

Accounting for the Metabolic Rift: The Limits of Capital

Shang Wu

shang.wu@bristol.ac.uk

University of Bristol Business School

Alice Bryer

alice.bryer@bristol.ac.uk

University of Bristol Business School

Stuart Cooper

s.m.cooper@bristol.ac.uk

University of Bristol Business School

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Abstract

Previous research has criticized the limits of business and capital to address the ecological crisis. Ecological Marxism provides us with a critical lens to explore how accounting might perform more positive roles within these limits by understanding them as “metabolic rift”, the disconnection between society and nature, which is regarded as a fundamental cause of ecological injustices. Drawing on this lens opens the possibilities to explore whether and how business and capital could play roles in mending the rift, which we explore through a qualitative case study on Alipay Ant Forest. Receiver of the UN Champions of the Earth Award, Alipay provides an interesting case providing a platform where Alipay users accumulate “green energy” through everyday low-carbon behaviours. Once sufficient “green energy” is collected, Ant Group plants trees in areas of desertification. We explore how this practice leverages digital technology to reconnect society and nature. We also explore the possibilities for capital moving beyond the emphasis on monetary returns to include and increasingly prioritize the underlying value of ecology and society. Drawing on data collected through 26 interviews and a focus group with managers, as well as documentary evidence, we find that while digital technology serves as a bridge between society and nature, it also functions as a mechanism of enclosing ecological and social activity within profitable boundaries. Bringing these findings and tensions together, we conceptualize Ant Forest’s dynamic as “mending by breaking”, and reflect on the implications for the literature.

Keywords

Metabolic Rift; Alipay Ant Forest; Ecological Civilization; Capital Transformation; Mending by Breaking

1. Introduction

Contemporary capitalism faces a profound ecological paradox. On one hand, the capitalist mode of production has long been predicated on exploiting human labour and natural resources and externalizing social and environmental costs, a dynamic Marxian theory terms the “metabolic rift”: an “irreparable rift in the interdependent process of social metabolism” between humanity and nature (Marx, 1873). Originally formulated to describe the rupture between humans and nature under capitalist agriculture (Foster, 2000), the metabolic rift remains a powerful analytical lens through which to rethink the structural tensions between capital and ecology.

Classic ecological Marxists like Foster (1999) and O'Connor (1998) argue that capitalism's drive for accumulation inherently undermines its natural conditions, leading to crisis tendencies. Foster (2000), for instance, traces how modern industries disrupt nutrient cycles and ecological equilibria, creating a widening rift between what capital takes from nature and what it restores. Similarly, O'Connor (1998)'s theory of a “second contradiction of capitalism” posits that by undervaluing and degrading nature, capital eventually erodes the environmental and social bases upon which it depends, generating crises that threaten its own survival.

Corporate sustainability discourse often proposes or implies that ecological concerns and business imperatives can be aligned through strategies that deliver “win-win” outcomes (Lohmann, 2009, Matsumura et al., 2014, Downar et al., 2021, Rambaud and Richard, 2015, Jones, 2003). The so-called “business case for sustainability” frames environmental initiatives as opportunities for enhancing profitability, managing risks, and securing competitive advantage (MacKenzie, 2009, Feger and Mermet, 2017). Critical accountants have resoundingly rejected these claims, pointing to the clear limits and contradictions of capital-centred initiatives, as superficial at best, and frequently, as obscuring and ignoring the persistence of practices that are destructive and harmful to people and the environment (Belal et al., 2015, Cho et al., 2015, Gray, 2010). While sympathetic to this critique, in this paper, we seek to develop the critical perspectives, problematizing the limits of business and capital by exploring whether and how capital can mend the metabolic rift, and what are the limits? So doing, we open space for rethinking capital not as a static force, but as a mutable form capable of adaptation and innovation in response to environmental crisis, even while such may be contradictory adaptations.

Rather than presuming capital's ecological transformation in the abstract, we ground our analysis in the situated realities of how capital responds to ecological imperatives under particular institutional, cultural, and political conditions. In 2007, the Chinese government integrated the concept of “Ecological Civilization” into the ideology of the Chinese Communist Party, aiming for harmonious coexistence between humans and nature (Hansen et al., 2018). This institutional shift creates an imperative to rethink the relationship between capital and ecology, raising critical questions regarding whether capital, as a social-economic force, can transform itself to mend the metabolic rift.

Within the context of ecological civilization, the emergence of Alipay Ant Forest (hereinafter referred to as “Ant Forest”) serves as an illustrative case for exploring the transformative

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potentials and inherent limits of capital at the societal level. Ant Forest was launched as an ecological initiative by Ant Group (an Alibaba affiliate) in 2016. Alipay users accumulate a certain amount of 'green energy' through daily low-carbon behaviour. This 'green energy' is virtually accumulated in Alipay's digital platform. Once the accumulated 'green energy' reaches a certain threshold, users can opt to convert their green energy into actions related to the protection of deserts through tree planting which are then actualized by Ant Group.

On September 19, 2019, Ant Forest received the United Nations' highest environmental honour in the Inspiration and Action category: the Champions of the Earth Award and the United Nations Global Climate Action Awards. Since then, Ant Forest has expanded to include wildlife conservation, marine preservation, and ancient tree protection initiatives. However, the scope of this study is limited to tree-planting project in desert regions. This paper seeks to understand what such initiatives reveal about capital's transformative potential. We conducted a fieldwork after visiting the headquarters of Ant Forest and collected data from semi-structured interviews, focus group discussion, non-participant observations, as well as the analysis of internal and external documents.

We find that the "mending" of the metabolic rift does not occur outside or beyond capital's existing structures; rather, it is achieved in ways that remain accumulating surplus value. In this process, new forms of "breaking" emerge. While mending expands the boundaries of what capital values, it also reproduces structural tensions: these dynamics we theorize to "mending by breaking". In revisiting classical ecological Marxist concerns with capital's metabolic rift (Marx, 1873, O'Connor, 1998, Foster, 2000, Foster, 2002b, Moore, 2014, Moore, 2015), this paper suggests that transformative potential of capital towards ecological civilization requires a more nuanced reading. For accounting scholars, this "mending by breaking" opens up critical questions about how value is recognized, by whom, and with what consequences. This paper seeks to contribute to understandings of capital's potential for ecological transformation by offering a perspective on the metabolic rift that foregrounds this possibility. It also engages with how the boundaries of value might be shifting and how digital technologies are implicated in reconfiguring value recognition and accumulation. These discussions aim to open further dialogue within environmental accounting and related fields.

The next section presents the theoretical framing on metabolism and metabolic rift. The following section describes the research method. The findings of the study are organized in Section 4. The Section 5 discusses those findings and their relevance for literature on mending of metabolic rift. The last section summarizes what we explored via this research and suggests areas for further research.

2. Theoretical Framing

2.1 Metabolism, Capital and the Metabolic Rift

Karl Marx's notion of "metabolism" describes the material exchange between society and nature through the process of labour (Marx, 1873). Marx saw human labour as mediating an ongoing interaction with natural systems, which is a social metabolism by which people draw on nature to produce and reproduce life. Under capitalism, however, this metabolism becomes profoundly disrupted. The drive for endless accumulation and profit leads capital to treat nature

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as an object to be exploited without regard for replenishment or natural limits. In *Capital, vol. 1* (1873) Marx observed that “*all progress in capitalist agriculture is a progress in the art, not only of robbing the worker, but of robbing the soil*”, such that every advance in short-term fertility or output “*is a progress towards ruining the more long-lasting sources*” of that fertility. This insight prefigures what later came to be known as the “metabolic rift”, which is a rupture in the vital metabolic interaction between society and nature.

Drawing on the work of agricultural chemist Justus von Liebig, Marx demonstrated that capitalist agriculture exhausts soil fertility, producing a lasting rift. While artificial interventions such as chemical fertilisers were deployed to patch the damage, they treated the symptoms rather than addressing the underlying exploitative logic that generated the rift (Marx, 1975, Foster, 2000, Moore, 2014). In this sense, capitalist ‘fixes’ such as chemical fertilisers not only failed to restore the natural metabolism but also entrenched the metabolic rift further, highlighting the need for a deeper transformation in the relations between society and nature.

Later Ecological Marxists such as John Bellamy Foster (1999, 2000, 2002a) build on Marx's analysis to theorize the metabolic rift as a general condition of capitalist society. For instance, the extraction of raw materials and the conversion of ecosystems into economic resources exemplify how this transfer entails a rupture in the natural-social metabolism (Agger, 1979). As Moore (2015) argues, this process often disrupts the metabolic interaction between humans and nature. Foster (2020) argues that capitalist production creates a material estrangement of human beings in society from the natural conditions of their existence, violating basic conditions of sustainability. In his reconstruction of Marx's ecology, Foster (2000) shows that the metabolic rift is central to understanding how capital's logic disrupts ecosystems.

Capital treats nature as a free input and a bottomless sink, externalising costs and breaking feedback loops that would normally maintain balance (Belal et al., 2015). The result is an ever-widening rift between society and nature, which is evident historically in soil degradation and today in ecological crises (Leiss, 1994). Crucially, this rift is not an accidental side-effect; it is structurally generated by capital's imperative to expand (O'Connor, 1998). Therefore, the “metabolic rift” encompasses two layers of meaning (Marx, 1873, Marx, 1975, Foster, 2000). Firstly, it refers to the unidirectional flow of material exchange between human society and nature driven by profit-oriented production under capitalism. This disrupts the cyclical nature of material exchange, causing natural materials to remain in human society as commodities, preventing their timely return to nature. Secondly, the purpose of production under capitalism is to generate profit and surplus value, necessitating the mass migration of workers to cities and the commodification of land. This severance of the direct connection between people and land subjugates both to capital, leading to the metabolic rift between humans and the land, and between society and nature as a whole.

