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Gamifying Green: Sustainable Innovation Through Digital Platform Ecosystems

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ABSTRACT

Platform-enabled innovation has come to dominate contemporary discourse on digital sustainability initiatives in emerging markets. Rather than offering a celebratory account of this new turn, this research explores how a digital platform initiative pioneered by Ant Forest leverages a gamified reward system to mobilize emotional incentives, platform integration, and social participation to cultivate what we term “digital green citizenry.” Incentivizing millions of users in China to engage in low-carbon behaviors—such as walking and making digital payments, we unpack how Ant Forest's dual incentive model—combining habit formation with emotional fulfillment—has enabled the integration of sustainability into users' everyday routines. Explicating a culturally grounded transferable framework for digital sustainability, we theorize how platform strategies could be aligned with environmental responsibility and ecological incentives in diverse sociotechnical environments to support digital sustainability.

1 | Introduction

In the pursuit of sustainability, emerging market enterprises are increasingly leveraging digital platforms to promote eco-friendly behaviors and align business strategies with environmental goals (Chen et al. 2021; Gao et al. 2022). For example, platforms like Grab in Southeast Asia and Mercado Libre's initiatives in Latin America have been actively promoting sustainability by encouraging low-carbon activities and supporting environmental projects. Ant Forest, launched by Ant Financial in 2016, stands as a pioneering example of sustainable innovation within the context of emerging markets (Zhu and Chu 2023; Ding et al. 2018). Ant Financial, now known as Ant Group, is a leading Chinese fintech company affiliated with Alibaba Group. The company operates Alipay, one of the world's largest digital payment platforms, and has been actively promoting sustainability through initiatives like carbon neutrality since 2021 and the introduction of green finance projects. As a gamified digital platform, Ant Forest encourages millions of users to engage in low-carbon activities, such as walking or using digital payments, by rewarding them with “green energy” points that can be redeemed for the planting of real trees in China's arid regions (Ashfaq et al. 2021; Loizeaux 2023). This model links individual behavioral incentives to large-scale ecological action, with over 100 million trees planted to date. However, while such achievements are widely recognized, current research tends to present these cases in descriptive or celebratory terms, lacking a critical framework to analyze how and why such models succeed—and under what conditions they might be transferable across contexts. In particular, the relevance of Ant Forest's model for other emerging markets and multinational enterprises (MNEs) remains undertheorized, especially in terms of how local digital infrastructures, user cultures, and platform governance shape platform-based sustainability efforts.

This study critically engages with these questions by examining Ant Forest not only as a successful platform but as a paradigmatic case within broader political-economic and cultural transformations in emerging markets. While studies on Grab (Lee et al. 2021) and Mercado Libre (Peña-García et al. 2024) demonstrate similar trends, few have unpacked the mechanisms of user participation, gamification, and value creation in ways that speak to both sustainability goals and platform logics. To unpack these dynamics, the study draws on three theoretical frameworks. Participatory culture (Jenkins 2006) offers insight into how users co-construct value within digital platforms, while the diffusion of innovations theory (Rogers et al. 2014) helps explain adoption patterns across user groups. Platform capitalism (Srnicek 2017), in contrast, foregrounds the infrastructural and economic power of platforms in shaping user behavior, raising critical questions about control, value extraction, and scalability in digital sustainability initiatives. Together, these frameworks help locate Ant Forest at the intersection of user engagement, digital governance, and platform economics.

To address these concerns, this research examines Ant Forest through a multi-method qualitative approach, including semi-structured interviews and netnographic observation. The aim is to move beyond celebratory accounts and instead assess the critical conditions under which such models succeed, adapt, or fail when exported to different emerging market contexts. Specifically, the study investigates: (1) how Ant Forest's platform design fosters sustainable behavior; (2) how gamification motivates user participation within a broader ecosystem of value creation; and (3) what implications this holds for MNEs navigating the tension between profitability and environmental responsibility. By focusing on these aspects, this study contributes to a more nuanced understanding of sustainable innovation in platform economies and highlights the contingent nature of transferring such models across regions. In doing so, it provides a critical framework for assessing how digital platforms can serve as both catalysts and gatekeepers of global climate action.

2 | Literature Review

2.1 | Gamified Sustainable Innovation in Emerging Markets

In recent years, the pursuit of sustainability has evolved from isolated corporate social responsibility (CSR) efforts to more integrated approaches that align environmental, social, and economic performance. This shift reflects growing recognition that traditional CSR frameworks are insufficient to address complex sustainability challenges (Perego and Kolk 2012; Burritt et al. 2020). Instead, scholars have highlighted the need for systemic innovation capabilities—particularly through digital ecosystems and platform-based coordination—that enable organizations to align diverse stakeholder interests and scale sustainability impact across markets (Nwagbara 2013; Liu and Stephens 2019; Wang et al. 2023).

Within emerging markets, scholars increasingly point to eco-innovation as a key pathway for achieving both sustainability and competitiveness—especially amid regulatory volatility and resource constraints. Eco-innovation encompasses not only products and processes but also new forms of organizational and platform-enabled innovation (Larbi-Siaw et al. 2022). Recent research has emphasized the strategic role of digital platforms in enabling such innovation, particularly by enhancing organizational agility and responsiveness to environmental challenges (Ahmed et al. 2022). These studies suggest that digital platform capabilities allow firms to integrate sustainability into core operations and navigate turbulent market conditions more effectively. However, this body of work remains largely focused on firm-level capabilities, with limited attention to how platform design and user engagement mechanisms contribute to the success of sustainable innovation initiatives. Moreover, the contextual challenges of emerging markets—such as infrastructural fragmentation, policy gaps, and user heterogeneity—are often underexplored in relation to platform-mediated sustainability.

