REALIZING CORPORATE DIGITAL RESPONSIBILITY WITH BLOCKCHAIN: A CASE STUDY OF E-WASTE MANAGEMENT

Short Paper

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Abstract

This study investigates the realization of Corporate Digital Responsibility (CDR) through effective e-waste management, a critical yet underexplored area in the digital sustainability landscape. Amid growing concerns over e-waste, driven by organizational, technical, and social factors, this research identifies a notable gap: the limited exploration of blockchain's role in realizing CDR in the context of e-waste management. By adopting activity theory as a theoretical lens, this study employs a case study methodology to offer in-depth insights into this complex phenomenon. Findings reveal how blockchain can be strategically utilized in e-waste management, significantly contributing to CDR practices. This research bridges a crucial gap in current literature and paves the way for the broader adoption of blockchain in promoting digital sustainability and responsible technology interactions.

Keywords: Activity Theory, Blockchain, Corporate Digital Responsibility, e-Waste

1 Introduction

The escalating crisis of e-waste, driven by rapid technological advancements and increasing consumer demand, poses significant environmental and social challenges. E-waste generation has surged due to factors like rapid technology turnover (Sahoo et al., 2021), planned obsolescence, shorter product lifespans and unsustainable digital practices (FranceStrategie, 2020), leading to a dramatic increase of about 60% over the past decade (Alves 2023). Alarmingly, only about 20% is recycled, with the rest contributing to environmental degradation and health risks (Morales, 2022). This situation underscores the urgent need for global action, as projections suggest a potential rise to 120 million tons of e-waste annually by 2050 (Morales, 2022)

In response to this crisis, Corporate Digital Responsibility (CDR) delineates the responsibility of companies concerning the prospects and challenges brought about by the development and use of technology (Mihale-Wilson et al., 2022). The existing literature has emphasized the significance of Corporate Digital Responsibility (CDR), addressing notable initiatives within organizations and elucidating the benefits of such endeavours (Leclerc & Badami, 2020; Mihale-Wilson et al., 2022). However, a conspicuous gap remains in exploring blockchain technology's role within this context (Qureshi et al., 2021).

Blockchain has gained much attention as a prospective tool in comparison to other technologies (e.g., RFID, QR codes) to address a range of issues within business, social, and environmental contexts (Li et al., 2017; Rossi et al., 2019), and make a transformative social impact. Blockchain is recognized for its capabilities like traceability, security, immutability, and decentralization and offers transformative solutions for sustainable practices in various contexts of transparency (Sultana et al., 2022; Sunny et al., 2020). Its applications span diverse realms, encompassing Sustainable Development Goals (SDG) (Medaglia & Damsgaard, 2020), poverty alleviation (Ning et al., 2019), sustainable supply chains (Yew et al., 2020), renewable energy (Balzani & Corsi, 2022), ecological sustainability issues (Delliere & Grange, 2018) and promoting sustainable practices (Kshetri, 2021). However, there is a thin focus on the digital aspects of sustainability. In the context of e-waste management, where transparency and traceability are critical, technology like blockchain will be arguably more effective because blockchain immutability

allows us to trace the e-waste through the life cycle and reduce the risk of unsustainable practices (Alarood et al., 2023).

To comprehensively understand this intersection of e-waste management, CDR, and blockchain technology, we adopt the Activity Theory (AT) as the theoretical lens. AT is rooted in a sociocultural perspective and centers on the actions and interactions of various actors within a specific context while accommodating technological uses (Allen et al., 2013). This theory enables us to delve into organizational action towards e-waste management by examining motivations, existing arrangements, resources, and relationships of stakeholders involved to provide a comprehensive framework for understanding how technological uses are harnessed (Anthony, 2011; Malik & Abdallah, 2019) and transformed into practical actions to tackle the pressing issue of e-waste and realize CDR.

Therefore, this study investigates how organizations implement blockchain technology in e-waste management to realize CDR. Guided by the research question, "*How do organizational actions in e-waste management realize CDR using blockchain?"* We conducted an in-depth case study of an organization employing blockchain for e-waste management. This empirical approach provides an in-depth understanding of organizational actions fostering responsible behavior and sustainable practices in the face of the global e-waste challenge. We specifically examine organizational adaptation and mitigation actions towards CDR, as highlighted in existing research (Du et al., 2019). This study makes four key contributions: (i) enriching CDR literature by demonstrating the role of blockchain in e-waste management; (ii) offering multi-dimensional insights into e-waste crisis management beyond just technology; (iii) advancing blockchain literature focuses on digital sustainability and encouraging blockchains' adoption for responsible technology interactions to ensure digital sustainability; and (iv) illustrating the application of AT in IS research, including its influence on data collection and analysis.

