SSRG International Journal of Recent Engineering Science
ISSN: 2349–7157 / https://doi.org/10.14445/23497157/IJRES-V11I6P109

Volume 11 Issue 6, 88-107, Nov-Dec 2024

Original Article

Blockchain and Consumer Data: How Decentralization is Reshaping Marketing Strategies in Iringa Municipal, Tanzania

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Received: 09 October 2024 Revised: 11 November 2024 Accepted: 28 November 2024 Published: 16 December 2024

Abstract *- This study explored the impact of blockchain technology on consumer data management and marketing strategies, focusing on how decentralization reshapes traditional practices. It aimed to assess the awareness and understanding of blockchain among marketing professionals, examine data privacy concerns, and evaluate the technology's potential to enhance data security and consumer trust. Utilizing a sample size of 127 respondents, the study employed a mixed-methods approach, combining quantitative and qualitative interviews. Key findings revealed that while there was a moderate understanding of blockchain concepts, significant concerns remained regarding data privacy and regulatory challenges. The research highlighted the perceived benefits of blockchain, such as improved efficiency and transparency in marketing initiatives, alongside the challenges of scalability and adoption. The study concluded that addressing educational gaps and regulatory issues is crucial for leveraging blockchain technology effectively in the marketing sector.*

Keywords *- Blockchain technology, Consumer data, Marketing strategies, Decentralization, Data privacy, Data security, Consumer trust, Targeted advertising.*

1. Introduction

The rapid evolution of digital technologies has dramatically transformed the marketing landscape, with consumer data emerging as a critical asset for businesses aiming to personalize and optimize their strategies. However, the traditional centralized systems for managing consumer data have increasingly come under scrutiny due to issues such as data breaches, unauthorized access, and the misuse of personal information. These challenges have eroded consumer trust and highlighted the need for more secure and transparent data management methods. Blockchain technology has emerged as a potential solution to address concerns in marketing related to data privacy, security, and transparency [1]. By leveraging its decentralized and immutable nature, blockchain offered opportunities to revolutionize marketing practices, enhancing trust, efficiency, and accountability [2]. The technology demonstrated potential applications in various marketing areas, including verifying ad impressions, combating ad fraud, ensuring data integrity, and optimizing customer reward programs [1]. Blockchain also fostered disintermediation, reinforced trust, and enabled enhanced privacy protection [2]. Its impact extended to supply chain management, customer relationship management, and digital identity [3]. While still in its early stages, blockchain technology showed promise in increasing consumer trust by guaranteeing data honesty and integrity and simplifying marketing processes by eliminating intermediaries [4]. Blockchain technology was proposed as a revolutionary solution for marketing challenges in Tanzania, offering enhanced data privacy, security, and transparency [1]. It can potentially address issues in various sectors, including healthcare, land registration, and banking, by improving record management, reducing fraud, and increasing transparency [5]. Blockchain was seen as a transformative force in marketing, enabling trust-building, fraud prevention, and efficient customer loyalty programs [2]. Its implementation in digital marketing was highly effective, as it increased consumer trust by ensuring data integrity and eliminating intermediaries, making the marketing process more straightforward, cost-effective, and faster [4]. Despite its potential benefits, adopting blockchain technology in Tanzania lagged behind other African countries, highlighting the need for increased investment and implementation across various business sectors [5]. Data privacy concerns in marketing have become increasingly significant in the digital age, presenting challenges for businesses and consumers. Studies have shown that consumers are wary of how their personal information is collected and used, leading to privacy-protecting behaviors that differ across countries [6].

This has prompted businesses to adapt their marketing strategies and comply with evolving legal obligations, such as GDPR and CCPA [7]. Small entrepreneurial firms often face greater disadvantages in addressing privacy concerns than large incumbents [8]. However, companies can mitigate these concerns through various strategies, including establishing comprehensive data privacy programs, employee training, and engaging reliable service providers [7]. The digital marketing landscape is being reshaped by privacy regulations, data breaches, and consumer fears, necessitating a balance between effective marketing and respecting consumer privacy [9]. Addressing privacy concerns may ultimately stimulate innovation and provide a competitive advantage for businesses [8].

Research on data privacy in Tanzania revealed significant challenges in protecting consumer data in the digital age. Tanzania lacked comprehensive data protection legislation, relying instead on fragmented laws that insufficiently addressed privacy concerns in cyberspace [10]. The country's history with privacy protection has been difficult, with unsuccessful attempts to enact privacy laws in the past [11]. Recent reforms aimed to address these issues, including a draft Personal Data Protection Bill [11]. The rapid technological developments and globalization have increased the scale of data collection and sharing, posing new challenges for privacy protection [12]. Adopting the EU's General Data Protection Regulation (GDPR) has influenced Tanzania's data privacy law and practice, sparking law and policy reforms to comply with international standards for personal data transfer [13]. These developments highlight the evolving nature of privacy rights and the need for comprehensive data protection measures in Tanzania.

Blockchain technology emerged as a promising solution for enhancing data security in various domains, including cloud computing and network security [14, 15]. Its decentralization, immutability, and transparency principles offered a unique approach to addressing vulnerabilities and mitigating risks in the digital realm [14]. Blockchain's distributed and secured hashed mechanism provided a new perspective for data security technology evolution [16]. It demonstrated potential in improving data integrity, authentication, and authorization processes across various applications, such as supply chain management and identity verification [17]. However, the adoption of blockchain faced challenges related to privacy concerns, regulatory uncertainty, and technological complexities [18]. Despite these obstacles, blockchain technology was recognized as a tool capable of reforming data management and security practices across multiple industries [16, 18]. Its decentralized, immutable, and encrypted nature offers improved security for managing patient records, land registration systems, and banking transactions in Tanzania [5]. Blockchain integration in cloud computing environments can address key security challenges such as data privacy, integrity, and identity management [16]. Studies have shown that blockchain is frequently cited as a key feature for improving data sharing processes in industries, with applications in finance, IoT, healthcare, and supply chain management [19]. The combination of decentralized cloud storage and blockchain technology, hashing algorithms like SHA-512, and encryption methods like AES can significantly enhance data security, reducing the risk of tampering and unauthorized access [20].Blockchain technology has emerged as a transformative force in marketing, offering solutions to enhance transparency, trust, and accountability [1, 21]. By leveraging distributed ledgers, blockchain can combat ad fraud, verify ad impressions, and ensure data integrity [1]. Research has shown that blockchain-based marketing initiatives can significantly impact consumer trust levels and engagement [21]. The technology fosters disintermediation, reinforces transparency, enhances privacy protection, and enables creative loyalty programs [2].

Blockchain's ability to monitor distributed marketing processes and inject transparency into the industry addresses accountability concerns and helps combat fraudulent practices, which are estimated to cost the industry $44 billion by 2022 [22]. As blockchain continues to evolve, it promises to reshape marketing practices, paving the way for a more secure, efficient, and consumer-centric future [1, 2]. In Tanzania, where manual record-keeping and weak systems have led to issues in healthcare, land registration, and banking, blockchain implementation could offer enhanced security and transparency [5]. The technology's decentralized and immutable nature allowed marketers to establish trust, enhance security, and foster transparency throughout the advertising supply chain [1]. Blockchain acted as incremental innovation, empowering the consumer-centric paradigm and fostering disintermediation [2]. It served as a missing trust layer in the evolution of the Internet, addressing the growing concern of trust erosion in the 21st-century business environment [23]. By adopting blockchain, businesses in

Tanzania could potentially benefit from reduced paperwork, improved transparency, and enhanced security across various sectors [5]. Recent studies have explored the adoption and applications of blockchain in marketing, revealing its potential to revolutionize traditional practices through decentralization, security, and transparency [24]. Researchers have identified key criteria for evaluating blockchain-based marketing platforms, employing methodologies like AHP-TOPSIS to provide a systematic framework for platform selection [25]. The technology has shown particular relevance in supply chain management, internal operations, and marketing campaigns [26]. While blockchain applications in marketing are still in their infancy, they offer promising opportunities for enhancing trust, efficiency, and accountability in advertising supply chains and customer reward programs [1, 24]. In Tanzania, the

adoption of blockchain-based marketing platforms has been slow despite its potential to address challenges in various sectors such as healthcare, land registration, and banking [5]. However, recent studies have shown that integrating blockchain and artificial intelligence significantly influences SME marketing strategies in Tanzania [27]. Evaluating blockchain-based marketing platforms requires consideration of criteria beyond traditional financial metrics, as highlighted by the AHP-TOPSIS approach [25]. While research on blockchain applications in marketing is maturing, the development of comprehensive blockchain-based marketing frameworks remains in its infancy [24]. As the field evolves, it presents opportunities for marketers, researchers, and practitioners to explore innovative strategies in an increasingly competitive digital landscape.

Blockchain technology demonstrated significant potential to transform customer-business relationships by enhancing transparency, security, and trust. It redefined customer service interactions across various stages of the customer lifecycle [28] and offered opportunities for improved brand positioning, storytelling, and loyalty programs [29]. The technology enabled a new generation of Customer Relationship Management (CRM) systems, prioritizing data security and trust in handling customer information [30]. Blockchain's decentralized ledger ensured data confidentiality and accuracy, automatically verifying information origins and interactions [31]. These features addressed challenges in traditional CRM systems and fostered stronger, more transparent relationships between businesses and consumers. As blockchain adoption increased, it presented opportunities for businesses to reimagine customer interactions and gain competitive advantages in the digital age [29, 31]. Studies have highlighted its potential to improve transparency, security, and efficiency across various sectors, including healthcare, land registration, and banking [5].

