

Changes of Consumer Purchase Behavior Under Data Mining Technology

Zijie Chen¹, Rosita Binti Mohd Tajuddin, Benhui Ren and Jing Deng
College of Creative Arts, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Malaysia

Abstract. In the era of rapid development of data mining technology, diversified consumption channels have led to changes in consumer online shopping behavior. In the face of changes in consumer purchasing behavior and driven by resources, demand and data, enterprises need to innovate business models. This article aims to summarize and summarize the connotation of data mining technology, analyze the changes in consumer purchasing behavior under data mining technology, identify the dilemma of business innovation, and propose business model innovation strategies to provide management decision-making reference for enterprise e-commerce platforms. The main changes of consumers' purchasing behavior: more rational choice of brands, more emphasis on personalized services and contract spirit, more self-directed consciousness, but the supporting policies, marketing ability, cooperation ability and risk management ability in the business model fail to keep pace with the times. Therefore, this paper gives relevant targeted strategies: create a 'government+society' policy support environment, pay attention to the value of user experience, upgrade business cooperation, and strengthen risk management, so as to keep up with the pace of consumer purchase behavior changes under the data mining technology.

Keywords. Data mining, Purchasing behavior, Business model

1. Introduction

Data mining technology is deeply integrated into the e-commerce industry. In the process of online shopping, businesses use the data left by users in online shopping to mine and analyze users' behavior information and guess preferences and concerns [1]. Driven by the development of data mining technology, the change of demand, intention and perceptual behavior affect the change of consumer behavior [2]. The business model of businesses needs to be adjusted in time according to the change of consumer behavior. Consumers also put forward higher requirements for the brand, contract spirit and service safety of consumer products [3]. How to use data mining technology combined with the change of consumer purchase behavior to drive the effective innovation of business model, so as to ensure that consumption has become a positive driving force for economic development is a topic worthy of in-depth study. This paper first summarizes the relevant literature review, then finds new difficulties and analyzes problems, and finally puts forward suggestions and countermeasures. Through analysis and summary, it is concluded that in the era of data mining, business model innovation should be based

¹ Corresponding author, Zijie Chen, College of Creative Arts, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Malaysia. E-mail: huang87956673@163.com.

on changes in consumer behavior, understand consumers' feelings for brands, form a top-level policy pattern of "government+society", comprehensively improve the brand market, and fully meet consumers' perceptual needs. Tap the maximum demand of consumers, improve the ability to discover new businesses and new markets in time through data, consolidate the underlying logic of enterprise profits, timely innovate the business model and scientifically carry out the future strategic layout of the enterprise. It is found that the idea of consumer contract has changed, and the resource integration has been realized through the efficient service platform system, which makes the business cooperation more flexible and convenient. Optimize the risk management system. Respect consumers' choice of goods, establish a risk case database based on consumer choice factors, reduce the occurrence of similar risks, so as to more effectively control the risk of business model innovation in the context of data mining in advance.

2. Literature review on Data Mining

Data mining is the basis of artificial intelligence or machine learning. At present, it is mainly to mine all kinds of useful information from complex and changeable data for industry use. Data mining is usually divided into three steps: data preparation, data discovery and data representation [4]. Because data mining technology involves a wide range of fields, scholars from different research directions use different classification methods for research. What is mentioned here is the data mining classification methods that have been learned in professional knowledge textbooks at this stage, which can be roughly divided into the following four categories: statistical learning methods, machine learning methods, neural networks and database methods [5].

In the context of big data, 'data mining' technology has been widely used in all aspects of life. No matter in health care or app development, or in finance, education and other fields, you can see the traces left by data mining technology everywhere. The application of data mining technology in all walks of life shows the importance of big data in society [6]. For example, in the financial sector, most banks provide customers with a variety of savings services, insurance services or investment services [7]. In sales, data mining technology plays an important role in accumulating sales customers, dividing sales groups, and counting sales data [8]. In scientific research, the application of data mining, such as observation satellites, remote sensors, DNA molecular technology and so on, is very important [9].

With the wider application of data mining technology in the e-commerce industry, businesses can develop precise marketing strategies to conduct more in-depth analysis of existing data, such as customer segmentation and customer churn analysis [10]. Enterprises can use data mining technology to analyze sales data, identifying important customers, valuable customers, and new customers. Based on the attributes of different customers, they can infer which customers may be lost, which may have an impact on the sales of some products. This technology can also be used for time series analysis from the perspective of customer value. [11].