The concept of metabolism highlights an inherent limit of capital: capital within an economic system premised on infinite growth inevitably clashes with the finite regenerative capacities of nature (O'Connor, 1998, Foster, 2000, Bigoni and Mohammed, 2023). This contradiction sets the stage for recurring crises, which can also undermine the effectiveness of accounting as a valuation tool. The theoretical framework of metabolic rift therefore offers a lens to rethink

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capital's relation to nature, emphasizing whether the capital–nature metabolism can be mended. Building on critical studies such as Belal et al. (2013) and Belal et al. (2015) that highlight corporate reproduction of ecological rift, this study advances the discussion by explicitly problematizing the structural limits of capital. It opens up new analytical space to reconsider how capital's responses to ecological crises entail acts of mending and new forms of rifts: a dynamic that emerges through the findings section and is subsequently theorized in the discussion section as “mending by breaking”.

2.2 Accounting Narratives with the Limits of Capital

Given this profound rift between capital's accumulation and ecological sustainability, a critical question is how the field of accounting has responded. Accounting, as central in shaping and representing capitalist ways of understanding and pursuing value, would seemingly have a central role in either exacerbating or addressing the metabolic rift. There is a long-standing structural critique in the accounting literature recognizes that systemic limits underpin unsustainability (Gray, 2010, Ng and Rezaee, 2015, Arjaliès and Gibassier, 2023, Kuokkanen, 2024). Bigoni and Mohammed (2023), for example, deliver a stark verdict: so long as accounting is inextricably entwined with capitalism, any notion of “*sustainable accounting*” is destined to serve capital's interests and thus “*all notions of sustainable accounting are protracted exercises in futility that serve rather than abate ecological collapse (page.1)*”.

These arguments resonate with earlier structural critiques. As Belal et al. (2015) have shown, corporations were largely reluctant to take responsibility for their environmental impacts and accounting continues to reflect and prioritize the imperatives of capital, while the deeper crises of sustainability are rendered invisible or reframed as mere financial externalities. Recent critical works have sharpened those point by connecting accounting to capitalism's core contradictions, argues that the accounting is not external to capital's engine but a gear within it (Bigoni and Mohammed, 2023, Tweedie, 2024). Tweedie (2024) cautions that “*the problem with such an approach is that environmental accounting appears...to have emboldened capitalism, offering it an opportunity to expand and extend into new markets and territories. (page. 8).*”

Empirical case studies reinforce how sustainability efforts remain circumscribed by capital's limits, even progressive-sounding accounting innovations can be co-opted (Alawattage et al., 2023). Such narratives of sustainability operate within the limits of capital, which is bounded by what is palatable to profit-oriented management and investors rather than the nature itself. Another strand of research has suggested accounting could have a more positive role in sustainability or ecological improvement (Baker et al., 2023), but the focus is typically on financial impacts or decision-usefulness for investors, which is in line with accounting's conventional role in serving capital markets (Dhaliwal et al., 2011, Dechow, 2023, Hales, 2023) without addressing the metabolic rift produced by this emphasis.

Some prior research normalizes a worldview in which economic growth overrides ecological limits by emphasizing the benefits from eco-efficiency yields cost savings, where any solution for ecological crisis is expected to become a business opportunity. Foster (2002a and 2002b) highlights that this could deepen the metabolic rift by extending commodification to the last

frontiers of the natural world. Yet, the very act of exposing these structural limits is a step toward transformation.

By making visible the hidden environmental contradictions of capitalism and business, critical accounting research can inform broader debates and further policy interventions. Belal et al. (2015) identify how ecological rifts are systemic to capitalism and call for further research make visible the capital's contradictions and irrationalities. Likewise, Larrinaga and Garcia-Torea (2022) suggest that critical accounting scholars actively participate in redefining how we value and narrate our relationship with nature. They argue that accounting calculations should be connected to broader ecological values to reveal the inextricable connections between social and biological worlds. By exploring capital's transformative potential in ecological context, accounting could help mend the metabolic rift rather than obscure it.

If capital is highly adept at anything, it is at adapting to crises (Marx, 1873): often by transforming itself in ways that absorb threats and turn them into new opportunities for accumulation. Previous critical studies agree that the deteriorating environment is posing a challenge to the boundaries of capital (Di Tullio et al., 2024, Quattrone, 2022, Russell et al., 2017). Rather than a straightforward external shock, it is a crisis of capital's own making as the results of the increasing metabolic rift. There have been many attempts such as sustainability reporting standards to provide some metric for ecological value, however, within these adaptive moves lies a seed of potential change as capital is not static when facing ecological crisis. Previous studies already indicate that capital has become increasingly aware of ecological limits, which can be interpreted as an initial attempt to engage with these constraints.

2.3 The Transformative Potential of Capital

Although previous studies have documented how corporate activity reproduces ecological rift (Belal et al., 2013, Belal et al., 2015), relatively little attention has been given to the transformative potential of capital, specifically regarding how it adapts through new organizational forms and technological strategies when confronted with ecological constraints. The fact that major accounting institutions and corporate coalitions feel compelled to engage with concepts like sustainability, multi-capital accounting, or stakeholder value indicates that ecological and social concerns are prompting realignments. Extending such a discussion by exploring the role and potential of capital is still needed in light of its recognition of these limits. The theory relates to metabolic rift provides a critical foundation for understanding the disjuncture between capital's imperative for infinite accumulation and the finite regenerative capacities of nature (Marx, 1873, Foster, 2000). Critical scholars approach the existing ecological developments with caution: are they genuine harbingers of a capitalism and business that will mend the rift it created, or merely sophisticated delays of the inevitable reckoning?

A key mediator in the relationship between society and nature is technology, particularly digital technology, which is often presented as a solution to ecological constraints (Joshi et al., 2001, Henri and Journeault, 2010). In previous research, such innovations have been praised for enhancing visibility into socio-ecological interactions, generating data that can inform environmental policy and potentially trigger corrective interventions (Jiang, 2024, Clarkson et al., 2008, Clarkson et al., 2004). However, they also enable capital to define and manage

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ecological limits on its own terms. With accounting as a computational tool, digital technology supports the creation of a moving frontier, in which limits are not abolished but continually pushed outward or reframed as manageable variables (Callon, 2009, Lohmann, 2009). Yet when deployed within the existing capitalist system, digital technologies may function as mechanisms for delaying systemic transformation. In Marxian terms, these technologies risk papering over the metabolic rift rather than mending it (Foster, 1999, Foster, 2000, Foster, 2002b), because they may also function and perhaps primarily as a means of enclosing social and ecological activity within commodity exchange, what we term 'mending by breaking'.

Amid the ambivalence, a hopeful thread in accounting literature argues for rethinking value itself as a route to potential transformation (Di Tullio et al., 2024, Vollmer, 2021, Bracci et al., 2021, Gallhofer et al., 2000). If the capital's metrics and incentives are fundamentally flawed to create rifts, then reshaping the limits could unlock new possibilities. This means moving away from a singular focus on price and profit to embrace values of social well-being, ecological integrity, and intergenerational justice. That would require rethinking notions of capital's potential with mending metabolic rift, topics now increasingly debated even in mainstream circles of accountability, sustainability and environmental accounting.

The phrase "transformative potential of capital" can thus be read in two ways. One reading is sceptical: it is the potential of capital to transform itself just enough to survive as a process that may mitigate certain problems but ultimately leaves the capitalist logic intact. The other reading is more hopeful: within capital's roles lie opportunities to mend the metabolic rift and redefine value in ways that could eventually transcend the narrow logic of profit. We thus see a dialectical tension in the current moment: capital is transforming as it creates both new spaces for change and new mechanisms of control.

Taking a case study of Alipay Ant Forest, this research critically explores capital's transformative potential, and seeks to illuminate pathways of the possibility of mending the metabolic rift. Capital's transformative process is deeply contradictory: while it may appear to mend certain ecological fractures, it also creates new tensions, dependencies, and vulnerabilities within the capital–nature relationship. Nevertheless, accounting, both as a professional practice and an academic field, has a critical role to play in either supporting or obstructing this transition after understanding these intertwined dynamics.

3. Research Method

3.1 Case study

This paper presents data from a case study of Ant Forest, which is situated within the Alibaba-affiliated business ecosystem, which includes Alibaba Group, Ant Group, and Alipay. In late 2003, Alibaba Group launched Alipay, a third-party escrow payment service for its e-commerce platform, *Taobao*. By the end of 2014, Alipay and its related financial services were spun off from Alibaba Group to form Ant Financial.

In 2016, Ant Financial introduced "Ant Forest" within the Alipay application. Alipay users accumulate a certain amount of 'green energy' through low-carbon behaviour scenarios. This green energy is amassed in a virtual form within Ant Forest. Once the accumulated green

energy reaches a certain threshold, users can opt to convert their green energy into actual tree planting activities in desert or arid areas, implemented by Ant Group to combat desertification. Users are afforded the liberty to select projects of their choice, such as the freedom to choose the variety of trees and the region where they wish to plant them. Ant Group periodically discloses the progress of Ant Forest projects, and users can also observe ongoing projects in real time through the Alipay app. As shown in Fig. 1, users’ low-carbon behaviours, undertaken in real life, are virtually transformed into ‘green energy’ through digital technology, which is subsequently converted into the actual labour of tree planters. Our research is based on the case of Ant Forest, which virtually connects human society and nature via digital technology.