In customer relationships, blockchain can foster stronger connections between businesses and consumers by enabling more secure and transparent transactions [29]. The technology's decentralized nature ensures data confidentiality and accuracy, which can enhance customer trust [31]. In the airline industry, blockchain has significantly improved customer loyalty programs by reducing administrative costs and enhancing user engagement. Despite its potential benefits, blockchain adoption in Tanzania was found to be lagging behind other African countries, suggesting a need for increased investment and implementation across various business sectors [5].The problem addressed in this study revolved around the growing concerns over data privacy, security, and consumer trust in the context of marketing strategies. Traditional centralized systems for managing consumer data had become increasingly vulnerable to breaches, unauthorized access, and misuse, significantly eroding consumer confidence. As businesses strived to harness data for personalized marketing, the need for secure, transparent, and consumer-controlled data management systems became more pressing. This study investigated how blockchain technology, with its decentralized and immutable structure, could address these challenges, offering a solution that enhanced data security and restored consumer trust in marketing practices. This study aimed to explore the potential of blockchain technology in enhancing data security and rebuilding consumer trust in marketing strategies.

Specifically, the study aimed to assess how blockchain's decentralized and transparent nature could address existing concerns about data privacy and security while evaluating its impact on consumer attitudes towards marketing practices that leverage this technology. The main contribution of this study was to provide a comprehensive analysis of how blockchain technology can be leveraged to address critical challenges in data security and consumer trust within marketing strategies. By examining blockchain's potential benefits, challenges, and applications in this context, the study offered valuable insights for marketers, businesses, and policymakers seeking to implement more secure and transparent data management practices that align with consumer expectations. The remaining part of the paper is organized as follows: methodology is in part two, results and discussion are in part three, and part four contains conclusion and recommendations.

2. Methodology

The methodology of this study involved a mixed-methods approach to comprehensively explore the impact of blockchain technology on data security and consumer trust in marketing strategies. A total of 127 respondents were selected through a purposive sampling technique, targeting individuals with relevant experience or knowledge in blockchain, data security, and marketing. The study utilized both quantitative and qualitative data collection methods. Quantitative data were gathered through structured questionnaires designed to assess respondents' awareness, understanding, and perceptions of blockchain technology's role in marketing.

Likert-scale questions were employed to measure the degree of agreement or concern regarding various aspects of blockchain, including its potential benefits, challenges, and impact on data security and consumer trust. Qualitative data were collected through in-depth interviews with a subset of respondents to gain deeper insights into their experiences and perspectives. These interviews focused on understanding the nuances of blockchain’s applicability in marketing and the specific challenges and opportunities perceived by industry professionals. The data were then analyzed using statistical software for quantitative responses, while thematic analysis was applied to the qualitative data to identify key themes and patterns. The findings were synthesized to understand the study's objectives comprehensively.

3. Results and Discussion

The results and discussion of this study provided a comprehensive analysis of how blockchain technology influences data security and consumer trust in marketing. The study revealed significant insights into the potential benefits and barriers to its adoption in marketing strategies by examining the key indicators such as awareness, perceptions, and challenges related to blockchain.

3.1. Demographic Information

The demographic information of the study offered essential context regarding the participants' characteristics, including their age, gender, education level, employment status, and years of experience. Understanding these demographic factors was crucial for interpreting the respondents' perspectives on blockchain technology and its impact on marketing strategies, as different demographic groups may have varied levels of awareness, trust, and engagement with the technology.

3.1.1. Age of the Respondents

The age distribution of the respondents in the study revealed a diverse group with varying experiences and perspectives. The majority of the respondents, 42 in total, were aged between 25-34 years, accounting for 33.1% of the sample. This group was likely to be in the early stages of their careers, possibly with a strong inclination towards adopting new technologies like blockchain due to their relative familiarity with digital tools.

Their participation provided valuable insights, particularly regarding how younger professionals might appeal to or utilise blockchain in marketing strategies. The second-largest age group was those between 35-44 years, comprising 35 respondents or 27.6% of the sample. Individuals in this age range typically have more established careers and might have a broader understanding of traditional marketing practices. Their input was crucial in assessing the potential integration of blockchain technology into existing marketing frameworks and understanding how it could impact more conventional approaches. Respondents aged 45 and above comprised 25.2% of the sample, with 32 individuals. This group likely included senior professionals with extensive experience in marketing. Their views were instrumental in evaluating the challenges and opportunities of adopting blockchain technology in a field they have seen evolve. The insights from this demographic helped to identify potential barriers to adoption, such as resistance to change or the perceived complexity of blockchain.The youngest group, aged 18-24 years, comprised 18 respondents, representing 14.2% of the sample. This demographic, being digital natives, provided perspectives on how the emerging generation of marketers might perceive blockchain. Their familiarity with new technologies and expectations for transparency and security in digital transactions likely influenced their responses. Overall, the age distribution highlighted the varying levels of familiarity, comfort, and expectations of different age groups regarding implementing blockchain technology in marketing.

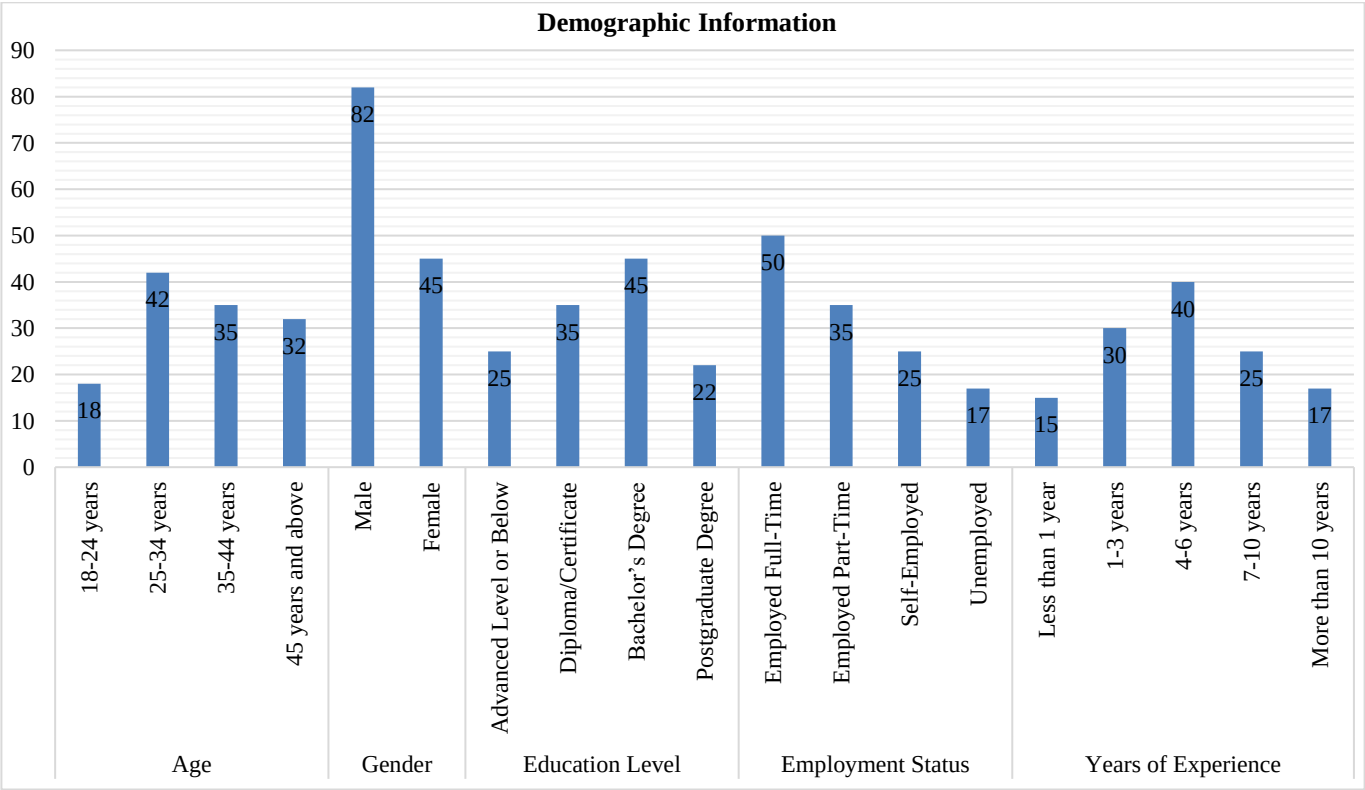

Fig. 1 Showing demographic information of the respondents

3.1.2. Gender of the Respondents

The gender distribution among the respondents in the study showed a noticeable difference in representation between males and females. Out of the total sample size, 82 respondents were male, accounting for 64.6% of the sample. This higher representation of males could reflect the demographic trends within the marketing and technology sectors, where men have historically been more prominent. The male respondents likely provided a perspective that may have leaned towards technical understanding and adoption of blockchain technology, given the common association of men with tech-oriented roles.On the other hand, there were 45 female respondents, making up 35.4% of the sample. While the number of female participants was lower, their contributions were equally important.

The female respondents possibly offered insights into consumer trust and ethical considerations, areas where women have been observed to express strong concerns. Their responses might have highlighted different priorities or concerns compared to their male counterparts, such as the importance of transparency and the impact of blockchain on data privacy.This gender disparity in the sample may also reflect broader industry patterns, where there is often a gender gap in technology-related fields. However, the inclusion of both genders in the study ensured a more comprehensive understanding of the potential impact of blockchain on marketing. The responses from male and female participants provided a balanced view, allowing for a more nuanced discussion of how blockchain technology could influence marketing strategies across different demographic groups. This gender-based analysis also emphasized the need to consider diverse perspectives when evaluating adopting and implementing new technologies in any field.