Data mining technology is based on customers' purchase behavior, as well as customers' own characteristics and attributes, and uses data mining to infer customers' future purchase behavior through comprehensive analysis of different dimensions [12]. That is to say, further management based on customer value can also realize store cross sales analysis, collaborative filtering recommendation, deepening customer purchase and mining customer value [13]. At the same time, the big data visualization technology can

also be used to analyze and infer the influence of customers in society, so that stores can carry out one-to-one precise sales, such as giving different discounts and preferences to customers with different influence [14]. In particular, the technology can also be used to provide personalized service mode based on customer characteristics, which not only improves the service quality, but also increases the sales profit of stores [15].

3. Research Process of Consumer Behavior Data Mining

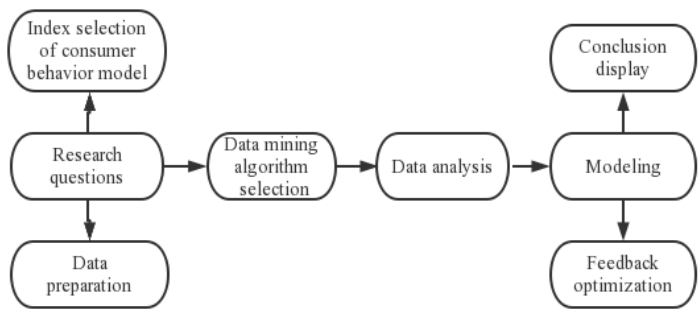


Figure 1. Consumer behavior flow chart of data mining

4. Comparative analysis of data mining algorithms

Table 1. The advantages and disadvantages comparative analysis of data mining algorithm

Algorithm name	Advantage	Disadvantage	Role
clustering algorithm	Solve numerical data	Unable to process text data, the algorithm sometimes needs to be improved	Mainly used for classification
Decision tree algorithm	The model has high efficiency and small amount of calculation	Difficult to handle continuous data	Used for forecasting and rule exploration, such as consumer churn early warning analysis
Association algorithm	Clear results, time-consuming and controllable	It is easy to ignore rare data, and the amount of calculation increases rapidly	Used for correlation analysis to find the correlation between things
Regression analysis	Clarify the relationship between variables and determine the degree of correlation	Interactions and non-linear relationships maybe ignored	For correlation analysis and hypothesis testing

5. Consumer behavior change and business innovation dilemma under data mining

Under the background of data mining, consumers choose brands more rationally, pay attention to personalized service and contract spirit, and enhance their safety awareness, but the supporting policies, marketing ability, cooperation ability and risk management ability required by the business model have not been improved in time.

5.1. *Consumers pay more attention to brand rationality*

Consumers' choice of brand is more rational, but the business strategy is insufficient. In the era of big data, Consumers no longer rely solely on advertising to judge the quality of a brand, and their decision-making behavior is becoming more and more rational [16]. Data mining technology makes information transparent, so that consumers are willing to spend more time and cognition to determine the final product choice, and rationally analyze the differences between brands in the form of data, so as to select the product that best meets the needs of consumers [17]. When a brand's products are far away from its needs, consumer loyalty will decline. Even in the context involvement stage, consumers will be affected by the online platform evaluation results and social media product purchase evaluation and turn to other brands [18]. It can be seen that at this stage, consumers' attention to brand rationality hides the problem of choice anxiety, which is largely due to the lack of brand management and the corresponding strategies are not in place.

5.2. *Consumers pay more attention to personalized services*

Personalized service is also the new demand of today's consumers, but the enterprise's exclusive big data capability is insufficient. The young consumer group's outlook on career, life and consumption is more personalized, and many middle-aged and elderly people have joined the Internet consumer group, showing diversified characteristics such as focusing on experience and giving priority to interest [19]. The overall consumption demand of consumers has been upgraded from meeting the basic needs of life to the refinement of all aspects of life, and the personalization and complexity have been continuously improved [20]. At this stage, most enterprises lack the ability of big data, lack the ability to obtain data mining resources, and lack data mining professionals, resulting in inaccurate grasp of the development trend of big data, lack of ability to use big data to locate consumer groups, and a large number of data resources are in a wasteful state.