Beyond firm-level strategies, recent literature also emphasizes the importance of institutional support—particularly government-led R&D incentives and policy alignment—in driving sustainable innovation across emerging markets. For example, Adomako and Tran (2024) show how public R&D funding enhances firms' ability to integrate sustainability into innovation processes, while Hamdallah and Srouji (2022) find that long-term investment in sustainability-linked entrepreneurship can improve financial and environmental outcomes in the financial sector. These studies collectively underscore a key trend: sustainable innovation in emerging markets increasingly relies on the interplay between institutional frameworks and enterprise innovation capacity. However, this institutional-business nexus tends to overlook a critical third actor—platform users—whose behaviors, values, and engagement are essential in scaling sustainability outcomes, particularly in digital ecosystems. By focusing primarily on top-down structures, much of the existing research misses how user-side participation mediates and amplifies the effectiveness of policy and innovation strategies. This study responds to this gap by examining Ant Forest as a case of triadic coordination among users, platforms, and policy institutions.

A growing body of research in emerging markets has turned to platform-enabled innovation as a means of enhancing sustainability performance through cross-organizational collaboration and digital capabilities. Case-based studies have traced how green process and product innovation contribute differently to economic performance—while process innovation often yields immediate operational benefits, product innovation tends to influence sustainability more indirectly over time (Wang et al. 2021). Meanwhile, scholars like Thao and Xie (2024) and Liu et al. (2022) emphasize how open innovation and regulatory environments shape green transformation at the firm level. Notably, digital platforms have been shown to facilitate high-level innovation through internal-external linkages, networked cooperation, and ecosystem-level support (Xing et al. 2024).

This line of research positions digital capabilities and inter-organizational collaboration as key enablers of sustainable innovation ecosystems. However, the majority of these studies focus on firm-centric dynamics, underexploring how user participation and platform-mediated design logics contribute to innovation outcomes. As Saheb and Hosseinpouli Mamaghani (2021) argue in the context of digital business ecosystems, platform governance and power asymmetries shape value co-creation processes—a point particularly relevant for cases like Ant Forest, where platform structure, user incentives, and external partnerships co-evolve. This study builds on this foundation by examining how Ant Forest orchestrates user-driven collaboration within a broader sustainability-oriented ecosystem. While sustainable innovation in emerging markets continues to advance, scholars also underscore the structural challenges that constrain such efforts. These include fragmented entrepreneurial ecosystems, limited access to capital, weak institutional infrastructures, and the absence of dense collaborative networks (Amissah et al. 2024; Qoriawan and Apriliyanti 2022). These systemic limitations hinder the scalability and coordination required for impactful sustainability strategies.

In this context, digital platform ecosystems have been increasingly framed as alternative coordination infrastructures—offering flexible mechanisms to pool resources, mobilize actors, and align environmental and economic objectives across institutional gaps. By integrating users, firms, NGOs, and sometimes even government actors, platform ecosystems have been proposed as viable responses to structural deficiencies in emerging markets. Yet, this optimistic framing often under-theorizes the governance dynamics, participation asymmetries, and institutional entanglements that platforms inevitably reproduce or reshape. This study therefore examines how Ant Forest navigates these tensions—positioned between market forces and state objectives—and whether its model offers a genuinely inclusive and sustainable infrastructure for overcoming systemic limitations in emerging markets.

A related stream of research explores how digital capabilities shape the evolution of sustainable business models in emerging markets. Luo et al. (2024), for instance, highlight that firms with strong digital infrastructure are more likely to integrate sustainability goals into their strategic core, improving both environmental responsibility and competitive positioning. Similarly, Liu et al. (2023), drawing on core competence theory and the resource-based view, argue that digital platform capabilities enhance firms' ability to identify, coordinate, and deploy resources toward innovation. These studies reflect a growing consensus that digital transformation is not merely a technological upgrade, but a strategic shift enabling firms to redesign value creation processes around sustainability.

Yet, much of this literature remains rooted in firm-level analysis, with limited exploration of how platforms mediate broader stakeholder interactions, govern user engagement, or align with institutional frameworks. In particular, there is a lack of critical attention to how platforms operationalize sustainability not only through firm innovation but through multi-actor ecosystems involving users, civil society, and policy actors. By investigating Ant Forest's hybrid approach—combining corporate strategy, platform design, and participatory environmental action—this study extends current discussions on sustainable business model innovation into the realm of ecosystem-level governance and user-centered design.

Digital platform ecosystems have become critical organizational infrastructures for advancing sustainability agendas in both developed and emerging markets. Beyond facilitating transactions or information exchange, platforms are increasingly recognized for their capacity to orchestrate complex networks of actors—ranging from users and firms to governments and NGOs—around shared environmental goals (Calabrese et al. 2021). This shift reflects a broader transformation in how sustainability is operationalized: from firm-centered CSR efforts to ecosystem-level coordination strategies that emphasize multi-stakeholder engagement, distributed governance, and adaptive capacity. Cases like Ant Forest exemplify this logic, using platform architecture to synchronize individual behavior, institutional collaboration, and ecological outcomes within a dynamic and scalable system.

