Big Data-Driven Business Model Innovation (BMI) From the Perspective of Ambidexterity: Case Study of L. Vending Intelligence

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ABSTRACT

This paper explores the dynamic path of business model innovation (BMI) driven by big data and builds a big data-driven BMI model based on ambidexterity perspective. Using the case study approach, this paper examines the ambidexterity theory and employs the structured-pragmatic-situational (SPS) research method to explore the BMI driven by big data. The findings are: 1) Companies could promote business innovation using big data from both exploratory and exploitative activities. 2) It is a dynamic process when the company promotes its BMI based on big data while balancing the ambidexterity activities. The paper illustrates the mechanism of ambidexterity for BMI driven by big data and sums up a theoretical model with general principles.

KEYWORDS

Ambidexterity, Big Data, Business Model Innovation (BMI), Case Study

INTRODUCTION

In the modern era, the competition among businesses is no longer centered on products or technology, but rather revolves around competing business models (Wang & Song, 2020). As suggested by management guru Drucker, a good business model is the core of enterprise competition, and a good business model means half success (Drucker, 1985; Wang, 2020). High-value Business Model Innovation (BMI) is the root cause of enterprise competitiveness (Zhang et al., 2021). BMI is a new
form of innovation, supplemental to innovation on a traditional product, technology, process, and organization (Casadesus-Masanell & Zhu, 2013). Designing innovative business models is a primary means for companies to improve their performance and competitiveness in the short term and to achieve long-term development (Hong et al., 2018). BMI has become the key for organizations to achieve high performance. Short of this, companies cannot achieve value and maintain a competitive advantage (Amit & Zott, 2012).

Despite the voluminous literature on BMI, issues are still related to operationalizing business model innovations (Minatogawa, et al., 2020). Prior studies primarily examine BMI from a process perspective, focusing on a single external view of change while ignoring the full utilization of existing corporate resources. Furthermore, there is a lack of consensus on the path and method of BMI companies can take to achieve success. Gao and Guan (2006) suggest that the innovation path involves expanding and reorientating value chain activities, while other researchers propose that BMI involves multi-element interaction and integrating systemic innovation (Demil & Lecocq, 2010). In particular, the implementation and management approach to BMI require further exploration. Much of the extant literature focuses on business model design, while there is still room for contribution to its validation and testing.

To address the gap in our understanding of the operationalization and building of ambidextrous capabilities for BMI, we turn to the literature on ambidexterity theory. Ambidexterity theory suggests an inherent conflict involving BMI, the tension between innovating and taking risks to pursue future growth opportunities versus managing existing assets in place. Successfully managing this tension requires ambidexterity, the balance between exploration and exploitation. However, achieving this balance is still debatable (Alizadeh and Jetter, 2019). Meanwhile, there is still a gap in our understanding of the underlying mechanisms, architectures, and dynamics by which organizations can achieve exploration and exploitation (Turner and Lee-Kelley, 2012). Although there is a consensus that ambidexterity significantly impacts the firm’s success, the question of how to build ambidextrous capability is still a matter of debate, and the recommendations are controversial to date. Furthermore, there has been little success in resolving or explaining the contradictions of different practices and even fewer practical insights into how and when such practices should be employed (Alizadeh and Jetter, 2019).

To operationalize and build ambidextrous capabilities for BMI, we review the literature on BMI through Big Data. We posit that big-data technology can facilitate BMI to achieve ambidexterity. The emergence of “big data” offers organizations unprecedented opportunities to gain and maintain a competitive advantage. Chaudhary et al. (2015) argue that big data platforms promise improved operational efficiencies and the generation of greater revenues with enhanced business growth. With the rapid development and widespread popularization of information technologies such as cloud computing, big data, the internet of things, artificial intelligence, blockchain, and mobile internet, the fourth industrial revolution is deeply integrated into society with the characteristics of digitization, networking, and intelligence of information technology (Ma & Zhang, 2022).

The value of big data for businesses has evolved from simple collection and storage to the subdivision of massive data mining. In the ongoing digital transformation, more industries are capitalizing on big data for innovation and business growth (Sultana et al., 2021). Companies use big data to make business analysis and decision-making and develop big-data-driven BMI with value innovation in operation management, marketing, resource integration, and strategic planning. As big data analytics penetrate deeply into organizational processes, firms with the more advanced deployment of big data have higher technology and information quality (Havierila et al., 2022). Yoo & Roh (2021) observe that firms are awash in big data and analytical technology as part of deriving values in the current turbulent environment. To exploit the strategic business potential embedded in big data, many organizations have innovated their business models or developed new ones, giving rise to big-data business models (Wiener et al., 2020; Sorescu, 2017). As a result, big data is becoming one of the primary driving forces of BMI (Sheng et al., 2017). Cheah and Wang (2017) develop a framework comprising perspectives, business model processes, and big data-driven business model
innovations. To a large extent, big data resources determine the growth direction of an enterprise and can change the management method and business model, bringing a competitive advantage to the firm (Bughin et al., 2011).

However, most studies on the big data business model literature concentrate on its technical or organizational aspects (Demirkan and Delen, 2013). Research on integrating big data into business model innovation is still in its infancy. Little empirical work analyzes the influence of big-data usage or capabilities on BMI (Ransbotham and Kiron, 2017; Ciampi et al., 2021). Indeed, there is limited literature synthesis integrating big data research in management and innovation research. There needs to be more research exploring the mechanism of ambidexterity for BMI driven by big data. Extant literature treats big data’s specific path and internal impact mechanism for BMI as a black box. In particular, little attention is paid to applying ambidexterity theory to the development path of BMI for Chinese companies.

To fill this gap, we integrate the three streams of literature on BMI, ambidexterity, and big data and propose to pursue BMI by leveraging big data to achieve ambidexterity. Specifically, we aim to develop a big-data-driven BMI model to achieve ambidexterity. Our study examines the relationship between BMI and potential big data capabilities. We analyze the mechanisms and pathways of BMI driven by big data as a dynamic process. We present a case study of a private company operating in a unique Chinese market environment to illustrate the mechanisms of BMI and the exploitation of big data analytics to achieve ambidexterity and value creation.

