Applicability of Blockchain Technology in Cryptocurrency and Return on Investment for Online Companies Operating in Kenya

Kamathi Fridah Kaunga & Dr. Fredrick W.S. Ndede

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*1Kamathi Fridah Kaunga & 2Dr. Fredrick W.S. Ndede

1Postgraduate Student, Department of Accounting and Finance, Kenyatta University, Kenya

2Lecturer, Department of Accounting and Finance, Kenyatta University, Kenya

*Email of the Corresponding Author: kamathifrida@gmail.com

Abstract

Kenya is a global leader in blockchain technology and cryptocurrency adoption, with many businesses implementing blockchain solutions. However, the relationship between blockchain technology in cryptocurrencies and return on investment (ROI) is unclear in the literature. This study looked at the impact of blockchain technology on cryptocurrencies and ROI for Kenyan internet businesses. The independent variables were blockchain digital ledgers, blockchain smart contracts, and permissioned blockchains, with ROI as the dependent variable. The study was founded on the resource-based view theory, disruptive innovation theory, and diffusion of innovation theory. A correlational research design was used to target 1,664 online companies in Kenya. A sample of 178 firms was selected from a group of 322 companies that had used blockchain for at least three years. Top managers were selected as respondents using stratified sampling. Questionnaires were used to collect data, which was then analyzed with SPSS version 21 for inferential and descriptive statistics. Regression and correlation analyses revealed that implementing blockchain technology had a positive and significant impact on ROI. Among the independent variables, blockchain digital ledger had the highest impact (0.065 units), while permissioned blockchains had the least (0.056 units). All findings were significant at $p < 0.05$. The study emphasized the importance of online companies prioritizing blockchain adoption in order to maximize ROI. It concluded that blockchain digital ledgers, smart contracts, and permissioned blockchains had a significant impact on ROI. Future research should investigate the indirect mediating effects of blockchain project goals and company characteristics. The study recommended that Kenyan online business leaders accelerate blockchain integration, particularly the use of blockchain digital ledgers, to improve transparency, security, and fraud prevention. In addition, permissioned blockchains should be implemented to strengthen data integrity and mitigate risks.

Keywords: *Applicability, Blockchain Technology, Cryptocurrency, Return on Investment, Online Companies*

1.1 Introduction

Return on Investment (ROI) is a commonly used metric for evaluating both tangible and intangible benefits of investments, which aids decision-making. Despite the growing adoption of blockchain technology by online businesses, its ROI evaluation is limited, preventing it from reaching its full potential. Cryptocurrency, a digital currency that uses encryption and blockchain technology, eliminates intermediaries, making it difficult for governments to regulate or tax transactions (Justinia 2019). The first cryptocurrency, Bitcoin, debuted in 2008, followed by Ethereum, Binance Coin, Ripple Coin, and Doge Coin. The rise of cryptocurrencies was largely influenced by the decline of public trust in traditional financial systems following the 2007/2008 financial crisis (Khan et al., 2021). Cryptocurrency has grown in popularity around the world, particularly in industrialized countries and, more recently, developing economies. South Africa and Nigeria have seen significant increases in digital currency adoption. Kenya is ranked sixth globally and second in Africa for cryptocurrency adoption, with Bitcoin transactions expected to reach 64 billion Kenya shillings by 2020. Unlike fiat money, cryptocurrency is not regulated centrally and instead relies on a decentralized mining process in which computers on a peer-to-peer network validate transactions using cryptographic rules (Mhlanga, 2023). Each machine on the network has a community address, which is used to transfer funds between users.

Transactions are recorded in digital blocks within a blockchain, which is cryptographically secured to ensure authenticity and traceability. Users protect their transactions with private keys, which provide mathematical proof and prevent alterations (Lineros, 2020). Blockchain technology is the foundation of cryptocurrency, and it has sparked significant research interest over the last decade. However, despite the growing popularity of cryptocurrency, there has been little research on the relationship between blockchain technology and ROI for businesses, indicating a knowledge gap in assessing its financial benefits. Return on investment (ROI) is a popular metric for determining the financial benefits of an investment, especially when comparing various investment options. Andru and Botchkarev (2011) define ROI as the net gain from an investment expressed as a percentage of the total cost. They emphasize the complexities of ROI measurement in various fields, pointing out that certain industries, such as social media, have difficulty quantifying financial returns. To address this, ROI calculations should include intangible benefits such as customer satisfaction, employee morale, efficiency, productivity, and cost savings. Wang et al. (2002) advocate for incorporating both monetary and non-monetary measures when calculating ROI, arguing that financial indicators alone may not fully capture an investment's impact. Similarly, Schroeder-Strong et al. (2022) emphasize the difficulty of determining the value of intangible benefits, especially when calculating the ROI of technological adoption. Their findings support ROI models that take into account both tangible and intangible benefits, which is relevant to research on the adoption of blockchain technology by Kenyan online businesses.