Scholars have conceptualized these systems as "ecosystem strategies" (Inoue, Hashimoto, and Takenaka 2019; Inoue, Takenaka, and Kurumatani 2019), emphasizing that platform sustainability hinges not only on technological affordances but also on the ability to establish stable, trust-based partnerships across sectors. In platforms like Ant Forest, such strategies manifest through collaborations with NGOs, government agencies, and local communities to align ecological action with broader institutional objectives. These cross-sectoral configurations enhance the resilience of platform ecosystems by distributing responsibility, diversifying expertise, and facilitating knowledge flows (Gamidullaeva et al. 2021). The success of these arrangements depends on ongoing negotiation and governance structures that maintain alignment between diverse actors, particularly under conditions of regulatory flux and public scrutiny.

2.2 | Governance Challenges in Platform Ecosystems

While platform ecosystems offer promising architectures for sustainable innovation, recent studies have drawn attention to the governance tensions inherent in such systems. On the one hand, platforms can evolve dynamically through iterative stakeholder collaboration and adaptive learning, as seen in industrial Internet ecosystems (Zhao et al. 2023). This perspective echoes Ant Forest's own trajectory of continuous innovation and cross-sector engagement.

On the other hand, the same decentralized and participatory logic introduces significant governance challenges—particularly in aligning diverse actor interests, ensuring contextual sensitivity, and maintaining legitimacy across regulatory and cultural environments. As Bream-Macintosh et al. (2021) argue, current digital tools often fall short in managing multi-scalar complexities and in supporting nuanced, data-driven collaboration among governments, communities, and businesses. Cuel et al. (2024) similarly highlight that unresolved tensions around power asymmetries, data transparency, and role definition can undermine the sustainability of platform ecosystems. These challenges are particularly acute in emerging markets, where institutional frameworks may be fragmented or underdeveloped. Against this backdrop, Ant Forest provides a compelling case to examine how platform governance mechanisms—such as incentive design, partner coordination, and state alignment—can be mobilized to stabilize and sustain collaborative action in complex sociotechnical environments.

The role of governments in shaping platform-based sustainability initiatives varies significantly across geopolitical contexts. In emerging markets, governments are often active participants in fostering digital innovation and sustainability, viewing platforms as tools for state-led modernization and economic upgrading. In contrast, firms in developed markets tend to face more nuanced institutional constraints and socio-cultural frictions, with state involvement often limited to regulatory oversight rather than proactive alignment (Nim et al. 2024).

This divergence reflects deeper differences in institutional embeddedness: where emerging market governments may engage in platform co-construction or even act as ecosystem partners, developed economies maintain more fragmented or arm's-length relationships. In China, for instance, the alignment between platform initiatives and national policy priorities is especially pronounced. As Su et al. (2022) demonstrate, digital transformation in China actively moderates the relationship between institutional constraints and firm-level internationalization. Ant Forest exemplifies this model of state–platform synergy. Supported by state narratives on green development, it operates not only as a corporate sustainability initiative but as an infrastructural extension of broader policy goals—an institutional configuration that distinguishes it from similar initiatives in other contexts.

Scholars have conceptualized digital platforms as "meta-organizations"—structures that coordinate heterogeneous actors under a shared framework without relying on traditional hierarchical control (Calabrese et al. 2021). Within this lens, Ant Forest can be understood as a meta-organizational system that integrates individual users, state agencies, NGOs, and commercial partners into a collaborative network oriented toward environmental goals. This organizational form enables flexible, cross-sectoral governance and dynamic value co-creation, positioning the platform not only as a service provider but as a mediator of societal challenges. The platform's capacity to mobilize mass participation while aligning with national sustainability narratives exemplifies this integrative potential. This perspective also resonates with the "living labs" model (Baran and Berkowicz 2021), where platforms act as experimental arenas for testing social and technological solutions in real-world conditions. In Ant Forest, gamified design, behavioral nudging, and user-data feedback loops form the experimental foundation for driving ecological action at scale. However, while these conceptual frameworks highlight Ant Forest's innovative structure, questions remain about the depth of user agency, the distribution of governance power, and the long-term sustainability of such orchestrated ecosystems—issues that this study seeks to investigate through empirical analysis.

2.3 | User Engagement and Gamification in Promoting Environmental Sustainability

In recent years, gamification has become a key design strategy in platform-based sustainability initiatives, transforming environmental action into interactive, rewarding, and socially embedded experiences. Within digital ecosystems such as Ant Forest, user engagement is not merely an ancillary effect but a foundational mechanism through which environmental outcomes are achieved. Scholars increasingly recognize that platforms succeed in driving sustainability not only through technological affordances or institutional alignment, but also through their ability to mobilize large-scale behavioral change via gamified and participatory design (Abou Kamar et al. 2024; Zhang and Anwar 2025).

Gamification refers to the integration of game-like elements—such as point systems, badges, social comparison, and real-world rewards—into non-game contexts to incentivize action. In the context of environmental sustainability, these tools can convert abstract or long-term ecological goals into immediate, tangible, and even enjoyable user experiences. Empirical research has shown that such mechanisms can satisfy users' psychological needs for autonomy, competence, and relatedness, thereby fostering durable engagement and pro-environmental behavior (Zhang and Anwar 2025; Douglas and Brauer 2021).