We conduct the case study in line with Zott and Amit (2010), conceptualizing a firm’s business model as a system of interdependent activities that transcends the focal firm and spans its boundaries. Zott and Amit (2010) suggest that we can view a business model as a template of how a firm conducts business, delivers value to stakeholders, and links factor and product markets. We focus on the activity system of the firm that can create value and transmit the value to shareholders and stakeholders. In other words, we examine the innovation pathways and mechanisms for BMI driven by big data and achieve ambidexterity. Our findings show that a firm can dynamically change its value network by balancing the ambidexterity of activities through big data technology and thus repeatedly achieve big-data-driven BMI.

Our study integrates the three streams of literature, i.e., the BMI literature, ambidexterity literature, and big-data literature, and fills the gaps at the various intersections of these three streams of literature.

First, our study fills the gaps in the BMI literature by incorporating the ambidexterity theory. We explore how to achieve the BMI by balancing ambidexterity activities. Our study shows that companies should focus on exploring potential resources and upgrading existing ones.

Second, our study opens the black box of internal mechanisms on BMI driven by big data. We study the ambidexterity of BMI, analyze the dynamic process, and excavate the specific pathways of corporate BMI. We analyze the L. Vending Intelligence case to illuminate how the implementation process of innovative activities eventually centers on the impact of exploratory and exploitative activities on the creating and transmitting corporate value.

Third, our analysis of Chinese companies emphasizes representativeness, particularity, and typicality. The rationale for representativeness is that China is the second-largest economy in the world, and the principal driving force for its economic growth is the development of private enterprises. The innovations of private enterprises account for a large proportion of the country’s innovations. Hence, the innovation in the private business sector is representative of China’s innovation as a whole. The particularity suggests that Chinese companies’ practices differ from Western companies. The innovation theories that originated in Western countries cannot invariably be directly applied to China. The typicality is that the company selected for our case study employs big data to drive its BMI and illustrates how to balance ambidexterity activities to achieve success.

Therefore, by incorporating ambidexterity theory, we explore the mechanisms and pathways of BMI driven by big data in organizations and develop a universal theoretical model with general principles. We provide empirical evidence and theoretical support for developing big-data-driven BMI
literature with important theoretical and practical implications. Overall, we contribute to the three streams of literature by providing a clear pathway to achieve ambidexterity for BMI through big data.

The rest of the paper proceeds as follows. First, a literature review on business model innovation, ambidexterity, and big data is provided. Grounded in the literature, the research framework is developed. Next, the research method, study sample, and data collection are detailed. The case study is then analyzed, and the findings are presented and discussed. The paper concludes by discussing the theoretical and practical implications, limitations, and potential areas for further research.

LITERATURE REVIEW AND RESEARCH FRAMEWORK

Business Models and BMI

Research on BMI has become a hot topic in recent years. The concept of a business model was first proposed in the 1950s, and we can divide the definition of a business model into three major directions (Wang et al., 2022). The first direction is based on the economic activities of an enterprise and describes how it generates profits and maintains earnings (Stewart & Zhao, 2000; Timmers, 1998). Emphasizing cost structure and sources of income is crucial in this direction (Huizingh, 2002). The second direction is centered on value creation, with strategy and business model mapping business processes, organizational forms, and enterprise management as the key factors for enterprises to consider (Casadesus-Masanell & Ricart, 2010; Zott & Amit, 2007). The third direction is based on system building, emphasizing the multi-dimensional integration and coordination of various factors, such as profitability, market positioning, value creation, organizational structure, and stakeholders (Peters et al., 2015). It is not a simple arrangement of various factors, but the mutual integration and construction of various factors to become a complete system (Ren et al., 2015). Innovation in any of these business model factors may trigger BMI.

Technological development has significantly subverted traditional enterprise models, allowing them to shift from traditional production distribution models to consumers (Teece, 2010). The development of information technology has reduced the cost of computation and communication, enabling enterprises to seek model innovation to adapt to the competitive environment and open a fresh round of commercial competition (Zott & Amit, 2010). Information technology promotes BMI through three mechanisms: learning, cross-interaction, and knowledge management (Li, 2012). Technological innovation has also accelerated the structural transformation of the upstream and downstream industries (Gambardella & McGahan, 2010). Technology capital is essential for innovation in business models, enabling innovative companies to gain greater market share. BMI includes innovation toward products, services, markets, channels, and value chains, requiring a change in traditional thinking and adopting innovative thinking from three perspectives: value, capital, and technology (Chesbrough, 2007; Koen et al., 2011).

Big Data

The world is transforming from an industrial to a digital economy, with data as a critical element and engine driving economic and social development. As a result, big data has emerged as a core competitive resource across various industries globally, with scholars defining it from three perspectives (Gong & Li, 2015). First, the attributive definition posits that big data has four characteristics: volume of data, variety of data types, a high data value, and high velocity of data processing, according to the International Data Center (IDC). Second, Franks (2012) defines big data as a collection of vast data that goes beyond the capacity of a general database for collection, storage, processing, and analysis. Finally, the architectural definition points out that enterprises’ current drive for big data promotion is mostly for the economic benefits they offer (Li & Cheng, 2012).

Big data has become an emerging technology as a crucial resource for creation and delivery and the core asset of an enterprise (Jing, 2014; Wang et al., 2016). Companies use big data to predict
market trends, consumer buying behavior, and product turnover cycles to reduce uncertainty in business decisions and activities (Kambatla et al., 2014; Salvador, 2014). Big data analytics for logistics and supply chain management have become an essential resource for companies as decisions for production and operation in big data rely on the ecological networks formed by partners, consumers, and even competitors (Feng et al., 2013). With the rise of cloud computing, big data, and the internet of things technology, intelligent manufacturing is transforming manufacturing models and upgrading the manufacturing industry (Deng, 2022).

