

Revolutionizing Logistics Business Models through Big Data and Blockchain: A Business Model Canvas Analysis

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ABSTRACT

The world is moving quickly towards automation and digitalization in the modern era. This change is becoming crucial to corporate competitive strategies, especially in the logistics industry. The use of data in organizational decision-making is an essential aspect of this digital and automated environment. Several business sectors are implementing Big Data and Blockchain technologies to improve organizational capabilities by developing effective business processes. This inexorably affects the development of new business models that fit the changing global business landscape. The Business Model Canvas (BMC) is an effective tool for analyzing internal and external business model changes. A SWOT analysis of these business model transformations is necessary to explain the new business process changes further. First, the analysis shows that for businesses to function at their best, current technological advancements—particularly in Big Data and Blockchain—will continue to disrupt them. Second, there have been significant internal and external changes to intra- and inter-organizational relationships due to the implementation of Big Data and Blockchain. Thirdly, the benefits of Blockchain and Big Data technologies for business, especially logistics, can be further explained by SWOT analysis.

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1. INTRODUCTION

The world is currently entering a period of automation and digitalization, which is essential for business competition strategies, especially in the logistics industry [1]. A component of this change is the application of data to organisational decision-making. Organising the enormous and complicated amount of data that exists today to maximise its use by businesses is the first problem. The management of this data is made more difficult by its diverse characteristics, which include text, images, sound, and video. The growth of internet-connected information technology, such as smartphones, CCTV, RFID, etc, influences these characteristics. Volume, Velocity, and Variety are the three Vs that are related to the idea of Big Data. In order to improve organisational capabilities, businesses must take advantage of these factors by managing customers, streamlining business processes, and eventually creating new business models that fit with the way the business world is

changing [2].

Increasing the effectiveness of work systems across departments and companies is the second challenge. At the moment, business stakeholders concur that having a wealth of information can lead to better results [3]. Every action or transaction is broken down into blocks using the newly developed Blockchain technology, and every time a transaction changes hands, it is recorded. Everyone can see who is involved in the process and follow specific details by connecting blocks [4]. A permanent digital record of the product's journey through the supply chain is created in the process. The objective is to establish a single version of the truth by linking data, fostering transparency among all supply chain participants, and identifying their roles in exchanging goods and services. All partners have access to this technology; none of the trading partners owns or controls it [5].

Without a doubt, blockchain technology and big data are having an impact on the logistics industry today. Walmart intends to track the movements of food products using blockchain technology [6]. Maersk and IBM declared their partnership to use blockchain technology. Shippers and 3PLs can enhance the supply chain with Blockchain. The data produced by blockchain technology can offer chances for information analysis, which is essential in today's world [7]. Retailers can monitor inventory because Blockchain allows for accurate tracking and transparency, which could turn the supply chain into a dynamic one. According to studies, shippers and 3PLs are just beginning to use blockchain technology, and since the ecosystem is still developing, more work needs to be done. This will undoubtedly alter how current business models integrate with future ones [8].

Using the business model canvas approach, this study attempts to determine the factors that influence changes in business models in the logistics industry, both internally and externally [9]. Examining the new business model will offer a clear understanding and inspire additional study [10]. Academically, this research will likely contribute to understanding present and future shifts in business models by offering fresh sources on the effects of Blockchain and big data on the business model canvas (particularly in the logistics industry) [11]. From a practical standpoint, the analysis produced by this research is intended to assist the business community in adjusting to technological advancements and to assist policymakers in crafting focused policies.

1.1. Literature Review

1.1.1. Big Data

Big Data is a modern technology used in businesses and society today to manage, analyse, and visualise ever-increasing amounts of data [12]. Big Data Analytics (BDA) is a crucial tool that uses technologies and frameworks to effectively store, transform, transfer, and analyse massive amounts of diverse, structured, and unstructured data that are updated continuously for both business and societal benefits. BDA's evolution from conventional large database management systems to cutting-edge cloud services has dramatically improved data processing and analysis, making it more affordable, effective, and user-friendly. Prominent international data suppliers, including SAS, IBM, Oracle, SAP, EMC, and Teradata, have been at the forefront of providing cutting-edge solutions in this field. These days, they offer cutting-edge data visualisation, decision support systems, automation interfaces, business analytics, business intelligence, sophisticated data mining techniques, advanced data warehousing, and business analytics [13–15].