Platforms like KlimaDAO and JouleBug illustrate how gamified participation can align with macro-level climate objectives (e.g., SDGs or carbon offsetting) by embedding daily environmental tasks into app-based reward cycles (Abou Kamar et al. 2024). In educational contexts, gamified learning and interactive sustainability interfaces have also been shown to deepen environmental knowledge and encourage habitual green practices (Ouariachi et al. 2020; Esguerra and van der Hel 2021). Despite their promise, gamified engagement strategies face several challenges. These include unequal user expertise and access (Armisen et al. 2024), short-term extrinsic motivation that may not translate into deep-seated behavioral change, and potential over-reliance on superficial participation metrics. Moreover, user participation remains unequally distributed across digital platforms, often reproducing existing divides in digital literacy, environmental awareness, and platform familiarity.

Against this backdrop, Ant Forest presents a particularly instructive case: it not only gamifies environmental behaviors but does so within a state-aligned policy framework, combining platform incentives, real-world ecological impact (tree planting), and large-scale user participation. What distinguishes Ant Forest is not just the scale of engagement, but its multi-layered integration of user feedback, government legitimacy, and ecological outcomes. Yet, the underlying governance of this gamified ecosystem—who defines the rules, how participation is structured, and whether users retain meaningful agency—remains underexplored. This study builds on and critiques existing gamification literature by investigating Ant Forest as a hybrid model: part behavioral nudging system, part platform governance tool, and part state-aligned environmental campaign. In doing so, it seeks to move beyond instrumental models of user engagement and toward a more critical understanding of participatory sustainability in digital ecosystems.

3 | Method and Data

3.1 | Fieldwork and Data Collection

This study employs a multi-method qualitative research design to investigate Ant Forest as a case of sustainable innovation in emerging markets. The fieldwork combines semi-structured interviews and the walkthrough method, conducted between January and July 2024. This approach allowed for a comprehensive understanding of how Ant Forest's platform design fosters user engagement and promotes sustainable behaviors.

The walkthrough method was employed to systematically analyze the Ant Forest app itself, focusing on features that encourage sustainable behavior. Researchers registered personal accounts on the Alipay app and actively participated in Ant Forest as regular users throughout the fieldwork period. This enabled an experiential understanding of the platform's functionality and interaction logic. The walkthrough aimed to understand how these features are designed to motivate users to engage in pro-environmental activities and contribute to the platform's sustainability goals. Fieldnotes and screenshots were collected systematically to track the onboarding process, the accumulation and spending of green energy points, and interactions with community features. Like ethnographic approaches in digital research, this method allowed for an in-depth exploration of how the app's interface, interaction design, and gamification strategies influence user behavior.

The semi-structured interviews were conducted with three key groups: Ant Forest users, platform developers, and NGO partners involved in reforestation projects. Participants were selected using purposive sampling to ensure diverse representation, encompassing different demographic backgrounds such as age, gender, and usage intensity. Key interview questions for users included: "What motivates you to participate in Ant Forest?", "How do you feel about the rewards system?", and "Have your behaviors changed since using the platform?" For developers, questions included: "What were the design principles behind Ant Forest's gamification features?" and "How are user feedback and environmental goals balanced?" NGO partners were asked: "How does collaboration with Ant Forest affect your sustainability work?" and "What challenges arise in aligning your goals with the platform's?" The interviews with users provided insights into their motivations, experiences, and perceptions of the platform. Interviews with platform developers focused on the design principles and decision-making processes underlying the app's features, while discussions with NGO partners explored their collaboration with Ant Forest in promoting sustainability.

To initiate fieldwork, we began by familiarizing ourselves with Ant Forest's user community, reaching out through social media groups and forums. This allowed us to identify key participants, establish rapport, and arrange interviews. Snowball sampling was also used to expand the pool of interviewees, enabling us to gather a broader range of perspectives from those involved in Ant Forest's ecosystem. By the end of July 2024, a total of 20 interviews were completed, including 10 users, 5 platform developers, and 5 NGO representatives. Table 1 is a summary of the research participants.

All interviews were audio-recorded and transcribed verbatim. We followed the Thematic Analysis approach as outlined by Terry et al. (2017). The initial phase involved familiarizing ourselves with the data by reading and re-reading transcripts, which facilitated the identification of potential patterns and themes. Open coding was then employed to label segments of the data that were relevant to our research questions, focusing on user motivations, experiences, and perspectives regarding Ant Forest's role in sustainability. Coding was conducted using NVivo software to organize and categorize data systematically. Two researchers independently coded a subset of transcripts to verify consistency and resolve discrepancies, thereby enhancing reliability. These codes were iteratively refined and grouped into broader themes, which were then reviewed to ensure they accurately represented the data. The walkthrough analysis focused on identifying and examining the app's gamification features—such as "green energy" points, badges, and real-world rewards like tree planting. These elements were analyzed to determine how they drive user engagement and foster sustainable behaviors. Reflections from the researchers' own participation were also incorporated to triangulate with interview data and identify alignment or dissonance between design intent and user experience. Additionally, the walkthrough considered how the app's interface and user experience design contribute to maintaining long-term participation in low-carbon activities. The analysis aimed to uncover the mechanisms behind user motivation and how design features align with environmental sustainability objectives. By combining insights from semi-structured interviews and the walkthrough method, this study aims to provide a nuanced understanding of how Ant Forest leverages digital platform design to promote sustainability.

