



*Routledge Studies in Accounting*

# **SUSTAINABILITY REPORTING AND BLOCKCHAIN TECHNOLOGY**

Edited by  
Harjit Singh, Neha Puri and Nandita Mishra



**ROUTLEDGE**



# Sustainability Reporting and Blockchain Technology

This book explores the much talked about but less understood issue of sustainability reporting, in a global context, linking it to the application of blockchain and other emerging technologies. It provides a transnational platform to examine the experiences of investors, researchers, academicians, and policymakers as they confront these concerns across a variety of industries and countries, thus offering best-practice guidance to assess the technological landscape and to model sustainable business initiatives. It offers relevant theoretical frameworks and the latest empirical research findings. Further, it argues that in order to reduce “carbon footprints” globally, by reporting all their emissions through a single blockchain platform, companies can create a standardized space for data to be collected and tracked reliably, allowing for meaningful measurements. The book benchmarks and analyses sustainability performance with respect to numerous laws, norms, codes, performance standards, and voluntary initiatives. It demonstrates how the organization influences and is influenced by expectations about sustainable development and emphasizes the link between financial and non-financial performance, enabling external stakeholders to understand the organization’s true value, along with tangible and intangible assets. It will enable readers to increase their understanding of the potential risks and opportunities and avoid environmental, social, and governance failures. The book provides insight into existing research, practice, and outcomes that could clarify and promote the state of the art on themes such as the drivers for sustainability reporting, environmental, social, and governance goals, the influence of blockchain on sustainability reporting as well as the issues and challenges. The book will be a useful guide for scholars, researchers, students, practitioners, regulators, and policymakers alike.

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Nandita Mishra**

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# Contents

<i>About the Editors</i>	<i>ix</i>
<i>List of Contributors</i>	<i>xi</i>
<i>Foreword</i>	<i>xv</i>
<b>PART I</b>	
<b>Blockchain and Sustainability Reporting</b>	<b>1</b>
1 Blockchain and ESG: Unfolding Landscape of Sustainable Reporting	3
HARJIT SINGH AND AVNEET SINGH	
2 A Bibliometric Analysis of Blockchain in Sustainability Reporting	15
NEHA PURI AND ANINDITA CHAKRAVORTY	
3 Role of Blockchain Technology in Sustainability Reporting	32
JYOTI SINGH	
4 Blockchain Technology: A Robust Tool for Corporate Social Responsibility (CSR) Communication	40
MD RASHID FAROOQI, MD FAIZ AHMAD, NEERAJ KUMAR, MUDASSIR RAFI, SERAJUL HAQUE, AND MOHAMMAD AFFAN AKHTAR	
5 A Bibliometric Review on the Evolution of Technology in Sustainability Reporting: With Reference to Artificial Intelligence	54
SIMRAT KAUR, ADARSH ARORA, AND ANIL KUMAR GOYAL	
6 Role of Blockchain in Enhancing the Quality of Sustainability Reporting	71
KHUSHBOO GULATI, SOUMYA SINGHAL, AND ISHA CHHABRA	

vi *Contents*

7	Sustainability Reporting Determinants in Asia and Europe	83
	FAOZI A. ALMAQTARI, NAJIB H. S. FARHAN, ABDULHADI IBRAHIM, AND TAMER ELSHEIKH	
8	Opportunities and Challenges for Better Sustainability Reporting	106
	RAHUL SHARMA AND SWETA GOEL	
9	A Bibliometric and Visualization Analysis of ESG Investment Research from 2011 to 2022	119
	HEM SHWETA RATHORE, NEHA SETH, AND DEEPTI SINGH	
<b>PART II</b>		
<b>Applications of Blockchain and Sustainability Reporting</b>		<b>137</b>
10	An Investigation of Blockchain Technology in Sustainable Energy Sector: Beyond Myth	139
	NURCAN KILINC-ATA	
11	The Unchained Sustainability: Exploring the Ripple Effect of Blockchain Technology on Hospitality's Environmental Resilience	151
	SUNITA JATAV, RUPALI GUPTA, AND VIJETA SINGH	
12	Search for Value Creation through Blockchain	161
	SANJEEV TEWARI AND SEEMA TEWARI	
13	Blockchain Technology Applications in CSR Reporting	171
	VICHANDANA BOTHRA AND NEHA BANKOTI	
14	Blockchain Usage for CSR Reporting: Indian Banking Perspectives and Corporate Practices	186
	NARINDER KUMAR BHASIN AND SUNIL KADYAN	
15	Role of Blockchain in Sustainability Reporting in the Banking Sector	198
	SUNIL KADYAN AND RICHA BHATIA	
16	Blockchain-Based Traceability Solutions for Environmental Sustainability	207
	CHITRA KRISHNAN, SUPRIYA LAMBA SAHDEV, AND GARY W. PAUL	

