. These measures have significantly enhanced customer satisfaction and directly contributed to increased revenue.

4.1. Implementation Process of Data Driven Product Transformation

Starbucks' data-driven product transformation has gone through many stages, from the construction of infrastructure to the in-depth application of data analysis, continuously optimizing the product strategy and user experience. Starbucks' data-driven product transformation process is shown in Figure 2.
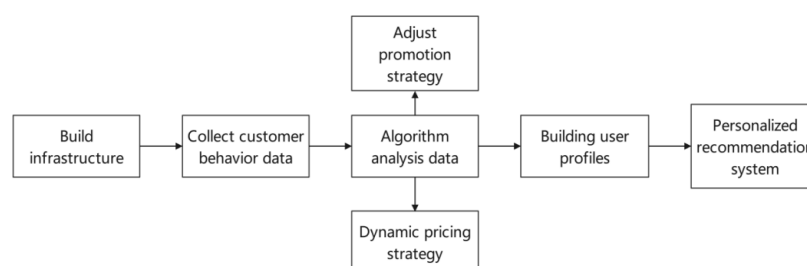

Figure 2. Starbucks' Data Driven Product Transformation Process.

4.1.1. Data Collection and Infrastructure Construction

Starbucks prioritizes data collection and the development of a robust data infrastructure. With the help of POS, mobile payment platform and its own mobile client applications, Starbucks has collected a large number of consumer data. The data covers many details such as consumers' shopping habits, payment methods, commodity preferences and location, laying a solid foundation for data analysis.

4.1.2. Data Analysis and User Portrait Construction

Through the application of intelligent algorithms, Starbucks makes an in-depth analysis of consumers' buying habits and creates an accurate user image. The company is able to distinguish between "daily coffee lovers" and "weekend coffee lovers", and subsequently tailor promotional strategies for different consumer segments.

4.1.3. Personalized Product Recommendation and Promotion Optimization

Through in-depth analysis of consumer data, Starbucks has developed a set of personalized recommendation system, which recommends drinks and foods that customers may prefer in mobile applications. On the way to work, customers will receive coffee recommendations with refreshing effect; In the hot season, you will receive cool cold drinks and fruit tea information. Starbucks also used data analysis to optimize its marketing strategies and launched a "buy one get one free" promotion based on customer purchasing records to boost repurchase rates.

4.2. Direct Impact of Data Driven Transformation on Income Growth

Starbucks' data-driven transformation has a direct impact on revenue growth, especially in the promotion of personalized product recommendation and mobile terminal sales. The formula for income growth is:

$$S = (U \times M) \times (1 + G) \tag{1}$$

Where S is the total revenue, U is the growth of the number of users, M is the consumption amount of a single user, and G is the growth rate. Key data before and after the transformation are shown in Table 1.

Table 1. Key Data before and after Transformation.

Index	Before transformation (2020)	After transformation (2023)	Growth rate
Annual revenue (US $100 million)	265	320	+20.75%
Number of member users (million)	190	250	+31.6%
Repurchase rate	45%	63%	+40%
Proportion of mobile terminal sales	25%	45%	+80%
Promotion conversion rate	12%	18%	+50%

Data-driven personalized recommendations and precision marketing strategies have effectively increased customer repurchase rates and overall purchasing engagement. In particular, Starbucks used its mobile application and membership system to create personalized promotion and recommendation services, which increased the repurchase rate of members from 45% to 63%. With the help of mobile applications, consumers can place an order in advance and choose self delivery or delivery services, which greatly shortens the waiting time in the store and optimizes the shopping experience. By analyzing the annual revenue, repurchase rate and the proportion of mobile sales before and after the transformation, it is obvious that Starbucks' revenue growth has increased significantly after the implementation of data-driven transformation.

4.3. Data Driven Transformation Improves User Experience and Market Competitiveness

User experience is primarily evaluated through satisfaction scores and average order waiting times, while market competitiveness is assessed via user engagement metrics and market share growth. The formula for the growth of competitiveness index (market share) is:

$$M = \frac{S_{after} - S_{front}}{S_{after}} \times 100 \tag{2}$$

Among them, M is the market share growth, S_{after} is the market share after the transformation, S_{front} is the market share before the transformation. The comparison of indicators before and after the transformation is shown in Table 2.