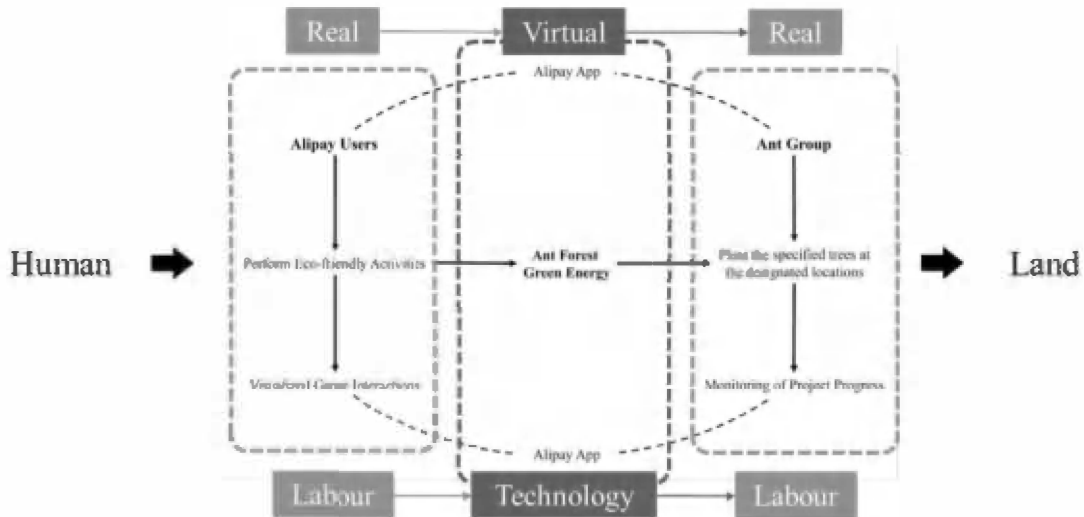


Figure 1. The Fundamental Mechanism of Ant Forest

As shown in the centre of Figure 1, the acquisition and conversion of green energy appears to be the central mechanism driving the entire Ant Forest. The quantum of ‘green energy’ rewards is calibrated solely on the basis of individual carbon emissions avoided, not explicitly reduced. This is attributable to the system’s orientation towards quantifying and incentivising specific behaviours, as opposed to conducting a comprehensive assessment of the net emissions reduction effected by users.

By mid-2020, Ant Financial was rebranded as Ant Group Co., Ltd. (hereinafter referred to as Ant Group). By the end of 2023, Alibaba Group held a one-third stake in Ant Group, alongside a long-term strategic partnership, affording it significant decision-making influence from an accounting perspective. Despite this equity relationship, both Alibaba and Ant Group operate independently with separate governance structures, management decisions, and financial strategies, as demonstrated by Alibaba’s public listing in the US and Ant Group’s previously attempted IPO. Nevertheless, in certain strategic initiatives such as Ant Forest, these legally independent entities within the Alibaba-affiliated ecosystem collaborate closely, sharing internal resources, data, technological infrastructures, and brand. Thus, rather than a traditional joint venture, this arrangement exemplifies a novel form of strategic ecosystem collaboration among independent corporate entities, highlighting a distinct mode of capital cooperation that transcends conventional organizational boundaries.

3.2 Data Collection

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This study collected data from semi-structured interviews, non-participant observations, and analysis of internal and external documents from the Alibaba-affiliated business ecosystem. We visited the headquarters of Ant Group (Ant Forest team) in August 2023 and attended the first stakeholders' conference held there in the seven-year history of Ant Forest. The stakeholder conference, titled the "2023 Ant Forest Ecological Partners Conference," was attended by representatives from nearly all key stakeholders. We participated in the conference in a dual capacity as an independent academic researcher and a user representative. Conference's participants who did not publicly speak were not included in the scope of this study, unless they participated in data collection as interviewees.

Prior to the start of the conference, the first author of this paper submitted a set of interview questions to the Ant Forest executive team, which partly were publicly addressed during the keynote session. During the visit of Ant Group's headquarters, the first author also participated in a 65-minute focus group discussion involving heads of various departments of Ant Forest (a total of 11 managers) and 20 top users, which was fully recorded and transcribed. Following the stakeholder conference and focus group discussion, three members of the Ant Forest management team and ten top users engaged in a two-hour leaderless discussion. We did not directly participate in posing questions or providing answers; instead, we observed and documented the entire process.

In addition to the content of the speeches at the *Conference*, products, videos, images, and materials related to Ant Forest displayed at the conference venue were collected as qualitative data. We also conducted, recorded and fully transcribed 26 interviews with Ant Forest users, with durations ranging from 25 to 70 minutes. Although the majority of the users' interview content is not presented in this paper due to the macro-level focus of our research, the users' insights provided us with valuable inspiration in whole data collection process. Ethical approval and informed consent were obtained from all participants prior to data collection. Participants were informed about the study's purpose, assured of confidentiality, and agreed explicitly to recording and transcription.

The data sources for this paper are highly diverse, allowing us to critically explore the multifaceted perspectives on capital in the process of mending metabolic rifts (Postaire et al., 2024). The term "informant" is used in this paper to refer to all data contributors, whether they were directly interviewed or observed, or indirectly responded to the questions we posed. Appendix A details the characteristics of the informants and Appendix B summarize all the documents and text-based materials collected for this paper.

3.3 Data Analysis

We began by meticulously reading all the documents (#D1-#D50) word by word and sentence by sentence. For particularly lengthy documents, such as D5, we conducted a paragraph-by-paragraph review, extracting and compiling all content relevant for coding into a more concise, standalone document. Following this, we transcribed all interviews, focus groups, conference speeches, observation and fieldwork notes. The data analysis in this paper first employed an inductive approach, using open coding to analyse all transcripts, notes, and all textual documentation. The coding process generated written memos focusing on specific areas of interest, such as "*ecological civilization*", "*participation*", and "*land restoration*".

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In the first round of coding, we applied 16 codes, some of which overlapped in content. The first-order coding aimed to describe the context, backdrop and driving factors of the Ant Forest. As the first-order codes emerged, we found that capital’s motivations for engaging in ecological civilization were influenced by higher-level factors. We use the category “*policy priority*” and “*sustainability*” to code governmental and organizational level decision making.

In the second stage of coding, we focused on the operational mechanisms of Ant Forest, which led to the further five categories: the “*digital technology*” that supports Ant Forest, the “*production and reproduction*” processes implicit in its operational workflow, the project’s “*outputs*”, the underlying “*business mechanisms*”, and the “*benefits*” it generates. The second-order coding also established two sub-categories that connect to further coding: the policy granting capital the “*discretion*” to make decisions and the “*use of technology*”.

The third-order coding abstracted five themes surrounding the transformative role of capital in ecological civilization efforts. Table 1 presents examples of quotations under each of these five themes, which include: capital’s stated purpose of “*public and social welfare*”, its use of “*technical rationality*” to achieve this goal, the transformation process itself as a process of “*capital accumulation*”, the “*collective ownership*” of the outputs from this process, and the ongoing “*capital logic*” throughout the transformation.

Table 1. Example of Coding Process (Theme)

Theme	Sample Quotations
Public and Social Welfare	<p>“<i>Ant Forest is a purely public and social welfare project, generating no financial profits for Ant Group... (#I-1)</i>”</p> <p>“<i>...the upgrade from a ‘public and social welfare project’ to a ‘public and social welfare foundation’ signifies that Ant Forest has entered a new phase of development... (#I-2)</i>”</p> <p>“<i>The third mode is social and public welfare participation, encouraging nonprofit organizations, individuals, and others to collaborate with the government... (#I-20)</i>”</p>
Technical Rationality	<p>“<i>Digital technology has been actively explored to play a more significant role. It is precisely within such a historical context that Ant Forest found its developmental opportunity... (#I-3)</i>”</p> <p>“<i>...through technology and innovation, we (Alibaba-affiliated business ecosystem) consistently address social issues and promote social advancement... (#D-40)</i>”</p> <p>“<i>...aims to join forces with partners from all sectors of society, with the purpose of using technology for good, to explore and co-build a new type of green public and social welfare open model with the whole society... (#D-47)</i>”</p>
Capital Accumulation	<p>“<i>...There is a particular emphasis on encouraging and supporting the participation of social capital in ecological conservation and restoration projects primarily funded by government expenditure, with returns in the form of ecological product values... (#I-21)</i>”</p> <p>“<i>...key factors measuring a company’s core competitiveness against other enterprises include the scale and activity level of users and merchants on the platform, the richness of payment scenarios, high-quality user experience, and merchant value-added payment capabilities... (#D-10)</i>”</p> <p>“<i>...For Alibaba, responsibility stems from a public and social welfare mindset, while commercial methods are effective in creating value through the practice of sustainability... (#D-42)</i>”</p>
Collective Ownership	<p>“<i>The trees planted by Ant Forest belong to the nation and society... (#I-2)</i>”</p> <p>“<i>...its departments in ecological conservation and restoration, collectively building ecological civilization... (#I-20)</i>”</p>

"...everyone is a protector, builder, and beneficiary of the ecological environment. No one is a bystander, outsider, or critic; nobody can afford to remain indifferent or uninvolved...(#D-16)"

"...the government aims to create a fair, just, and transparent investment environment for social capital, establishing mechanisms for sustainable returns and reasonable exit strategies, ensuring that social capital can enter, exit, and profit...(#D-22)"

Capital Logic *"...for Alibaba, responsibility stems from a public and social welfare mindset, while commercial methods are effective in creating value through the practice of sustainability...(#D-41)"*

"...Alipay charges merchants a transaction fee ranging from 0.6% to 1% for each transaction conducted through its platform...(#D-12)"

4. Findings

4.1 Ecological Civilization and Capital's Self-Transformation

When tracing the origins of Ant Forest, it reveals that environmental considerations, serving as the cornerstone of Ant Group's sustainability agenda, align with the expectations held by a diverse array of interested parties. The senior manager describes the initial intentions behind the launch of the Ant Forest as:

"In 2016, the Group of Twenty Summit (G20 Summit) was convened in Hangzhou, China, and our company (Ant Group) - headquartered in Hangzhou - heeded the call to contribute to this international event with a focus on green themes... By integrating green living with digital finance, we conceived the idea of encouraging users to adopt green lifestyles through Alipay. This led to the inception of what is now the well-known Ant Forest" (#I-1).

In this quote, the manager noted that the impetus behind the launch of Ant Forest was a response to the expectations of the government for responsible behaviour from prominent local enterprises. As we trace back to the original intersection of Ant Forest and "green living", the initial inspiration comes from a speech delivered by China's General Secretary Xi Jinping at the opening ceremony of the Business 20 (B20) Summit, where he emphasized:

"...I have often said that 'lucid waters and lush mountains are invaluable assets'... Our promotion of green development is also a proactive response to climate change and the issue of excess production capacity... to build a beautiful China...where the public can...tangibly feel the ecological benefits brought by economic development" (#D-15).