3.1.3. Education Level of the Respondents

The educational background of the respondents in the study demonstrated a diverse range of qualifications, which contributed to a multifaceted understanding of blockchain technology and its impact on marketing strategies. Among the participants, a significant portion, 45 respondents (35.4%), held a Bachelor’s degree. This group likely represented individuals with a solid academic foundation, often associated with higher critical thinking and analytical skills. Their responses might have reflected a more in-depth understanding of blockchain's technical aspects and potential marketing applications, as they may have been more familiar with advanced concepts and industry-specific knowledge.Respondents with a Diploma or Certificate comprised the second-largest group, with 35 participants (27.6%). This group probably consisted of individuals with specialized training or vocational education, often focusing on practical skills and hands-on experience. Their insights could have emphasized the operational aspects of blockchain technology, such as its implementation challenges and the practical benefits it offers in marketing. These respondents might have provided a more grounded perspective, focusing on blockchain's feasibility and real-world application within marketing practices.There were 25 respondents (19.7%) who had an advanced level education or below. This group likely included those who might not have had formal higher education but possibly had extensive experience in the field. Their contributions were valuable in providing a grassroots perspective on blockchain technology, possibly highlighting concerns about accessibility, ease of use, and the broader implications of blockchain on everyday marketing activities. Their views might have focused more on the practical challenges and the need for simplified solutions that those with varying technical expertise could easily adopt.Lastly, 22 respondents (17.3%) had a Postgraduate degree, representing the most academically advanced group in the study.

This group likely included individuals with a deep theoretical understanding and possibly specialized knowledge in areas such as technology, finance, or marketing. Their responses could have been more analytical, addressing the broader implications of blockchain technology on the marketing industry, including its potential to reshape market dynamics, influence consumer behavior, and introduce new ethical considerations. This group might have also been more aware of emerging trends and the future outlook of blockchain technology in marketing.Overall, the varied educational backgrounds of the respondents enriched the study, providing a comprehensive view of how blockchain technology is perceived and understood across different levels of education. This diversity in education levels allowed for a more robust discussion, capturing a wide range of opinions and insights that reflect the complexities and multifaceted nature of blockchain's impact on marketing strategies.

3.1.4. Employment Status of the Respondents

The respondent's employment status in the study revealed a varied workforce with distinct perspectives on the implications of blockchain technology in marketing. A significant portion of the respondents, 50 individuals (39.4%), were employed full-time. This group likely consisted of professionals who were deeply embedded in their respective industries and had extensive experience with current marketing practices.

Their full-time employment status suggested that they were regularly engaged with the challenges and opportunities within their fields, possibly making them more attuned to the practical applications of blockchain technology in a professional setting. These respondents may have provided insights that reflected their daily interactions with data security issues, consumer trust, and the potential benefits of integrating blockchain technology into existing marketing strategies.The second-largest group, consisting of 35 respondents (27.6%), was employed part-time. This group

might have included individuals who were balancing multiple roles or pursuing further education while working. Their part-time status could indicate a more flexible approach to their professional responsibilities, possibly allowing them to engage with blockchain technology more exploratory or innovatively. These respondents may have highlighted the adaptability of blockchain technology in various marketing contexts, particularly in smaller or more agile organizations where part-time roles are common. Their insights likely emphasized the practical benefits and challenges of implementing blockchain solutions on a smaller scale and the potential for blockchain to enhance efficiency in part-time or freelance work settings. There were also 25 respondents (19.7%) who were self-employed, representing a group with a unique perspective on blockchain technology.

Self-employed individuals often operate in more entrepreneurial or independent environments where they are directly responsible for their business operations. This group likely viewed blockchain technology through the lens of its potential to disrupt traditional business models and create new opportunities for innovation in marketing. Their responses may have focused on the flexibility and scalability of blockchain solutions and how blockchain could empower small businesses or independent marketers to compete more effectively in a digital marketplace. The self-employed respondents might have also discussed the challenges of adopting new technologies without the support of a larger organizational infrastructure. Finally, 17 respondents (13.4%) were unemployed during the study. This group provided a valuable perspective on the accessibility and inclusivity of blockchain technology. Their unemployment status might have made them more sensitive to issues related to economic opportunities, job security, and the potential of blockchain to create new pathways for employment in the marketing sector.

These respondents could have expressed concerns about the barriers to entry in the blockchain space, particularly those without current employment or those transitioning between jobs. Their insights may have highlighted the need for education and training initiatives to ensure that blockchain technology is accessible to a broader population, including those who are currently unemployed or underemployed. In general, the diverse employment statuses of the respondents contributed to a rich understanding of how blockchain technology is perceived across different workforce segments. This diversity allowed the study to capture a wide range of opinions and experiences, reflecting how blockchain could impact marketing practices in both traditional and non-traditional employment contexts.

3.1.5. Years of Experience of the Respondents

The study's respondents demonstrated a wide range of professional experience, which provided valuable insights into how familiarity with blockchain technology and its potential applications in marketing varied across different career stages. Among the participants, 40 individuals (31.5%) reported having 4 to 6 years of experience. This group represented professionals who had likely moved beyond the initial learning phases of their careers and were now deeply engaged in their industries. Their experience may have given them a solid foundation in traditional marketing practices, allowing them to assess blockchain technology's disruptive potential critically. These respondents likely offered a balanced view, recognizing both the benefits and challenges of integrating blockchain into established marketing strategies.

Their perspectives might have reflected a blend of optimism and caution, as they were seasoned enough to understand the complexities of technological adoption but still early enough in their careers to be open to innovation.The next significant group, consisting of 30 respondents (23.6%), had between 1 to 3 years of experience. These participants were relatively new to their professions, likely still adapting to industry standards and practices. Their fresh perspectives could have made them more enthusiastic about new technologies like blockchain, seeing it as a way to differentiate themselves in a competitive job market. However, their limited experience might have also led them to view blockchain with some degree of uncertainty, particularly in understanding how such a transformative technology could be applied in practical marketing scenarios.

This group likely provided insights into the learning curve associated with blockchain technology, highlighting the need for comprehensive training and education to ensure that emerging professionals can effectively leverage blockchain in their work.A small but significant portion of respondents, 25 individuals (19.7%), reported having 7 to 10 years of experience. This group likely included mid-career professionals who had witnessed substantial industry changes over the years. A combination of deep industry knowledge and an awareness of the ongoing technological evolution in marketing may have shaped their perspectives. These respondents were likely well-versed in the limitations of current marketing technologies.

They could have seen blockchain as a promising solution to persistent challenges such as data security and consumer trust. However, they may have also expressed concerns about the scalability and interoperability of blockchain technology, given their experience with the complexities of implementing new systems in large organizations.Another group of 17 respondents (13.4%) had more than 10 years of experience, representing the most seasoned professionals in the study. These individuals likely had a comprehensive understanding of the marketing landscape and may have approached blockchain technology with a more critical eye. Their extensive experience could

have made them cautious about adopting new technologies, particularly if they perceived blockchain as untested or lacking in practical applications. On the other hand, their deep industry knowledge might have allowed them to recognize the strategic value of blockchain in addressing long-standing issues related to transparency and accountability in marketing. Their insights would have been invaluable in understanding the potential barriers to adoption among more experienced professionals and identifying the factors that could encourage this group to embrace blockchain technology.

Lastly, 15 respondents (11.8%) had less than 1 year of experience. This group likely consisted of individuals just starting their careers and still building their professional identities. Their views on blockchain technology were probably influenced by their recent exposure to contemporary marketing education, where emerging technologies like blockchain are often emphasized.

While their lack of experience might have limited their understanding of the practical challenges associated with blockchain, their enthusiasm and openness to new ideas could have made them strong advocates for its adoption. This group likely highlighted the importance of integrating blockchain education into marketing curricula to prepare the next generation of professionals for a rapidly evolving industry. The respondents' varying years of experience provided a comprehensive view of how blockchain technology is perceived across different career stages. This diversity in experience levels enriched the study's findings, offering a nuanced understanding of the opportunities and challenges associated with blockchain adoption in marketing.

3.2. Awareness and Understanding of Blockchain Technology

The study assessed participants' awareness and understanding of blockchain technology, focusing on three key sub-indicators: Familiarity with Blockchain Concepts, Understanding of Blockchain's Potential Applications in Marketing, and Perceived Benefits and Challenges of Blockchain. The research revealed that respondents generally demonstrated a moderate to high level of familiarity with foundational blockchain concepts, such as decentralization and smart contracts. Additionally, their understanding of how blockchain could be applied in marketing varied, with many recognizing its potential to enhance transparency and efficiency. However, concerns over technical and regulatory challenges often tempered perceptions of the benefits.

3.2.1. Familiarity with Blockchain Concepts

The study explored respondents' understanding of fundamental blockchain concepts, including their knowledge of key principles and awareness of different types of blockchains. By examining these factors, the research aimed to assess the level of familiarity with and potential for future adoption of blockchain technology in the marketing industry.

Understanding of Key Blockchain Principles

As per Figure 2, the study's findings revealed varying levels of familiarity among respondents with key blockchain principles such as decentralization, immutability, and smart contracts. A significant portion of participants, about 50, reported being "very familiar" with these principles, demonstrating a deep understanding of how decentralization eliminates the need for central authority, thereby enhancing security and transparency in transactions.