2 Literature Review

This study builds on the multidisciplinary stream of literature, including blockchain and CDR, that focuses on e-waste management. As an effective e-waste management solution, Blockchain stands out for its ability to enhance accountability, transparency, and traceability in e-waste recycling from its source to its recycling destination (Ali et al., 2021). The transparency provided by blockchain is crucial for tracking e-waste and supports responsible recycling practices (Sahoo & Halder, 2020). Additionally, blockchain can establish digital identities for electronic products, simplify lifecycle management (Brown, 2023), and incentivize responsible behavior through smart contracts for those adhering to recycling regulations and environmental practices (Alarood et al., 2023).

Despite its potential, blockchain's practical application in e-waste management remains in its infancy, with limited studies exploring its use in specific contexts like general (Jiang et al., 2023) and medical waste (Bamakan et al., 2022). Research focusing on blockchain on e-waste has mainly discussed its challenges, limitations, and implementation aspects (Joshi et al., 2023) or proposed a blockchain-based framework (Sahoo & Halder, 2020). This is because e-waste management faces challenges across its lifecycle, from design to recycling. These include inadequate infrastructure, lack of technology and equipment (Dhir et al., 2021), complex supply chains (Thapa et al., 2023), cost of specialized equipment for diverse electronic products (Liu et al., 2023), limited incentives for participation (Alarood et al., 2023), and a gap in consumer awareness about e-waste's environmental and health impacts (Islam et al., 2021). Addressing these challenges requires a multifaceted approach, focusing on tracing, collaboration, responsible behavior, incentivization, and awareness.

Recent literature emphasizes the need for organizational adjustments to tackle these challenges effectively and realize CDR. Suggested strategies include employee education, carbon footprint reduction (Review, 2023), collaboration and partnerships (Medium, 2023), and the adoption of digital technologies like blockchain (Sahoo & Halder, 2020), and incentivization (Alarood et al., 2023). This underscores the interplay of technical, social, and organizational forces in managing e-waste.

From a technical aspect, blockchain technology helps revolutionize e-waste management by tracing recycling processes, enhancing stakeholder collaboration, and facilitating incentivization strategies

(Alarood et al., 2023). Additionally, from socio-organizational aspects, the challenges of e-waste management, including responsible behavior and awareness, can be effectively addressed through collaborative efforts towards realizing CDR, as described by Lobschat et al. (2021). CDR represents the collective values and norms that shape a company's actions in digital innovation, highlighting the critical role of both internal and external stakeholders in guiding a company's self-regulated conduct concerning digital innovation. This concept extends to encompass accountabilities, liabilities, responsibilities, obligations, and duties related to the design, development, implementation, use, and disposal of digital technologies (Recker, 2023). Despite the current focus of CDR research predominantly on data privacy (Lobschat et al., 2021), responsibility (van der Merwe & Al Achkar, 2022), and vulnerability (Liyanaarachchi et al., 2021), there is a notable gap in its exploration into environmental and social impacts, especially concerning unsustainable e-waste practices and a comprehensive understanding of how organizations practically implement CDR initiatives remains underdeveloped.

Therefore, this study proposes investigating how organizations adapt and mitigate challenges using blockchain to manage e-waste and realize CDR, considering organizational, social, and technical perspectives. This approach extends beyond theoretical explorations, emphasizing the practical application of CDR through e-waste management in organizations (Joshi et al., 2023). The following section will discuss applying activity theoretical approaches to analyze organizational, social, and technical aspects of realizing CDR in organizations.

3 Theoretical Framing

Activity Theory (AT) is a modern, interdisciplinary theoretical framework focusing on mediated activities (Karanasios, 2018; Sultana et al., 2023). It delves into the intricacies of activities shaped by socially constructed components like community, rules, and the division of labor, all within the context of technology (Karanasios, 2018). AT is valuable in this context by integrating technical and socio-organizational perspectives to analyze socio-organizational issues. By considering organizational components like its established structure (Rules), its human resources (Division of labor), and the social (Community) and technical contexts (Tool), AT enables a comprehensive analysis of organizational goal-oriented actions influenced by organizational factors and broader communal, as shown in Figure 1. Within the AT-based framework, the 'Subject' is the doers, whether they are individuals, groups, or organizations (Sultana et al., 2023), actively pursuing a common goal, which serves as the 'Object' of their collective endeavors (Karanasios, 2018). In this study, organizations are the 'Subjects' that recycle e-waste to realize their CDR. 'Object' refers to the e-waste management issue in which the actors engage in activities. It is a dynamic and propelling force for all object-oriented actions (Engeström, 1995). Organizational actions cannot be isolated; they are intrinsically linked to an 'Object' (Leont'ev, 1978).