Using big data analytics enables companies to extract hidden information that was previously not attainable, such as consumer preferences, customer relationships, and trading tendencies, through various data analyzes (Kambatla et al., 2014). Moreover, big data mining and analysis can accurately segment populations to implement precise marketing strategies (Ram et al., 2016). As a result, big data has become one of the major drivers of business model innovation, with the ability for creative destruction and transformation (Sheng et al., 2017). Moreover, big data analytics are essential for social entrepreneurship and sustainable development (Zulkefly et al., 2021).

Investing in big data can improve channel service levels, reduce channel prices, and enhance the income of the supply chain (Rong et al., 2022). Companies use big data to improve management systems, and business models, reduce corruption and enhance corporate social responsibility, manage risk, and develop smart factories and intelligent manufacturing, thus gaining competitive advantages (Bughin et al., 2011; Ma and Zhang, 2022; Qin and Xiang, 2022; Xing et al., 2022; and Zhang and Guo, 2022). Big data analytics capability is crucial for organizational performance (Xie et al., 2022).

Overall, big data can help to uncover potential market demand, promote products, and innovate services. The development of big data has provided a fresh round of innovation space for enterprises, enabling many commercial practices that were once impossible. It has become an essential tool for business model innovation, driving many BMIs across various industries worldwide.

**Ambidexterity**

Businesses face the persistent challenge of balancing continuous improvement with innovative problem-solving. Continuous business model innovations inherently create tension between innovation to adapt to environmental change and continuing to do what one does well and what current customers appreciate. Managing this tension successfully leads to ambidexterity (Alizdeh and Jetter, 2019). Raisch et al. (2009) document that the debate on ambidexterity has risen rapidly and that an organization’s long-term success depends on its ability to exploit its current capabilities while simultaneously exploring fundamentally new competencies.

March (1991) differentiates exploitation and exploration in ambidexterity, in that exploration refers to innovation, research, invention, creativity, new capabilities, and emerging industries, while exploitation refers to refining, selection, production, efficiency, selection, and implementation. He believes enterprises should have two capabilities of exploration and exploitation to adapt to changes in the external environment. We can consider innovation and learning in enterprises as exploratory activities, while activities based on existing knowledge are exploitative (Rosenkopf & Nerkar, 2001). Exploratory activities are essential for opening new markets. Meanwhile, exploitative activities are conducive to expanding the market share of existing products (Cao et al., 2010).

However, most scholars consider that exploration and exploitation are contradictory and complementary. Companies relying too much on original technology and experience in BMI (Zhu et al., 2009) may fail to explore emerging markets and seek long-term development. Similarly, companies focusing too much on exploration and blindly pursuing business change may cause enterprises to consume enormous resources for uncertain exploration results and lose their core competitiveness. Either exploitation or exploration alone cannot be completely compatible with corporate decision-making. Companies must strive to achieve an effective balance between exploration and exploitation to maximize the use of resources when innovating business models.
Ambidexterity allows companies to use existing capabilities to pursue incremental returns while exploring new opportunities with disruptive innovation (O’Reilly III & Tushman, 2004). The interaction between exploration and exploitation positively affects company performance (He & Wong, 2004). If enterprises want to achieve ambidexterity innovation, they need to balance factors, such as the distribution of benefits, behavior patterns, and ideology, so that the two eventually are consistent (Nadkarni & Narayanan, 2007). The complementarity of plans and projects can help achieve ambidexterity and implement strategic change (Pellegrinelli et al., 2015). Silva et al. (2021) find that ambidexterity is crucial in the SMEs’ speed of internationalization and that the manager’s cognitive systems can have a different influence on international exploitation and exploration.

Scholars have focused on defining the concepts of balancing ambidexterity to promote business development. However, there is a need for a greater understanding of the underlying mechanisms, architectures, and dynamics that enable firms to achieve both exploration and exploitation. The literature has limited empirical evidence on how exploitation and exploration can be achieved (Turner and Lee-Keylley, 2012). Exploratory activities provide companies with innovative opportunities, while exploitative activities improve the efficient use of existing resources (Huang et al., 2014). Thus, a greater understanding of the underlying mechanisms, architectures, and dynamics underlying the exploration and exploitation is necessary for achieving success.

Overall, ambidexterity is crucial for businesses to adapt to changes in the external environment while maintaining their core competencies. Ambidexterity allows companies to use existing capabilities to pursue incremental returns while exploring new opportunities with disruptive innovation. Companies must strive to achieve an effective balance between exploration and exploitation to maximize the use of resources when innovating business models.

The Research Framework
Grounded in the existing research, we draw on Amit and Zott (2012) to define BMI as an innovation in which enterprises create value for stakeholders and deliver value through new behavioral logic. Specifically, it is a process in which the firm builds, coordinates, integrates, and cooperates with its partners, transforms resources of all parties into new value, and then transmits it to consumers. Thus, a value network is created. The ambidexterity perspective refers to both exploration and exploitation. Huang et al. (2014) suggest that the exploration identifies innovation opportunities for enterprises, while the exploitation improves the efficient use of the company’s original resources.

We analyze the case of L.Vending Intelligence and show that a company can dynamically change its value network by balancing the ambidexterity of activities and thus repeatedly achieve BMI. We illustrate how big data is instrumental as a driving force for BMI. First, we examine how businesses employ big data technology for various exploratory and exploitative innovations. The implementation process of innovative activities eventually centers on the impact of exploratory and exploitative activities on creating and transmitting corporate value. Hence, our study attempts to open the black box of the ambidexterity mechanism in the innovation stage of the business model innovation. Finally, we show the research framework of this article in Figure 1.