Three key elements make up big data: variety, velocity, and volume [16]. In order to obtain a competitive edge, the emphasis has moved from simply storing enormous volumes of data to efficiently managing the speed (velocity) and diversity (variety) of data. The variety includes a wide range of data formats, including unstructured data like text, photos, music, and videos and structured data that is simple to sort. Making informed decisions requires having access to a more nuanced reflection of reality, which unstructured data, in particular, provides. Another critical factor is velocity, highlighting companies' need to quickly collect and process data to outperform rivals and make timely decisions. Businesses can gain significant economic value and strategic insights from this ability to process and leverage large, rapidly changing datasets [17–19].

1.1.2. Blockchain

Blockchain is a distributed digital ledger recognized for its immutability due to advanced cryptographic techniques. It features three key characteristics: immutability, verifiability, and decentralization [20]. Its decentralized structure is maintained by users independently operating the network without a central authority, fostering a trust-based environment [21]. Every transaction is distributed across the peer-to-peer network, with each participant retaining a local copy of the ledger. The system's verifiability is ensured through public-private key cryptography for transaction authentication [22]. Consensus algorithms enforce immutability, where blocks are verified before being added to the chain [23]. Reversing a transaction would require

altering the cryptographic hashes of all blocks in the chain and most devices' local records on the network [24–26].

Blockchain surpasses centralized systems by creating a trustless environment, providing all network members with consistent, verified information [27]. It facilitates asset transfers, such as digital currencies and carbon credits, without intermediaries [28]. Recent research highlights its potential to revolutionize various industries, including finance and supply chain management [29].

1.1.3. Business Model Canvas (BMC)

A PhD dissertation that was started in 2000 served as the inspiration for the Business Model Canvas, which has since been widely used. Users from various organisational sectors have used Canvas for a range of objectives. Most users who responded to the survey said they had used the Business Model Canvas to create brand-new companies [30], introduce novel goods and services, or update current business plans and tactics [31]. Academic use of the Business Model Canvas is also widespread; leading business schools worldwide, including Stanford, Harvard, and IESE, have included it in their curricula [32]. In top MBA and Executive programmes, students learn how to apply the Canvas to strategy and innovation; they then take this state-of-the-art knowledge back to their organisations. Users are using the Business Model Canvas more and more to describe their present and future strategies [33, 34].

The Scheme of Business A business model comprises nine essential elements that include Canvas [35]. The arrangement of these elements on a canvas improves the visual representation of the connections between different problems. It helps users with business model mapping, discussion, design, and innovation. In essence, the value proposition is demarcated in the middle of the model, split into products on the left and the market on the right [36]. The 'Customer Segments' section on the right-hand side includes all individuals or organisations that generate value, such as customers and users [37]. There is a unique "Value Proposition" for every segment, a collection of goods and services that add value for the client. 'Channels' explain how value is delivered and interactions with customers; 'Customer Relationships' describe the relationships formed with customers. 'Revenue Streams', which complete the right side of the canvas, describe how revenue is produced and by what pricing strategies [38]. On the left side, essential business assets are represented by 'Key Resources' directly below 'Key Activities,' the things that need to be done well [19]. 'Key Partners' assist in leveraging the business model, as one cannot possess all key resources or perform all key activities independently. Understanding the business infrastructure with BMC provides insights into the 'Cost Structure'.