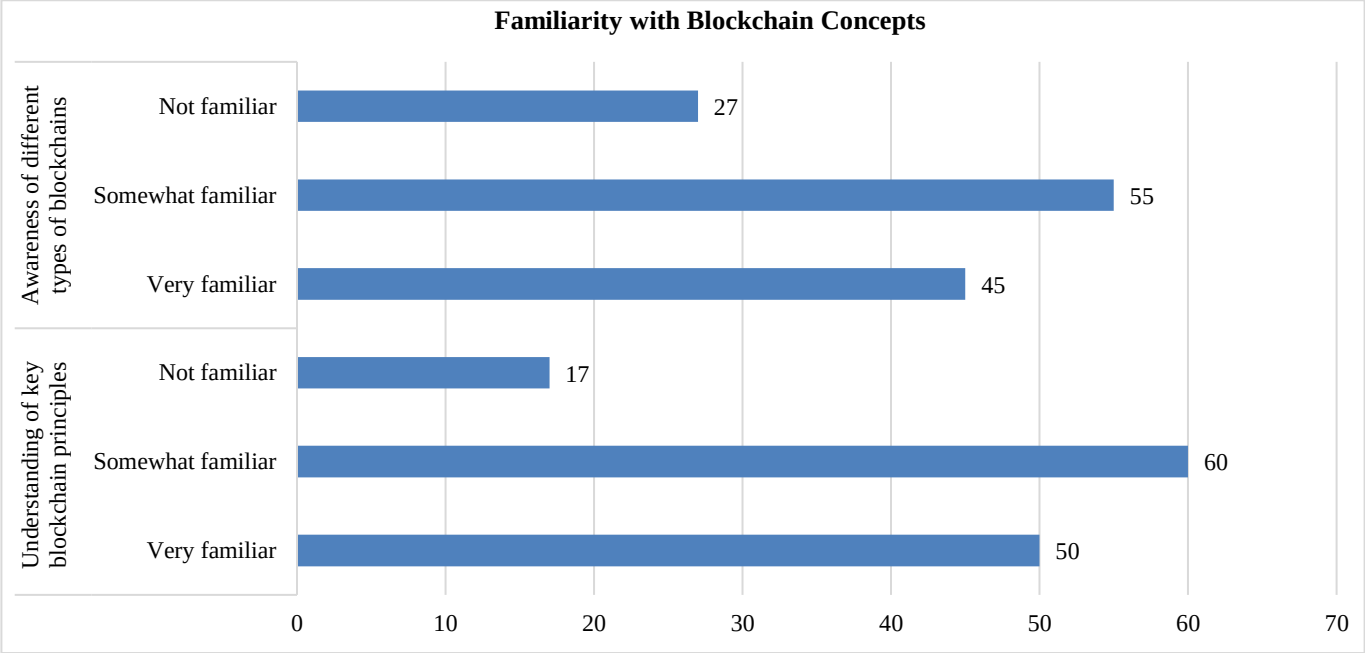

Fig. 2 The Familiarity with blockchain concepts

These respondents often spoke about the transformative potential of decentralization in creating more democratic and resilient systems. One respondent highlighted:

"...Decentralization is revolutionary. It gives power back to the people, ensuring that no single entity can control or manipulate the network..."

In contrast, 60 respondents were "somewhat familiar" with these concepts. While they understood basic terms like immutability and smart contracts, their grasp of how these principles functioned in practice was less comprehensive. These participants acknowledged the importance of immutability in ensuring that blockchain records are permanent and tamper-proof, but they were less confident in explaining the technical mechanisms that achieve this. Similarly, their understanding of smart contracts was limited to the idea that these are self-executing contracts with the terms of the agreement directly written into code, without delving into the complexities of how these contracts operate across different blockchain platforms. A respondent in this group noted:

"...I know smart contracts automate processes, but I am not fully clear on how they are implemented across various blockchains..."

On the other hand, 17 respondents admitted to being "unfamiliar" with these principles, indicating a significant knowledge gap. These individuals often found blockchain concepts overwhelming or too technical, which hindered their ability to engage meaningfully in discussions about blockchain technology's potential applications. This group desired more accessible information and training to understand better how these principles could be applied in real-world scenarios. One participant candidly shared:

"...Blockchain seems too complicated for someone like me who is not tech-savvy. I have heard of decentralization and smart contracts, but I do not really understand what they mean or how they work..."

The results highlighted a need for more targeted education and outreach to bridge the knowledge gap among users who are "somewhat familiar" or "not familiar" with these key blockchain principles. Understanding these concepts could enhance blockchain technology's broader adoption and effective use in various sectors.

Awareness of Different Types of Blockchains

According to Figure 2, the study explored the respondents' awareness of different blockchains, including public, private, and consortium blockchains. The findings indicated that 45 participants were "very familiar" with these distinctions. These respondents demonstrated a comprehensive understanding of how each type of blockchain operates and the specific use cases for which they are best suited. They could articulate the differences clearly, noting that public blockchains, like Bitcoin and Ethereum, are open to anyone and operate on a decentralized network where anyone can participate as a node or miner. In contrast, they understood that private blockchains are restricted and typically used within organizations where only selected participants have access, which enhances control but reduces decentralization. Consortium blockchains, a hybrid model, were recognized as controlled by a group of organizations, balancing transparency with controlled participation. One respondent explained:

"...Public blockchains are great for transparency and decentralization, but in a corporate setting, a private or consortium blockchain is more practical because it allows for more control and privacy..."

Meanwhile, 55 respondents reported being "somewhat familiar" with the different types of blockchains. These participants had a basic understanding of the concepts but lacked in-depth knowledge, especially regarding practical applications and the nuanced differences between the blockchain types. They could identify that public blockchains were more open and transparent, but their grasp of the specifics of private and consortium blockchains was unclear. For example, some in this group knew that private blockchains offer more control but were unsure how this impacts the blockchain's functionality compared to a public blockchain. A respondent mentioned:

"...I know public blockchains are more decentralized, but I am not entirely sure how private or consortium blockchains function differently in real-world applications..."

On the other hand, 27 respondents admitted to being "not familiar" with the different types of blockchains. This group often conflated the concepts or did not know the distinctions. Their lack of awareness was a barrier to understanding the potential applications of blockchain technology across different sectors. These respondents expressed that the complexity of blockchain types made the technology seem inaccessible or irrelevant to their everyday experiences. One participant expressed frustration, saying:

"... I have heard of blockchain in general, but all the different types confuse me. It is hard to keep track of what each one does and why it matters..."

Respondents' varying levels of awareness highlighted the need for educational initiatives tailored to different knowledge levels. While those "very familiar" could benefit from advanced discussions on strategic applications of different blockchain types, those "somewhat familiar" and "not familiar" might require foundational education that simplifies the distinctions and explains their significance in

practical terms. Enhancing this awareness could help users and organizations make more informed decisions about which type of blockchain to implement based on their specific needs.

3.2.2. Understanding of Blockchain's Potential Applications in Marketing

The study focused on understanding how respondents perceived the potential applications of blockchain in marketing, specifically examining their knowledge of blockchain's role in enhancing data transparency, enabling smart contracts for ad buys, and their awareness of specific use cases such as loyalty programs and supply chain transparency. The findings revealed varying levels of understanding among the participants, which reflected their familiarity with blockchain technology and its implications for modern marketing strategies. The study sought to identify gaps and opportunities for further education and adoption of blockchain in marketing practices by analysing their knowledge and awareness.

Knowledge of How Blockchain Can be Used in Marketing

In exploring the knowledge of how blockchain can be utilized in marketing, the study revealed a spectrum of understanding among respondents. As per Figure 3, accounting for 75 participants, a significant portion expressed a moderate understanding of blockchain's potential applications. Many of these respondents articulated the importance of data transparency, emphasizing how blockchain could provide immutable records that enhance trust between consumers and brands.

For instance, one participant noted:

"...I see blockchain as a way to ensure that the data marketers use is accurate and verifiable, which can help reduce consumer skepticism..."

Conversely, only 35 respondents indicated a high level of understanding, demonstrating a more profound grasp of concepts such as smart contracts for advertising transactions.

These participants highlighted the efficiency that smart contracts could introduce, allowing for automated and transparent transactions without intermediaries. One respondent stated:

"...using smart contracts means we could streamline the ad buying process, making it faster and more reliable. This could transform how brands interact with their customers..."

However, a smaller group of 17 respondents reported a low understanding of blockchain's applications in marketing. This lack of awareness often stemmed from limited exposure to the technology, as one participant admitted:

"... I have heard of blockchain but do not really know how it applies to marketing or how it could affect my interactions with brands..."

This gap underlines the necessity for further education and resources to inform marketers and consumers alike about the transformative potential of blockchain in enhancing marketing strategies.

The findings generally highlighted the varying degrees of understanding regarding blockchain's role in marketing, indicating both opportunities for advancement and the need for targeted educational initiatives.