RESEARCH DESIGN
Research Methods
This paper uses the case study approach (Yin, 2014) and the Structured-Pragmatic-Situational (SPS) method (Pan & Tan, 2011). The case study method is an empirical study of a real-life phenomenon by systematically collecting data and information to answer the “What, How and Why” questions. This method is suitable when the research object is multivariate, and variables affect each other, so researchers cannot reliably control these variables (Wang et al. 2022). Depending on different research purposes, we can divide case studies into exploration, description, and explanation (Yin, 2014).
This paper adopts a combination of the exploratory and explanatory case study methods. First, we analyze the development path for businesses to achieve BMI from the perspective of ambidexterity to address the question of “what” and “how.” Second, we focus on the cause-and-effect process to explore the mechanism of ambidexterity in the BMI using single-case analysis of exploratory and explanatory activities, which can help understand the causal connection between innovation path selection. Third, the single case study approach can analyze cases at an in-depth level, extract theories or development rules that help explain complex phenomena and explore new phenomena in management practice, which is conducive to the realization of the research purpose of this paper (Eisenhardt, 1989).

Study Sample

Our case selection goal is to more accurately grasp the causal relationship between events and reflect the advantages of the case study methodology. Moreover, we attempt to enhance the article’s persuasion and ensure the theoretical model’s robustness. We follow the following principles to select our case sample.

Typicality and Representativeness

A Positive Case: L. Vending Intelligence is a leading company in the vending machine industry. Driven by big data technology, it has carried out many BMIs, balanced exploratory and exploitative activities, and successfully implemented BMI repetitively.

From the ambidexterity perspective, this case represents positive and successful scenarios for big data-driven BMI, reflecting the principle of typicality and representativeness of case selection.

Adaptability Between the Theory and the Case Object

BMIs implemented in L. Vending Intelligence are all dominated by the development of big data technology. The innovation process considers the balance of ambidexterity and follows the appropriateness of theories and case studies.

This case study highlights the importance of balancing between exploratory and exploitative activities for companies to achieve BMI driven by big data.
Data Collection and Analysis Strategy

In the data collection stage, this paper chooses a combination of primary and secondary data sources to ensure the efficiency and authenticity of the data collection. For L. Vending Intelligence case, we conducted formal and informal interviews with the company’s presidents, vice presidents, and related staff. In addition, we obtained first-hand information by consulting the company files, which recorded the implementation process of the enterprise’s BMI. At the same time, we researched networks and databases to collect second-hand data as a supplement. Finally, we triangulated the data obtained from different sources and collection methods and selected credible data supported by multiple parties. When necessary, we consulted three experts and scholars to ensure the adequacy and authenticity of the case data in the research process.

First, in the data analysis stage, we integrate the original data chronologically, compare the first-hand and second-hand data, filter out inconsistent information, repeat verification by related personnel, remove the error information, and summarize and verify the original text. Second, we determine relevant issues and establish the research direction to meet the research goals based on our collected literature and materials. Third, we analyze the BMI development process of the selected case. Finally, based on our case study and conclusion, we construct the relevant theoretical framework and universal path model of BMI.

INTRODUCTION AND ANALYSIS OF L. VENDING INTELLIGENCE

Company Overview

Founded in 2007, Suzhou L. Vending Intelligence IOT Technology Co., Ltd. (L. Vending Intelligence) is a leading national operator of vending machines in China, providing an automatic sales model for Fast-moving Consumer Goods (FMCG) products such as beverages and instant food. Compared with the traditional retail model of supermarket stores, vending automatic sales and the convenience and intelligence of the sales process, which can significantly reduce operating costs characterize machines. L. Vending Intelligence seized the business opportunity and occupied high-quality placement sites for its vending machines in the core areas of first-tier cities and other important cities in China. Its market share ranked first in the industry.

In the early days, L. Vending’s operating model was relatively simple. First, L. Vending designed its vending machine and handed it to the equipment supplier for mass production. Its salesperson then searched for suitable vending machine placement sites. After that, L. Vending purchased FMCG products from the supplier to supplement the vending machine. Ultimately, consumers bought the desired goods by inserting banknotes or coins. L. Vending Intelligence would send a commissioner to check the sales of vending machines in real-time and regularly replenish products according to a fixed route. The company’s primary revenue came from the sale of goods and the advertising revenue on the vending machines.

As one of the earliest enterprises entering the vending machine industry, L. Vending quickly occupied the market with a first-mover advantage. Before 2010, it was one company that occupied the most market positions with the most vending machines in China. At the same time, L. Vending entered the market early and occupied a high-quality spot with a large flow of people. The turnover rate of the goods in the vending machine was high, realizing enormous profitability for the company.

Development Stage

Around 2010, many strong competitors, such as Youbao, entered the field of vending machines. L. Vending Intelligence fell from first to fourth in the industry in less than a year. The battle for high-quality nooks and crannies became increasingly fierce. As a result, L. Vending’s growth slowed down. L. Vending had to increase maintenance costs, such as site rents, to prevent the loss of existing market share. It urgently needed a new business model to replace the original business model. We present the main driving factors for its BMI in Table 1.
Stages of BMI

L. Vending Intelligence has experienced two important BMIs from 2012 to 2018.

The First BMI

In 2012, the homogeneity competition in the vending machine industry intensified. Various costs continued to rise. Companies had to reduce operating costs to compete for market positions. As a result, L. Vending’s market share dropped. L. Vending believed that the biggest problem faced was operational efficiency, especially the unreasonable replenishment caused by the substantial expansion of the replenishment system of the vending machine. Originally, L. Vending’s sales department had to arrange the same quantity and type of goods daily to supplement the goods in the vending machine with a fixed route and estimated quantity. This business model was prone to mismatch the type, demand, and quantities of supplementary goods. As a result, multiple re-deliveries were required, and operating costs increased. Consumers were increasingly inclined to use Alipay and WeChat as priority payment methods, given the ease of mobile payment technology. The traditional cash payment could no longer meet consumers’ demand for convenient and efficient shopping. L. Vending sought its first business transformation and BMI strategy, as shown in Table 2.