5.3. *Consumers pay more attention to the spirit of re contract*

The new contract spirit has become a trend, but the enterprise industry barriers have not been broken through. The unremitting efforts of the state in the field of network security and the in-depth response of enterprises based on the consumer information have, to a large extent, prompted consumers to re-examine the spirit of contract, and it has gradually become a trend to buy 'owned' items to buy 'shared' items [21]. However, the ability to share data between different enterprises has not been improved in time, and consumer data may be cross cutting. In the face of this situation, enterprises are affected by traditional trade barriers and trade barriers in the era of big data. The insufficient and

low quality of consumer data directly affects the establishment of a close relationship between enterprises and consumers. The gap between the spirit of contract held by consumers and the connotation of enterprise business model continues to widen, which is not conducive to the breakthrough of industrial barriers.

5.4. Consumers pay more attention to self leading

Enhanced consumer subjectivity is easy to change the result of purchase choice, but the commercial risk is large. Consumers are faced with more choices of content and methods, which are affected by more objective factors, and the subjective dominance of consumption is stronger [22]. In many cases, it is easy for consumers to change their choice results through virtual purchase, or their consumption behavior has occurred and may change their choice again, bringing some unpredictable risks to the operation of enterprises [23]. The fundamental reason is that consumers' choice cost is low, but it has a great negative impact on enterprises. If the enterprise does not have certain anti risk ability, the existing business model may collapse at a faster speed, and it is too late to improve the corresponding risk management mechanism. This is a practical problem faced by many enterprises at this stage. Enterprises are likely to fail in their innovative business model due to the lack of this aspect.

6. Conclusions and Countermeasures

In the era of data mining, business model innovation should be based on the change of consumer behavior, actively create a business environment supported by the government and society, respect the value of consumer experience, reshape the cooperative relationship, and optimize the risk management system.

6.1. Understand consumers' brand feelings

Understand consumers' brand feelings and create a 'government+society' policy support environment. Under the influence of data mining technology, the environment created by the 'government+society' policy support can enhance the connotation and mode of brand, play a macro-control and even decisive role in brand management. The layout of government policies represents a system, which can guide the brand management and application of relevant departments and social enterprises in the general direction, broaden the development path of society and enterprises. As a stakeholder of business model innovation, the government should formulate an open policy in line with the development of commercial brands in the era of big data, and at the same time, with the assistance of special support policies [24], invest in the development of a big data commercial brand promotion platform, build a bridge between different enterprises, and promote the interconnection of different brands. On this solid basis, the government should further strengthen legislation and supervision in the face of the characteristics of prominent consumer information property rights in the era of big data, weak personal controllability, wider scope, easy disclosure, and both public and private. To this end, the government can improve the technical specifications for information security, personal information security specifications and other policy documents, specify the scope of personal data and enterprise data, and clearly define the legal, personality and

public attributes of consumer personal information, so as to enhance the attention of all sectors of society to data security [25].

6.2. Tap the biggest demand of consumers

Tap the maximum demand of consumers and strengthen the marketing operation ability. Enterprises should continue to expand the source of data resources, accurately locate consumer groups, and obtain accurate data. As a specific resource required by enterprises and even different departments, enterprises should combine their business scope with consumer data, make effective use of data analysis functions, adjust the direction of data processing and integration, realize the demand of extracting value from consumer data information, promote resource reorganization and integration, improve the ability of personal data analysis and problem solving, and accelerate the process of digitalization of individuals and enterprises. At the same time, enterprises also need to regularly organize employees to carry out data analysis reports, grasp the regions and platforms where consumers are mainly concentrated, realize user sinking, improve the ability to discover new businesses and new markets in time through data, consolidate the underlying logic of enterprise profits, timely innovate business models, and scientifically carry out the future strategic layout of enterprises [26].

6.3. Comply with the change of consumer contract concept

Comply with the change of consumer contract concept and upgrade business cooperation. In the data age, consumers' concept has changed from passive to active. They not only have a single understanding of the contract between themselves and enterprises, but also can understand the needs of enterprises to collect information. Enterprises should recognize the significant changes in consumer concepts, upgrade the business cooperation relationship in the business model, and enhance the sharing ability of 'partner+customer relationship' exchange. In the innovation of business model, the cooperation relationship is more subtle. We should not continue to rely on the so-called experience to perceive the market, but should use the big data platform to establish online cooperation relationship [27]. Enterprises should also make good use of the large-scale platform mode, use the effective service system and transaction space, and promote the formation of extensive cooperative relations between two or more enterprises to form a value-added effect. Therefore, the platform model can become a business model innovation, help enterprises accurately expand their business scope, form a new relationship of comprehensive perception and wisdom exchange between people, people and machines, people and things, promote enterprises and industries to break through barriers by using big data, realize resource integration through efficient service platform system, and make business cooperation more flexible and convenient [28].