17 Blockchain Technology and Environment Sustainability S. K. JHA	229
--	-----

**PART III**

**Industrial Use Cases in ESG and CSR 247**

18 Adoption of Blockchain in ESG (Environmental, Social, and Governance) B. R. SINGH AND NARINDER KUMAR BHASIN	249
---	-----

19 Next-Gen Strategies and Industry Use Cases in CSR and ESG JYOT BAXI	262
---	-----

20 Blockchain Technology Enabler for CSR and ESG Reporting K. SMITA AND R. ROSHAN	282
--	-----

21 Emerging Perspective on Corporate Sustainability Reporting: Main Drivers amongst COVID-19 DEEPIKA DHINGRA, NANDITA MISHRA, AND SHRUTI ASHOK	291
---	-----

**PART IV**

**Future Outlook and NextGen Strategies 309**

22 Cognitive Factors Motivating Blockchain Adoption Decisions in SCF for Indian MSMEs: Fuzzy-AHP-DEMATEL P. S. BISWA BHUSAN SAHOO AND VIKAS THAKUR	311
---	-----

23 ESG Compliance and Its Impact on Automobile and Ancillary Firms' Performance: Evidence from India DEEPIKA UPADHYAY, KARTHIK GAVOOR, AND SUSHMITA NAG	325
--	-----

24 Country Readiness in Adopting Standardized Global Sustainability Reporting Standards: A Porter's Diamond Model Perspective SAMANTHI SENARATNE, NUWAN GUNARATHNE, ISURU MANAWADU, AND KUMARA KANCHANA	341
--	-----



viii *Contents*

25 Hydroponics and Sustainability: An Emerging Business’ Perspective	353
VIDHI TYAGI, NEHA SINGH, AND SHIVANGI VASHISTHA	
26 Achieving Financial Inclusion through Blockchain-Based Decentralized Finance and the Fintech Revolution	364
PALLAVI KUDAL, SUNNY DAWAR, VARADA INAMDAR, AMITABH PATNAIK, AND TUSHAR RATHORE	
<i>Index</i>	376

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# Foreword

In the ever-evolving landscape of sustainable development and the implications of climate change, the intersection of technological innovation and responsible business practices has become a powerful catalyst for positive change for society and the well-being of the planet. It is with great enthusiasm that I present this ground-breaking book, *Sustainability Reporting and Blockchain Technology*, a journey into the dynamic realms of sustainability, cutting-edge technology, and the transformative power of blockchain technology.

As we stand at the crossroads of global challenges unprecedented in human history, the need for sustainable practices in every facet of our lives and in every organization has never been more critical. We are still on track to reach temperatures above 1.5 degrees Celsius by 2030, with catastrophic impacts around the corner if we do not do enough to correct that trajectory. Climate change, resource depletion, and social inequalities are urgent calls to action that demand innovative solutions. This book aims to be a beacon that guides academics, entrepreneurs, and decision-makers on an enlightening expedition towards the synergy of sustainability reporting and blockchain technology.