Similarly, a senior executive of Ant Forest corroborated this point:

"...under the guidance of Xi Jinping's paradigm on ecological civilization, the concept that 'lucid waters and lush mountains are invaluable assets' has been widely disseminated and diligently implemented. Digital technology has also been actively explored to play a more significant role. It is precisely within such a historical context that Ant Forest found its developmental opportunity" (#I-3).

In the two quotations above, the phrase "lucid waters and lush mountains are invaluable assets" is reiterated, reinforcing the cultural and political setting that underpins Ant Forest and its role in capital's self-reconfiguration. The management's statement describes ecological civilization as an official vision for harmonizing development with nature, which is a "historic opportunity"

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for Ant Forest. While digital technology has previously been only employed as a means of generating economic value for Alipay, the explicit emphasis on ecological priorities developed within this framework signifies a shift whereby digital technology is increasingly mobilized to address ecological objectives rather than merely to enhance profitability. Ant Forest thus exemplifies how capital actively explores the potential of technology to reconcile economic development with ecological imperatives. We further explore whether the cultural and political setting reshape capital's pursuits, as highlighted by a government official:

“General Secretary Xi has pointed out that ecological civilization is an endeavour in which all people collectively participate, build, and enjoy... Everyone is a protector, builder, and beneficiary of the ecological environment... No one is a bystander, outsider, or critic; nobody can afford to remain indifferent or uninvolved” (#I-21).

This quotation further explains the internal motivation behind capital's transformation toward ecological civilization, emphasizing that *“nobody can afford to remain indifferent or uninvolved.”* It highlights that Ant Forest does not operate in isolation but is developed within the ideological discourse of ecological civilization. This discourse promotes the idea that economic development and environmental sustainability can be mutually reinforcing rather than contradictory, as reflected in the claim that *“everyone is a builder and beneficiary.”* The quotation describes how Ant Forest functions as a potential tool, mobilizing individuals' environmental aspirations to become *“protectors, builders, and beneficiaries.”* In doing so, Ant Forest extends ecological concerns into everyday life, as reflected in the words of two users interviewed:

“...when making purchasing decisions, I give priority to products that collaborate with Ant Forest, motivated by my fondness for the project... The ‘green energy’ labels on product packaging subtly elevate their priority in my selection process...” (#I-37).

“In the presence of the term ‘tree planting,’ I find it deeply appealing, as if it resonates with an innate predisposition within me... In the past, prior to the existence of Alipay, I engaged in the virtual farming game on another platform, reflecting a cultural inclination among the Chinese population towards ‘planting’. Consequently, I became intrigued by Alipay's tree planting feature, particularly due to its environmental implications, which I deemed highly meaningful... In truth, though I may not consciously undertake environmental endeavours on a regular basis, I have a genuine desire to contribute towards safeguarding our planet and lend my support to this cause” (#I-30).

These two quotations explain that, within the cultural and political setting of ecological civilization, citizens at the societal level are also seeking self-transformation. Ant Forest serves as a vehicle for this transition, which points out that the internal reconfiguration of capital is driven not only by government policies but also by societal expectations. The quotation mentions that, in the context of China's unique institutional and sociocultural context, the act of tree planting holds special significance. At the end of 1981, China adopted a resolution to initiate a nationwide compulsory tree-planting campaign (#D-27). According to this resolution, citizens of the People's Republic of China aged 11 and above, except for the elderly, frail, sick, and disabled, are obligated to plant 3-5 trees annually wherever conditions permit. However,

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in practice, the fulfilment of this obligation varies significantly across regions and individuals, as “wherever conditions permit” introduces considerable flexibility, allowing many citizens to be exempted from active participation due to geographical, environmental, or logistical constraints. In 2013, China's General Secretary Xi Jinping has further emphasized:

“...China is generally a country with sparse forests and fragile ecosystems... it is essential to strengthen propaganda and education, innovate activity formats, and guide the masses to actively participate in voluntary tree planting ...” (#D-26)

This quotation can be related back to the broader cultural and political setting in which ecological consciousness and citizen self-transformation are actively encouraged. Citizens were already familiar with the ethos of tree planting through longstanding state-led greening campaigns, even though practical constraints often limited widespread individual participation. The introduction of Ant Forest offers a new channel to overcome these barriers by enabling citizens to engage in tree planting virtually. In this sense, Ant Forest resonates with pre-existing cultural values while leveraging technological innovation to actualize ecological participation that had previously remained largely a formal obligation rather than an everyday reality.

On 23 October 2018, Ant Forest was officially integrated into the mandatory tree planting system of China. For every three trees planted through Ant Forest, users are awarded a “*Certificate of Due Diligence for Compulsory Tree Planting for All Citizens*”, as issued by the Chinese government. The initial content of Ant Forest involved tree planting, which can be partially attributed to aligning with relevant policies, as stated by government officials:

“...On March 24, 2015, General Secretary Xi Jinping chaired a meeting...emphasized the necessity of accelerating the greening of lifestyles, advocating for a shift towards frugality, eco-friendliness, low carbon emissions, and healthy living standards. In August 2016, in response to this directive, Ant Forest was launched, encouraging users to start with themselves, focusing on small actions and everyday matters, to promote a low-carbon lifestyle....” (#I-20).

This quotation highlights how political setting reinforces capital's self-transformation: Ant Forest's narrative of environmental harmony and technological mechanism supports a broader eco-civilizational transformation. By aligning with the state-sanctioned ideal, capital garners societal supports for ecological practices. As stated by the managers of Ant Forest, “*The trust our users place in us serves as motivation and support for us to actively practice our sustainability (#I-3)*”. The senior executive further explained:

“When the user base of Ant Forest escalated from a few million to three hundred million within a year, it became apparent that Ant Forest had transcended its initial status as a minor experimental sustainability project within the company...At that time, we encountered pressures and sceptical voices from various quarters. In response to this, the top management associated with Ant Forest urgently convened a meeting...We revisited the original intent behind designing this project, which was to motivate a greater number of individuals to experience and practice a green lifestyle rather than focus on financial transactions...” (#I-2)

This quotation reveals that capital's self-transformation toward ecological civilization is not a

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seamless process but one marked by struggle. The managers' statement that they ultimately decided to stay true to their original aspiration directly addresses the underlying motivation driving capital's reconfiguration in alignment with the ideological dimensions and broader societal expectations. This suggests that capital's shift towards ecological engagement was not purely a response to external pressures, but also stemmed from an internal reaffirmation of its original environmental aspirations and a consideration of broader societal values.

4.2 Ecological Restoration: A New Relationship of Shared Ownership

In the second year after the launch of the Ant Forest project, the senior executive stated:

"Alibaba's commitment to sustainability is the passion, dedication, and sense of mission that keeps the company...continuously integrates its development with societal progress. Through technology and innovation, we consistently address social issues... our approach is 'public and social welfare mindset, commercial methods' ..." (#I-1).

In the 2017-2018 Social Responsibility Report of Ant Group, the aforementioned principle of "public and social welfare mindset, commercial methods" was further explained as follows:

"Alibaba firmly believes that sustainability practices, when integrated into Alibaba's business model, can achieve sustainable development... Sustainability is not a burden for enterprises... we have embedded public and social welfare elements into various business products within its ecosystem..." (#D-42)

Both quotations reveal a tension: while capital positions itself as a force for addressing ecological and social challenges through a "public and social welfare mindset," it continues to operate through "commercial methods," thereby embedding a potential contradiction at the heart of its mending efforts, whereby the former enables the possibility of ecological repair, while the latter risks reproducing new rifts within the capital–nature metabolism. In the context of ecological civilization, shaped by policy guidance, societal expectations, and capital's own transformative aspirations, this shift appears not merely as a reactive adjustment but as an intentional reconfiguration. As the government documents outlines:

"...the role of the government is...ensuring that social capital can enter, exit, and profit...should be based on the principle of 'benefits to the restorer,' aligning ecological benefits with socio-economic gains..." (#D-23)

In the case of Ant Forest, rather than resisting change, capital seeks to align itself with emerging ecological imperatives, suggesting a potential transformative role in reshaping its relationship with nature. However, this transformation does not signify an abandonment of economic pursuits. Instead, it reflects the emergence of alternative pathways to value creation, where ecological restoration itself becomes a new source of "socio-economic gains". As the government documents outline, the principle of "benefits to the restorer" proposes the integration of ecological benefits with economic profitability, providing incentives for capital to engage in environmental initiatives while continuing to pursue economic growth. However, the tension between capital's pursuit and the structural constraints posed by the nature of ecological restoration itself also raises questions about ownership and control.

Ant Forest operationalizes ecological efforts through collective participation, where users

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engage in daily low-carbon activities, and capital subsequently funds tree planting in desert regions as a countermeasure against desertification. Ecological assets, such as the restored land facilitated by Ant Forest, exhibit characteristics of public goods, making them difficult for capital to fully privatize. The *Constitution of China* establishes a system of socialist public ownership of land, under which land is nominally owned collectively by the people. The state, represented by the *State Council*, exercises the rights of ownership and management on behalf of the people. Consequently, Ant Forest's restoration projects primarily involve the rights to use natural resource assets and priority rights to operate them, rather than ownership of the land itself. Based on the political context of China, the value returns of ecological products include property rights incentives, resource utilization, fiscal support, and financial assistance. Specifically, the governmental documents stipulate:

“For social capital engaged in...ecological restoration that achieve a certain scale and predetermined objectives, the policy allows them, in accordance with laws and regulations, to obtain a certain share of natural resource asset usage rights... Projects primarily focused on forest and grassland restoration may utilize up to 3% of the restored area for ecological industrial development...may enjoy environmental protection, energy and water conservation tax incentives as stipulated.” (#D-22).

This quotation highlights an alternative form of value creation, wherein capital generates additional 'value' through ecological restoration. For instance, by transforming desert areas into forests, the newly created ecological and economic value can then be redistributed through the joint efforts of the government and capital. The ownership of restored land remains communal rather than being absorbed into capital's privatized accumulation process. This signals the potential to mend the rift as the restored ecological areas do not become the private property of any single capital entity.