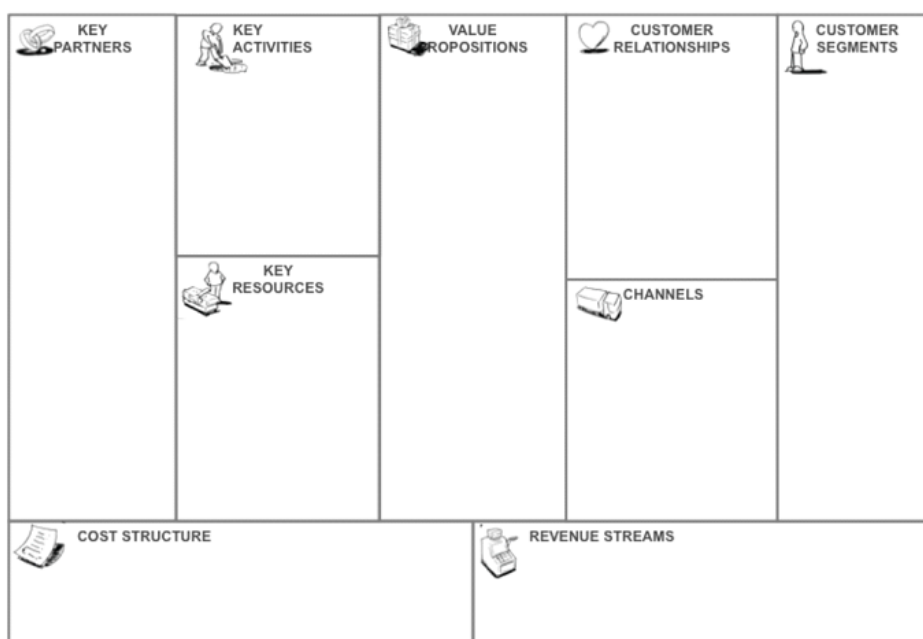


Figure 1. Business Model Canvas (BMC)

2. THE COMPREHENSIVE THEORETICAL BASIS

In order to evaluate the impact of applying Big Data and Blockchain technologies, the researcher will look into the changes made to internal and external operational systems within the Business Model Canvas (BMC) [39]. An extensive SWOT analysis will be part of this investigation, focusing on the logistics industry. The SWOT analysis aims to find an organization's strengths, weaknesses, and capacity for change in the business environment [40]. According to recent studies, this method aligns with modern viewpoints on organisational analysis and strategic management. The analysis's conclusions should offer insightful information on how to best optimise the company's business model in light of recent technological advancements [41].



Figure 2. Research Framework

Descriptive qualitative research is the methodology used, and its goals are to collect data, evaluate it critically, and make inferences from the facts observed during the research period. This study focuses on the Business Model Canvas's (BMC) operational procedure. The business model canvas, which is impacted by blockchain technology and big data, is the subject of this study. The nature of the data sources is secondary. Books, journals, and internet data are the secondary data sources used in this study [42].

3. RESULT AND DISCUSSION

The main idea behind implementing blockchain technology is moving from a centralized to a distributed system. The primary benefit of the centralized approach is control. Businesses can control the messages and information that are sent to their clientele. The simplicity of working with other divisions or departments is another advantage. The disadvantage of the centralized structure is the substantial resources needed to create an entire infrastructure from scratch. The sluggish response time to changes is another glaring flaw, as it is unsuitable for the quickly changing digital technology environment. Figure 3 illustrates this idea. On the other hand, businesses that use a distributed approach forfeit control over information and content. However, this substitute offers several benefits that counteract centralization's drawbacks. First, every entity has the power and liberty to develop in various ways. If a business wishes to increase its adaptability to changes in the market, this structure is also more appropriate. The idea of distributed ledger technology, or blockchain, can also be understood as a system in which users make decisions, and no one person can force their will on others without the approval of the majority.

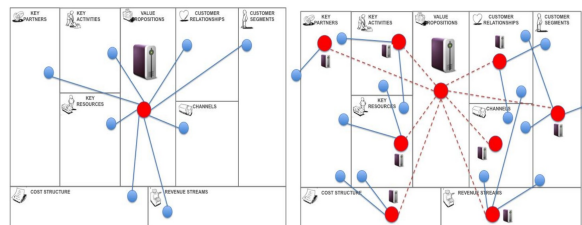


Figure 3. Centralization and Decentralization Concepts within the Internal Business Model Canvas (BMC)

Big Data and Blockchain technologies impact the Business Model Canvas (BMC), resulting in internal operational changes. Big Data uses cloud technology to enable centralised storage, and Blockchain increases

each business unit's visibility about information sharing. Figure 4 shows an illustration of this.