Yaga et al. (2019) define blockchain technology as a tamper-proof digital ledger system in which every modification leaves a traceable record. The technology is made up of smart contracts that automate agreement execution, permissioned blockchains that govern user identity, and distributed ledgers that track transactions. Blockchain's decentralized nature eliminates the need for central authorities, allowing users to monitor and track transactions across the network. Blockchain technology enables the secure exchange of assets and commodities while lowering costs and risks (Saberi et al., 2019). The introduction of Bitcoin in 2008 raised public awareness of blockchain technology, demonstrating the possibility of digital payments via a decentralized network. Blockchain is particularly well-suited for data transfer, as it allows for shared access to information that can only be retrieved by authorized

network participants. It also allows organizations to keep track of payments, production, inventory, and accounts while ensuring transparency and security.

Blockchain networks have four primary characteristics that promote trust and eliminate the need for intermediaries. Mhlanga (2023) divides these networks into four categories: public, private, permissioned, and consortium blockchains, each with its own structure. Public blockchain networks, such as Bitcoin, are accessible to all, but they pose challenges such as limited transactional confidentiality, security risks, and high computational costs. Smart contracts speed up transactions by enforcing predefined rules automatically. Private blockchain networks, on the other hand, are managed by a single entity responsible for the consensus protocol and ledger management. Organizations developing private blockchains frequently create permissioned networks that limit transaction participation to invited or authorized users. Consortium blockchains are collaborative networks in which multiple organizations are responsible for maintaining and updating the ledger. Pre-selected members decide who can transact on the network, providing greater control and security. Blockchain technology was originally developed for cryptocurrency applications but has since spread to a variety of industries. While extensive research has been conducted on blockchain applications in cryptocurrency, little is known about the return on investment for Kenyan online businesses.

Online businesses operate on web-based platforms that use internet and extranet systems for business transactions. Kenya's blockchain ecosystem is rapidly expanding, with many companies leveraging the technology for innovative solutions. Pezesha, for example, is a digital lending marketplace that connects small and medium-sized businesses (SMEs) with affordable capital providers. Pezesha uses blockchain to improve loan accessibility and create a global network effect, increasing loan competitiveness. Similarly, Pesabase simplifies money transfers by removing the bureaucratic barriers associated with bank settlements, resulting in faster and more cost-effective transactions (The Kenya Wallstreet, 2021). Play Bobby is another online platform that uses blockchain to connect SMEs with virtual workers, thereby improving service delivery and efficiency. Blockchain adoption in Kenya is changing data access and ownership, taking control away from traditional technology monopolies. Many Kenyan businesses struggle to obtain APIs for financial services, necessitating collaboration with established tech companies to process payments. However, blockchain integration enables businesses to create digital wallets on blockchain platforms, making financial transactions easier (Kirwa, 2022). Several firms in Kenya specialize in cryptocurrency-related services and use blockchain technology to ensure secure and efficient transactions. Despite the country's increasing adoption of blockchain technology, no comprehensive study has been conducted to assess its impact on cryptocurrency and the ROI for online businesses that use it.