Sustainability reporting has evolved from a niche practice to a cornerstone of corporate responsibility. It is not an option for organizations, it is an obligation if they want to survive, grow, and contribute to the new economy. Beyond mere compliance, it has become a powerful tool for organizations to communicate their environmental, social, and governance (ESG) performance transparently. The book delves into the evolution of sustainability reporting, exploring its evolution as a driving force behind corporate responsibility, stakeholder engagement, and long-term value creation.

At the same time, our world is undergoing a technological renaissance, where innovations are shaping the future of industries. Blockchain technology, once confined to the realm of cryptocurrencies, has transcended its origins to revolutionize transparency and accountability in various sectors. The integration of blockchain into sustainability reporting promises to elevate the accuracy, security, and accessibility of data, transforming the way we measure and manage our environmental and social impact.



This book serves as a compass for collaboration, urging academics, entrepreneurs, and decision-makers to embark on a collective journey towards a more sustainable future. Explore real-world examples of how organizations, regardless of size or industry, are leveraging blockchain to improve the credibility and reliability of their sustainability reporting.

Innovation is the engine that drives progress, and this book champions the idea that blockchain technology, when harnessed effectively, can amplify the impact of sustainability initiatives. From supply chain transparency to renewable energy certificates, the applications of blockchain in sustainable development are vast and transformative. Decision-makers will find inspiration in the success stories shared in these pages, motivating them to integrate these technologies into their organizational fabric.

As you navigate through the 26 chapters divided into four themes in this book, I hope readers will be inspired to become agents of change. Adopting sustainability reporting and blockchain technology is not simply a choice; it is an imperative for a resilient and prosperous future. Academics will find fertile ground for research, entrepreneurs will discover avenues for innovation, and decision-makers will gain insights to guide their strategic decisions.

The journey ahead is promising and, as we navigate the intricate web of sustainable development and the risks of climate, reporting, and technology, let us forge a collective path towards a world where prosperity is harmonized with environmental stewardship and social benefits. *Sustainability Reporting and Blockchain Technology* is an invitation to participate in this incredible journey – an invitation to shape a sustainable future for generations to come.

Gratitude to Routledge, editors, and all contributors for enriching this insightful and impactful book.

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**Part I**

**Blockchain and  
Sustainability Reporting**



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# 1 Blockchain and ESG

## Unfolding Landscape of Sustainable Reporting

*Harjit Singh and Avneet Singh*

### 1.1 Introduction

In a time when people are more conscious of global issues, the relationship between technology and sustainability has drawn attention from companies and organizations worldwide. Transparent and responsible reporting systems are more important than ever as worries about the effects on the environment, social responsibility, and ethical governance grow. This introduction lays the groundwork for an examination of the mutually beneficial relationship between blockchain technology and sustainability reporting, a dynamic and revolutionary partnership that has the potential to completely change the way businesses monitor, oversee, and convey their commitment to sustainable practices.

Environmental, social, and governance (ESG) concerns have become key global business considerations. Businesses increasingly realize how important ethical governance, responsible operations, and sustainability are. ESG is now an essential component of company strategy, not just a trendy term. In this regard, the collection, verification, and reporting of ESG data stand to be completely transformed by blockchain technology. Blockchain Web Services, or BWS, is leading this change by providing organizations with the tools they need to embrace transparency and sustainability like never before.

Owing to the technology revolution, ‘sustainability reporting’ has emerged as a crucial game-changer component for modern businesses seeking to show their dedication to ESG objectives. Consequently, transparent and trustworthy techniques for monitoring and disclosing sustainability measures are becoming inevitable as concerns about social responsibility and climate change grow. The relationship between blockchain technology and sustainability reporting is examined in this chapter, which looks at how blockchain can completely change how businesses gather, handle, and present their sustainability data. This introductory chapter lays the groundwork for an examination of the mutually beneficial relationship between blockchain technology and sustainability reporting, a dynamic and revolutionary partnership that has the potential to completely change the way businesses monitor, oversee, and convey their commitment to sustainable practices.