Capital can also derive benefits from ecological restoration that extend beyond the reclaimed land in desert regions to include the trees planted by Ant Forest, the fruits they produce, and the products generated from these resources. These ecological assets become developed within capital accumulation processes, raising critical questions about their ownership, control, and distribution. Regarding this matter, the governmental document states:

“When social capital harvests economic forests...they may design their harvesting plans or strategies independently based on forest management schemes or planning, and legally determine the age and method of harvesting autonomously” (#D-22).

On November 19, 2018, Ant Forest introduced its first ecological economic forest tree species, the sea buckthorn. *“This species helps fix sand and protect soil, which contributes to combating desertification. Since desertification is closely linked to climate change, the cultivation of sea buckthorn supports local climate adaptation by stabilizing soil, increasing carbon sequestration, and mitigating the effects of extreme weather. In addition, it provides an alternative source of income for local farmers through the harvesting of sea buckthorn berries. (#I-13)”*. On December 9, 2019, Ant Forest launched the sale of sea buckthorn juice under the brand *“MA Sea Buckthorn”* (#D-35). For all revenue generated from fruits, juices, and similar products, the senior executive of the Ant Forest explained:

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“The Ant Forest team is, in fact, classified as a public and social welfare team within (the entire) organization. For this segment, we do not generate any commercial income... we have also heard from some users who wish to purchase Ant Forest-related merchandise and brand-related items... All commercial revenue generated from these activities ultimately contributes back to public and social welfare causes” (#I-3).

This quotation positions capital's transformation within a discourse of public and social welfare, reinforcing its alignment with ecological civilization narratives. The manager mentions the phrase *“ultimately contributes back”* appears to suggest a collective dimension to Ant Forest's harvest, framing it as part of a cyclical process. However, this raises questions about the ownership of the trees planted through the initiative. The foundation of Ant Forest's model rests on users engaging in daily low-carbon behaviours to accumulate green energy, which is then converted into real trees planted and maintained under the project, nominally in the users' names. When users opt to convert their green energy into tree planting within Ant Forest, they receive a certificate:

“Dear user [Name], thank you. The tree you applied to plant on [Date] has been claimed by [Foundation] and will be planted in [Area]. The sapling number is XXX.”

The certificate issued by Ant Forest does not explicitly define the ownership of the trees it plants; it merely states *“the tree you applied for,”* leaving the question of ownership open-ended. Although this ambiguity aligns with public-oriented narratives and supports the ecological civilization agenda by not directly appropriating the trees as commodities, it also preserves openings for the appropriation and potential extraction of surplus value from ecological assets. Such flexibility exemplifies how efforts to mend the rift may paradoxically create the conditions for future breaking.

The lack of clearly defined ownership, however, could raise important questions about accountability. On October 7, 2023, news reports surfaced that a large area of plants used for desertification control in China's Tengger Desert was crushed by off-road vehicles during the holiday period, resulting in damage to tens of thousands of plants. The location of this incident coincides with an ecological restoration area associated with a project by Ant Forest. Consequently, following the event, numerous users and social media influencers held the Ant Forest team accountable with queries such as, *“Have the trees I diligently planted been destroyed?”* and *“What is going on with the Ant Forest team? Do they only care about planting trees without maintaining them?”* In response, the official social media account of Ant Forest posted in the afternoon of the same day: *“It has been verified that this is NOT a project site of Ant Forest. Regardless, every sapling in the desert is hard to grow and deserves our care and attention.”*

This event suggests that capital's transformation is not only an internal adjustment but is also reshaped by external ideological and societal forces. If capital merely adopts vague and ambiguous narratives rather than making structural changes, these external forces could shift from being drivers to constraints on capital's transformation. Regulatory oversight and public critique then serve as mechanisms of accountability, potentially challenging capital's claims of alignment with ecological goals. To respond to the tension in capital's transformation within the discourse of ecological civilization, a senior executive of Ant Forest stated:

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“The trees planted by Ant Forest belong to the nation and society... Ant Forest has agreed through protocols with entities dedicated to public good that, should these trees generate carbon credits in the future, all will be allocated for public and social welfare purposes... To date, Ant Forest has not engaged in carbon credit trading” (#I-2).

In this quotation, the manager states that the trees remain publicly owned rather than becoming private assets. This could indicate a shift away from a singular focus on firm-level profit maximization toward a mode of distribution that incorporates collective benefits, potentially signalling a reconfiguration of accumulation where economic and ecological interests begin to converge rather than conflict. These assets do not belong to any single individual or to capital itself but are instead developed in a process which everyone contributes and everyone benefits. It seemingly aligns with the ecological civilization, where the cycle suggests the possibility of capital repositioning itself and re-establishing connections between society and nature through digital technology. It raises the potential for mending of the metabolic rift, though the extent of this transformation warrants further critical exploration in next section.

4.3 Pushing the Boundaries of Value

Although capital is positioning itself within the discourse of ecological civilization and emphasizing the public nature and shared ownership of ecological restoration outcomes, it remains important to critically explore how value creation continues to shape its accumulation process. The extent to which capital's transition contributes to mending the metabolic rift depends on how its pursuit of value interacts with its claims of ecological commitment. As a senior executive of Ant Forest stated:

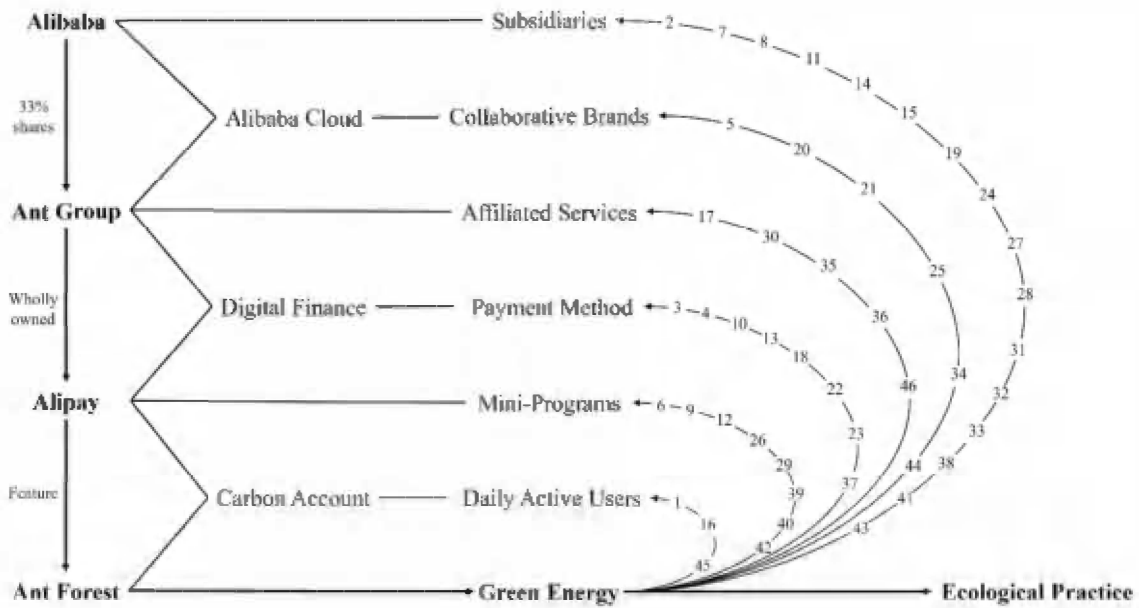
“Ant Forest is a purely public and social welfare project, generating no financial profits for Ant Group... The expenditures of several hundred million (RMB) annually by Ant Group on the Ant Forest constitute pure charitable donations” (#I-1).

While the emphasis on “no financial profits” explicitly underscores the lack of direct monetary benefits for Ant Group, the earlier reference to a “public and social welfare mindset” alongside “commercial methods” suggests that capital does not entirely abandon its pursuit of value but rather integrates it into its transformation.

4.3.1 Breaking Dynamics: Surplus Value Extraction within Green Energy

If we consider the Alibaba-affiliated business ecosystem as a broader entity of capital, Ant Forest may provide Ant Group with ‘non-financial benefits’ while potentially generating financial benefits for the broader Alibaba-affiliated business ecosystem rather than exclusively for Ant Group itself. Therefore, we present Figure 2, where the horizontal axis represents the functional logic of Ant Forest, while the vertical axis denotes the equity relationships related to Ant Forest.

Figure 2. Mechanisms for Generating Green Energy in 46 Scenarios*



* The numbers contained in Figure 2 represent 46 scenarios of generating green energy, from scenario 1 to scenario 46. For the examples of the scenes corresponding to specific numbers, please refer to Table 2.

Table 2. Examples of scenarios in Figure 2.

#	Scenarios	Calculation Rules and Daily Maximum Limit
Monetary-related Scenarios		
11	Online Movie Ticket Purchase	Each online purchase of movie tickets through the TaoPiaoPiao platform (subsidiary within Alibaba-affiliated business ecosystem) earns 180 grams of green energy, with a monthly limit of ten transactions.
20	Green Hotel Stay	Guests who stay at hotels cooperating with Ant Forest and opt not to use the provided amenities set (toothpaste, toothbrush, comb, soap) can earn 92 grams of green energy upon completion of their stay, with a monthly cap of 20 stays.
35	Electronic Car Insurance Policy	Users who take out car insurance on the Ant Insurance platform (Ant Group affiliated services) and opt for an electronic policy, completing the issuance process, can earn green energy. Choosing compulsory insurance or commercial insurance earns 59 grams of green energy, and insuring both compulsory and commercial insurance simultaneously earns 118 grams.
4	Tube Travel	When using Alipay to scan for tube rides or opting for Alipay as the payment method while using the official tube app for scanning and riding, each transaction yields 52 grams of green energy. The daily cap is set at five transactions.
9	Renting New Energy Vehicles	Within the Alipay mini-program named “car rental”, by selecting a vehicle model marked with a ‘Green Energy’ label and completing the order, users can earn 33 grams of green energy per kilometre. The same user has a daily limit of one transaction, with a cap of 27 kilometres per order. The maximum green energy a user can earn per day is 891 grams.
Non-monetary-related Scenarios		
1	Walking	Approximately 1 gram of green energy is acquired for every 60 steps walked with a daily maximum limit of 296 grams.
16	No-Drive Days	Alipay has launched the Green Car Owner Plan, which involves not driving for one day each week. A full day of not driving, spanning 24 hours (which can be overnight), earns 819 grams of green energy. If the no-drive period exceeds 120 hours, green energy cannot be earned. The total mileage recorded at the start and end of the no-drive period must be unchanged, as evidenced by on-site photos taken inside the vehicle (rephotographed images are invalid). Only one of the vehicle

	owner or shared vehicle user can earn green energy. The same user can only earn green energy once per week, with a monthly limit of four times, equating to 3276 grams of green energy.
45	Clean Plate Initiative (finishing all the food) Users activate the 'Green Action' feature within Alipay, take a photo of their food before eating and again after finishing, then upload and submit the check-in. After verification by Ant Forest's backend, users will receive green energy. There is only one opportunity per day to earn green energy from the Clean Plate check-in, which must be completed before 24:00 each day. Each successful check-in earns 107 grams of green energy. Currently, only real-time photos are supported, not uploads from the photo gallery. The Clean Plate action check-in for green energy is only available on Alipay version 10.2.80 and above.

