Tech for Trees

Green Digital Finance Alliance

Tech for Trees

Can digital technology help restore tropical rainforests and preserve their biodiversity?

Ant Forest, the green lifestyle initiative launched by Alipay in China, is to date the only environmentally conscious digital technology play to achieve massive scale. Launched in August 2016, Alipay Ant Forest attracts over 500 million users who collectively have planted over 100 million new trees in arid areas in China in three years; its effect on reversing desertification can be seen from space. (See "Alipay Ant Forest at a Glance" sidebar for more details.) The scale and speed of Alipay Ant Forest's reforestation efforts pose several intriguing questions—especially whether Alipay Ant Forest users can be inspired to participate in forest protection and reforestation efforts outside of China. Newly published research[1] profiles the "best users" who have the highest potential to help reverse deforestation and protect biodiversity in the environmentally crucial Congo Basin. The research also yielded a sequential set of filters to quickly identify those best candidates from among the total user base, and describes the incentives most likely to spur them to action.

---

1   Dr. Chen Bo. Research on Internet Public Welfare Behaviors. 2019. Beijing: Central University of Finance and Economics, November 11. (Commissioned by the Green Digital Finance Alliance [Geneva] and produced in cooperation with Institute for Finance and Economics [Beijing].)

Tech for Trees

The Problem:
Survival Depends on the Forests

The future climate of the planet is inextricably linked to the health of its forests. Recent research has found that two-thirds of all carbon dioxide emissions that remain in the atmosphere today as a result of human activity could be removed by a world-wide tree planting program.[2] Calling reforestation "one of the most robust options for climate change mitigation at a global scale," the Intergovernmental Panel on Climate Change states that expanding the world's forest cover by one billion hectares will be necessary to help limit global warming to 1.5 degrees Celsius by 2050.[3] [4] Estimates vary for the cost of such an expansion, but even the funds necessary to achieve the reforestation targets previously established under the Bonn Challenge (USD 359 billion) or the New York Declaration of Forest (USD 837 billion) have not been secured.

The upshot is that despite their vital role in removing carbon dioxide from the atmosphere and mitigating the impact of climate change, the world's forests are in serious decline. Part of the challenge is political geography. Some of the largest and most environmentally sensitive rainforests are located within countries with weak governance and large populations of households living in poverty. Subsistence farmers can hardly be expected to prioritize the long-term well-being of the planet over their own immediate need to clear land to feed their families. No surprise, perhaps, that the Global Forest Resources Assessment conducted by the United Nations Food and Agricultural Office revealed a loss of about 3.1 million hectares of natural forests per year in the last five years in the Central African region.[5]

Central Africa is home to the second largest (after the Amazon) rainforest in the world. A surprising finding of a recent study in Nature magazine shows that despite covering a much smaller area than the Amazon, Central African forests currently absorb almost as much carbon as the Amazon each year.[6] But because of the structure of forest financing mechanisms under the Paris agreement, the six Congo Basin nations—the Democratic Republic of Congo, Gabon, the Republic of Congo, Cameroon, the Central African Republic, and Equatorial Guinea—find it more difficult to access climate-negotiated funds than do other countries (e.g., Indonesia and Brazil) that are also home to significant rainforest areas. Finally, China's growing economy combined with that country's restrictions on domestic logging have resulted in an increase in Chinese imports of timber, including from the environmentally-sensitive Congo Basin areas.

6   Hubau, Lewis et al. "Asynchronous carbon sink saturation in African and Amazonian tropical rainforests" Nature 579, pages 80–87(2020)

2   https://ethz.ch/En/news-and-events/eth-news/2017/07/how-trees-could-save-the-climate.html
3   www.wri.org/blog/2019/08/forests-ipcc-special-report-land-use-7-things-know
4   https://www.ipcc.ch/sr15/
5   www.fao.org/redd/initiatives/central-african-forest-initiative/en/

Tech for Trees

The Experiment

Because climate change is a global crisis, proposed responses have tended to emphasize similarly global-level, public sector-driven actions. But individual citizens have a role to play. Given the high percentage of greenhouse gas emissions originating at the household level—as high as 75[7] percent by some estimates—effective, comprehensive environmental strategies must include tactics to inspire ordinary people to do what they can, both to reduce harmful behaviors and to participate in restoration efforts.