1.2 Problem Statement

Many Kenyan online businesses have incorporated blockchain and distributed ledger technology into their operations to keep up with rapid technological advancements (Chainalysis, 2021). The widespread use of cryptocurrency has accelerated this integration, allowing businesses to improve service delivery (Kirwa, 2022). However, many businesses struggle to quantify the benefits of blockchain, creating uncertainty about its return on investment (ROI) and potentially discouraging future investment (Atinda, 2022). To address this, a multi-factorial decision analysis is required to assess both tangible and intangible benefits, giving businesses a clearer picture of blockchain's impact. This study sought to fill contextual gaps in existing literature, as most research on blockchain adoption, including studies by Bonnet and Teuteberg (2023) and Varfolomeev et al. (2021), has been conducted globally, with little emphasis on Kenya. Given Kenya's distinct economic and technological landscape, these findings may not be directly applicable. To address this gap,

the study looked at blockchain's impact on cryptocurrency and ROI for Kenyan online businesses. Further, the study filled conceptual gaps in previous research. For example, Vigliotti et al. (2021) analysed smart contract benefits based solely on certainties, whereas this study took a broader approach. Similarly, Grietzmann and Grossetti (2021) used accounting as their sole ROI measure, whereas this study included both tangible and intangible metrics. Further, previous research examined blockchain applications without considering ROI (Punathumkandi et al., 2021; Lineros, 2020). This study established the relationship between blockchain adoption and ROI for Kenya's online businesses.

1.3 Objective of the Study

The general objective of this study was to investigate the application of blockchain technology in cryptocurrency and its influence on the return on investment for online companies operating in Kenya.

The Specific Objectives were;

   i.   To determine the effect of digital ledger on return on investment for online companies operating in Kenya
   ii. To find out the effect of smart contracts on return on investment for online companies operating in Kenya
   iii. To establish the effect of permission block chains on return on investment for online companies operating in Kenya

2.0 Literature Review

2.1 Theoretical Review

This study's theoretical review is based on three key theories: disruptive innovation theory, resource-based view theory (RBV), and diffusion of innovation theory (DOI). These theories provide a framework for understanding blockchain technology's impact on Kenyan online businesses. Clayton Christensen's Disruptive Innovation Theory, introduced in the 1990s, describes how revolutionary innovations enter established markets and displace existing technologies. These innovations, which are frequently developed by entrepreneurs rather than established industry players, disrupt business models and create new value networks. Disruptive technologies quickly penetrate markets, posing new challenges to traditional business operations. In this study, the theory is used to investigate the impact of blockchain technology on online businesses, demonstrating how it has opened up new markets and transformed business models. Previous research has also supported this viewpoint, including Atinda (2022), who highlighted blockchain's role in revolutionizing Kenya's power sector, and Aketch et al. (2021), who demonstrated how blockchain has helped financial institutions combat cybercrime and fraud. Furthermore, the study investigates how blockchain has facilitated the formation of coherent value networks, allowing businesses to adapt to a changing technological landscape.

The Resource-Based View (RBV) Theory, proposed by Barney (1991), holds that an organization's tangible and intangible resources are the foundation of its competitive advantage. Key resources include knowledge-based assets, human capital, technological assets, and physical assets. According to the theory, firms can strategically leverage their assets to increase efficiency, lower operational costs, boost innovation, and achieve long-term competitive advantage. However, critics such as Kraaijenbrink et al. (2009) argue that different resources can provide similar benefits to firms, making it difficult to create a distinct advantage. Despite this, a well-balanced asset mix can still provide a high return on investment (ROI) and boost overall business performance. This study uses RBV Theory to look at how blockchain technology in cryptocurrency has helped Kenyan online businesses optimize their asset base

for higher ROI. It specifically looks at the relationship between digital ledger systems, smart contracts, transaction validation, permissioned blockchains, and business profitability. This is consistent with Muena (2013) study, which showed how Safaricom leveraged its asset mix to become the most profitable company in East Africa. Moreover, Nzioka (2012) used RBV Theory to explain how Kenyan commercial banks leveraged their resources to gain competitive advantages.

Rodgers (1962) introduced the Diffusion of Innovation (DOI) Theory, which describes how new technologies emerge, evolve, and spread within a system or population. According to Dearing (2009), technology adoption does not occur instantly, but rather through a process in which different groups adopt innovations at varying rates. The theory divides adopters into five categories: innovators, who are the first to embrace a technology; early adopters, who influence others through their leadership; the early majority, who require proof of a technology's effectiveness before adopting it; the late majority, who adopt only after widespread use; and laggards, who are extremely resistant to change. Factors that influence the adoption process include compatibility, relative advantage, trialability, complexity, and observability. This study uses DOI Theory to examine how online companies in Kenya have adopted blockchain technology, outlining the stages of diffusion. Blockchain technology, which was initially used primarily in cryptocurrency, has since spread to a variety of industries. Understanding these adoption stages sheds light on blockchain's potential benefits for online businesses.