Table 2. Comparison of Indicators before and after Transformation.

Index	Before transformation (2020)	After transformation (2023)	Improvement Rate
User satisfaction score	7.5/10	9.2/10	+22.7%
Order waiting time (minutes)	7.5	4.8	-36%
User stickiness (weekly activity rate)	40%	58%	+45%
Competitiveness index (market share)	35%	42%	+20%

From the perspective of market competitiveness, Starbucks has achieved a significant increase in market share after the data-driven transformation. Through precise data analytics, Starbucks was able to adjust its product offerings and marketing strategies in response to evolving market demands and individual consumer preferences, reduce customer waiting times and increase user engagement. The comparative data reveal that data-driven transformation significantly enhanced both user satisfaction and market share, underscoring its crucial role in improving user experience and competitiveness.

5. Conclusion

In the era of digital transformation, leveraging data to enhance product value has become a key factor in shaping enterprise competitiveness. The product upgrade with data as the core not only reshapes the business process of the enterprise, but also promotes the precise docking of market trends and product iterations. Industry leaders such as Starbucks and Tesla have implemented personalized recommendation systems, intelligent product innovations, and dynamic pricing strategies with the help of in-depth data analysis, which not only greatly enriched the user experience, but also significantly improved profitability and market share. This transformation relies not only on technological innovation but also on the ongoing refinement of strategic planning and execution capabilities within enterprises. Data driven transformation is a dynamic development process. With the improvement of technology level, enterprises will more accurately capture market demand, provide customized solutions, and promote revenue growth and continuous improvement of market competitiveness. Enterprises must continuously refine their strategic direction and enhance product differentiation based on ongoing data collection and analysis in the continuous data collection and analysis to cope with the continuous evolution of the market and ensure to maintain the leading edge in the highly competitive environment. Data driven transformation is not only a technological leap, but also a key path for enterprises to build new competitive advantages in the digital era.

References

1.   A. Anand, J. Petzschmann, K. Strecker, R. Braunbehrens, A. Kaifel, C. L. Bottasso, et al., "Profit-optimal data-driven operation of a hybrid power plant participating in energy markets," *J. Phys.: Conf. Ser.,* vol. 2767, no. 9, p. 092069, Jun. 2024, doi: 10.1088/1742-6596/2767/9/092069.

2.   M. Mubanga and J. Phiri, "Using a data-driven model to predict taxpayers filing false returns: A case of Zambia Revenue Authority," in *Int. Congr. Inf. Commun. Technol.*, Singapore: Springer Nature Singapore, Feb. 2024, pp. 421–431, doi: 10.1007/978-981-97-3556-3_34.

3.   A. M. Krais, B. V. W. de Joode, E. R. Liljedahl, A. J. Blomberg, A. Rönnholm, M. Bengtsson, *et al.*, "Detection of the fungicide transformation product 4-hydroxychlorothalonil in serum of pregnant women from Sweden and Costa Rica," *J. Expo. Sci. Environ. Epidemiol.*, vol. 34, no. 2, pp. 270–277, 2024, doi: 10.1038/s41370-023-00580-8.

4.   F. Babaei, R. B. Boozarjomehry, Z. K. Ravandi, and M. R. Pishvaie, "Enabling digital transformation of dynamic location-inventory-routing optimization in natural gas-to-product and energy networks via a domain-adaptable ontological agent-based framework," *Adv. Eng. Inform.*, vol. 60, p. 102380, 2024, doi: 10.1016/j.aei.2024.102380.

5.   V. Haputhanthrige, I. Asghar, S. Saleem, and S. Shamim, "The impact of a skill-driven model on scrum teams in software projects: A catalyst for digital transformation," *Systems*, vol. 12, no. 5, p. 149, 2024, doi: 10.3390/systems12050149.