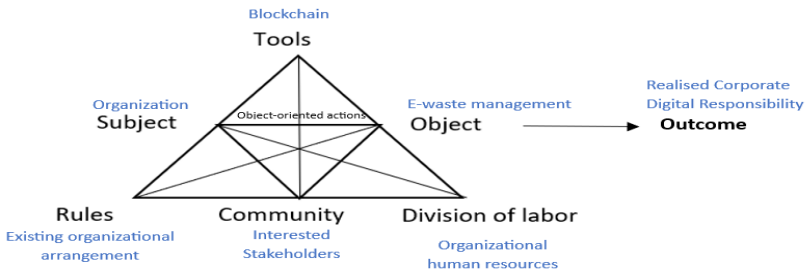


Figure 1: Organizational activity system

The relationship between 'Subject' and 'Object' is mediated by 'Tools' (Blockchain technology), which is introduced and used to facilitate the achievement of an 'Object' (Karanasios, 2018). Given that blockchain is a multifaceted technology comprising a unique combination of technical components (Beck & Müller-Bloch, 2017), the AT enables us to perceive the blockchain as a multidimensional 'Tool' within the e-waste management network, encompassing features like a shared ledger, smart contracts, authenticators (Sultana et al., 2023).

'Rules' pertains to the existing established regulations and standards that oversee the interactions between the community and the organizations to shape the dynamics of related actions (Karanasios, 2018; Sultana et al., 2023). Furthermore, the participants' interactions with the 'Community' also influence these activities (Sultana et al., 2023). Taking the 'Community' into account aids in comprehending how different perspectives contribute to working towards the same 'Object'- e-waste management (Karanasios, 2018; Sultana et al., 2023). It is worth noting that all activities are carried out through labor, such as- incorporating the e-waste management policy into job roles and monitoring duties that enhance CDR (Dodhia, 2021). So the 'Division of Labor'- management of human resources within the e-waste is an essential aspect to consider when analyzing these activities. All these elements will collectively influence the realization of the 'Outcome', which is CDR in this context.

The activity system (Figure 1) is also built on many sub-activities. For better understanding, it is broken down into sub-activity triangles based on the mediation relationship (Mwanza-Simwami, 2001). For instance, the mediation relationship can be understood based on this combination of organizational (Subject) actions for e-waste management (Object) by tools (Technology) to realize CDR (Outcome). AT helps zoom in and out the research focus as required (Ding, 2020). This study developed a holistic picture of organizational activity systems (Figure 1). By zooming out, this study decomposed the activity system into sub-triangles to understand each of the mediation relationships in the activity of e-waste management to realize CDR.

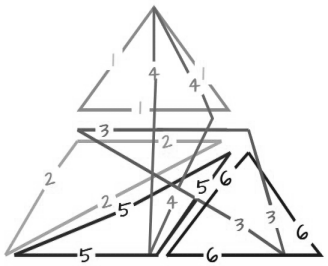
AT informed this study in different stages, including theoretical framing, data collection by mapping interview questions, data analysis and deriving insights. Decomposing the sub-triangles will help to map out the interview questions for collecting data in the case study (refer to Table 1). Column 1 of Table 1 represents the organizational activity system. Column 2 represents the decomposition of the organizational activity system. We identified six sub-triangles by zooming in and decomposing the organizational activity system. Column 3 highlights the insight from the literature and the underlying aspects of unknowns. Lastly, Column 4 describes the mapping out our interview questions based on the triangular interaction (Column 2) and literature insights (Column 3).

4 Method

Given the nature of the research questions, this research adopted a case study approach to investigate the given phenomenon. First, the research questions are exploratory and are better answered through inductive methods and qualitative data (Pan & Tan, 2011; Walsham, 2006). Second, the rapid change in the information systems field gives rise to numerous new topics each year, making case research a particularly invaluable method for gaining insights- especially in emerging technologies like blockchain (Benbasat et al., 1987). Third, case study is a powerful medium for understanding complex subject matter and translating industry experiences into theory development (Dyer Jr & Wilkins, 1991).

Based on our research questions, ASA (a pseudonym) was chosen as the case subject based on two main criteria: its pioneering role in using blockchain to revamp the e-waste ecosystem in Asia and its collaborative accomplishments with various stakeholders, offering a rich socio-organizational context for analysis.