2.2 Empirical Literature

The empirical literature review looks at how blockchain technology affects the return on investment (ROI) of Kenyan online businesses, with a focus on digital ledgers, smart contracts, and permissioned blockchains. A digital ledger is a system for recording transactions, including Bitcoin, in which data is entered simultaneously in multiple locations. Blockchain technology has expanded its reach beyond finance, with applications in energy, insurance, and healthcare. Sotani et al. (2022) investigated the challenges and applications of digital ledger technologies and found that ledger records influence ROI for companies implementing blockchain. The distributed ledger technology improves trust by ensuring that transaction records cannot be changed without leaving traces. Other applications include peer-to-peer energy trading and insurance, which improve accuracy and cost efficiency. However, there has been limited research linking digital ledger technology to ROI for Kenyan online businesses. Similarly, Justinia (2019) investigated digital ledger technology in healthcare, emphasizing its benefits such as improved patient outcomes, cost savings, and data integrity. Despite these benefits, the study focused on healthcare and did not consider online businesses.

Xu et al. (2019) examined blockchain applications in cryptocurrency and other industries, concluding that digital ledger technology improves transparency, reduces fraud, and streamlines data management. However, the study did not investigate ROI in Kenyan online businesses, necessitating additional research. Grietzmann and Grossetti (2021) investigated the economic benefits of blockchain in cryptocurrency, focusing on its role in increasing accountability and fraud prevention. However, their research focused solely on economic benefits, without investigating ROI for Kenyan online businesses. Bonnet and Teuteberg (2023) investigated blockchain applications in intellectual property management and concluded that digital ledger technology improves security and decentralization. Despite these findings, the study did not investigate the relationship between digital ledgers and ROI in Kenya's online business sector, emphasizing the need for additional research.

Smart contracts, another important aspect of blockchain technology, automate contract enforcement and ensure contractual obligations are met. According to Mhlanga (2023), blockchain was originally designed for cryptocurrency but has since evolved to enable smart
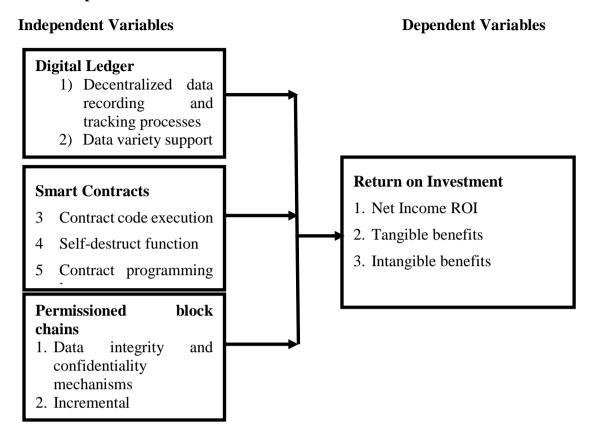
contracts, which eliminate uncertainties in business transactions. Khan et al. (2021) conducted a systematic review of smart contracts, identifying benefits such as decentralization, verifiability, and automated agreement enforcement. However, the study identified several challenges, including legal issues, reliance on off-chain resources, scalability concerns, and immutability issues. While these are important considerations, the study did not look at how smart contracts affect ROI for Kenyan online businesses. In addition, Varfolomeev et al. (2021) investigated smart contracts in smart cities, highlighting their importance in improving data security and reliability. Vigliotti et al. (2021) emphasized the ability of smart contracts to reduce uncertainty in contractual processes. However, neither study provided empirical data on ROI for online businesses in Kenya. Anter et al. (2020) conducted a bibliometric analysis of 468 peer-reviewed articles and found that smart contracts promote innovation by replacing traditional contract methods. Kirwa (2022) emphasized that smart contracts reduce legal and administrative costs, making them an indispensable tool for businesses. Despite these findings, the relationship between smart contracts and ROI in Kenya's online businesses remains unexplored, highlighting the need for additional research.