### 1.1.1 The Unfolding Landscape of Sustainability Reporting

The process of revealing an organization's governance, social, and environmental performance is known as sustainability reporting (Al-Htaybat et al., 2017). For stakeholders, including investors, customers, and regulatory agencies, these reports are essential to assess a company's environmental and social effects (Arena et al., 2014; Parker, 2005). There is a need for creative solutions because traditional reporting techniques frequently have issues with data security, transparency, and veracity (Gray et al., 2009; Gregor et al., 2013; Seele, 2016).

- An increasing number of organizations globally are implementing sustainability reporting, according to the Global Reporting Initiative (GRI), a prominent standard-setter for sustainability reporting.
- According to a 2022 GRI study, more than 10,450 firms in 167 countries employed its sustainability reporting standards.

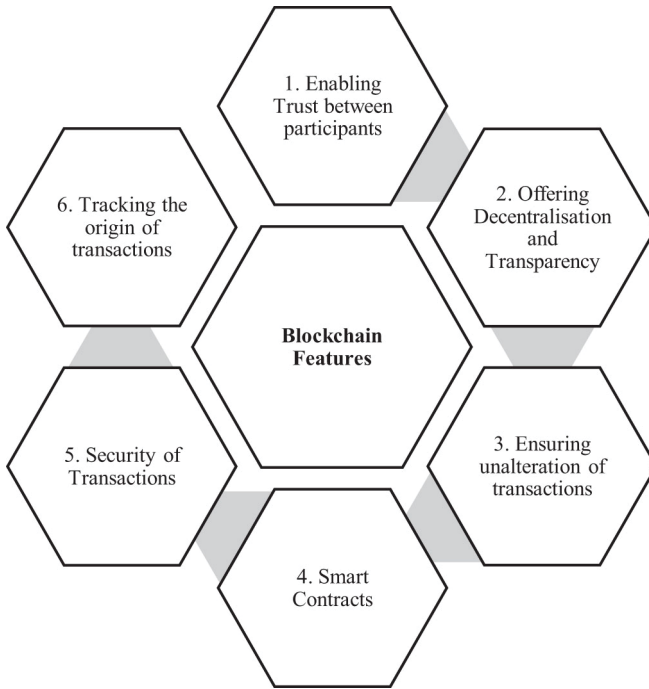
## 1.2 The Role of Blockchain in Sustainability Reporting

Originally developed for safe and transparent cryptocurrency transactions, such as those involving Bitcoin (Bernardi et al., 2018), blockchain technology has now become a flexible instrument that may be used in many different sectors of the economy (Bebbington et al., 2018). The decentralized and transparent characteristics of blockchain technology (Omoteso, 2012) make it a perfect option for enhancing the precision and dependability of sustainability reporting (Swan, 2015).

### 1.2.1 Decentralization and Transparency

Blockchain ensures that no single entity controls the entire system by operating on a decentralized network of computers (Zhou et al., 2022). This decentralization encourages 'transparency' in sustainability reporting by reducing the possibility of fraud and data tampering (Xu et al., 2018). A tamper-resistant and verifiable record of transactions is produced because every member of the blockchain network possesses an identical copy of the ledger (Bakarich et al., 2020).

The decentralized nature of blockchain is at the heart of its contribution to sustainability reporting (Bonsón et al., 2019). Conventional reporting systems frequently rely on centralized databases that are prone to inaccuracy or manipulation (Burritt et al., 2014). On the other hand, blockchain ensures that no single party controls the entire system by operating on a distributed ledger over a network of computers (Spangenberg, 2016; Singh et al., 2022). Stakeholder confidence in the accuracy of sustainability data is boosted by this decentralization, which reduces the possibility of fraud and data manipulation (Jain et al., 2020).



*Figure 1.1* Features of blockchain supporting use cases along multiple industries.

*Source:* Compiled by authors.

Another important aspect that blockchain emphasizes is transparency (Figure 1.1). An open and impenetrable record of transactions is produced by each member of the blockchain network having an identical copy of the ledger. In addition to addressing issues with data accuracy, this transparency enables stakeholders—such as investors and customers—to confirm the veracity of sustainability claims made by businesses (Singh et al., 2019).