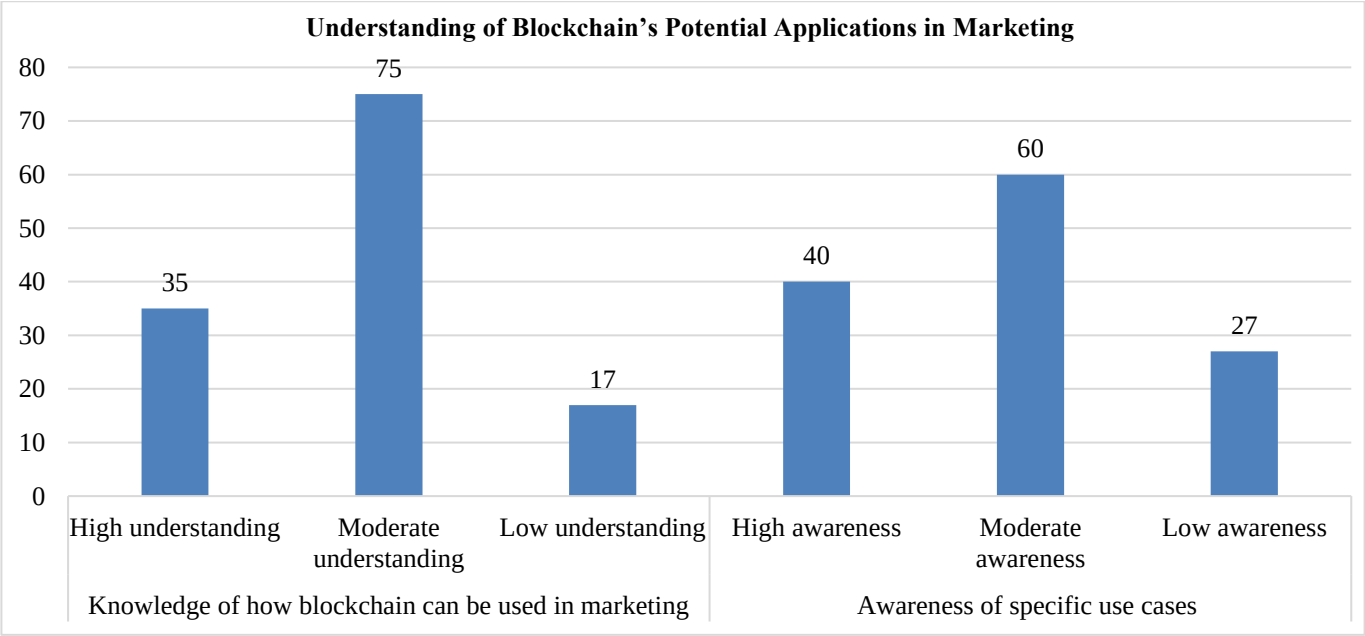

Fig. 3 The understanding of blockchain potential sub-indicators

Awareness of Specific Use Cases

The study found a wide range of familiarity among respondents in assessing the awareness of specific blockchain use cases such as loyalty programs and supply chain transparency. According to figure 3, out of the 127 participants, 60 demonstrated a moderate awareness, which reflected a basic understanding of how blockchain could be applied in marketing initiatives. These respondents knew blockchain could enhance loyalty programs by creating transparent and tamper-proof systems for tracking consumer rewards. As one participant shared:

"…Blockchain can make it easier for customers to trust loyalty programs because they would know that their points are secured and cannot be changed or erased…"

Those with high awareness, totaling 40 respondents, exhibited a more profound comprehension of blockchain's potential, especially in more intricate applications like supply chain transparency. These individuals recognized that blockchain could revolutionize supply chains by offering real-time visibility into product origins, movements, and conditions, ultimately fostering greater trust among consumers. A respondent highlighted this potential by saying:

"…In industries like food or luxury goods, blockchain could show consumers exactly where their products came from and verify that what they buy is authentic. It is a game-changer for both brands and buyers…"

On the other hand, 27 respondents expressed low awareness of these specific use cases, reflecting a lack of exposure to how blockchain could be applied beyond general data security. Many individuals had only a surface-level understanding of blockchain and struggled to see its relevance in marketing contexts. As one participant remarked:

"… I have heard about blockchain being used for security, but I did not know it could be applied to things like loyalty programs or supply chains. It seems like something that only big companies might use..."

This gap in awareness suggests that while some respondents were familiar with specific blockchain applications in marketing, many lacked a comprehensive understanding of the technology's broader capabilities.

The data indicates a need for more education and case studies highlighting practical examples of blockchain's impact on consumer-facing programs. As these technologies become more integrated into marketing strategies, a clearer understanding of their use cases could help bridge the knowledge gap among marketers and consumers.

3.2.3. Perceived Benefits and Challenges of Blockchain

The study revealed that while respondents generally perceived blockchain as a tool to enhance marketing efficiency and effectiveness through improved transparency and data security, they also had significant concerns about its challenges. These included issues like scalability, energy consumption, and navigating regulatory hurdles. Despite recognizing its potential benefits, many participants expressed caution regarding the practical implementation of blockchain in marketing due to these limitations.

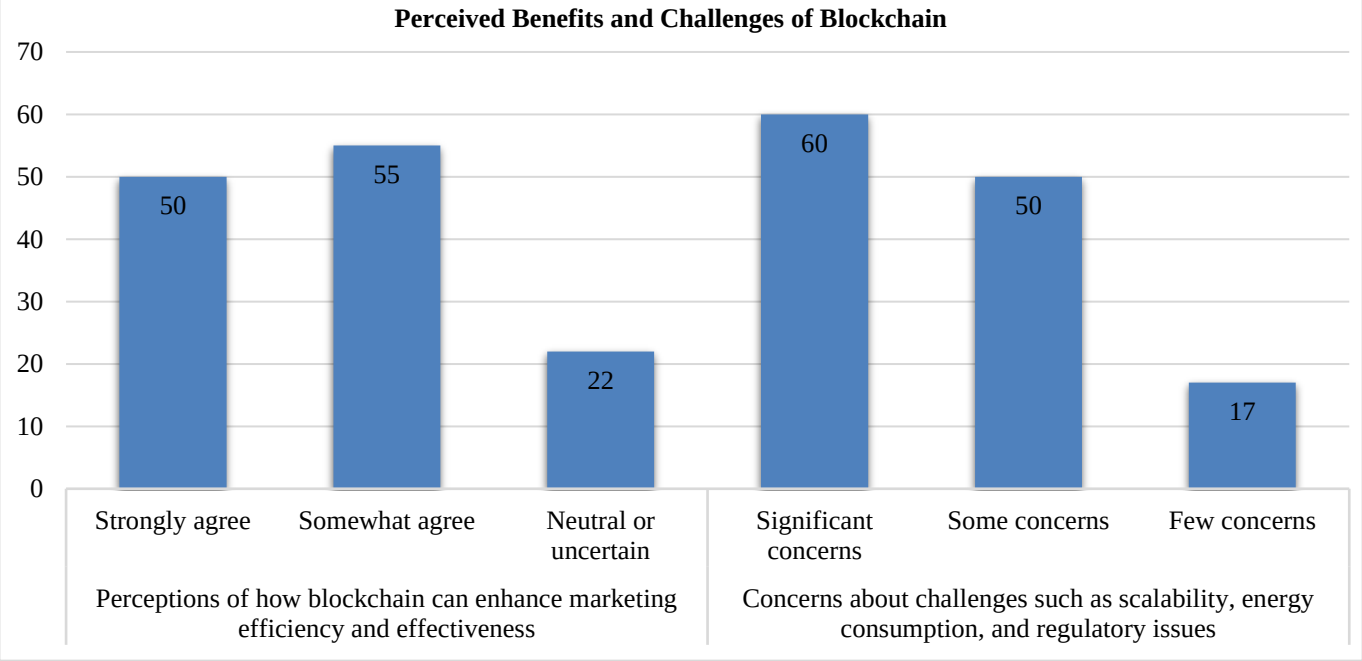

Fig. 4 Showing the perceived benefits and concerns

Perceptions of How Blockchain can Enhance Marketing Efficiency and Effectiveness

The respondents generally held positive views regarding the potential of blockchain to enhance marketing efficiency and effectiveness. As per figure 4, a significant portion, about 50 respondents, strongly agreed that blockchain could revolutionize marketing by increasing transparency, improving data management, and fostering trust between businesses and consumers.

These participants emphasized that the decentralized nature of blockchain would help streamline marketing processes by eliminating intermediaries and reducing delays in transaction verification. As one respondent put it:

"...Blockchain can cut through the traditional bureaucracy of marketing operations, making everything faster and more accountable..."

Others cited the immutable nature of blockchain as a key advantage, noting how smart contracts could automate agreements and enhance reliability. However, some participants, around 55 respondents, agreed with these sentiments but expressed reservations regarding the broader applicability of blockchain in marketing. They acknowledged the potential benefits but felt that the technology's complexity might slow adoption. One interviewee noted:

"...while blockchain offers promising solutions for transparency and data security, the learning curve is steep, and businesses may be hesitant to fully integrate it into their marketing strategies without seeing clear success stories…"

Meanwhile, a smaller group of 22 respondents remained neutral or uncertain about blockchain's impact on marketing. These participants were less convinced, pointing out scalability and energy consumption challenges that could hinder its widespread use. As one of them stated:

"...I see the promise of blockchain, but I am unsure whether it is ready to meet the demands of large-scale marketing operations just yet…"

This mixed perspective highlights the enthusiasm and skepticism regarding blockchain's role in transforming the marketing industry.

Concerns about Challenges Such as Scalability

The concerns about challenges such as scalability, energy consumption, and regulatory issues were prevalent among the respondents, as per Figure 4, with 60 expressing significant apprehension. Those with the strongest concerns highlighted how blockchain while promising, has yet to overcome critical limitations that could hinder its implementation in marketing. Scalability, in particular, was frequently mentioned as a major obstacle, as blockchain systems often struggle to handle many transactions quickly. One respondent emphasized:

"...For blockchain to truly revolutionize marketing, it must scale efficiently. Right now, it is slow, which is a huge problem when you are talking about processing thousands of transactions in real-time..."