Permissioned blockchains provide restricted access to maintain data confidentiality. Only authorized participants can access transactions on permissioned blockchains, as opposed to public blockchains. Amiri et al. (2021) examined the characteristics and applications of permissioned blockchains, highlighting advantages such as confidentiality, verifiability, performance, and scalability. However, their research did not look at the return on investment for online businesses that use permissioned blockchains, particularly in Kenya. Polge et al. (2021) compared five majors permissioned blockchain frameworks, including Quorum, Fabric, R3 Corda, Ethereum, and Multichain, to assess their performance, privacy, scalability, and adoption. They found that newer frameworks outperformed older ones, but the study did not assess their ROI impact on Kenyan online businesses. Lineros (2020) supported the idea that permissioned blockchains improve collaboration, data privacy, and verification. However, like other studies, it did not investigate the impact on ROI. Punathumkandi et al. (2021) investigated the benefits of permissioned blockchains, such as decentralization, transparency, and immutability, while highlighting interoperability issues. Because different frameworks operate independently, businesses must conduct extensive assessments to determine the best option.

2.3 Conceptual framework

Independent Variables   **Dependent Variables**

Figure 1: Conceptual Framework

3.0 Methodology

The study employed a correlational research design to examine the relationship between blockchain technologies digital ledgers, smart contracts, and permissioned blockchains and return on investment, allowing analysis without pre-existing hypotheses (Mugenda & Mugenda, 2003). The target population comprised 1,664 online companies in Kenya, a leading adopter of blockchain technology, with a sample of 322 firms using blockchain for at least three years. Simple random sampling was applied using Yamane's (1967) formula to ensure representation. Data collection involved structured online questionnaires with a five-point Likert scale, covering key study variables. A pilot study assessed validity and reliability through expert review and Cronbach's Alpha, with necessary adjustments made. Ethical approvals were secured from Kenyatta University and NACOSTI, and company management was contacted before data collection. Data analysis, conducted using SPSS version 22, applied inferential and descriptive methods, including correlation and regression analyses. Diagnostic tests, such as normality, multicollinearity (VIF threshold of 5), and linearity checks, ensured valid regression assumptions. Ethical considerations, including participant privacy and voluntary participation, were strictly adhered to, reinforcing the study's credibility.

4.0 Key Result and Findings

The study achieved an 82% response rate, exceeding the 70% adequacy threshold for effective analysis (Mugenda & Mugenda, 2003). It examined the impact of blockchain technology—digital ledgers, smart contracts, and permissioned blockchains—on the return on investment (ROI) of online companies in Kenya. Descriptive analysis revealed that blockchain digital ledgers enhance trust, fraud detection, and efficiency, leading to cost savings and improved

company performance. Smart contracts automate transactions, boost security, and increase stakeholder confidence, ensuring transparency and reliability. Permissioned blockchains strengthen data security and regulate access, fostering efficiency and decentralization. Overall, blockchain technology positively influences ROI by improving transparency, reducing costs, and preventing fraud, highlighting its strategic value for online companies

4.1 Correlation Analysis

This section presents the correlation between blockchain technologies and the return on investment (ROI) of online companies. The analysis examines the strength and direction of relationships among blockchain digital ledgers, smart contracts, and permissioned blockchains, providing insights into their impact on business performance. The results are summarized in Table 1.

Table 1: Correlation Analysis Results

		ROI of online companies	Blockchain digital ledger	Blockchain smart contracts	Permissioned block chains
ROI of online companies	Pearson correlation	1			
	Sig(2-tailed)				
	N	146			
Blockchain digital ledger	Pearson correlation	.7129*	1		
	Sig(2-tailed)	.0000			
	N	146	146	146	
Blockchain smart contracts	Pearson correlation	.7821*	.7736*	1	
	Sig(2-tailed)	.0000	.0000		
	N	146	146	146	
Permissioned block chains	Pearson correlation	.7355*	.7292*	.7603*	1
	Sig(2-tailed)	0.0000	0.0000	.0000	
	N	**146**	**146**	**146**	

The correlation analysis in Table 1 reveals a significant and positive relationship between the ROI of online businesses and blockchain technologies. Specifically, blockchain digital ledgers ($r = 0.7129$, $p < 0.05$), blockchain smart contracts ($r = 0.7821$, $p < 0.05$), and permissioned blockchains ($r = 0.7355$, $p < 0.05$) all demonstrated strong correlations with online business performance. These findings align with prior research, such as Sotani et al. (2022), which highlighted the role of blockchain digital ledgers in enhancing cost efficiency and security. Similarly, Khan et al. (2021) and Vigliotti et al. (2021) emphasized the structural and economic advantages of smart contracts in boosting ROI. Additionally, the study supports the work of Polga et al. (2021), Novotny et al. (2018), and Amiri et al. (2021), who outlined the benefits of permissioned blockchains in improving online business performance. Overall, the study confirms blockchain's crucial role in enhancing ROI.