### **1.2.2 Smart Contracts for Automated Reporting**

Self-executing contracts, or smart contracts, have the conditions of the contract explicitly encoded into the code. Smart contracts provide the capability to automate data gathering and verification in the context of sustainability reporting (Xu et al., 2018). One way to reduce errors and manual intervention is to build a smart contract to trigger data changes when predetermined sustainability goals are met automatically (Zaman et al., 2021). It is possible to configure these contracts to update automatically upon achieving predetermined sustainability goals (Liang et al., 2020). By reducing the need for human data entry, this automation lowers

the risk of error and improves the effectiveness of the reporting process (Burritt et al., 2014).

### 1.3 Blockchain Applications in Sustainability Reporting

#### 1.3.1 Supply Chain Transparency

Blockchain technology can be utilized to improve supply chain transparency, which is an essential component of reporting on sustainability (Singh et al., 2019). Businesses may give stakeholders an unchangeable and traceable record by logging every step of the supply chain—from the extraction of raw materials to the distribution of the finished product—on a blockchain protocol (O’Dwyer et al., 2005). In addition to bolstering sustainability claims, this openness aids in spotting and resolving possible social and environmental problems (Jain et al., 2020) along the supply chain (Figure 1.2).

The influence of blockchain technology on supply chain transparency and ESG is especially significant when it comes to reporting on sustainability (Amel-Zadeh et al., 2018; Coyne et al., 2017). Organizations can build an unchangeable and traceable record by logging each step of the supply chain onto a blockchain (Dai et al., 2017). This transparency guarantees that items are sourced, produced, and distributed responsibly, hence supporting sustainability claims (Machado et al., 2020). By tracking products from the extraction of raw materials to the end user, stakeholders can build confidence and accountability along the supply chain (Bebbington et al., 1994; Bonsón et al., 2019; Demirkan et al., 2020).

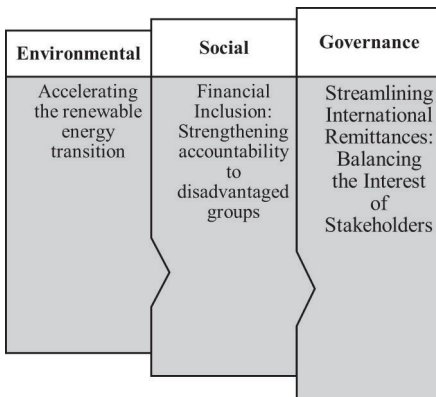


Figure 1.2 ESG benefits of blockchain.

### **Blockchain and Supply Chain Trends**

- According to World Economic Forum research, 10% of the world's GDP might be kept on blockchains by 2025. Applications for supply chain management and reporting on sustainability fall under this category.
- The contribution of blockchain to supply chain transparency has drawn notice. Businesses that have partnered to leverage blockchain technology for food supply chain traceability include Walmart and IBM.

#### **1.3.2 Carbon Footprint Tracking**

Blockchain is a great tool for monitoring and controlling carbon emissions because it can produce a transparent and safe record (Porru et al., 2017). Blockchain technology can be used by businesses to record and verify their carbon footprint data, making it accessible to stakeholders and auditors (Ray et al., 2020). This contributes to the worldwide effort to prevent climate change and guarantees the legitimacy of sustainability reporting (Underwood, 2016).

Sustainability reporting requires careful tracking and management of carbon emissions, and blockchain offers a transparent and safe way to do this (Corazza et al., 2020). Blockchain technology can be utilized to document and validate an entity's carbon footprint information, guaranteeing its precision and availability to auditors and interested parties (Rossi et al., 2017). Sustainability reports are more credible because of the blockchain's immutability and openness, which supports international efforts to combat climate change (Fuhrmann et al., 2016).