Figure 2 illustrates the overall process of Ant Forest: users accumulate green energy through various daily activities, which can then be converted into tree planting practice. Each green energy scenario is linked to Alibaba-affiliated business ecosystem. In some cases, users obtain green energy by purchasing products from specific brands that are subsidiaries within Alibaba's corporate structure. In other cases, the services themselves are launched by affiliated brands, or are provided by companies that have established long-term strategic partnerships with Alibaba through platforms such as Alibaba Cloud. Table 2 provides selected examples of how different scenario designs are connected to Alibaba-affiliated business ecosystem¹.

The specific rules highlighted in these scenarios, such as “*purchasing from brands cooperating with Ant Forest,*” “*using Alipay as the payment method,*” and “*utilizing the Alipay mini-program,*” suggest a possible structural connection between users' environmental engagement and particular commercial activities. While users themselves incur no transaction fees when making payments via Alipay, merchants are required to pay transaction fees ranging from 0.6% to 1% per transaction (#D-12). A similar dynamic appears in Alibaba-affiliated services, such as scenario #36, if merchants need to access a user's credit score through Zhima Credit for hotel reservations, they are required to pay Ant Group on a per-query basis. Thus, although participation in Ant Forest and the use of Alipay appear cost-free from the users' perspective, these interactions potentially generate financial benefits for broader Alibaba-affiliated business ecosystem. It raises critical questions regarding the extent to which ecological practice such as Ant Forest depend upon and potentially reinforce existing mechanisms of capital accumulation.

There are the remaining three scenarios in Table 2 and Figure 2: walking (the 1st scenario), no driving day (the 16th scenario), and the clean plate initiative (the 45th scenario). The three non-monetary transaction scenarios provide users with a pretext for frequently opening the Alipay application. The behaviours and psychological patterns of users precisely corroborate the management's positioning of Ant Forest within Alipay's value assessment system. The manager explained:

“Ant Forest enhances two core performance metrics for Alipay: one is Daily Active User (DAU), and the other is user retention... This is because collecting green energy daily can encourage user's open rate and increase user stickiness to Alipay, thereby

¹ Note: Table 2 illustrates representative examples of monetary and non-monetary scenarios in Ant Forest but does not exhaustively present all 46 scenarios. Researchers interested in the full dataset and the associated rules are invited to contact the corresponding author.

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boosting the number of daily active users” (#I-3).

This quotation mentions two key metrics: DAU and user retention. The prospectus further explained how such intangibles benefit the Alibaba-affiliated business ecosystem:

“In the field of digital payments and merchant services, key factors measuring a company's core competitiveness against other enterprises include the scale and activity level of users and merchants on the platform, the richness of payment scenarios, high-quality user experience, and merchant value-added payment capabilities...” (#D-10).

The non-monetary green energy acquisition scenarios enhance user stickiness and activity, while the monetary scenarios strengthen the connection between merchants and consumers. These approaches converge on a commonality: each scenario contributes to maintaining a high level of daily active users for Alipay. The importance of such non-financial metrics has been extensively acknowledged in prior studies (Amir and Lev, 1996, Perera et al., 1997, Ittner and Larcker, 1998, Kelly, 2007). Partially reflecting this, Ant Group's IPO prospectus provided detailed disclosures, highlighting as the *“economies of scale in the business model”*:

“As more users and merchants engage on the Alipay platform, it is capable of attracting additional users and merchants, thereby continuously driving transaction growth... reduce the users acquisition costs for Ant Group's various services... Through the economies of scale associated with Ant Group's operations, it continues to enhance its capability to meet users' needs, thereby achieving sustained growth” (#D-10).

In this quotation, the capital's logic is premised on expanding user and merchant participation to achieve economies of scale, thus driving sustained growth. The senior executive of the Ant Forest highlighted:

“Given the substantial user base of Ant Forest, with over 650 million users, no company would overlook such a product... Therefore, although we do not profit and, in fact, spend a significant amount of the company's money annually, the (entire) business ecosystem still places great importance on Ant Forest... Based on backend statistical data, the time slot when Alipay is most frequently opened is 7 a.m., which coincides with the maturation time of green energy in Ant Forest. Therefore, the peak period of Alipay's user opening rate is also attributable to the users of Ant Forest” (#I-5).

Although the green energy mechanism design within Ant Forest enables the extraction of surplus value from participant activity, it also results in tangible ecological restoration, with real trees being planted in desert regions. Importantly, participants are not required to pay additional monetary costs in either the monetary or non-monetary scenarios; at most, users' behaviours are influenced, such as choice of brands or modes of travel, but without incurring direct financial expenditure. When discussing the specific expenditures for Ant Forest each year, the management stated, *“Ant Group invests hundreds of millions annually in Ant Forest, recorded as pure public welfare donations. In 2020, the related investment of Ant Forest exceeded 760 million RMB (approx. 84.7 million GBP)” (Informants#2).* All costs associated with tree planting are borne by the Alibaba-affiliated business ecosystem rather than from users. The three non-monetary scenarios contribute to user engagement and stickiness without

imposing monetary transactions, indicating that capital recognizes the value of non-financial participation. Notably, the transformative potential of mending is further evidenced by cases where users accumulate sufficient green energy solely through non-monetary actions. As Informants#45 explained, (s)he had “*successfully planted three trees without spending any money, relying entirely on activities such as daily walking and food conservation check-ins*”. In such instances, capital incurs actual ecological restoration costs without extracting monetary payment from users, and ownership of the planted trees remains framed within a shared, non-privatized structure. This demonstrates that, despite the underlying extraction dynamics, ecological mending is occurring, suggesting a substantive, rather than merely symbolic, transformative potential of capital.

4.3.2 Mending Dynamics: Reprioritizing Ecological and Economic Objectives

The transformative potential of mending becomes most evident when capital is compelled to fulfil its ecological promises at financial cost. Following the explosive growth of Ant Forest by the end of 2016, the project faced a critical juncture: the accumulated green energy of millions of users had to be translated into actual tree planting. This transition was not merely symbolic: it required Ant Group to make tangible financial commitments toward ecological restoration. As the manager reflected:

“...At the inception of Ant Forest, the project department quickly became anxious. Just six months after launch, the number of trees Ant Forest committed to plant had surpassed one million. However, at that time, it was a completely niche project with no allocated budget for specific initiatives. Consequently, we promptly arranged a meeting with the company's top management...” (#I-2).

It is important to note that when Ant Forest was first launched in 2016, the platform only offered nine green energy scenarios: walking, green office practices, digital payments, online utility payments, online train ticket purchases, online movie ticket purchases, online hospital appointment bookings, ETC payments, and electronic invoicing. These initial scenarios fell into two broad categories: walking to reduce transport emissions and promoting paperless office operations. Significantly, most of these activities did not directly generate substantial commercial revenue for the Alibaba-affiliated business ecosystem. Executives from Alipay, Ant Group (then known as Ant Financial), and Alibaba Group gathered for a meeting. One senior executive recalled:

“...the overall head of management did not focus on the screen displaying the project cost calculations... Instead, his attention was captured by the page showing user feedback and involvement. He felt it was magnificent to see users' comment, 'What wakes me up in the morning isn't an alarm, but Ant Forest,' 'The world is finally a little different because of me.' 'This tree is the first living being in my twenty-some years of life to which I have granted the right to exist.' After reading these comments, he pointed to them and asked, 'Are these truly messages and stories from our users?' He received an affirmative answer...he experienced a sense of accomplishment and pride...as well as reflecting the vast user base and engagement with the project... At the time, I also felt quite noble, as though through Ant Forest, I had contributed something to the world...In a very short time during that meeting, the management collectively made a

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decision: they instructed the project department not to worry about the budget and simply fulfil the promises made to the users... ” (#I-2).

The quotation illustrates the initial internal deliberations and struggles concerning the project's budget within the management team. The manager mentioned two considerations for the budget: the extensive active participation of users, and the sense of achievement derived from the Ant Forest. This moment marked a critical point, where managers from Alibaba-affiliated business ecosystem were required to act beyond short-term profitability considerations, signalling a shift towards integrating ecological priorities into its broader value framework. However, this transformation is not linear or inevitable; rather, it is shaped by the interplay between cultural narratives, policy settings, broader societal transitions, and capital's growing recognition of broader forms of value beyond immediate economic returns.

The aspiration to mend was insufficient on its own. Capital's internal willingness could not, by itself, overcome the practical challenges of ecological restoration. The Alibaba-affiliated business ecosystem, within which Ant Forest is rooted, was primarily composed of internet-based enterprises, none of which had direct experience in ecological restoration or afforestation (#I-3). Simply announcing a commitment to environmental transformation was not enough; real change required sourcing, planting, and sustaining actual trees on a large scale.