3.2 | From Gamification to Emotional and Social Engagement: The Evolution of User Motivation

Gamification functions as the initial gateway through which Ant Forest attracts and maintains user engagement. The platform integrates familiar game elements—such as green energy points, virtual badges, and leaderboards—to reward pro-environmental behaviors with visible and trackable progress. These features appeal to users' sense of achievement and recognition, converting abstract sustainability goals into tangible digital milestones. During the walkthrough analysis, elements like the daily energy check-in and visible ranking boards reinforced recurring interaction by presenting participation as a playful competition. As one user explained, "Initially, I joined because of the competitive nature of collecting green energy" (User 15, 2024), highlighting how Ant Forest taps into extrinsic motivations to activate engagement.

A central mechanism that enables Ant Forest's gamification to translate into real-world behavior is its seamless integration with movement data collected via Alipay. The platform converts physical actions such as walking, biking, or using digital payments into green energy points, thereby incentivizing low-carbon routines through everyday digital interactions. Our walkthrough analysis revealed that these points are automatically updated in real-time on users' dashboards, offering immediate feedback that encourages continued participation. This design effectively lowers the cognitive and logistical barriers to sustainable action, embedding eco-friendly behavior into users' existing digital and physical routines. As one interviewee observed, "*It fits naturally into my routine. I don't have to do anything extra, but I still feel like I'm helping the environment*" (User 3, 2024).

Beyond basic rewards, Ant Forest introduces strategic tools—referred to as "props"—that deepen user involvement by enhancing the gamification experience. Props like the Energy Shield and Time Accelerator enable users to multiply their green energy points or speed up virtual tree growth, adding layers of interactivity and tactical choice. These features were prominently

TABLE 1 | Interviewee lists.

User no.	Interview date	Demographics			Usage duration	Key focus area
		Gender	Age	Location		
1	15-Jan-24	Female	22	Urban	6 years, 3 months	User motivations, experience
2	18-Jan-24	Female	22	Urban	1 year, 9 months	Emotional impact, financial benefits
3	05-Feb-24	Male	21	Urban	2 years, 4 months	Community engagement
4	03-May-24	Female	23	Urban	3 years, 3 months	User journey, app features
5	15-Jun-24	Male	23	Urban	6 years, 8 months	Long-term engagement strategies
6	20-Jun-24	Female	24	Rural	2 years, 3 months	Gamification elements
7	22-Jun-24	Male	25	Urban	2 years, 6 months	User retention and incentives
8	25-Jun-24	Female	26	Rural	4 years, 6 months	Social influence on engagement
9	30-Jun-24	Male	27	Urban	0 years, 5 months	Perceived ecological impact
10	02-Jul-24	Female	28	Rural	3 years, 2 months	Financial benefits
11	05-Jul-24	Male	29	Urban	2 years, 11 months	Emotional rewards
12	07-Jul-24	Female	30	Rural	2 years, 10 months	Community challenges
13	10-Jul-24	Male	22	Urban	3 years, 1 month	App design preferences
14	12-Jul-24	Female	23	Urban	1 year, 9 months	User journey insights
15	14-Jul-24	Male	24	Rural	6 years, 3 months	Long-term impact on behavior
16	16-Jul-24	Female	25	Urban	2 years, 1 month	Features encouraging participation
17	18-Jul-24	Male	26	Rural	4 years, 0 months	Emotional and financial incentives
18	20-Jul-24	Female	27	Urban	5 years, 10 months	Social rewards
19	22-Jul-24	Male	28	Rural	4 years, 11 months	User feedback on features
20	24-Jul-24	Female	29	Urban	3 years, 5 months	Motivational factors
21	26-Jul-24	Male	30	Rural	4 years, 0 months	Perceived community impact
22	28-Jul-24	Female	22	Urban	2 years, 5 months	User interface satisfaction
23	30-Jul-24	Male	23	Rural	5 years, 2 months	App usability and accessibility
24	01-Aug-24	Female	24	Urban	5 years, 6 months	Gamification effectiveness
25	03-Aug-24	Male	25	Rural	2 years, 0 months	Rewards and user loyalty
26	05-Aug-24	Female	26	Urban	6 years, 10 months	Impact of green energy points
27	07-Aug-24	Male	27	Rural	2 years, 2 months	Engagement sustainability
28	09-Aug-24	Female	28	Urban	0 years, 1 month	Perception of environmental goals
29	11-Aug-24	Male	29	Rural	3 years, 0 months	Group challenges and collaboration
30	13-Aug-24	Female	30	Urban	1 year, 8 months	Behavioral change drivers
31	15-Aug-24	Male	22	Rural	4 years, 7 months	Community support and motivation
32	17-Aug-24	Female	23	Urban	0 years, 9 months	Social engagement and habits

visible during our walkthrough analysis, where in-app tutorials explained how props could be earned or unlocked through consistent engagement. Users reported that props made their actions feel more consequential and goal-directed, fostering a sense of control and progress. As one user remarked, "*Seeing the tree grow faster because of a prop made me feel like I had a real impact*" (User 7, 2024). Such tools extend beyond surface-level rewards by introducing elements of gamified strategy and personalization, thereby encouraging repeat engagement and long-term behavioral change.