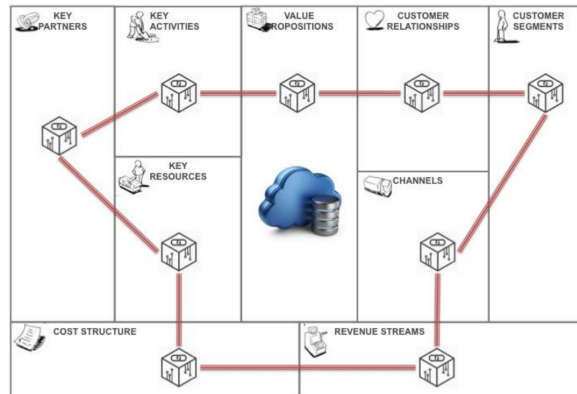


Figure 4. Big Data and Blockchain Influence on the Internal Working of BMC

The relationship between contemporary organizations is characterized by mutual interdependence due to the dynamic and constantly changing environmental situation. The shift from an independent to an interdependent nature has given rise to various thoughts directing towards a partnership-based business management model, rather than one based on competition. Therefore, collaboration is highly essential in the current scenario. Big Data and Blockchain technologies support companies to collaborate effectively in terms of the ability to use and share data.

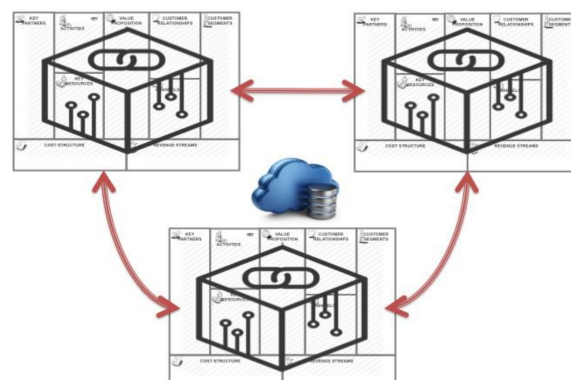


Figure 5. Big Data and Blockchain's Impact on Inter-Company BMC

Figure 6 illustrates how the use of Big Data and Blockchain technologies will affect the logistics industry. These benefits include (1) quick and safe access to information about the entire supply chain, serving as a single source of truth; (2) verifiable digital document authenticity and validity; (3) reliable cross-organizational workflows; (4) enhanced risk assessment and fewer interventions; and (5) significantly lower administrative costs and the elimination of costs associated with shipping physical paper across international borders.



Figure 6. Implementation of Big Data and Blockchain in Logistics Business

3.1. SWOT for Big Data

Strengths: Supports business intelligence, statistical computations, and analysis in the business world. Real-time information gathering about operations and logistics will be made possible by integrating analytical tools with modern, increasingly affordable technologies (like RFID, GPS, etc.). This results in a more

prompt and effective handling of problems. Weaknesses: The current implementations could be more logically complex due to a lack of technology supporting all formats. On websites like social media, there is a lot of unstructured data. Opportunities: Processing large data types, such as audio, video, and images, presents a significant opportunity. Analytical skills must be improved to bridge the gap between the sheer volume of data and valuable information for particular businesses. Unaccessible data is just as useless as information that is missed. Online retailers, service providers, software product companies, network companies, storage companies, and the healthcare sector have opportunities. Demand-based supply chain strategies could be extended by exchanging more data with essential partners and obtaining consumer and customer market intelligence. This would allow them to anticipate trends and innovations rather than primarily depending on erroneous forecasts. Dangers: Inaccurate forecasts resulting from low-quality data, as observed in social analysis, cannot forecast human behaviour. The disruption caused by new inventions. This can occur anytime an IT innovation leads to the development of a new business model better suited to the customer base's needs or even generates unique needs. New business models produce new supplier networks.