In 2016, its first collaboration was established with the SEE Foundation, a well-known environmental NGO in China. Ant Group provided funding to the foundation to support the planting and maintenance of the first batch of trees (*Haloxyylon ammodendron*) in desert regions. In the quotation above, the manager stated that the expenditure for Ant Forest is classified as a “*charitable donation*,” a classification also stated by a government official:

“Ant Forest has adopted an unprecedented mode of engaging hundreds of millions of users’ participation in ecological conservation public welfare activities...through corporate social and public welfare donations...” (#I-24)

In this quotation, the mention of “*social and public welfare donations*” also corroborates the managerial assertion regarding the accounting treatment of expenditures related to Ant Forest as charitable donations. Crucially, under China's *Corporate Income Tax Law*, expenditures by enterprises for charitable activities and public welfare undertakings are permitted to be deducted from the taxable income amount if they are within 12% of the total annual profits. Amounts exceeding 12% of the total annual profits are allowed to be carried forward and deducted from the taxable income over the next three years. Although Ant Forest in this way could offer some tax benefits, these were marginal compared to the overall scale of financial outlays required as users were not asked to contribute any additional monetary payments and the costs were borne entirely by capital.

Capital thus functioned not solely as a provider of financial resources, but as a catalyst for broader systemic change, drawing in other businesses, institutions, and community actors to collectively participate in the ecological initiatives spearheaded by Ant Forest. In this case, the expansion to eighteen scenarios occurred by 2018, and the full development to forty-six scenarios was achieved by 2023. As the management expressed:

“In the continuous upgrading of Ant Forest's mechanisms, we have maintained a

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commitment to openness and diversity... We envision Ant Forest as a technology-driven project that anyone can participate in... It is a place where all resources can be connected... We hope that Ant Forest will become a place where ecological dreams converge, and perhaps, truly change the world... (#I-8)

This quotation articulated by the management illustrates capital's emerging capacity to transcend narrow cost-benefit rationality, embracing a broader value horizon that integrates ecological and social concerns. The proactive dimension of capital's transformation is further illustrated by the formal establishment of the "Ant Forest Eco Green Development Foundation" on April 22, 2023. As the senior executive stated:

"Every tree planted by Ant Forest belongs to the state and to society. From the first tree planted seven years ago, Ant Forest has continually evolved, actively integrating into the broader societal landscape. The upgrade from a 'public and social welfare project' to a 'public and social welfare foundation' marks the beginning of a new developmental stage for Ant Forest." (#I-1).

The foundation was initiated by Ant Group and its affiliated enterprises, with a governance structure that introduces external board members beyond the Ant Group itself. It aims to collaborate with broader stakeholders in ecological restoration, environmental education, and ecological research initiatives. The policy documents emphasise that after the establishment of the Ant Forest Eco Green Development Foundation, Ant Forest will continue to align its operations with national policy directives related to capital, such as the #D-22 and #D23, but it has been granted tax-exempt status (#D-48). Whereas Ant Forest previously relied on partners to implement tree-planting activities, it now possesses greater operational autonomy to directly procure and plant trees, reinforcing its active role in the ecological transformation process. This articulation underscores that the creation of the foundation does not represent a withdrawal from the Alibaba-affiliated business ecosystem. Rather, Ant Forest remains an ecological practice of capital, developed within the political setting while continuing to operate under the broader logic of the Alibaba-affiliated business ecosystem. The foundation's formation reflects an effort to reposition capital's role and also represents an organizational innovation towards ecological civilization.

These findings suggest that the trajectory of Ant Forest illustrates an emerging, though deeply contradictory, transformation within capital's ecological engagement. On the one hand, the initiative demonstrates a broadening of value recognition, where ecological restoration and social participation are no longer peripheral but has become more important strategically. The establishment of the Ant Forest Foundation reflects this repositioning, pointing to capital's potential beyond economic boundaries by reshaping the very nature of value. On the other hand, this transformation remains incomplete and tension-laden.

While it is true that the Alibaba-affiliated business ecosystem continues to generate vast surplus value through platform-based extraction, the emergence of Ant Forest may nonetheless signal an important shift: if capital begins to seek value not through the plunder of nature but through its repair, then this marks a potentially significant transformation in its logic. Although marginal in quantitative terms, Ant Forest's value lies in its experimental role, which signals an emerging mode of capital accumulation that incorporates ecological repair into its logic. Such peripheral

initiatives should not be dismissed as inconsequential; their marginality may in fact position them as experimental spaces: test beds where capital tentatively explores new strategies of valuation, accumulation, and legitimation. This paper does not claim that capital has already overcome its structural limits or ceased to be exploitative. Rather, it explores the tensions and possibilities developed in these transformation attempts. The focus of this paper, then, is not on whether capital has fully transitioned, but on how it is beginning to reconfigure its relationship with nature and society, and what this tells us about the evolving boundaries of value. Thus, mending and breaking are not sequential but intertwined processes with the boundaries of value are being pushed.

5. Discussion

Marx (1873), in *Capital* Volume I, described how capitalist production “*disturbs the metabolic interaction between man and the earth*” by preventing the return of essential nutrients to the soil, thereby undermining what he called “*the eternal natural condition for the lasting fertility of the soil.*” This disconnection of the socio-natural metabolism is widely theorized as the metabolic rift, which highlights capital's structural indifference to the ecological conditions upon which it depends. Later, in *Capital* Volume III, Marx (1873) further observed that capitalist production advances the techniques and social organization of production only by simultaneously undermining “*the original sources of all wealth are the soil and the worker.*” These insights form the foundation of much critical ecological thought and continue to shape how scholars understand the contradictory dynamics of capital's relationship to nature.

While critical scholarship has long emphasized the destructive and extractive tendencies of capital in its relation to nature (Cooper, 1992, O'Connor, 1998, Foster, 2000, Senkl and Cooper, 2023, Tregidga and Laine, 2022), our analysis shifts attention towards the potential in which capital may internalize ecological and social concerns, thereby reshaping the boundaries of value and reconfiguring its metabolic relation with nature. Through digital technology, Ant Forest constructs a virtual connection between societal behavioural change and ecological restoration. What emerges is the potential attempt to mend the metabolic rift: a form of mending that leverages digital technology to re-establish links between society and nature. In this configuration, digital technology plays a more than instrumental role. It does not merely measure or track ecological actions but mediates a broader revaluation of what individuals consider meaningful and valuable. By linking everyday behaviours via green energy to tangible environmental outputs, Ant Forest invites users to participate in ecological restoration not as distant observers but as co-contributors. Through the interface, users and managers come to see their actions as having material ecological impact.

Ant Forest reveals the transformative potential within capital's encounter with ecological limits. Capital extends itself into ecological domains with pushing the boundaries of value. However, the capital's transformation in Ant Forest case is neither complete nor unambiguous. As the findings highlight, mechanisms of surplus value extraction persist. These dynamics foreground a key tension: while digital technology serves as a bridge between society and nature, it still functions as a mechanism of enclosing ecological and social activity within calculable forms. Bringing these findings and tensions together, we conceptualize Ant Forest's dynamic as mending by breaking: a process whereby capital attempts to mend the metabolic rift while

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restructuring and extending the very boundaries that produce it. In advancing the notion of “mending by breaking”, this study offers an alternative lens for understanding ecological limits not as a resolved contradiction, but as a fluid and ongoing reshaping of capital's metabolic relationship with nature: both hopeful and deeply conflictual.

Rather than waiting for worse ecological crisis to derail profits, capital here pre-emptively “mends” a piece of the metabolic rift. In Marx (1873)'s original example of metabolic rift, capitalist agriculture sapped soil nutrients, then tried to mend the soil by importing guano or making synthetic fertilizer, which temporarily boosted fertility yet ravaged Peruvian ecosystems. Analogously, today's capital observes ecological crisis as threats, and responds by planting trees and promoting low-carbon behaviours via digital technology. Afforestation is not merely a by-product of production, but a deliberately coordinated output of user participation and capital's design. Nature is no longer treated solely as a passive limit, but becomes an active site of engagement and value. Nevertheless, the process is not free of contradiction. The underlying drivers of ecological crisis, ever-expanding production and consumption, are left unaddressed, or “broken” in new ways. Consequently, while mending expands the boundaries of what capital values, it also reproduces structural tensions, generating new sources of surplus value within the newly configured value space.

We find that the outputs of restoration in Ant Forest are not privately owned nor fully commodified; instead, they remain under shared or public ownership. While capital continues to design the mechanism, it does not enclose the restored land for exclusive appropriation. This approach signals capital's evolving orientation, in which public and social welfare are increasingly absorbed into its accumulation logic. These dynamics reveal that mending and breaking are not separate stages, but mutually constitutive processes within capital's ongoing adaptation to ecological limits. Recognizing this tension allows us to move beyond a binary of either critique or celebration. It suggests an ongoing struggle over what counts as valuable, who gets to define it, and how socio-ecological relations are organized.

We contribute to the critical accounting and sustainability literature by explicitly problematizing the limits of capital, critically interrogating how these limits are encountered, negotiated, and at least partly reshaped within capital's evolving practices. This mending in Ant Forest remains partial and conditional, as it unfolds within and through the framework of capital accumulation rather than outside or against it. The breaking that digital technology still used as a function to generate surplus value is not simply a residual effect. It is constitutive of the mending process. In this sense, breaking is the very condition of possibility for capital's attempt at ecological mending. This does not render the initiative meaningless or purely extractive. Rather, it invites a more situated understanding of the dual character of capital's mending: the use of digital technology is both generative, in creating new socio-ecological linkages, and reductive, in that it abstracts complex ecological relations into simplified, quantifiable metrics such as green energy accumulated in Ant Forest.

Users are invited to participate but are not positioned to shape the capital's logic or its ecological priorities. There is also a clear spatial asymmetry. Green energy is generated in affluent urban centres, while ecological restoration takes place in remote and underdeveloped desert regions. The environmental improvement is physically detached from the sphere of

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consumption that gives rise to it. Engagement with nature is mediated through digital technology rather than through direct and lived relationships.