L. Vending needed to optimize its existing replenishment system to improve its competitive advantage. In 2013, L. Vending officially introduced big data technology and established an intelligent cloud management system to manage each vending machine at all market points accurately. The big

Table 1. The key drivers of BMI

<table>
<thead>
<tr>
<th>Core Constructs</th>
<th>Secondary Encoding</th>
<th>Three-Level Encoding</th>
<th>Examples of Typical Reference</th>
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<tbody>
<tr>
<td>Drivers of BMI</td>
<td>Market development</td>
<td>Market share shrinking rapidly</td>
<td>“L. Vending has been far ahead in the four or five years since its establishment. In just six months, the company’s market share has fallen from the first to the fourth.” - Comments from CEO</td>
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<tr>
<td>Value creation orientation</td>
<td>Competition is fierce, cost control has been unable to maintain a leading position</td>
<td>“Nowadays, the homogenization of vending machines is fierce. Everyone is struggling to compete for channel resources and reduce operating costs, but there is a ‘ceiling’. We cannot prevent the entry of opponents, but can only improve our competitive advantage... Only by truly understanding what consumers need and what they like can there be a market.” - Comments from CEO</td>
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<td>Technology driven</td>
<td>Comprehensively establish or introduce an information management system</td>
<td>“The company must apply Internet technology as soon as possible to catch a ride on technological development.” - Comments from CEO</td>
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Table 2. The first BMI strategy

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</thead>
<tbody>
<tr>
<td>BMI strategy</td>
<td>Optimize management system</td>
<td>Insufficient operational efficiency</td>
<td>“Every time I have to go to a lot of points for replenishment, I often find that the products do not match at all, the missing ones are not missing, and the ones are not missing, which wastes a lot of time and energy.” - Comments from Replenisher</td>
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<td></td>
<td>Cooperation with mobile payment platforms</td>
<td>Money and goods are not equal, consumption is not convenient</td>
<td>“Through field investigations of various vending machines, I found that cash payment is very inconvenient and sometimes malfunctions.” Comments from CEO</td>
</tr>
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</table>
data system calculated the optimal daily distribution route based on the sales and inventory information, thus shortening delivery time, reducing distribution cost, and continuously improving overall efficiency. Meanwhile, L. Vending actively developed new vending machines using mobile payment platforms such as Alipay and WeChat. Thus, optimizing transaction convenience and improving transaction efficiency increased sales and market share. Furthermore, mobile payment brought countless valuable consumer data to L. Vending, laying the foundation for its next BMI.

The deployment of big data helped L. Vending improve its operational efficiency and brought enormous economic profit.

The Second BMI

For vending machine operators, the number of market locations and the quality of sites are crucial. Unfortunately, by 2017, because of inadequate funds and technical support, L. Vending could not acquire high-quality market locations compared to its competitors.

L. Vending had already tasted the innovation benefits brought by big data technology in the first BMI. Hence, the company decided to fully introduce big data systems, develop and integrate technical resources, and improve the company’s core competitiveness. We illustrate the BMI strategy in Table 3. On the one hand, L. Vending expanded its vending machine intelligent cloud management system, gradually extending from merely supplementary inventory information to managing market sites. On the other hand, L. Vending found that focusing on salespeople to find market locations and increasing site rents could no longer effectively expand the market. Therefore, L. Vending quickly responded to the government’s policy of “Mass Entrepreneurship, Mass Innovation” (referred to as “double entrepreneurship”) and cooperated with small entrepreneurs. Although most entrepreneurs were students and office workers with limited funds, they could use their unique social relationships to find attractive spots and crannies. Moreover, these market spots were relatively reliable and would not be easily lost, and the cost of market maintenance was low (Wang, 2020). Subsequently, L. Vending regained its market share.

On the other hand, L. Vending used electronic payment channels such as Alipay and WeChat to obtain user and consumption data and used big data technology to evaluate these data comprehensively. First, L. Vending could accurately find what kind of product is suitable for what kind of points. Second, even for the same machine, the sales volume of products was not consistent in different periods. Third, the same product with a different brand might lead to different sales results. Fourth, L. Vending could conduct a sales scenario simulation analysis to sell more products, such as diapers, bandages, and other medical supplies in hospital vending machines, over-the-counter drugs in stadiums, and more. According

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</thead>
<tbody>
<tr>
<td>BMI strategy</td>
<td>Point expansion</td>
<td>Insufficient funds, points are seized by competitors</td>
<td>“The market point that originally cooperated with L. Vending proposed to raise the rent of the spot, or directly turn to cooperate with competitors. Thus, the market position and product sales did not rise but fell.” – Comments from CEO</td>
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<td></td>
<td>In-depth cooperation with mobile payment platforms</td>
<td>Insufficient consumer experience and stagnant sales growth</td>
<td>“More than a dozen operators have reached in-depth cooperation with Alipay... This made the market we reoccupied at that time become precarious...” – Comments from Marketing Manager</td>
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<td></td>
<td>Segment customer needs</td>
<td>Consumer demand does not correspond to product supply</td>
<td>“I observe that there are many beverage vending machines in hospitals. Few people buy drinks, but they urgently need medical supplies such as diapers. I think maybe vending machines can sell diapers and become another opportunity for us to expand the market.” – Comments from Marketing staff</td>
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to the data analysis, different kinds of vending machines could be placed in a targeted and purposeful manner to supplement products of different types of brands. In the first week of its trial operation, the company recovered its total operation cost, and the unit gross profit of the product increased significantly.

L. Vending installed intelligent electronic displayed on vending machines. First, consumers could more intuitively browse information and directly click to buy products through the touch screen, which enhanced the consumer experience. Second, the advertising media resources formed by electronic displays and intelligent network systems were more abundant, including body ads, display ads, product display ads, and mobile payment page ads. Third, the big data model of human-computer interaction could explore segment customers, which caused L. Vending to develop considerable advertising revenue.

Because of system integration with big data mining and customer segmentation, L. Vending returned to the forefront of the industry.

CASE ANALYSIS AND DISCUSSION

BMI Process

L. Vending’s two BMIs divided the innovation process into three stages: the preparation period, the decision-making period, and the implementation period, as shown in Figure 2.