### **Blockchain and Carbon Footprint Tracking**

Blockchain has been investigated by the World Wildlife Fund (WWF) to track carbon footprints. Blockchain has been used in trial projects to track the source and effects of carbon credits, increasing market credibility and transparency for carbon offsets.

#### **1.3.3 Renewable Energy Credits (RECs)**

The transparent issuing and trading of renewable energy credits (RECs) can be facilitated by blockchain technology (Singh et al., 2019). Organizations can establish a safe and effective marketplace for the purchase and sale of renewable energy certificates by tokenizing these credits on a blockchain (Corazza et al., 2020). This encourages using renewable energy sources and gives businesses a trustworthy way to demonstrate their dedication to environmentally friendly operations (Kozlowski, 2018).



### **Blockchain and Renewable Energy Trends**

- Blockchain is becoming more and more popular in the renewable energy industry. For example, the Energy Web Foundation (EWF) is actively working on blockchain solutions for the energy sector to improve renewable energy source traceability and transparency.
- The blockchain market in the energy sector is anticipated to develop at a compound annual growth rate (CAGR) of 78.32% from 2018 to 2025, reaching \$10.4 billion, according to a report by Allied Market Research.

## **1.4 Industrial Use Cases**

### ***1.4.1 IBM Food Trust***

One example of how blockchain technology can be used to improve sustainability in the food supply chain is IBM Food Trust. By adopting blockchain, IBM enables players in the supply chain to access a shared ledger that gives real-time information about the origin, processing, and distribution of food goods. By guaranteeing the veracity of claims on ethical sourcing, fair labor practices, and environmental effects, this openness promotes sustainability reporting (Fuhrmann et al., 2016).

### ***1.4.2 Energy Web Foundation (EWF)***

The EWF is committed to expediting the shift to a decentralized, democratized, and decarbonized energy sector through the use of blockchain technology (Kozłowski, 2018). The foundation makes it possible to measure renewable energy generation in a transparent and traceable manner through the Energy Web Chain, a blockchain specifically created for the energy industry (Wirfs-Brock, 1993). This innovation helps businesses that are dedicated to lowering their carbon footprint to provide trustworthy sustainability reporting (Figure 1.3).

## **1.5 Problems and Concerns**

Although blockchain technology presents a promising avenue to improve sustainability reporting, it is imperative to recognize the various problems and concerns of implementing it.

### ***1.5.1 Scalability***

The scalability of blockchain networks becomes an issue when the amount of sustainability data increases (Kozłowski, 2018). Scalability concerns must be

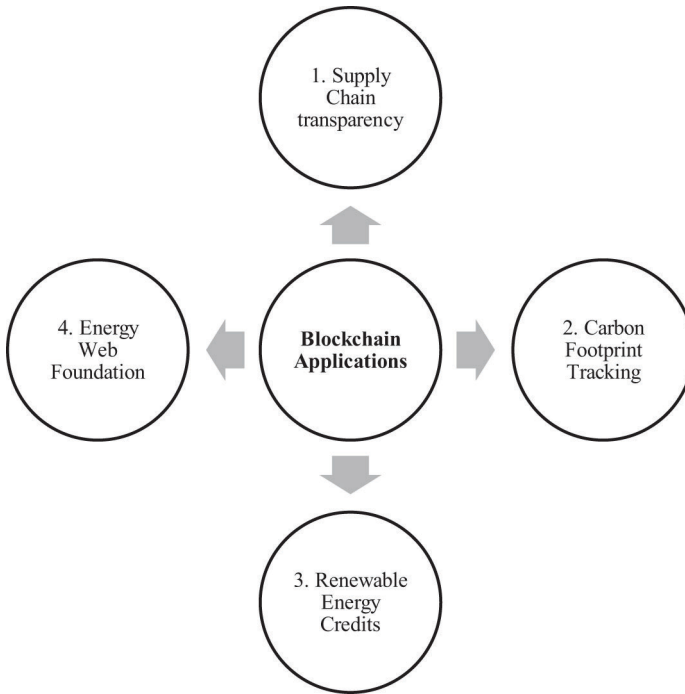


Figure 1.3 Blockchain applications in sustainability reporting.