The mending of the metabolic rift is not a straightforward or unidirectional shift. It proceeds through uneven terrain, marked by tensions, simplifications, and exclusions. However, it also opens space for critical engagement with capital's evolving orientation. As critical scholars such as Hines (1988) remind us, accounting constructs reality in the very act of communicating it. The way in which we account for nature therefore plays a fundamental role in shaping what is recognized. What emerges is not a world beyond the metabolic rift, but a world in which the rift is differently configured: partially acknowledged, selectively addressed, and unevenly mended. This partial mending involves structural tensions, but it also reveals an emergent transformation in capital's relation to society, nature, and value itself.

6. Conclusion and Further Research

In conclusion, the discussion has traced how capital, exemplified by Ant Forest, internalizes ecological concerns and contributes to restoration, thereby shifting its value logic and partially mending the metabolic rift. This paper explores how Ant Forest reflects capital's transformative potential in mending the metabolic rift. We go beyond through problematizing the limits of capital and exploring mending possibilities, leading to the finding of mending through breaking. This shift invites renewed attention to the role of accounting, not merely as a tool of measurement, but as a practice that participates in reshaping what is recognized as valuable.

Our contribution shifts the analytical focus from capital's externalization and destruction of nature to the contemporary tendency of capital to incorporate ecological constraints into its logic of self-reproduction. Ant Forest exemplifies this tendency. We therefore echo *Critical Perspectives on Accounting's* call to reconsider what it means to adopt a critical perspective on environmental accounting. Only by maintaining a critical and theoretically informed lens can we hope to leverage accounting in a way that addresses metabolic rifts rather than papering them over.

We therefore encourage further inquiry into how accounting might be reimagined in ways that move beyond the imperatives of accumulation (Gray, 2010, Bebbington and Larrinaga, 2014). We hope this paper will inspire further researchers to discuss the different possibilities for mending the metabolic rift within various cultural and institutional contexts. We believe this will help us move towards ecological civilization and prompt a reconsideration of why we should draw upon to ecological Marxism when addressing issues arising from ecological crises.

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Appendix A

Details of Informants (Anonymised and De-gendered)

No.	Affiliated Institution	Position
I1	Alibaba Affiliate	Senior Executive of Sustainable Department
I2	Alibaba Affiliate	Senior Executive of Sustainable Department
I3	Ant Forest	Senior Executive
I4	Ant Forest	Senior Department Manager
I5	Ant Forest	Senior Department Manager
I6	Ant Forest	Senior Department Manager
I7	Ant Forest	Senior Department Manager
I8	Ant Forest	Senior Department Manager
I9	Ant Forest	Senior Department Manager
I10	Ant Forest	Senior Department Manager
I11	Ant Forest	Department Manager
I12-I17	Local Community	Ant Forest Local Project Manager
I18-I19	Local Community	Ant Forest Local Project Patrol Officer
I20	Local Government	Director of the Forestry Bureau
I21	Government	President of Governmental Research Association
I22	Government	Governmental Agency Researcher
I23	Foundation X	The Chairman of the Foundation
I24	Foundation Y	The President of the Foundation
I25	IUCN	Representative of International Union for Conservation of Nature (IUCN)
I26-I30	China's Leading Academic Institutions	Ant Forest Research Consultant
I31-I33	Alibaba-Affiliated	Ant Forest Business Collaborator
I34-I35	Society	Top Active Ant Forest Users
I36-I56	Society	Ant Forest Users

Appendix B

Details of Documentation

No.	Title of Document	Issuing Authority	Pages
D1	Ant Group Announces Further Corporate Governance Optimization	Ant Group Co., Ltd.	4
D2	Gross Ecosystem Product Accounting Report for Afforestation of Alipay Ant Forest Projects from 2016 to 2020	Research Centre for Eco-Environmental Sciences (RCEES) of the Chinese Academy of Science and the International Union for Conservation of Nature (IUCN)	30
D3	Digital Technology Shaping Green and Sustainable Lifestyles: Exploring Alipay Ant Forest	Data-Pop Alliance (by the Harvard Humanitarian Initiative, MIT Connection Science, and Overseas Development Institute), Green Digital Finance Alliance (by UN Environment and Ant Financial Services) and United Nations Environment Programme (UNEP)	25
D4	Fiscal Year 2023 Annual Report	Alibaba Group Holding Limited	360
D5	IPO Prospectus, Submitted to the Hong Kong Stock Exchange, October 27, 2020	Ant Group Co., Ltd.	752
D6	Annual Audit Report 2021	China Green Carbon Foundation	31
D7	Annual Report of the Beijing Entrepreneurs Environmental Protection Foundation 2019	Society of Entrepreneurs and Ecology (SEE) Foundation	58
D8	A New Starting Point for China's Development and A New Blueprint for Global Growth (Sept. 3, 2016)	The keynote speech by China's General Secretary Xi Jinping at the opening ceremony of the G20 Business Summit (B20)	9
D9	Building an Innovative, Dynamic, Interconnected, and Inclusive Global Economy (Sept. 4, 2016)	The opening remarks by China's General Secretary Xi Jinping at the G20 Leaders' Summit	3
D10	IPO Prospectus, Submitted to the Shanghai Stock Exchange, 23, August, 2020	Ant Group Co., Ltd.	493
D11	Response to the Inquiry Letter Regarding the Review of the Application Documents for the IPO	Ant Group Co., Ltd.	197
D12	Product Fees and Requirements for Applying for a Payment QR Code	Alipay	3
D13	Twenty Years of China's Conversion of Cropland to Forests and Grasslands (1999-2019)	China National Forestry and Grassland Administration	35
D14	The Theme and Key Topics of the 2016 G20 Summit	Keynote Speech at the Opening Ceremony of the G20 Summit	23

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D15	Embedding the Gene of Innovation in the Chinese Economy: A Collective Portrait of Chinese Enterprises at the B20 Summit. Sept. 4, 2016.	G20 Business Summit (B20)	3
D16	Ecological Civilization Paradigm of China's General Secretary Xi Jinping	Central Government of China	3
D17	Lucid Waters and Lush Mountains Are Invaluable Assets: On the vigorous promotion of ecological civilization construction	Central Government of China	5
D18	Deeply advance the practice of voluntary tree planting to create ecological conditions for building a Beautiful China	Central Government of China	3
D19	Promote the development of green production and lifestyle practices to create a favourable environment for production and living for the people	Central Government of China	3
D20	Strengthening the construction of ecological civilization requires top-level design as a first priority	Central Government of China	7
D21	Reform is the driving force behind the institutional development of ecological civilization	Central Government of China	7
D22	Opinions of the General Office of the State Council of China on Encouraging and Supporting Social Capital Participation in Ecological Protection and Restoration [2021] No. 40	Central Government of China	4
D23	General Contract Guidelines for Government and Social Capital Cooperation Projects issued by the National Development and Reform Commission of China	Central Government of China	34
D24	The Innovation and Development of Marxist Theory of Productive Forces	Central Government of China	5
D25	Over the past 40 years, a total of 17.5 billion eligible citizens in China have participated in voluntary tree planting, with 78.1 billion trees planted	Central Government of China	2
D26	Resolution on Launching a Nationwide Voluntary Tree Planting Campaign during the Fourth Session of the Fifth National People's Congress	China National Forestry and Grassland Administration and National Park Administration	2
D27	The Origin of the Nationwide Voluntary Tree Planting Campaign	China National Forestry and Grassland Administration and National Park Administration	1
D28	Implementation Measures of the State Council of China for Carrying Out the Nationwide Voluntary Tree Planting Campaign	China National Forestry and Grassland Administration and National Park Administration	2
D29	Farmers at the foot of the Great Wall in China are exploring the path to prosperity through sea buckthorn cultivation	Local Governmental Forestry and Grassland Administration	3
D30	The Ant Forest public welfare project has been established in Kongtong	Local Government	5
D31	550 million footsteps have contributed to the creation of this Ant Forest Project	Local Government	5
D32	The impact brought by a "Alibaba" county mayor	Local Government	1

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D33	From the “Ten Million Project” to Ant Forest: China’s green governance approach has gained global recognition	Local Government	5
D34	Tackling the “tough challenges” along the thousands of miles of wind and sand: An investigation from the frontline of the Three-North Shelterbelt Project	China National Forestry and Grassland Administration	3
D35	A small fruit with significant ecological and economic impact: The Ant Forest poverty alleviation product “MA Sea Buckthorn” is now available	Internal Documentation	2
D36	The Ant Forest Sea Buckthorn Ecological Poverty Alleviation Demonstration Base in Qingshui County has been officially launched	Internal Documentation	11
D37	Alibaba Poverty Relief Fund 2020 Annual Report	Alibaba Group Holding Limited	15
D38	Alibaba Rural Revitalization Fund 2023 Work Report	Alibaba Group Holding Limited	36
D39	Alibaba 2018 Mid-Year Poverty Alleviation Work Report	Alibaba Group Holding Limited	22
D40	Alibaba Group Social Responsibility Report 2018	Alibaba Group Holding Limited	48
D41	Ant Financial 2016 - 2017 Sustainability Report	Ant Group Co., Ltd.	70
D42	Ant Financial 2017 - 2018 Sustainability Report	Ant Group Co., Ltd.	51
D43	Alipay 2019 - 2020 Sustainability Report	Ant Group Co., Ltd.	44
D44	Ant Group 2020 Sustainability Report	Ant Group Co., Ltd.	149
D45	Ant Group 2021 Sustainability Report	Ant Group Co., Ltd.	97
D46	Ant Group Carbon Neutrality Roadmap 2021	Ant Group Co., Ltd.	19
D47	Public and Social Welfare Open Plan	Internal Documentation	12
D48	Shanghai Tax Notice [2023] No. 118: Notification on the Recognition of Tax-Exempt Status for 106 Non-Profit Organizations	Local Municipal Tax Service, State Taxation Administration, and Local Municipal Finance Bureau	6
D49	Documentary: The Carbon to Forest Road	Ant Group Co., Ltd.	51 mins
D50	All posts and their comments published on the official social media platform from mid-2018 to mid-2023	Sina Weibo	1383 posts and 27661 comments