Alipay Ant Forest is the signal success story. Available to customers of Alipay, the world's leading open digital lifestyle platform founded by Alibaba, the Ant Forest green initiative provides users with a concrete setlist of low-carbon activities. The more such actions they take (and the list is constantly refreshed as new service providers [e.g., public transit providers, grocery chains] join the app), the more points the user accumulates. These actions include taking the bus instead of driving (or for even more points, cycling), skipping the disposable utensils when ordering carry-out food, paying bills online, and similarly everyday behaviors. When a user has accumulated enough points in the app, Alipay's parent company, Ant Financial Services Group, will plant a real tree on that user's behalf.

The question of scale is all-important. The impact of any single individual making such decisions might be trivial. The impact of *500 million people*—the latest number of Alipay Ant Forest users—is another matter. In three years, Alipay Ant Forest players have caused 100 million new trees to be planted, not to mention making many multiples of that number in small behavioral choices that collectively can help drive down greenhouse gas emissions in the world's most populous nation.

---

7   https://link.springer.com/chapter/10.1007/978-3-319-20571-7_9

Alipay Ant Forest at a Glance

Launched: August 2016
Developer/operator: Ant Financial Services Group (parent company of internet/mobile payments platform Alipay, an affiliated company of Alibaba)
Headquarters: Hangzhou, China

Users: 500 million*
Trees planted to date: 100 million,* covering an area of 933 square kilometers

How it works

Chinese consumers use the Alipay platform to pay for everything from groceries and carry-out, to bus and train tickets, to gasoline, to water and electric bills. At this point, there are very few purchases in China that cannot be paid for via the Alipay app, and thanks to artificial Intelligence, Alipay provides its users with real-time feedback about concrete actions and behaviors they could take to reduce their individual carbon emission. Such actions might be anything from turning off lights in rooms not in use, to skipping the disposable utensils with carry-out, taking the bus (or better, cycling) instead of driving, and countless other modifications to everyday behaviors. Any carbon-light behavioral changes** are immediately rewarded with green-energy points. If the user chooses to "make a game of it," he or she can use the Ant Forest app to monitor the accumulated energy points so as to aggregate them into a "virtual tree" on the app.

A fun feature of Ant Forest enhances user engagement by having them continually accumulate the additional energy points needed to sow, water, and care for their virtual tree until it reaches maturity on the screen. Users can challenge each other and even "steal" each other's energy. Once the virtual tree has grown, Alipay matches the virtual tree with the planting of a real tree (and more recently the protection of a conservation area) as a reward for the continuous reduction in the user's individual carbon footprint. The trees are planted in partnership with established NGOs and funded directly by Alipay's parent company, Ant Financial Services Group. Users can actually view images of their trees in real-time via satellite.

First extension outside China

In June 2019, GCash Forest, launched by Alipay's partner in the Philippines, became the first Ant Forest replicator outside China. GCash Forest aims to plant 365,000 trees in 365 days in the Ipo Watershed, a protected rainforest area that supplies most of the fresh water needs of Metro Manila.

*Figures are rounded and are based on self-reported data from Ant Financial.
**The individual carbon footprint is based on existing methodologies such as the Clean Development Mechanism and the Chinese Certified Emission Reduction (CCER) which are then converted into the options on the platform.

For all of the excitement Alipay Ant Forest has generated, one of the urgent questions is how well the model can travel. After all, there is a big difference between planting trees in your own home country where the need is understood and the impact can be seen and verified versus worrying about deforestation problems on the other side of the world. Evidence suggests that an Ant Forest-like app solution, adapted for a different context, can trigger local people to relate to the problem and to invest in preserving the rainforest. Case in point: Alipay Ant Forest shared its experiences and provided technical support to GCash in the Philippines, which launched GCash Forest in June 2019 in that country. But could an app aimed at communities outside China also potentially inspire Chinese people themselves to engage, too, if that was the app's intention and it was designed and delivered effectively?