After analyzing its existing market share, profitability, and resource exploitation, the preparation period was when L. Vending found problems in its business model. The decision-making period was when the company formulated a new business model for transformational direction based on internal and external environmental changes and development trends. The implementation period was to implement the innovative plan and deal with the unexpected situation in the implementation process. The implementation period is slow, showing that the company needs to continuously consolidate and strengthen all activities to achieve the goals set during the decision-making period.

Figure 2 shows that the ambidexterity of exploration and exploitation exists in the three stages of the whole BMI process. L. Vending coordinated exploratory and exploitative activities to make them relatively balanced in the innovation process. There are two logical ways of exploration and exploitation during the preparation period. First, because it was relatively passive in finding problems, L. Vending could not effectively balance the ambidexterity. Nevertheless, the company incorporated

Figure 2. L. Vending’s BMI stage model driven by big data

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**Figure 2. L. Vending’s BMI stage model driven by big data**

[Diagram showing the BMI process with various stages and activities]

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exploration and exploitation in decision-making and formulated reform and innovation measures. Therefore, it is the main stage of balancing exploration and exploitation. For the implementation period, the company did not need to focus on the logic of ambidexterity. The company should instead take exploratory and exploitative actions to support and extend the activities of the first two phases. Continuously coordinating and improving activities can ensure the company meets the goals of the new business model and bring resources and benefits to the business itself.

Subsequently, the company can develop the next BMI based on the previous cycle when the company has strengthened and consolidated previous exploratory activities, thus internalizing the internal resources of the enterprise. Figure 2 illustrates this process in the yellow area. The previous exploratory activity becomes the basis of exploitative activity in the following stage for the next BMI.

**Analysis of Big Data-Driven BMI From the Perspective of Ambidexterity**

**Analysis of the First BMI**

In the rapid development stage of the vending machine industry, L. Vending mainly had two methods of profit growth: reducing operating costs and increasing sales prices. In the first BMI, L. Vending realized that the homogeneity competition was severe, and thus it was difficult to raise the sales price. Therefore, L. Vending captured the opportunity to apply and develop big data technology and optimize the vending machine sales model and replenishment distribution system based on external technological progress and changes in consumer demand. We show the specific innovation methods in Table 4.

As shown in Table 4, L. Vending effectively balanced exploration and exploitation in its first BMI. On the one hand, L. Vending boldly explored big data management and built an intelligent cloud management system to optimize the replenishment and distribution mechanism in intensified external competition. The cloud management system analyzed transaction and sensory data to keep abreast of commodity inventory dynamics and back-end management, significantly reducing operating costs and improving operating efficiency. Specifically, L. Vending analyzed and integrated sales and inventory information through its ERP, SCM, CRM, and WEB transaction systems and used SQL databases to store data. Meanwhile, it used observation equipment such as RFID and GPS chips installed on vending machines to transmit product information, replenishment routes, site layouts, and customer consumption. These technologies and applications helped L. Vending to manage each vending machine accurately, calculate the delivery time and plan the optimal delivery route, reducing delivery time and delivery costs, accelerating inventory turnover, improving enterprise operation management, and ultimately improving L. Vending’s response to the market.

On the other hand, L. Vending applied mobile payment ways such as WeChat and Alipay to vending machine sales. The speed and convenience of mobile payment were consistent with the

<table>
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<th>Core Constructs</th>
<th>Secondary Encoding</th>
<th>Three-Level Encoding</th>
<th>Typical References</th>
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<tbody>
<tr>
<td>Exploratory activity</td>
<td>Introduce big data information technology</td>
<td>Build an intelligent cloud management system based on big data technology to optimize the distribution route</td>
<td>“The company can use the big data system to grasp the sales and product inventory of each vending machine in real time. The delivery worker can also allocate the goods according to the optimal route calculated by the computer. Both time and cost are saved.” – Comments from Sales Manager</td>
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<td>Exploitative activity</td>
<td>Exploitation of external mobile payment technology</td>
<td>Support vending machines using mobile payment</td>
<td>“We promote mobile payment in the vending machine, which is not only popular with consumers, but also accumulates various customer data invisibly.” – Comments from Finance manager</td>
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efficient transactions consumers expect from autonomous vending machines. In addition, consumers’ clicks, previews, remarks, operation modes, and selection preferences reflected their personality characteristics and behavior habits. Companies could thus convert real-world customers’ behavior into business intelligence data via the central analysis system using sensor data connected to a big data system. This system helps enterprises infinitely be close to consumers, thus better-serving consumers and improving transaction efficiency and success rates.

Overall, in the first BMI, L. Vending innovated the intelligent cloud distribution system with big data technology, built big data technology facilities, completed the innovation of the whole operation process with data information flow, and identified new opportunities. At the same time, L. Vending combined the design of vending machines with new mobile payment ways in an external environment to improve the exploitation of external resources. The balance between exploration and exploitation helped L. Vending improve operational efficiency, reduce operating costs and create a better consumer experience.

Analysis of the Second BMI

Although L. Vending returned to the forefront of the industry after its first BMI, it soon fell far behind its rivals in the number of vending sites and technology development because of the lack of strong financial support. To avoid capital shortcomings, L. Vending launched a fresh round of BMI to avoid capital shortcomings, trying to build a new data network on the big data technology it first tried and gaining profits. We show the specific innovation methods in Table 5.

When L. Vending carried out its second BMI, all its operating advantages accumulated in the first BMI vanished, and competitors gradually eroded its market share. To break the deadlock, L. Vending invested heavily in big data technology research and development to build a new business model.