3.2. SWOT for Blockchain

Strengths: No Centralised Network: The critical feature of Blockchain that makes it a good security solution for IoT is its decentralised network. For a block to be validated, the data must be verified by at least 50% of the network's systems. Sturdy Ecosystem: There is no single point of failure because the technology runs on a decentralised network. Extendable Database: The Blockchain model offers ample database capacity. Blockchain can reduce the risks associated with the supply chain's goods transfer process by tracking and verifying movements at every production stage, shipping, and goods flow. Blockchain identifies the parties involved at every step. Shipments can be tracked by providing details like price, date, location, product condition, and other information. Products can be tracked back to the source of their raw materials if a ledger is available. This data is essential and should be updated continuously to minimise the amount of work required for reconciliation amongst all parties involved in the supply chain. Moreover, since no one party has complete control over the ledger, its decentralised structure prevents any party from manipulating data. This boosts data security and accountability. Information sharing will increase clarity and reduce the possibility of human error. In addition, this can cut down on activity duration, do away with extra expenses, lessen errors, and lessen corruption. Data analysis related to the supply chain can benefit from Blockchain's enhanced data management accountability. Because Blockchain can track and transmit consumption-related data quickly, when it is managed up to the end-user, it can create a demand chain. Blockchain technology guarantees customers' security and transparency, one of the shippers' most significant advantages. This reduces fraud and guarantees precise delivery. Because blockchain technology can promote more effective and efficient supply chain management, it can also aid in addressing errors.

Weaknesses: Entities could compromise data that needs a lot of processing power with many resources and computing power. Not every Internet of Things (IoT) device has the processing power to run sophisticated encryption algorithms. Extra expenses are involved in integrating such data, and a responsible party is required. Although some parties might be very secretive regarding information sharing, integration is essential and advantageous. Blockchain centralises data and makes it accessible to relevant parties; therefore, rules governing it are necessary to ensure interoperability between private and public needs. One of the problems that Blockchain technology needs to solve is privacy, scalability, and protocol issues. Under certain circumstances, businesses might wish to give only some parties involved in the supply chain complete transparency. There may also be liability issues. There is more to be held accountable for in a supply chain with more information. Businesses may be tracked in a manageable amount of detail.

Blockchain technology must address several issues, including protocol, scalability, and privacy. Businesses may decide in some situations to only provide partial transparency to some supply chain participants. Liability issues might also arise. With more excellent information, there is more to be held responsible for in a supply chain. This may lead businesses to conclude that they want to avoid being closely monitored.

3.3. Opportunities

Secure Interaction of IoT Devices: The supply chain is more integrated thanks to blockchain technology. Though its application is complex, it can potentially alter supply chain operations and procedures.

3.4. Threats

Tax Issues: While blockchain technology has many advantages in the Internet of Things ecosystem, its implementation will take more work and time. For instance, certain legal matters must be resolved before using the technology internationally.

4. CONSLUSION

The study comes to three different conclusions based on the previous discussion. First off, the study successfully created several clusters using RapidMiner's K-means clustering method, classifying 12 as belonging to the high group, 46 as belonging to the low group, and 24 as belonging to the medium group—all of which were validated with reliable values. This demonstrates the effectiveness of the K-means clustering technique in differentiating data attributes at different levels. Second, clustering Indonesian cities using a combination of manual Excel calculations and RapidMiner proved to be a successful strategy, highlighting the benefits of combining automated and manual data processing methods in geographical data analysis. The results demonstrate how well the K-means clustering technique in RapidMiner works for analysing geographic data. The findings, divided into high, low, and medium clusters, offer critical new perspectives on how data attributes differ among Indonesian cities. This method is valuable in efficiently classifying geographical data by integrating automated and manual techniques. Even with these conclusions, certain areas still need more research. Subsequent studies should focus on improving the clustering procedure by incorporating sophisticated data processing instruments or investigating substitute clustering algorithms. Furthermore, a thorough examination of the traits and consequences of each cluster may produce more complex insights that can help with regional economic planning and policymaking. These research gaps offer chances for subsequent investigations to expand on the groundwork laid by this study, advancing the field of geographical data clustering techniques.

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