To explore these questions, CUFE (the Central University of Finance and Economics) in Beijing, CAFI (the Central African Forestry Initiative) and the Green Digital Finance Alliance began an experimental collaboration. The group sought to test ways to extend Chinese households' engagement with reforestation and conservation initiatives beyond China and into Central Africa. The experiment's first steps were to understand the triggers that have motivated Chinese users to plant trees in the first place, and from there to gain insights about incentives that could encourage them to do so in Central Africa.

Tech for Trees

Five Key Findings

1

There is significant potential for Chinese users to address deforestation in Central Africa.

With 22 percent (more than one-fifth of users) indicating their interest to create positive environmental impact through Alipay Ant Forest, the findings provide a good theoretical basis for adding a new module for engagement with the rainforests of Central Africa. The research found that Ant Forest players (not unlike on-line gamers generally) crave novelty. Expanding the ways to create positive impact could help satisfy that drive for "the next thing" while at the same time addressing both the collaborative and competitive impulses (described below) that motivate the best users.

2

Proof of impact was a universally important behavioral trigger.

Across all segments, verified proof of the user's impact on the deforestation problem appears to be the most important factor to keep in mind in designing incentives for Chinese users.

3

Men care about winning.

In addition to awareness and curiosity to learn about deforestation in Central Africa, two additional behavioral triggers emerge as important to male users. The first is competition on the platform with ranking of individual achievements. The second is ensuring that value on the platform translates into long-term value in the real world. Male users are found to be motivated by the value of the green points earned on the platform and (as noted) by proof of impact.

4

Women care about networking.

The research shows that for women, engagement with the deforestation problem in Central Africa needs to include elements of social networking and collaboration. On Alipay Ant Forest platform, this collaboration can take the form of players helping each other to collect energy points. The research suggests that this networking and collaborating would likely be an important motivator for "best user" women for Central African reforestation also.

5

Users with a high degree of engagement on Alipay Ant Forest are more inclined to be motivated to create impact in Central Africa.

The intensity of a user's engagement on Ant Forest was a strong predictor of likely motivation to engage with Central Africa. Income levels and overall environmental awareness, in turn, were important predictors of high engagement with Ant Forest.

Tech for Trees

Two Best-User Profiles: The Happy Warrior and the Social Networker

Two categories emerged from the research (see sidebar "Notes on Methodology" for details) as the best users with the highest potential to extend their reforestation interests to the Congo Basin context.

The Happy Warriors: Men aged 18 to 40

The elements of entertainment, fun interaction, and competition are of greater interest and motivation for the Happy Warriors than for other user groups. This group is also much more likely, relative to the other users surveyed, to actively add Alipay friends to their Ant Forest network. They are more concerned about their energy ranking, (i.e., the competitive element of Ant Forest, where users are ranked according to the energy points they have accumulated for various reductions in personal carbon footprint). Perhaps not surprisingly given this interest in the competition and hierarchical rankings, Happy Warriors also have a high propensity to become angry when another player steals their energy (something the game allows). The certificates that Ant Forest sends as proof that a real tree has actually been planted are important to the Happy Warriors, as is the ability to monitor the growth of their seedlings in real time on the app.

Happy Warriors are highly engaged—on the platform at least once a day—and demonstrate a high degree of understanding about the carbon-light behaviors required to earn points. They are more optimistic than other respondents about the trading value of the green energy points on the Ant Forest platform, seeing the future of the platform as one where the points can translate into new and different forms of green value along with the real-tree-planting option currently available.

Happy Warrior incomes range between CNY 50,000 to 1000,000 (equivalent to USD 7,150 to 14,300).[8] They report being satisfied with local environmental conditions, indicating that a user does not need to be exposed to pollution or environmental degradation in order to feel motivated to engage in reforestation.

---

8   Currency conversion by oanda.com, accessed 22 December 2019.

Tech for Trees

Behavioral characteristics of Ant Users across the four dimensions: immersion, social motivation (interaction and competition), public welfare awareness China, and public welfare for Africa

Both Sets of Ideal Users:

- They use the app an average of once a day
- Annual income of 50,000 to 200,000 Yuan
- Located in eastern province and cities of China

Female users between 18 and 25 years old

- Level of satisfaction with the environmental level is high (yet slightly lower than that of men)
- Willingness to cooporate is significantly higher than that of men but
- Lower willingness of female users to add Alipay friends slightly lower than average
- Attention to energy rankings and the transaction value are lower
- Less likely to be angry when their energy is stolen by their friends
- Less concern about sapling functio and area, growth status and public welfare familiarity with props is close...
- Immersion

Women show significantly higher willingness to cooperate and collect the energy of friends and less likely to be angry because their friends steal energy.