As users become more embedded in the platform, Ant Forest evolves from a game-like experience into a site of emotional and social resonance. Features such as tree-planting certificates, co-planting with friends, and public leaderboards support a shift from superficial engagement to more intrinsic forms of motivation. Rather than participating only for points or rankings, many users described a growing sense of connection to the environmental mission itself. Our walkthrough analysis showed how the app visually tracks tree growth and provides symbolic rewards like digital certificates, which users can share in social spaces—further reinforcing emotional investment. As one participant reflected, “The playful interactions with friends, like sending energy or co-planting, actually made me feel we were doing something meaningful together” (User 23, 2024).

The transition from short-term gratification to long-term engagement is reinforced by users' reflections on real-world outcomes, such as planting actual trees in desertified regions. These achievements give users a sense of tangible impact and deepen their emotional attachment to the platform's mission. One interviewee shared, “Planting a big tree gave me a real sense of accomplishment” (User 14, 2024), highlighting how symbolic digital actions are linked to material environmental results. In addition to individual impact, Ant Forest cultivates a sense of shared purpose through socially interactive features. From co-planting trees to playful energy exchanges, users experience their participation not as isolated behavior, but as part of a collective environmental journey. As another user put it, “It's not just about what I achieve but about what we achieve together” (User 20, 2024). These interactions foster emotional resonance and social belonging, helping sustain long-term motivation through a sense of community and contribution.

Ant Forest's long-term success lies in its ability to transform gamified participation into emotionally resonant and socially embedded practice. While gamification operates as the entry point, sustained engagement is driven by users' intrinsic motivations—such as pride, purpose, and belonging. As one user noted, “The real satisfaction comes from knowing that my daily actions contribute to something bigger, and the social interactions make it even more worthwhile” (User 31, 2024). This shift from extrinsic incentives to intrinsic alignment reflects a participatory culture in which users co-construct meaning and value through routine digital actions. Rather than viewing environmental behavior as task completion, users begin to perceive themselves as contributors to a collective cause. By combining personalized interaction, emotional feedback loops, and social features, Ant Forest moves beyond conventional gamification models. It demonstrates how digital sustainability platforms can cultivate deeper civic and affective commitments that endure over time.

3.3 | The Dual Incentive Model: Emotional Satisfaction and Habit Formation Through Routine Integration

Ant Forest illustrates how digital platforms can embed sustainability into everyday life by integrating behavioral nudges with infrastructural design. Embedded directly into the Alipay app's core interface—alongside high-frequency features like “Pay” and “Transfer”—Ant Forest minimizes friction and positions green participation as part of habitual platform use. This design aligns with theories of platform embeddedness and habit formation, which emphasize how routine digital interfaces shape and reinforce behavior over time. Walkthrough observations revealed that Ant Forest is placed prominently on the Alipay homepage, reducing the cognitive effort needed for users to engage with environmental actions and reinforcing their integration into everyday routines.

The Dual Incentive Model refers to Ant Forest's combination of practical convenience and emotional gratification as mutually reinforcing drivers of sustained engagement. On the practical side, the platform is embedded into Alipay's high-use interface, allowing users to engage with environmental features during routine activities like scanning QR codes or transferring funds. Our walkthrough analysis confirmed that green energy accumulation happens automatically when users complete such actions, requiring no additional steps. This automation significantly lowers behavioral thresholds and embeds sustainability into everyday routines.

On the emotional side, users receive immediate feedback in the form of growing virtual trees, energy notifications, and symbolic milestones. This reinforces their perception of meaningful contribution. As one user explained, “I just walk, and my steps become energy that helps plant trees—it doesn't feel like work, but it feels important” (User 1, 2024). The model thus leverages frictionless participation and emotional affirmation in tandem, enabling habit formation and long-term behavioral alignment with environmental values.

Beyond ease of access, Ant Forest strategically deploys emotional feedback loops that reinforce users' commitment to environmental participation. Visual elements—such as animated trees, real-time energy growth indicators, and video updates from reforestation sites—translate otherwise abstract environmental contributions into concrete, emotionally resonant experiences. These features, observed during the walkthrough, were prominently placed within the user dashboard and framed with motivational language (e.g., “Your tree is thriving!”). This design elicits a sense of progress and personal impact, encouraging users to internalize their role as active contributors. As one participant described, “It's motivating to actually see the progress you've made—it makes you feel like what you're doing matters” (User 19, 2024). Such visual and affective cues strengthen emotional identification with the platform's mission and cultivate sustained behavioral commitment.

Ant Forest's interface architecture leverages habit-forming design principles, transforming ordinary digital actions into sustainable routines. When users perform common behaviors—such as walking, paying bills, or commuting—green energy points are automatically recorded, linking low-effort tasks with visible environmental outcomes. Walkthrough analysis revealed that energy updates appear with gamified sound effects and visual animations immediately after each eligible action, reinforcing behavioral cues and establishing a continuous feedback loop. As one user commented, “It just becomes something you do—open the app, check your tree, collect energy—it's part of my daily rhythm now” (User 8, 2024). This behavioral automation, coupled with the app's immediate reinforcement mechanisms, plays a critical role in shifting environmental participation from intentional decision to habitual engagement.