Table 5. L. Vending’s second BMI From the perspective of ambidexterity

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<tbody>
<tr>
<td>Exploratory activity</td>
<td>Digging for partnerships</td>
<td>Change the market point development model and innovate point management</td>
<td>“We cooperate with a large number of small entrepreneurs to obtain market points relying on their personal network resources. All the point information is automatically uploaded to the cloud management system; thus we can easily manage and operate all points.” – Comments from Marketing manager</td>
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<td>Draw consumer portraits and create diversified consumer product category for vending machines</td>
<td>“We always keep thinking on the customer’s standpoint: what exactly do customers need? How can it be really convenient for consumers to consume?... We try to place vending machines in open places such as hospital departments and residential buildings, and replace traditional beverages with medical supplies, oil, salt, sauce and vinegar and others...” – Comments from CEO</td>
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<tr>
<td>Exploitative activity</td>
<td>Use external information technology</td>
<td>Equipped with electronic display screen to realize human-computer interaction experience</td>
<td>“The electronic display on the L. Vending vending machine can not only make consumers browse and select commodity information more intuitively, but also realizes human-computer interaction, which improves consumers’ interest of shopping.” – Comments from COO</td>
</tr>
<tr>
<td></td>
<td>Use media resources and mobile payment platform information resources</td>
<td>Expand marketing radiation and expand revenue channels</td>
<td>“We can obtain user data from electronic payment channels such as Alipay and WeChat, and then through the help of big data, select the best commodity portfolio and recommend to different consumer groups. We also combine with electronic display screens and rich advertising media resources on the intelligent network to achieve precise marketing.” – Comments from Marketing manager</td>
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In terms of exploratory activities, L. Vending found that it was no longer possible to expand the market by relying on salespeople to find vending spots and increase rents. Hence, L. Vending responded to the “double entrepreneurship” policy and cooperated with many entrepreneurs to obtain vending spots through their network resources, which eventually helped L. Vending regain its market share. In order to effectively manage these newly added market locations, L. Vending Intelligence continued to develop an intelligent cloud management system based on the optimal distribution function. By controlling many vending machine nooks and crannies developed by entrepreneurs through big cloud data, L. Vending not only did not have to worry about the management chaos caused by the rapid expansion of vending spots but also could intelligently generate information on consumer preferences, commodity turnover, and profitability at each location, and thus eliminating relatively unpopular vending sites or unsalable commodities. Thus, L. Vending realized cooperation with many small entrepreneurs based on the “double entrepreneurship” strategy, which reduced capital investment, alleviated the pressure on capital flow, and improved the usage of resources to explore the market and develop the big data system. In addition, L. Vending sought in-depth cooperation with brand owners, such as local beverage brands, by placing brand merchandise in the center of the vending machine.

In addition, L. Vending obtained users’ data through electronic payment channels. The company used big data analysis technology to profile consumer characteristics, analyze their consumption behavior, and match consumer shopping patterns with each vending machine. The company turned consumer data into business intelligence on more consumer goods, achieving machine product differentiation sales. With this strategy, L. Vending combined personalized customer choices with consumption and perception data and integrated it into its business operations. The company excavated consumer actual demand information through data analysis and optimized the commodity structure at different vending locations. For example, iced sports drinks were more popular in gyms; high-calorie snacks were more popular in college buildings. Through the analysis of the location distribution, the flow of people, surrounding competitors, consumption habits, and other data, L. Vending’s business model changed from a model of even distribution and rigid supplementation to a model of dynamic operation guided by multiple factors such as time, place and consumer preferences.

L. Vending’s exploratory activities through cooperation with many small entrepreneurs allowed its sales locations to move from core cities to small and medium-sized cities and from closed to open spaces. As a result, the company could place its vending machines in densely populated commercial schools, parks, and office buildings, improving consumers’ convenience and thus establishing consumer-centered value creation.

In terms of its exploitive activities, L. Vending independently designed vending machines equipped with smart displays, which could better interact with consumers through touch screens, built-in networking functions to achieve human-computer interaction, and also introduced WeChat pay and Alipay face recognition to enhance the interest and operability of the operation. L. Vending’s cooperation with the mobile payment platform helped its big data technology to collect, record and feedback customer data and personal information, model consumer behavior and preferences, quickly identify customer purchasing decisions, and actively recommend products or services based on the results of data analysis.

On the other hand, L. Vending’s main profit models were commodity sales and advertising revenue. In the second BMI, electronic display screens and intelligent network systems enriched L. Vending’s media resources. Vending machines were distributed in areas with a large flow of people or specific groups and were natural advertising space resources. L. Vending obtained considerable advertising revenue through merchandise display advertising, product display advertising, and mobile payment page advertising. In addition, L. Vending obtained customer needs and purchase behavior information through big data and cloud backup, subdividing consumers from different dimensions with big data analysis tools to achieve accurate marketing for customers.

In summary, L. Vending fully invested in big data technology research and development in the second BMI, which optimized and upgraded the intelligent cloud management system and designed
new vending machines to meet innovative creation. L. Vending also fully used resources by adding electronic display screens and multiple advertisements. Based on the ambidexterity interaction, L. Vending’s second BMI was successful.

**RESEARCH FINDINGS**

With big data technology, L. Vending Intelligence uses ambidexterity for exploration and exploitation, steadily upgrades its corporate value creation model, and realizes the BMI to obtain core competitiveness and sustainable development. It evidenced that the comprehensive application of big data technology in business cannot be achieved overnight. Through the introduction, deployment, and systematic application of big data technology, companies can carry out many BMIs until they build an ecological value network as the enterprise’s core. Therefore, we propose the following BMI path model, as shown in Figure 3.

BMI driven by big data technology is often based on the ambidexterity of using existing resources and exploring potential ones. The core goal is incorporating customer value into the enterprise’s value chain system.

In the initial stage, the company’s efforts to integrate internal and external resources in the enterprise may not be insufficient to create value effectively. At this stage, the driver for corporate value creation is the commodity, and sales income is the primary source of the enterprise. Under such a model, the enterprise is only for sales profit. The primary source of value creation is the company itself. The company obtains financial returns from the price differences in commodity transactions for corporate value creation. This way of value creation is passive and non-diversified. Therefore, companies need to maximize their use of internal and external resources to build closer ties with consumers and drive the direction of BMI through consumer demand. Big data drives the first enterprise BMI, and companies should focus on reducing operating costs and improving

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**Figure 3. Path model of BMI driven by big data technology**
efficiency. Although the driver of corporate value creation in this process still relies on a commodity and the difference in the cost advantage formed by the economy of scale, enterprises understand the real needs of consumers through technological means such as big data storage and a more accurate value proposition. In other words, big data helps enterprises segment and locate customers and meet genuine consumer needs based on predicting consumer preferences and habits. At the same time, using data visualization in enterprise operations can optimize consumers’ consumption environment and experience. Hence, the exploitative and exploratory nature of the ambidexterity logic helps companies achieve corporate value creation by gaining market leadership for meeting consumer demand. The enterprise can improve its consumers’ experiences and preferences by optimizing its products and services. The user value transmitted by enterprises to consumers can increase the stickiness and loyalty of consumers. The core path of corporate value creation changes from the enterprise supply chain to consumer demand.