Sample of 600 active users of Ant Forest

Male users between 18 and 40

- Higher level of satisfaction with the environmental quality than average
- High social immersion including willingness to actively add and discuss with friends (social trigger) but not as interested in cooperation
- More optimistic about the energy ball transaction value willingness to discuss these with others
- Interest in the energy ranking but collect energy from friends less often
- Angrier when their energy is "stolen" by friends
- Higher interest in the real planting methodology and public welfare of tree planting
- Familiarity of props
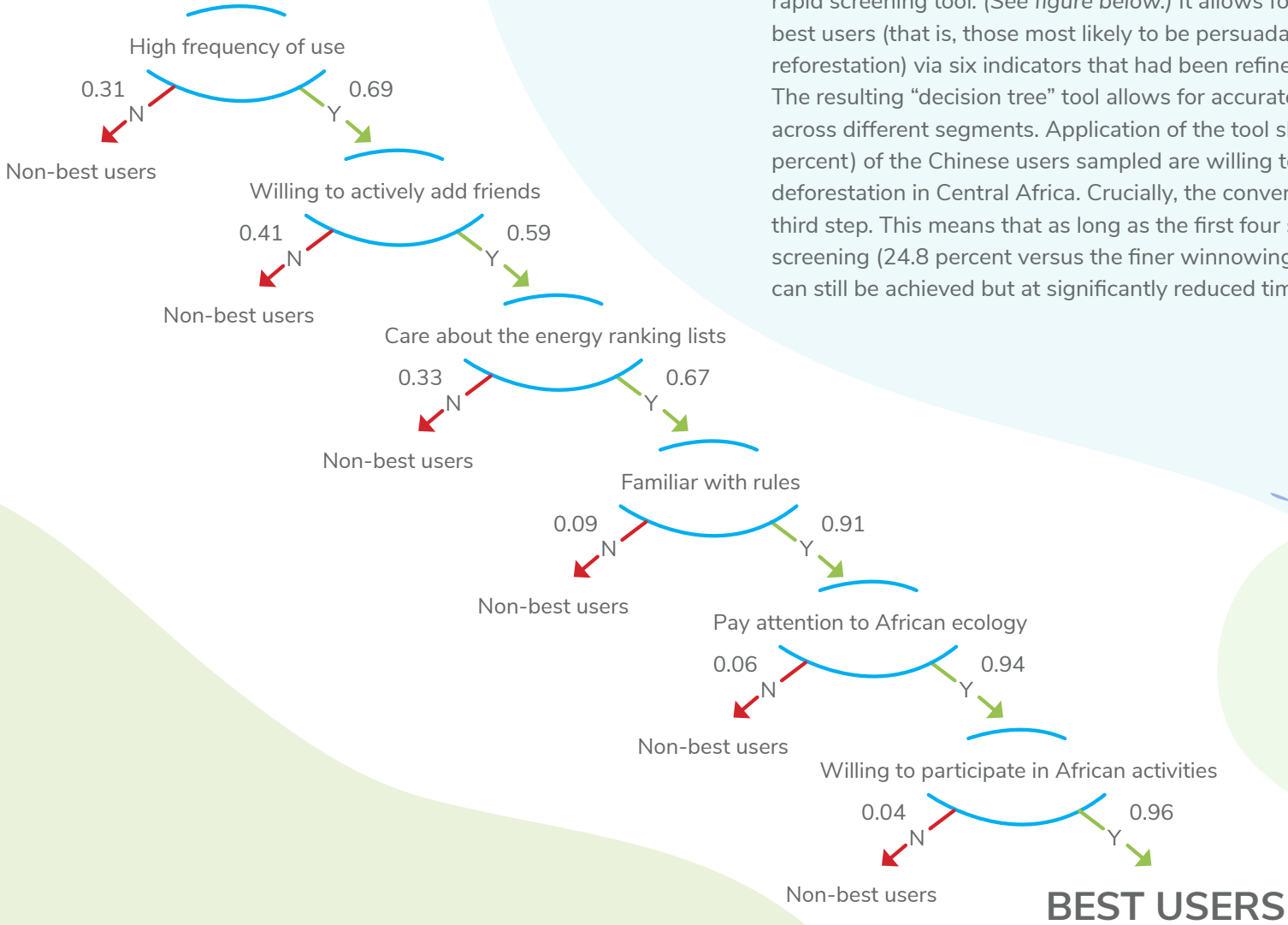
The Social Networkers: Women aged 18 to 25