The Dual Incentive Model exemplifies how sustainable digital platforms can combine behavioral convenience with affective

FIGURE 1 | Gamified design and tools. [Color figure can be viewed at wileyonlinelibrary.com]

engagement to cultivate lasting user participation. Ant Forest lowers the threshold for action through seamless integration into daily digital routines while simultaneously offering emotionally meaningful feedback—transforming eco-friendly behavior from a discretionary act into a normalized habit. This dual mechanism not only supports the formation of individual environmental routines but also aligns personal behavior with broader sustainability narratives.

As a design strategy, the model demonstrates how emotional resonance and habitual interaction can be mutually reinforcing, allowing platforms to transcend short-term gamification and foster enduring environmental commitment. These findings offer a transferable framework for other digital ecosystems seeking to balance usability, motivation, and civic participation. In this way, Ant Forest provides a powerful template for how ecological values can be scaled through interface design, feedback loops, and routine digital touchpoints—laying the groundwork for the emergence of digital green citizenry.

3.4 | Digital Green Citizenry: Fostering a Sense of Civic Engagement and Collective Impact

While gamified participation often centers on individual rewards, Ant Forest gradually cultivates a form of digital green citizenry—a civic identity rooted in environmentally responsible actions mediated through digital platforms. This concept refers to users who move beyond self-oriented engagement and begin to understand their behaviors as part of a collective environmental effort. Ant Forest's design encourages this shift by aligning individual action with communal outcomes, embedding civic purpose into everyday digital routines. Rather than viewing sustainability as a personal lifestyle choice, users begin to experience it as a shared social commitment enacted through platform participation.

Initially, Ant Forest attracts users through gamified features such as point accumulation, virtual badges, and friendly competition. Yet, over time, users begin to reframe their participation through a collective lens. This motivational shift is facilitated by platform-level affordances—community leaderboards, collaborative tree planting, and visual displays of collective progress (Figure 1)—which foreground users' contributions as part of a shared environmental endeavor. These features do not merely track individual achievement but actively re-narrate personal actions as collective accomplishments, prompting users to perceive themselves as members of an environmentally conscious digital community. As one participant reflected, “It's not just about how many points I earn—it's about doing something important together” (User 4, 2024). Through this evolution, Ant Forest reconfigures user engagement from personal gratification to civic identification.

Ant Forest's collaborative features—such as co-planting trees and inviting friends to participate—transform environmental participation into a relational practice. These design elements function not merely as social extensions, but as affective

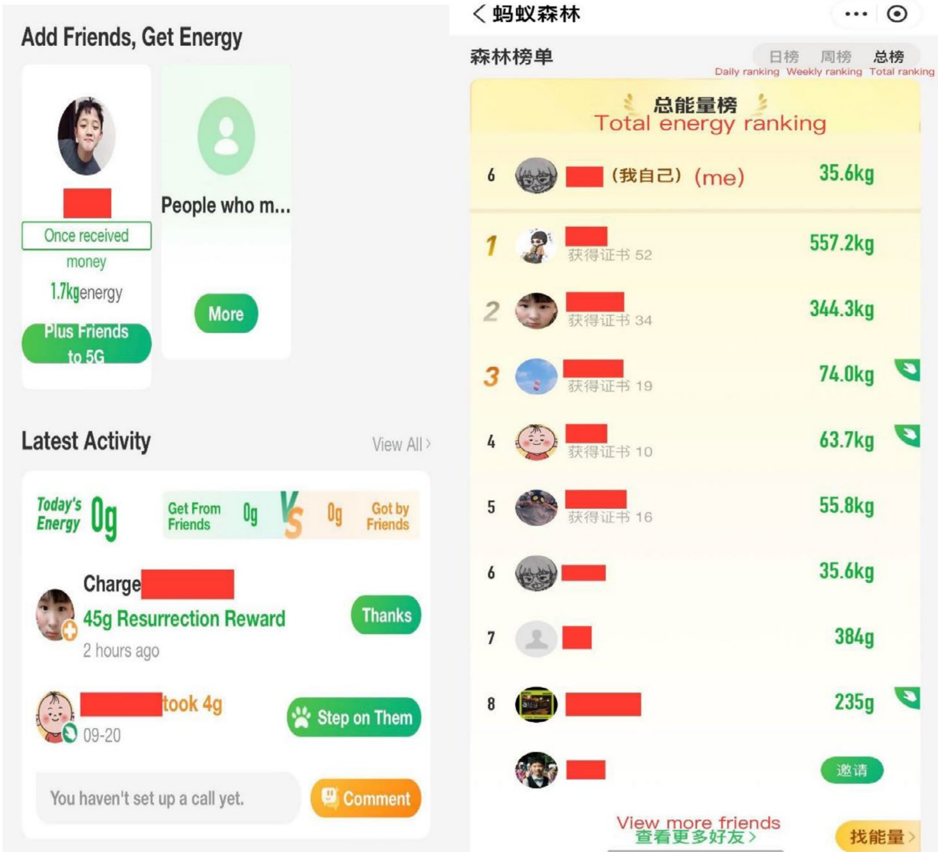

FIGURE 2 | Community activities and leaderboards (ranking). [Color figure can be viewed at wileyonlinelibrary.com]

infrastructures that enable users to form and reinforce interpersonal bonds through shared ecological goals (Figure 2). For many participants, co-planting acts as a symbolic act of solidarity, strengthening both emotional ties and platform loyalty. As described by several interviewees, these activities generate a sense of "teamwork" and mutual accountability, encouraging deeper engagement than individual tasks alone. This social embeddedness of sustainability amplifies users' investment in the platform, not only through personal satisfaction, but through a felt connection to others pursuing the same goals.