4.2 Regression Analysis

This section presents the regression analysis results, which examine the effect of blockchain technologies—digital ledgers, smart contracts, and permissioned blockchains—on the return on investment (ROI) of online companies in Kenya. The analysis includes the model summary, ANOVA, and regression coefficients, providing a comprehensive understanding of the

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relationship between blockchain adoption and business performance. The results are summarized in Table 3.

Table 3: Regression Analysis Results

Model	R	R Square	Adjusted R Square	Std. Error	Sig.
1	0.837	0.589	0.611	0.46031	0.000
Source	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig**
Regression	0.651	4	0.264	0.544	0.000
Residual	17.45	142	0.768		
Total	18.101	146			
Model	**B**	**Std. Error**	**Beta**	**t**	**Sig**
Constant	0.851	0.127		8.246	0.000
Digital Ledger	0.065	0.029	0.119	2.243	0.046
Smart Contracts	0.058	0.034	0.124	1.802	0.021
Permissioned Blockchains	0.056	0.042	0.144	1.651	0.039

The coefficient of determination (R^2 = 0.589) indicates that blockchain digital ledger, smart contracts, and permissioned blockchains collectively explain 58.9% of the variance in ROI ($p < 0.05$). The ANOVA results confirm the model's statistical significance ($p = 0.000$), demonstrating that blockchain adoption significantly influences business performance. Regression coefficients reveal that all three blockchain components positively impact ROI, with the digital ledger having the highest effect (B = 0.065, $p = 0.046$), followed by smart contracts (B = 0.058, $p = 0.021$), and permissioned blockchains (B = 0.056, $p = 0.039$). These findings align with prior research by Sotani et al. (2022) and Xu et al. (2019), which highlighted blockchain's role in enhancing security, transparency, and efficiency. Additionally, Khan et al. (2021) and Vigliotti et al. (2021) emphasized the structural and economic advantages of smart contracts, while Amiri et al. (2021) and Novotny et al. (2018) demonstrated the benefits of permissioned blockchains in improving data security and access control. These results confirm blockchain's strategic significance in driving business performance and financial growth.

5.0 Conclusion

The study concluded that the blockchain digital ledger had a significant impact on the return on investment (ROI) of Kenyan online companies by improving data security, service speed, confidentiality, and cost savings. Blockchain smart contracts improved transaction security, autonomy, and trust, resulting in a higher ROI. In addition, permissioned blockchains increased ROI significantly by improving data integrity, increasing transparency, preventing fraud, and restricting access to legitimate users. The study adds to the existing literature on blockchain's impact on financial performance, expanding our understanding of its applications and encouraging adoption in Kenya's financial sector. Firms may use blockchain to improve financial security, and future research can explore additional blockchain applications.

6.0 Recommendations

The study suggests that Kenyan online companies integrate blockchain digital ledger systems to improve data management efficiency, fraud detection, and return on investment (ROI). Given the strong correlation between blockchain adoption and ROI, businesses should shift away from traditional transaction methods and toward distributed ledger systems. Permissioned blockchains are particularly recommended for improving data security, transparency, and fraud prevention by limiting network access to verified users. At the policy level, the Kenyan government, through the National Assembly, could enact legislation to encourage blockchain adoption across various economic sectors. Furthermore, technical support and training initiatives should be provided to startups and other businesses in order to raise awareness and facilitate blockchain adoption. These measures would improve data security, reduce cybercrime, and increase the efficiency of electronic transactions. For future research, the study recommends investigating the indirect roles of blockchain project purpose and firm characteristics in influencing ROI. Beyond determining whether blockchain adoption improves returns, future research should look into the conditions under which ROI can increase or decrease. This would provide a better understanding of how blockchain technology can be effectively used to drive business growth.

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