Energy consumption was another key concern. Many respondents pointed out that the energy-intensive nature of blockchain, especially those built on proof-of-work systems, could lead to sustainability issues, making it less viable for large-scale operations. One interviewee remarked:

"...The environmental impact of blockchain, particularly Bitcoin's energy use, is alarming. If marketers start relying on these systems, it could create a backlash from environmentally conscious consumers..."

This view highlights a growing tension between the technological benefits of blockchain and its environmental costs, which some believe could limit its appeal in marketing campaigns. In addition, regulatory issues were a common concern among 50 respondents who indicated moderate apprehension. These individuals felt that the lack of clear regulations surrounding blockchain technology could create legal uncertainties, particularly in industries like marketing, where data privacy and consumer protection are critical. One respondent noted:

"...Until a clear regulatory framework exists, companies will be cautious about adopting blockchain for marketing. There is too much risk involved, especially when it comes to handling sensitive consumer data…"

A smaller group of respondents, about 17, expressed only minimal concerns. They felt that while scalability, energy consumption, and regulatory hurdles existed, they were confident that these challenges could be overcome with time and innovation. One optimistic participant shared:

"...Every new technology has its hurdles, but blockchain's potential outweighs these challenges. With the right regulations and advancements, it could transform how we do marketing..."

Despite these differing views, it was clear that the technology's current limitations weighed heavily on the minds of many respondents, indicating that further improvements and regulatory clarity are needed for blockchain to realize its full potential in marketing.

3.3. Data Privacy Concerns in Marketing

The study addressed the critical issue of Data Privacy Concerns in Marketing, which significantly shaped respondents' perceptions of blockchain technology. The

investigation focused on three key sub-indicators: Data Breaches and Unauthorized Access, Concerns about the Use of Personal Data for Targeted Advertising, and Perceptions of Current Data Privacy Regulations. Despite blockchain's security features, participants expressed varying degrees of worry regarding the potential for unauthorized access to their data. Additionally, concerns about how personal data could be used for targeted advertising reflected broader apprehensions about consumer privacy. Finally, the study explored participants' views on the adequacy of existing data privacy regulations, especially in rapidly evolving digital marketing practices.

3.3.1. Concerns about Data Breaches and Unauthorized Access

The concerns surrounding data breaches and unauthorized access, as shown in Table 1, emerged as a predominant theme in the discussions with respondents. A significant majority expressed a high level of apprehension, with 43.3% indicating that they were "very concerned" about the potential risks associated with data breaches, particularly in the context of blockchain technology. Many respondents highlighted the paradox of relying on a technology touted for security while fearing the possibility of unauthorized access. One participant articulated this sentiment, stating:

"...while I understand that blockchain is designed to be secure, the reality is that no system is infallible. The thought of my personal data being compromised still keeps me awake at night..."

Additionally, 39.4% of the respondents reported being "somewhat concerned," reflecting a slightly different view of the risks involved. This group acknowledged the protective features of blockchain but simultaneously pointed out that the technology is not a silver bullet. A respondent noted:

"...I see the benefits of blockchain, but I cannot ignore the fact that hackers are always evolving. Just because something is secure does not mean it is impervious to attack..."

This indicates a pragmatic approach to their understanding of blockchain's security capabilities.
In contrast, only 17.3% of the respondents indicated they were "unconcerned" about data breaches and unauthorized access. Those in this minority often cited their confidence in blockchain technology as a key factor in their lack of concern. One individual remarked:

"...I believe blockchain's decentralized nature makes it inherently more secure than traditional databases. I trust that my data is safer in a blockchain environment..."

However, this perspective was less common, underscoring the prevailing anxiety surrounding data security in the marketing landscape. Overall, these responses illustrate the complex landscape of trust and concern that individuals navigate when considering the implications of blockchain technology for data privacy.

Table 1. The data privacy concerns in marketing

Sub-Indicators	Frequency (n = 127)	Percentage (%)
Concerns about Data Breaches and Unauthorized Access		
Very concerned	55	43.3%
Somewhat concerned	50	39.4%
Not concerned	22	17.3%
Concerns about the Use of Personal Data for Targeted Advertising		
Very concerned	60	47.2%
Somewhat concerned	45	35.4%
Not concerned	22	17.3%
Perceptions of Current Data Privacy Regulations		
Adequate	40	31.5%
Somewhat adequate	55	43.3%
Inadequate	32	25.2%

3.3.2. Concerns about the Use of Personal Data for Targeted Advertising

Concerns about using personal data for targeted advertising, according to Table 1, emerged as a prominent theme among respondents, with 47.2% indicating that they were "very concerned." Many participants expressed deep unease regarding how their personal information might be collected, analyzed, and utilized to influence their purchasing decisions without explicit consent. One respondent articulated this anxiety, stating:

"...Even though I understand the marketing benefits, my privacy is at risk. Companies often know more about me than I am comfortable with, and the idea of being targeted based on my data is unsettling…"

Others echoed this sentiment, highlighting instances where they felt their privacy had been compromised due to aggressive data collection practices. Additionally, 35.4% of respondents reported being "somewhat concerned," suggesting a nuanced perspective. These individuals

recognized that while targeted advertising could offer personalized experiences, it raised ethical questions about consent and data ownership. One participant noted:

"...I see the value in targeted ads sometimes. They even showed me the products I wanted. However, I cannot shake the feeling that my data is being used in ways I disagree with. There should be clearer boundaries about what is acceptable..."

This group appeared to grapple with the benefits and drawbacks of targeted marketing, illustrating a general wariness of data practices in an increasingly digital world. Conversely, only 17.3% of the participants stated they were "not concerned." These respondents tended to trust the systems in place for data protection and believed that advances like blockchain could enhance privacy. One such respondent remarked:

"...I think the technology is getting better at protecting our data. If companies use blockchain, I feel they have a better way to manage my information securely. I am not worried about being targeted as long as I know I have control..."

However, this viewpoint was significantly less common, underscoring the prevalent anxieties surrounding personal data use in advertising. In short, these findings shed light on the complex landscape of consumer attitudes toward data privacy in targeted advertising, emphasizing the need for transparent practices that align consumer interests with technological advancements.

3.3.3. Perceptions of Current Data Privacy Regulations

The perceptions of current data privacy regulations, as illustrated in Table 1, revealed a significant range of opinions among respondents, with 31.5% characterizing these regulations as "adequate."

These participants generally acknowledged that existing laws offered a foundational level of protection for personal data. One respondent articulated a cautious optimism, stating:

"...I think our regulations are a step in the right direction. They assure that companies are held accountable for handling our data, even if there is still a long way to go…"

This perspective reflected a belief that while regulations may not be perfect, they were necessary in creating a more secure digital environment. In contrast, 43.3% of respondents felt the regulations were "somewhat adequate." This group expressed a mix of approval and concern, recognizing the efforts made and highlighting significant gaps. One interviewe pointed out:

"...there are rules in place, but it often feels like they are not strict enough. Companies can find loopholes, and consumers are left in the dark about how their data is being used…"

Many in this category echoed sentiments of frustration, emphasizing that while some protections existed, they were insufficient to address emerging challenges posed by rapid technological advancements. A 25.2% of respondents deemed the regulations "inadequate," highlighting a critical view of the current legal framework.

These individuals expressed deep dissatisfaction with the effectiveness of existing laws, believing they fell short of safeguarding consumer privacy adequately. One respondent voiced this concern strongly, stating:

"...the regulations seem outdated and are struggling to keep up with how fast technology changes. It feels like a game of catch-up, and meanwhile, our data continues to be exploited…"

This opinion of inadequacy highlighted a growing demand for more robust and adaptive regulations to address the evolving data privacy landscape in a digital age.

Generally, these findings indicate a complex interplay of recognition and criticism regarding current data privacy regulations, emphasizing the need for ongoing dialogue and reform to ensure consumer protection remains a priority in the face of advancing technologies.

3.4. Blockchain's Potential to Enhance Data Security

The exploration of blockchain's potential to enhance data security provided insightful perspectives on its perceived effectiveness among respondents. The sub-indicators perception of blockchain's ability to protect data privacy, understanding of blockchain-based encryption and security features, and trust in blockchain technology for data security illuminated individuals' varying degrees of confidence regarding this emerging technology.

3.4.1. Perception of Blockchain's Ability to Protect Data Privacy

The perception of blockchain's ability to protect data privacy, as indicated in Table 2, emerged as a significant theme during the interviews, revealing a range of attitudes among respondents. Many participants expressed confidence in blockchain technology, with 50 individuals categorizing it as "very effective" in safeguarding personal information. One respondent stated:

"...I believe blockchain's decentralized nature inherently makes it more secure against breaches. The way it encrypts data and requires consensus to alter any information gives me peace of mind…"

This sentiment accentuated the trust that some users placed in blockchain to manage their data securely. Conversely, a notable group of 55 respondents viewed blockchain as "somewhat effective." These individuals acknowledged the technology's strengths and highlighted concerns about its implementation and scalability. One participant remarked:

"...while I see the potential of blockchain for privacy protection, I worry about how well it will hold up in real-world applications. The technology is still relatively new, and I think we need more evidence of its effectiveness in everyday use..."