6.4. Respect consumers' choice

Respect consumers' choices and strengthen risk management. In the process of business model innovation, the increase of uncertain factors in enterprise activities, the increase of the probability of uncertain consumer behavior and some unpredictable and uncontrollable factors jointly lead to the increase of enterprise risk [29]. It is urgent to build a risk identification framework for business model innovation, and subdivide environmental analysis, model design, organizational planning and model

implementation as macro modules. Environmental analysis should comprehensively analyze the external environment and consider customers, partners, suppliers, governments and social organizations. The risk management system should integrate and analyze the environmental subjects involved by using big data in combination with relevant theories, enterprise conditions and network environment. The pattern design module should identify the most attractive value proposition of the enterprise, analyze the potential and potential risks of value creation and innovation by using the use value and customer perception. The organization planning module comprehensively analyzes the enterprise infrastructure, the organization and coordination ability of personnel at all levels, personnel quality, employee recognition, consumer recognition and other factors, and obtains the possible risk categories of human resources using data technology software and hardware resources. The mode implementation module focuses on the recent stakeholders around the interests of the enterprise, as well as the macro risks posed by the economy, laws and policies. For the former, the risk analysis index can be refined to supplier bargaining power, competitor price strategy, partner information sharing and enterprise technology cooperation ability. For the latter, the analysis of risk indicators can be specific to social and economic stability, legal improvement and government policy support. Therefore, enterprises should further improve the risk early warning system, preset risk emergency plans, and establish a risk case database based on consumer selection factors to reduce the occurrence of similar risks, so as to more effectively control the risk of business model innovation in the context of data mining in advance [30].

References

- [1] Cai Yifan. Research on online purchase behavior prediction based on user clustering and feature selection [Internet] [Master]. Huazhong University of science and technology; 2019 [see cited on August 3, 2023]. https://kns.cnki.net/kcms2/article/abstract?v=3uoqlhG8C475K0m_zrgu4lQARvvp2SAkEcTGK3Qt5VuzQzk0e7M1z2ILn4Bf5QXfCulhJTp3xBVts0tFEBI4-7QWFag4Bir&uniplatform=NZKPT
- [2] Yang Dan. Research on Consumer Behavior and Precision Marketing in the Era of Big Data [Internet] [Master]. Shanghai University of Engineering and Technology; 2015 [see cited on September 15, 2023]. https://kns.cnki.net/kcms2/article/abstract?v=3uoqlhG8C475K0m_zrgu4lQARvvp2SAkVnKpvpjdBoadmPonNwLRuZyjMsvzbWum03obSQGa7rDqAkT6tMGrqIXMHKTJ2K83O&uniplatform=NZKPT
- [3] Chen Kun. Research on consumer behavior changes and business model innovation in the era of big data. *Journal of Shenyang Agricultural University (Social Sciences Edition)*. 2022;24(6):678–82.
- [4] Niu Jiahui. Analysis of the Application of Data Mining in Human Resource Informationization Management. *Digital Communication World*. 2022;(3):94–6.
- [5] Zhang Liyi, Li Yiran, Wen Xuan. Research on Predicting New Consumers' Repetitive Purchase Intention. *Data Analysis and Knowledge Discovery*. 2018;2(11):10–8.
- [6] Sunhare P, Chowdhary RR, Chattopadhyay MK. Internet of things and data mining: An application oriented survey. *Journal of King Saud University-Computer and Information Sciences*. 2022;34(6):3569–90.
- [7] Regin R, Rajest SS, Shynu T. A Review of Secure Neural Networks and Big Data Mining Applications in Financial Risk Assessment. *Central Asian Journal of Innovations on Tourism Management and Finance*. 2023;4(2):73–90.
- [8] Ramageri BM, Desai BL. Role of data mining in retail sector. *International Journal on Computer Science and Engineering*. 2013;5(1):47.
- [9] Liu Kui. Application of data mining method based on digital neural network in CRM [Internet] [Master]. Sichuan University; 2004 [see cited on 3 August 2023]. https://kns.cnki.net/kcms2/article/abstract?v=3uoqlhG8C475K0m_zrgu4h_jQYUCnj_co8vp4jCXsivDpWurecxftJTF2MS6zd8B5vrJyrheHOFTzAnMT4Fi6dRaD4n_r2Wk&uniplatform=NZKPT