Source: Compiled by authors.

resolved by organizations in order to handle and store massive datasets effectively (Fuhrmann et al., 2016) while maintaining the benefits of blockchain's decentralization and openness (Kokina et al., 2017).

### 1.5.2 Harmonization

Industry-wide standards are necessary to utilize blockchain fully in sustainability reporting. Standardization would let different blockchain systems work together, making it easier for data to be shared and validated across several platforms (Biondi et al., 2020).

## 1.6 Future Trends and Opportunities

As blockchain technology develops further, a number of new trends and chances are appearing at the nexus of sustainability reporting and blockchain.

### **1.6.1 Environmental Asset Tokenization**

Blockchain technology offers an interesting new way to leverage environmental assets, including carbon offsets and biodiversity offsets, for sustainability reporting. Organizations can expedite trade and improve the transparency and traceability of environmental impact by turning these assets into tokens on a blockchain.

### **1.6.2 Internet of Things (IoT) Integration**

The Internet of Things (IoT) and blockchain integration have the potential to improve sustainability reporting accuracy even more (Arnaboldi et al., 2017). Blockchain networks can receive data directly from IoT devices, providing accurate and up-to-date information on various social and environmental factors (Corazza et al., 2020).

#### **Blockchain and IoT Integration**

A developing trend is combining blockchain technology and the IoT. The global blockchain IoT market is expected to reach \$5.8 billion by 2026, according to research from MarketsandMarkets, with a CAGR of 45.1%.

## **1.7 Summary, Implications, and Future Outlook**

Blockchain technology has the potential to completely transform sustainability reporting by resolving issues with automation, accuracy, and transparency (Fuhrmann et al., 2016). Building trust in sustainability data is made secure by blockchain's tamper-resistant and decentralized architecture. A more transparent, responsible, and sustainable future is being paved by ongoing advances and cooperation within the blockchain and sustainability sectors, despite the hurdles that still face both (Corazza et al., 2020; Coyne et al., 2017; Guthrie et al., 2019).

Although there are obstacles, the use of blockchain in sustainability reporting seems promising. For broad acceptance, scalability concerns and the requirement for industry-wide standards are challenges that must be addressed. However, continuous advancements, collaborations, and new trends, such as the tokenization of environmental assets and integration with the IoT, indicate a promising trajectory (Hahn et al., 2013; Petriu et al., 2002).

However, by resolving enduring issues with transparency, accuracy, and automation, blockchain technology can change sustainability reporting (Truant et al., 2017). Businesses that incorporate blockchain technology into their reporting procedures not only improve their reputation (Sutton et al., 2016) but also advance the larger objectives of creating a more open, accountable, and sustainable global economy (Aboud et al., 2018; Zhang et al., 2017). Blockchain technology will play

a bigger part in sustainability reporting as it develops, helping to create a more ethical and ecologically friendly company environment (Swart et al., 2004; Weber O, 2018; Wagner et al., 2017).

Further, businesses must embrace sustainability and transparency as ESG factors continue to affect consumer and investment decisions (Bocken et al., 2021). Blockchain technology is the ideal ally on this trip because of its built-in trust and transparency qualities. Businesses are empowered by BWS' (Blockchain Web Services) ESG solutions to flourish in a sustainable society, as well as to comply with ESG reporting regulations (Duren et al., 2017). Therefore, BWS needs to fully prepare to work with businesses to help create a more transparent and sustainable society as we look toward a day when ethical behavior is expected and not simply an option (Duque et al., 2019; Schleicher et al., 2010).

Hence, the incorporation of blockchain technology into sustainability reporting is a revolutionary step in the direction of harmonizing corporate operations with international sustainability objectives. Businesses that use this technology will not only enhance their reporting procedures but also help create a more sustainable and transparent global economy. Blockchain's influence on sustainability reporting will grow as it develops and becomes more widely used (Traunt et al., 2017).

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