This perspective indicated a cautious optimism, recognizing blockchain's advantages while remaining skeptical about its current capabilities. Additionally, 22 respondents outright rejected the notion that blockchain could effectively protect data privacy, suggesting that the technology might not address all existing vulnerabilities. One respondent articulated this skepticism, saying:

"...I do not think blockchain is a silver bullet for data privacy. Just because it is decentralized does not mean it is immune to all types of attacks. We have seen instances where even the most secure systems have been compromised..."

This diverse range of perceptions illustrated blockchain technology's complexity and its role in data privacy, highlighting both the excitement for its potential and the caution stemming from its limitations.

3.4.2. Understanding of Blockchain-Based Encryption and Security Features

The understanding of blockchain-based encryption and security features, according to data in Table 2, varied significantly among respondents, reflecting a spectrum of familiarity with the technology. A total of 40 participants reported a "high understanding" of how blockchain encryption works and the security measures it employs. One respondent, who considered themselves well-versed in the subject, explained:

"... I have taken the time to study how blockchain uses cryptographic methods to secure transactions. The idea that each block is linked and protected by complex algorithms gives me much confidence in its security capabilities..."

This sentiment highlighted a deep appreciation for the intricacies of blockchain technology and its potential to enhance data security. In contrast, the majority of respondents, 60 individuals, indicated a "moderate understanding" of blockchain-based encryption and security features. Many participants acknowledged some knowledge of the principles involved but were not fully informed about all the nuances. One participant mentioned:

"...I know that blockchain uses encryption, but I cannot say I fully grasp how it operates behind the scenes. I understand it is supposed to be secure, but I still have questions about how that translates into real-world applications..."

This reflection illustrated a gap between awareness and more profound comprehension, suggesting that while respondents recognized the importance of encryption, their grasp of the underlying mechanics was less robust. Lastly, 27 respondents reported a "low understanding" of blockchain-based encryption and security features, indicating a significant knowledge gap. One individual expressed their confusion, stating:

"...honestly, I have heard the term 'encryption' thrown around a lot, but I do not know what it entails in blockchain. It seems complicated, and I have not had the chance to learn about it in detail..."

This lack of understanding accentuated the ongoing challenges in educating users about blockchain technology, suggesting a need for more accessible resources and clearer explanations to demystify its security features. The varying levels of understanding among respondents reflected enthusiasm for blockchain technology and the necessity for further education.

3.4.3. Trust in Blockchain Technology for Data Security

Trust in blockchain technology for data security, according to table 2, was a prominent theme among respondents, reflecting varied levels of confidence in its capabilities. A significant portion of the participants—60 individuals, accounting for 47.2%- expressed "high trust" in blockchain as a secure data storage and transfer platform. One respondent noted:

"...I really believe that blockchain offers a level of security that traditional systems cannot match. The immutability and decentralized nature of the technology give me peace of mind when handling sensitive data..."

This confidence stressed recognising blockchain's unique features contributing to its perceived security, highlighting a growing belief that it can effectively safeguard personal information. In contrast, 50 respondents (39.4%) reported a "moderate trust" in blockchain technology for data security. These individuals acknowledged the potential of blockchain but also expressed caution. One participant elaborated:

"...while I see the advantages of blockchain, especially in preventing data tampering, I still have some reservations. Technology is always evolving, and with innovations come new vulnerabilities. I am not fully convinced that blockchain is entirely secure..."

Table 2. Blockchain's Potential to Enhance Data Security Sub-indicators

Sub-Indicators	Frequency (n = 127)	Percentage (%)
Perception of Blockchain's Ability to Protect Data Privacy		
Very effective	50	39.4%
Somewhat effective	55	43.3%
Not effective	22	17.3%
Understanding of Blockchain-Based Encryption and Security Features		
High understanding	40	31.5%
Moderate understanding	60	47.2%
Low understanding	27	21.3%
Trust in Blockchain Technology for Data Security		
High trust	60	47.2%
Moderate trust	50	39.4%
Low trust	17	13.4%

Table 3. Building consumer trust through blockchain sub-indicators

Sub-Indicator	Frequency (n=127)	Percentage (%)
Perception of Blockchain's Role in Building Trust		
Strongly agree	55	43.3%
Somewhat agree	60	47.3%
Disagree	12	9.4%
Impact of Blockchain on Transparency and Accountability		
Very positive impact	60	47.2%
Somewhat positive impact	50	39.4%
No impact	17	13.4%
Consumer Attitudes Towards Blockchain-Based Marketing Initiatives		
Very favorable	50	39.4%
Somewhat favorable	60	47.2%
Not favorable	17	13.4%

This perception indicated a nuanced understanding of the technology, suggesting that while respondents recognized its strengths, they remained wary of potential risks associated with its implementation. Finally, 17 respondents (13.4%) indicated a "low trust" in blockchain technology for data security. These participants articulated significant skepticism about the reliability of blockchain in protecting data. One respondent shared their concerns, stating:

"... I have heard stories about hacks and vulnerabilities even in blockchain systems. Until I see consistent, proven examples of its security in action, I am hesitant to trust it with my data..."

This sentiment highlighted a critical challenge for the blockchain community as there is a need to build trust through transparent practices and demonstrable security measures. The overall data illustrated a range of trust levels, pointing to optimism and caution in adopting blockchain technology for securing sensitive information.

3.5. Building Consumer Trust Through Blockchain

The indicator on Building Consumer Trust Through Blockchain encompassed several key sub-indicators that provided insights into respondents' perceptions and attitudes toward blockchain's impact on marketing. Participants reflected on the role of blockchain in fostering trust, highlighting its potential for enhancing transparency and accountability in marketing practices. Additionally, respondents evaluated the security features of blockchain technology, recognizing their importance in safeguarding personal information and maintaining trust in marketing initiatives. Furthermore, opinions varied regarding consumer attitudes toward blockchain-based marketing initiatives, with some expressing enthusiasm for its adoption while others remainedskeptical.

3.5.1. Perception of Blockchain's Role in Building Trust

The perception of blockchain's role in building trust emerged as a significant theme among respondents, with many indicating strong confidence in the technology's potential to enhance consumer trust in marketing practices. According to data in Table 3, a notable portion of participants, specifically 55 individuals, strongly agreed that blockchain could be a robust mechanism for establishing trust between consumers and brands. They highlighted the unique attributes of blockchain, such as its transparency and immutability, as essential features that could eliminate the opacity often associated with traditional marketing methods. One respondent stated:

"...with blockchain, consumers can see every step of the transaction process, which makes it much harder for companies to misrepresent themselves or hide information..."

Conversely, while 60 respondents somewhat agreed with the notion that blockchain could build trust, they expressed a degree of caution, noting that its effectiveness largely depended on widespread adoption and a better understanding of the technology. Some mentioned that while they recognized the theoretical benefits of blockchain, practical applications were still lacking in many industries. As one participant pointed out:

"...It sounds great on paper, but unless I see companies using it effectively, I remain skeptical about its trust-building capabilities..."

Finally, a smaller group of 12 respondents disagreed with the idea that blockchain could inherently foster trust, suggesting that technology alone could not resolve deeper issues related to consumer confidence. They argued that trust also hinges on the reputation and behavior of individual brands, regardless of the systems they implement. As one interviewee noted:

"...even with blockchain, if a company has a history of bad practices, I do not think technology will change my perception of them..."

This diversity of opinions reflects the slightly different views on blockchain's role in establishing trust, stressing that while many see its potential, skepticism remains among certain population segments.

3.5.2. Impact of Blockchain on Transparency and Accountability

The impact of blockchain on transparency and accountability, as per Table 3, was a focal point of discussion among respondents, with many expressing a strong belief in its transformative potential. A substantial portion of participants, totaling 60 individuals, noted that they perceived a very positive impact of blockchain in enhancing transparency within marketing practices. They emphasized that blockchain's inherent characteristics, such as its decentralized nature and immutability, provided a framework for verifying information in real-time. One respondent remarked:

"...with blockchain, every transaction is recorded and can be audited by anyone. This kind of transparency can hold companies accountable for their actions and promises, making them more trustworthy in the eyes of consumers..."

Additionally, 50 respondents indicated a somewhat positive impact, acknowledging the benefits of blockchain and highlighting some limitations in its current applications. They pointed out that while blockchain technology could improve transparency, the effectiveness of this improvement depended on how companies implemented it. As one participant noted:

"...I see the potential for blockchain to enhance accountability, but it comes down to whether businesses use it to share information honestly. If they do not, then the technology is just another tool without real change..."

This view reflects a cautious optimism among those who recognize the advantages of blockchain but remain skeptical about its practical execution in real-world scenarios. In contrast, 17 respondents reported that they saw no impact of blockchain on transparency and accountability. These individuals expressed doubts about the actual influence of blockchain technology on consumer behavior and business practices. They often cited a lack of understanding about how blockchain functions and its potential applications in marketing. One interviewee stated:

"... I have heard a lot about blockchain and its benefits, but I do not see how it changes anything in the marketing world. Companies need to earn consumer trust through their actions, not just technology..."

This skepticism accentuates the need for further education and clarity regarding the role of blockchain in promoting transparency and accountability in marketing, as well as the broader implications of adopting such technologies.

3.5.3. Consumer Attitudes Towards Blockchain-Based Marketing Initiatives

According to data illustrated in Table 3, consumer attitudes towards blockchain-based marketing initiatives revealed a slightly different opinion among respondents, highlighting a general openness to integrating this technology into marketing practices.

Out of the total participants, 50 individuals expressed very favorable opinions, accentuating their belief in the potential benefits of blockchain for enhancing marketing transparency and accountability. One respondent enthusiastically noted:

"...I believe that blockchain can revolutionize how companies interact with consumers. The ability to track and verify the authenticity of products and services gives me confidence that I am making informed choices..."