After the first BMI, enterprises integrate internal and external resources and maximize operational efficiency. To seek expansion opportunity, enterprises improve their layout of big data, and technological upgrades will drive an additional round of changes. In the second BMI, enterprises continue to deepen consumer-centered value creation and use big data technology to amplify the energy value of other resources effectively. Big data technology’s demand for information resources will inevitably prompt enterprises to actively seek resource sharing from strategic partners, and resource sharing will further encourage exploration and exploitation activities. Although strategic cooperation requires companies to share part of the sales profits, companies can realize the transformation from the self-employed model of heavy assets to the platform model of light assets. This way, enterprises form a platform business ecological model with a two-way connection, such as consumer demand, industrial chain supply, multi-channel sales, and big data technical support. The strategic platform can expand companies’ business scope and create more consumption scenarios and consumer experiences, enhancing competitiveness, freeing up free cash flow, and reducing operating risks in an asset-light model. These factors transform the value system from the exchange value of commodity sales to the value transmission based on consumer perception. Thus, a company gradually transforms itself into a platform business. Of course, enterprises, only as bilateral platform providers, are connected to the bilateral platform of consumers-enterprise-partners, and the value can only be transmitted in two ways among the three parties. Therefore, enterprises must continuously innovate using a big data-led business model. To create a multilateral value network, companies need to integrate internal and external resources while attracting more partners (such as upstream and downstream enterprises in the industry) to create a multilateral value network.

The research found that under the support of exploitative and exploratory activities, the value network creation of enterprises presents a continuous upward spiral trend. Companies share big data resources with multiple parties to help them build an external relationship and value delivery network. Under this business model, companies act on creating value and delivering value and realize that strategic partners and other stakeholders are included in the value network based on consumer value propositions. Through the integration of data obtained from multiple company information, the production of innovative products and services, and the creation of a better consumer experience, enhancing the corporate value of all parties in the supply chain, achieving a win-win business, and ultimately creating an ecological value network.

**CONCLUSION**

With big data technology’s rapid growth, academia and enterprises have recognized its enormous commercial value. Companies are beginning to realize that big data will become one of the powerful driving forces to establish competitive advantages and enhance corporate value. Like all kinds of emerging technologies in the past, big data technology also drives a new wave of innovation in corporate business models. This paper conducts the case study of L. Vending Intelligence to
illuminate the importance of ambidexterity in a company’s development path to achieve business model innovation (BMI) by utilizing big data technology. Our findings have led to three significant conclusions.

First, to achieve continuous BMI and maintain or enhance core competitiveness, the company should optimize and upgrade its big data resources from both dimensions of exploration and exploitation. The company must first protect and utilize the company’s existing resources, maximize the resource sharing of enterprises in the value chain, and enhance customers’ consumption experience. Meanwhile, the company should also explore potential resources for technological development, i.e., pursuing less capital-intensive but more diversified operating models to ultimately achieve BMI driven by big data technology.

Second, the firm must utilize big data technology to operationalize its ambidextrous capabilities by carefully balancing its exploitative and exploratory activities when transitioning from a traditional business model to an innovative business model, thus mitigating the turbulence and challenges when competition intensifies. BMI can effectively improve corporate value creation when a company evolves from a static single value transfer of the business to customers to a dynamic value ecosystem involving multiple parties. Moreover, through big data technology, BMI enables the company to transform from an operator to a platform provider and promotes a win-win development of the enterprises with various stakeholders.

Third, because of China’s unique market environment, Chinese companies should pursue big-data BMI according to the established theories and practices. On the one hand, from the perspective of ambidexterity theory, we need to combine our own and external realities to achieve an effective combination of exploitation and exploration. Tilting the balance towards exploitative or exploratory activities cannot achieve effective transitions and innovations in business models. On the other hand, while promoting big data-driven BMI, we must incorporate the Chinese market characteristics with the ambidexterity theory to achieve enduring BMI.

**Theoretical Contributions and Practical Implications**

Our study fills a research gap by integrating three areas of study: business model innovation (BMI), ambidexterity, and big data. Our results shed light on how a firm can use big data to achieve ambidexterity in BMI. We use a case study of a Chinese company to illustrate and open up the black box of internal mechanisms and pathways of BMI driven by big data as a dynamic process. Our study results provide empirical evidence and theoretical support for developing big-data-driven BMI literature with important theoretical and practical implications.

Our study results indicate companies can leverage big data technology to balance the ambidexterity of explorative and exploitative activities and continuously achieve big-data-driven BMI for core competitiveness and sustainable development. Our study contributes to the literature by providing a clear pathway for achieving ambidexterity for big-data-driven business model innovations.

Additionally, our findings have important policy implications for the government. Based on technology development, especially big data, the government should introduce policies encouraging enterprises to use big data to promote business innovation and development. Furthermore, the government should issue specific guidance on using big data to promote the sustainable development of enterprises.

**Limitations and Future Research**

We constructed the theoretical model based on Chinese companies influenced by China’s unique social and business context. Therefore, testing the model further using cases from Western countries could be beneficial. Additionally, case data limitations restrict large-sample empirical research. Additionally, future research should use typical cases from developed countries to verify the model constructed in this paper. Meanwhile, we will manually collect more sample data for empirical research to consolidate further the research theory developed in this paper.
REFERENCES


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