- [10] Çelik O, Osmanoglu UO. Comparing to techniques used in customer churn analysis. *Journal of Multidisciplinary Developments*. 2019;4(1):30–8.
- [11] Zhao Tingting, Han Yajie, Yang Mengnan, Ren Dehua, Chen Yaru, Wang Yuan, Liu Jianzheng. A survey of time series data prediction methods based on machine learning. *Journal of Tianjin University of science and technology*. 2021;36(5):1–9.
- [12] Alghanam OA, Al-Khatib SN, Hiari MO. Data mining model for predicting customer purchase behavior in e-commerce context. *International Journal of Advanced Computer Science and Applications*. 2022;13(2).
- [13] Sumathi S, Sivanandam SN. Data mining in customer value and customer relationship management. *Introduction to Data Mining and its Applications*. 2006;321–86.
- [14] Zhang Guangkai. The application of big data technology in enterprise strategic management. *China's collective economy*. 2021;3(3):160–2.
- [15] Cheng X, Liu H. Personalized services research based on web data mining technology. Included in: 2009 Second International Symposium on Computational Intelligence and Design. IEEE; 2009. 177–80.
- [16] Yu J, Zhao J, Zhou C, Ren Y. Strategic business mode choices for e-commerce platforms under brand competition. *Journal of Theoretical and Applied Electronic Commerce Research*. 2022;17(4):1769–90.
- [17] Pina R, Dias Á. The influence of brand experiences on consumer-based brand equity. *Journal of brand Management*. 2021;28:99–115.
- [18] Yang Jie, Wang Lu. Influencing factors of consumers' repurchase intention under the mode of 'live+e-commerce'. *China's circulation economy*. 2021;35(11):56–66.
- [19] Vullam N, Vellela SS, Reddy V, Rao MV, SK KB, Roja D. Multi-Agent Personalized Recommendation System in E-Commerce based on User. Included in: 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC). IEEE; 2023.1194–9.
- [20] Li T, Ye X, Ryzhikh A. Consumer behavior in China and Russia: Comparative analysis. *BRICS Journal of Economics*. 2021;2(1):74–90.
- [21] Redine A, Deshpande S, Jebarajakirthy C, Surachartkumtonkun J. Impulse buying: A systematic literature review and future research directions. *International Journal of Consumer Studies*. 2023;47(1):3–41.
- [22] Haider M, Shannon R, Moschis GP. Sustainable consumption research and the role of marketing: A review of the literature (1976–2021). *Sustainability*. 2022;14(7):3999.
- [23] Wang RJH, Malthouse EC, Krishnamurthi L. On the go: How mobile shopping affects customer purchase behavior. *Journal of retailing*. 2015;91(2):217–34.
- [24] Chen CL, Lin YC, Chen WH, Chao CF, Pandia H. Role of government to enhance digital transformation in small service business. *Sustainability*. 2021;13(3):1028.
- [25] Ikenwe II, Igbinovia OM, Elogie AA. Information security in the digital age: The case of developing countries. *Chinese Librarianship: An International Electronic Journal*. 2016;42:16–24.
- [26] Lin R, Xie Z, Hao Y, Wang J. Improving high-tech enterprise innovation in big data environment: a combinative view of internal and external governance. *International Journal of Information Management*. 2020;50:575–85.
- [27] Chen Jianxin, Zhao Xiaoke. Reconstruction of retail business model under the background of big data: factor perspective. *Business economics research*. 2021;(16):21–4.
- [28] Ciampi F, Demi S, Magrini A, Marzi G, Papa A. Exploring the impact of big data analytics capabilities on business model innovation: The mediating role of entrepreneurial orientation. *Journal of Business Research*. 2021;123:1–13.
- [29] Horvath J, Gavurova B, Bacik R, Fedorko R. Identification of Uncertainty Factors in the Consumer Behaviour of the New Generation of Customers at the E-commerce Level. *Journal of Tourism and Services*. 2021;12(22):168–83.
- [30] Tohănean D, Buzatu AI, Baba CA, Georgescu B. Business model innovation through the use of digital technologies: Managing risks and creating sustainability. *Amfiteatru Economic*. 2020;22(55):758–74.