This feeling reflects a broader trend among consumers increasingly seeking assurance regarding the integrity of marketing claims and product authenticity. In contrast, 60 respondents indicated a somewhat favorable attitude towards blockchain-based marketing initiatives. While they

acknowledged the advantages of blockchain technology, they also voiced some reservations about its implementation. For instance, one participant remarked:

"...I see the potential of blockchain in providing more transparency in marketing. However, I worry that not all companies will adopt it genuinely. There is always the risk of becoming just another marketing gimmick rather than a true commitment to transparency…"

This opinion indicates a cautious optimism, where consumers recognize the benefits but are also wary of the technology's potential misuse or superficial applications. Conversely, 17 respondents expressed unfavourable attitudes towards blockchain-based marketing initiatives, reflecting significant skepticism. Many of these individuals cited a lack of understanding of how blockchain worked and its relevance to purchasing decisions. One interviewee shared:

"...I do not get what blockchain has to do with me as a consumer. It sounds complicated, and I am not sure how it would change my experience with brands…"

This skepticism highlights the need for further consumer education about blockchain's functionalities and its direct implications for marketing.

In general, the responses illustrated diverse attitudes, suggesting that while many consumers are optimistic about blockchain's potential, others remain uncertain or unconvinced of its practical benefits in the marketing landscape.

3.6. Challenges of Blockchain in Marketing

The challenges of blockchain in marketing were identified as significant hurdles that needed to be addressed for successful implementation. Respondents expressed concerns about technical challenges, particularly scalability and interoperability, which were seen as barriers to the widespread adoption of blockchain technology. Additionally, regulatory challenges were highlighted, with respondents acknowledging the complex landscape of laws and regulations that could hinder blockchain's adoption in marketing. Finally, adoption barriers were discussed extensively, as interviewees pointed out issues related to costs, complexity, and the pace of technological change, which could deter companies from fully embracing blockchain solutions.

3.6.1. Technical Challenges

The technical challenges associated with blockchain technology, as shown in Table 4, emerged as a prominent theme during the interviews, particularly concerning scalability and interoperability. A substantial portion of the respondents, 47.3%, expressed that these challenges were significant obstacles to effective implementation. Many participants articulated their concerns about scalability, noting that the current blockchain systems often struggled to efficiently handle large volumes of transactions. One respondent pointed out:

"…while blockchain has incredible potential, the reality is that many platforms become sluggish when faced with high demand. This could hinder its application in real-time marketing scenarios…"

Similarly, interoperability was frequently mentioned as a critical issue. A notable number of interviewees, representing 43.4%, acknowledged that while there were some challenges, they felt solutions could be developed. As one respondent stated:

"…there are multiple blockchain protocols out there, and the lack of a standardized approach means that integrating them into existing marketing systems is often complicated…"

This sentiment reflected a broader understanding among respondents that while challenges existed, there was hope for collaborative efforts to create more seamless integration pathways. On the other hand, a smaller group, about 9.4%, believed that the challenges were few and manageable. These respondents often highlighted successful case studies where organizations had effectively navigated the complexities of blockchain implementation. One participant noted:

"…In my experience, the barriers are not insurmountable. With the right resources and partnerships, many companies have already begun leveraging blockchain without significant issues…"

This insight provided a counterpoint to the more widespread concerns, suggesting that the perceived technical challenges could be addressed with strategic planning and investment.

Table 4. The Challenges of blockchain in marketing sub-indicators

Sub-Indicator	Frequency (n = 127)	Percentage (%)
Technical Challenges		
Significant challenges	60	47.3%
Some challenges	55	43.3%
Few challenges	12	9.4%
Regulatory Challenges		
Significant challenges	55	43.3%
Some challenges	60	47.3%
Few challenges	12	9.4%
Adoption Barriers		
Significant barriers	45	35.4%
Some barriers	60	47.3%
Few barriers	22	17.3%

3.6.2. Regulatory Challenges

The regulatory challenges associated with blockchain technology, as presented in Table 4, were a significant concern among respondents during the interviews, reflecting a shared apprehension about the evolving legal landscape surrounding digital assets. Approximately 43.3% of participants identified these challenges as substantial hurdles that could impede the adoption of blockchain in marketing. Many respondents articulated their frustrations regarding the lack of clear regulations. One interviewee remarked:

"…the regulatory framework is still quite ambiguous. Companies hesitate to fully commit to blockchain initiatives when they do not know how regulations will evolve in the coming years…"

This uncertainty was echoed by several participants, who emphasized that without comprehensive guidelines, businesses faced a precarious situation regarding compliance and legal risk. A nearly equal proportion of respondents, around 47.3%, acknowledged that while there were some regulatory challenges, they believed these could be navigated with proper planning and adaptation. Many highlighted that companies could proactively engage with regulators to shape future policies. One participant stated:

"…I think it is about building relationships with regulatory bodies. If companies take the initiative to communicate and educate regulators about the benefits and nuances of blockchain, we might see a more favorable environment for innovation…"

This perception indicated a degree of optimism that collaboration could lead to clearer regulations supporting blockchain development. In contrast, a smaller segment of respondents, approximately 9.4%, felt that regulatory challenges were minimal. These individuals often pointed to specific jurisdictions that had adopted progressive regulations as examples of successful blockchain integration into the regulatory framework. One respondent shared:

"…In some places, regulators have already established a supportive environment for blockchain, which has made it easier for companies to innovate without fear of repercussions..."

This viewpoint suggested that while regulatory challenges exist, there are also examples of positive regulatory engagement that could serve as models for other regions seeking to embrace blockchain technology. The interviews underlined a landscape of regulatory complexity that required careful navigation but also presented opportunities for proactive engagement.

3.6.3. Adoption Barriers

The adoption barriers associated with blockchain technology were a prominent theme in the interviews, with respondents, as per Table 4, expressing a range of concerns that could hinder widespread implementation in marketing. Approximately 35.4% of participants identified these barriers as significant, highlighting a consensus that the transition to blockchain required overcoming various hurdles. Many interviewees pointed to a lack of understanding and familiarity with the technology as a primary obstacle. One respondent emphasized:

"… there is still much confusion about what blockchain really is and how it can be effectively applied in marketing. Until people grasp its potential, adoption will be slow..."

This sentiment reflected a broader concern that educational gaps prevented organizations from fully embracing blockchain solutions. In contrast, 47.3% of respondents acknowledged that while there were some barriers, they believed these could be mitigated with the right strategies and resources. Several participants discussed the importance of demonstrating blockchain's value through pilot projects and case studies. One participant noted:

"…if we can show clear benefits and successful implementations in smaller projects, I think it will help convince others to adopt the technology..."

This insight accentuated a sense of optimism that tangible results could pave the way for broader acceptance and integration of blockchain into marketing practices. On the other hand, a smaller group, around 17.3%, felt that the barriers to adoption were relatively few. These respondents often highlighted the advantages of blockchain that could outweigh potential challenges, such as enhanced transparency and efficiency. One interviewee remarked:

"…for companies willing to invest in the technology, the benefits far outweigh the risks. We need to focus on how to harness its potential..."

This optimistic viewpoint suggested that while barriers existed, there were also pathways for successful integration, especially for organizations ready to embrace innovation.

In short, the discussions highlighted a slightly different understanding of the adoption landscape, where significant challenges coexisted with opportunities for growth and advancement in using blockchain technology in marketing.

4. Conclusion and Recommendation

The study highlighted blockchain technology's transformative potential in addressing key marketing sector challenges. The findings revealed a significant level of awareness and understanding of blockchain concepts among respondents, particularly regarding its potential applications and perceived benefits. While many participants recognized

the efficiency gains and enhanced transparency that blockchain could provide, data privacy and security concerns remained prevalent. These insights accentuated the dual nature of blockchain's impact as it presents exciting opportunities for innovation while raising important questions about trust, regulatory compliance, and the overall effectiveness of implementation strategies.

Moreover, the research identified critical barriers to adopting blockchain in marketing, including technical challenges, regulatory issues, and varying levels of consumer trust. Despite these hurdles, there was a palpable sense of optimism among participants, with many suggesting that increased education, successful pilot projects, and a focus on demonstrable benefits could facilitate broader adoption. Ultimately, the study concluded that while blockchain technology holds great promise for reshaping marketing strategies and enhancing consumer engagement, stakeholders must address the inherent challenges and uncertainties to realize its full potential. Future research should continue to explore these dynamics and investigate strategies for overcoming obstacles to blockchain integration in marketing practices.Based on the findings of the study, it is recommended that stakeholders in the marketing sector prioritize education and awareness initiatives to enhance understanding of blockchain technology and its applications.Companies should invest in pilot projects that demonstrate the practical benefits of blockchain, focusing on transparency and efficiency to build consumer trust. Collaboration with regulatory bodies is also essential to navigate compliance challenges and establish frameworks that facilitate blockchain adoption. By addressing these areas, the industry can effectively harness the potential of blockchain to transform marketing strategies and enhance consumer engagement.

Acknowledgments

I want to extend my appreciation to Juma Mdimu Rugina and Dani Mfungo from Ruaha Catholic University (RUCU) for their support during the preparation of this manuscript, Ruaha Catholic University management and staff for the encouragement they gave us during data collection, analysis and interpretation. Also, I would like to thank my family, especially my kids (Neema, Nelson, Nelvin, Nelvis and Angel Lusekelo Kibona) for always being there when I needed them.

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