A critical component of Ant Forest's civic engagement strategy lies in its collective visualization interface—a dashboard that tracks and displays aggregated achievements such as total trees planted or carbon saved by the entire user base. These real-time statistics transform personal participation into a visible contribution to a shared environmental narrative, offering users a sense of belonging to a cause larger than themselves. This visual reinforcement functions as both a motivational tool and an identity-building mechanism, aligning with the platform's broader project of cultivating digital green citizenry. Rather than presenting sustainability as an isolated, individual journey, Ant Forest curates a sense of collective efficacy, prompting users to see their micro-actions as part of a systemic response to environmental challenges. In doing so, the platform embeds civic values within everyday digital practices—positioning sustainability not as an external obligation, but as a shared norm emerging from within the user community.

4 | Discussion and Conclusion

Ant Forest exemplifies how digital platforms can cultivate "digital green citizenry" by integrating personal behavior change with collective environmental responsibility. Digital green citizens, as conceptualized in this study, are individuals who move beyond gamified engagement to embrace civic participation in sustainability through digital means. By facilitating both individual and collective environmental actions—through gamified rewards, social collaboration, and progress visualization—Ant Forest operationalizes Jenkins' (2006) participatory culture and Srnicek's (2017) platform capitalism in a distinctively Chinese context. These findings extend earlier studies on gamification (Zhang and Anwar 2025; Abou Kamar et al. 2024) by demonstrating how emotional incentives and social features are not merely engagement tools, but mechanisms of identity formation and civic activation. In doing so, our study critically reorients celebratory narratives about platform-enabled sustainability by grounding them in the socio-technical mechanisms that enable user transformation.

Crucially, our study responds to calls for more contextually grounded research on emerging markets (Ahmed et al. 2022; Ishaq et al. 2024). While much of the existing literature tends to universalize platform effects, often based on models from developed economies, our findings underscore the specificity of Ant Forest's success within China's digital infrastructure, Alipay ecosystem, and sociopolitical alignment with state-led green development goals. This embeddedness resonates with Su et al. (2022), who argue that digital transformation in emerging economies is inseparable from institutional and policy frameworks. Our analysis builds on this perspective by showing how state-platform synergies enable sustainability initiatives that go beyond market incentives. Yet this also highlights both the opportunities and limitations for model transferability. For example, in markets such as India and Indonesia, where digital ecosystems and environmental imaginaries differ, direct replication is unlikely to yield similar results. Nevertheless, the core principles of integrating sustainability into routine digital life, leveraging emotional incentives, and emphasizing collective achievement can be adapted to suit local conditions. In India, for instance, environmental behaviors could be tied to communal rituals or festivals; in Indonesia, mobile payment platforms may be mobilized through public-private partnerships.

These insights hold important implications for emerging market multinational enterprises (EMNEs). As firms like Grab or GoTo expand their platforms, they can draw from Ant Forest's dual incentive model to embed sustainability within their existing ecosystems. This aligns with Burritt et al. (2020), who call for a rethinking of MNE strategies that address sustainability not just as compliance, but as innovation in user engagement and ecosystem coordination. Such efforts, however, must be sensitive to local cultural values, technological infrastructures, and regulatory environments. Rather than treating Ant Forest as a universal blueprint, we propose it as a conceptual template—illustrating how platform design, emotional engagement, and civic identity can coalesce to drive environmental participation at scale. In this sense, our study offers both a critique and a contribution: it challenges simplistic narratives of platform-driven sustainability while offering a transferable framework for adaptive innovation.

This research contributes to the growing literature on sustainable innovation by identifying key mechanisms through which digital platforms promote long-term user engagement in environmental practices. Our empirical findings emphasize the effectiveness of combining habitual ease of access with emotional fulfillment, enabling users to integrate sustainability into everyday routines. This expands the platform innovation literature (Luo et al. 2024; Wang et al. 2023) by showing how behavioral change is achieved not solely through technological affordances, but through emotional resonance and relational infrastructures. Moreover, the emergence of digital green citizenry underscores the importance of social connection and civic identity in sustaining engagement. This adds a new dimension to platform studies by demonstrating how participatory design and normative alignment can transform platforms from transactional tools into socio-political actors.

Future research should explore how cultural and institutional differences affect the adoption of platform-based sustainability models. Comparative studies across regions such as Latin America, Southeast Asia, and Africa would help elucidate the socio-cultural mediators of user engagement. Additionally, longitudinal studies could examine how user motivations evolve over time and whether civic identities forged through platforms like Ant Forest persist beyond the interface. Finally, researchers should further investigate the governance implications of digital green citizenry: What roles do platforms, states, and civil society actors play in shaping the norms and responsibilities of sustainable participation?

For Ant Financial, globalizing Ant Forest demands more than scaling a technological solution; it requires a deep sensitivity to local values, digital habits, and institutional partnerships. Strategic adaptations—such as localized gamification strategies, multilingual interfaces, and collaborations with local NGOs—will be essential for success. More broadly, Ant Forest's case reveals how sustainability can be designed not just as a corporate responsibility initiative, but as a co-produced civic project grounded in emotion, habit, and collective meaning-making. It offers a vision of digital sustainability that is participatory, culturally embedded, and adaptable—one that emerging markets can learn from, but must also reshape to reflect their own contexts.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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