At this stage, we have secured access and prepared interview questions, with data collection set to begin in December 2023. We adopt the structured–pragmatic–situational (SPS) approach to conduct this case study due to structure and pragmatic steps (Pan & Tan, 2011). Our key set data validation measurements are guided by (Yin, 2009) to ensure the quality of data collection. For instance, we employ data triangulation from various sources (existing policy/ CDR initiative document and interview) to ensure construct validity. We also employ construct explanations tactics during data analysis to ensure internal validity and utilize replication logic for external validity. Further, developing a case study protocol helps to enhance reliability (Yin, 2009).

Table 1: Mapping out Interview Questions			
Zooming out	**Zooming in**	**Insights from Literature about the sub-activity triangles**	**Mapping out interview questions (Mwanza-Simwami, 2001)**
	**Sub-activity triangle**	**Blockchain, CDR and e-waste**	
	1 *Subject- Tool-object* (organization- blockchain- e-waste management)	Organizations use blockchain to ensure traceability, transparency and collaboration (Alarood et al., 2023; Dua et al., 2020) within e-waste management systems. A blockchain-focused study (Du et al., 2019) identified specific mitigation and adaptation for blockchain implementation but not in e-waste management or CDR.	How does your organization adapt or mitigate actions in e-waste management using blockchain to realize CDR?
	2 *Subject-rule-object* (organization- existing arrangement- e-waste management)	Established norms and practices of e-waste management influence organizational actions. However, established compliance can improve the organizational culture and practice (The State of Victoria Department of Environment, 2017). How e-waste management compliance initiatives adjust the organizational arrangement is yet to develop.	How do you adapt or mitigate existing organizational arrangements or established rules to facilitate CDR by managing e-waste?
	3 *Subject-division of labor- object* (organization- human resources- e-waste management)	An organization must incorporate the e-waste management policy into job roles and monitoring duties that enhance CDR (Dodhia, 2021). The importance of education, awareness, training and embedding sustainability practices into human resources operations are highlighted in the literature (Paulyne, 2023; Review, 2023). However, organizational action related to job role adjustment in realizing CDR in practice is yet to develop.	How do you adapt or mitigate your human resources (a division of labor) to achieve e-waste management?
	4 *Community-tool-object* (Interested stakeholders - blockchain- e-waste management)	Blockchain enhances e-waste management by providing stakeholders with a secure, shared platform to track and authenticate sustainable practices (Ahmad et al., 2021). Nevertheless, organizational adaptation or mitigation actions to facilitate stakeholders with blockchain should be highlighted.	How does blockchain influence the adaptation or mitigation actions for e-waste management while working with other interested stakeholders?
	5 *Community-rule-object* (Interested stakeholders – organizational existing arrangement - e-waste management)	Interested stakeholders can impose compliance regulations and policies for CDR that organizations need to adopt in the existing operation or to incentivize organizational CDR activities (Alarood et al., 2023; Kumar & Singh, 2013). How organizations need to facilitate adjustments to adopt such regulations should be highlighted in the literature.	How does an interested stakeholder affect the organizational actions in adapting or mitigating existing arrangements while working on e-waste management?
	6 *Community-division of labor-object* (Interested stakeholders - human resources - e-waste management)	Different stakeholders perform different roles in the process of e-waste management. Each group's role impacts the job role of other groups (Borthakur & Sinha, 2013) due to stakeholder roles. How organizations need to adapt and mitigate actions is still emerging.	How does community affect your organization's adaptation or mitigation of human resources (a division of labor) to achieve e-waste management and ascertain CDR?

5 Implications and Future Steps

In the findings, this study will highlight different organizational adaptation and mitigation actions for managing e-waste and realizing CDR through blockchain uses. Most existing research studied either blockchain for e-waste management (Sahoo & Halder, 2020) or highlighted CDR's importance in tackling the e-waste issue (Mihale-Wilson et al., 2022). By integrating blockchain and CDR within the context of e-waste management, this research provides a holistic view of how blockchain can aid CDR through e-waste management. This will also contribute to blockchain research that emphasizes digital sustainability and responsible technology use. Additionally, illustrating the decomposition of the AT framework for mapping interview questions will provide methodological guidance for data collection for future AT research.

Our future steps include data collection and data analysis. This study utilizes two primary sources of data: documentation and interviews. All the collected data will be analyzed and interpreted interactively among data and theoretical models to answer research questions (Pan & Tan, 2011). We plan to conduct thematic analysis using qualitative analysis software N-vivo. We aim to explain organizational adaptation and mitigation actions concerning each AT element.

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