The other highest-potential cohort, the "Social Networkers," have several traits in common with the Happy Warriors. Their income levels are in the same range, and they are similarly high-intensity users, on the platform at least once a day (although the Happy Warriors tend to higher usage). The key differentiator is that the Social Networkers are less motivated by the competitive aspects in the process (and less angry when others steal their energy) than the Happy Warriors, and significantly more willing to cooperate with other players. For example, when a friend's Ant Forest activity goes dormant (that friend fails for a significant period of time to collect energy), other users can help that friend collect energy. The friend who was thus helped can choose to return an amount of energy to express gratitude. The Social Networkers were more inclined than the sample as a whole, and significantly more inclined than the Happy Warriors, to engage in such collaborative behaviors.

Like the Happy Warriors, the Social Networkers are generally satisfied with the quality of the environment in their own community (although their level of satisfaction was slightly lower than the Happy Warriors'). They showed less concern with the verification certificates and sapling monitoring, and interestingly, although they showed a higher motivation to cooperate with others who were already in the initiative, they were less inclined to proactively add their Alipay-using friends to their Ant Forest network. The Social Networkers, for whom the top end of the age range is 25, also tend to be younger than the Happy Warriors for whom the comparable figure is 40.

How to Identify Them: Sorting "the Best from the Rest"

One of the most significant concrete outcomes from the research was the validation of a rapid screening tool. *(See figure below.)* It allows for the accurate identification of potential best users (that is, those most likely to be persuadable to act on behalf of Congo Basin reforestation) via six indicators that had been refined through the course of the research. The resulting "decision tree" tool allows for accurate identification of potential best users across different segments. Application of the tool shows that more than one-fifth (22.3 percent) of the Chinese users sampled are willing to create an impact on the problem of deforestation in Central Africa. Crucially, the convergence starts to slow down after the third step. This means that as long as the first four steps are completed, then near-ideal screening (24.8 percent versus the finer winnowing to the aforementioned 22.3 percent) can still be achieved but at significantly reduced time and cost.

High frequency of use
0.31 N — Non-best users
0.69 Y

Willing to actively add friends
0.41 N — Non-best users
0.59 Y

Care about the energy ranking lists
0.33 N — Non-best users
0.67 Y

Familiar with rules
0.09 N — Non-best users
0.91 Y

Pay attention to African ecology
0.06 N — Non-best users
0.94 Y

Willing to participate in African activities
0.04 N — Non-best users
0.96 Y — BEST USERS

Tech for Trees

How to Motivate Them: Uncovering Behavioral Triggers

The survey explored four key dimensions to understand the relationship of each to a user's likely willingness to engage with reforestation efforts in Central Africa. Those four dimensions were:

1

Engagement
Frequency of use and length of time spent on the Alipay Ant Forest platform; familiarity with key features including the "collection of energy points from friends."

2

Social Trigger/Motivation
Importance of the social networking and fun interaction elements (i.e., energy points, ranking, interaction with others to collect more energy, and concern over others collecting/stealing their energy).

3

Environmental Awareness
Importance of real and verified impact (improving the environment in China as a public good through real tree planting), access to visualizing this impact, and receiving certificate for planting real seedlings. This dimension is important to explore because if public awareness about the importance of forests for a climate-secure future is the main motivation, then continuously updated, prominently displayed evidence of the positive environmental impact in Central Africa would need to be integrated into the platform's design.

4

Willingness to Act in Africa
Awareness of problems in African rainforests; willingness to engage in tree-planting or preservation of biodiversity activities for Central Africa.

Tech for Trees
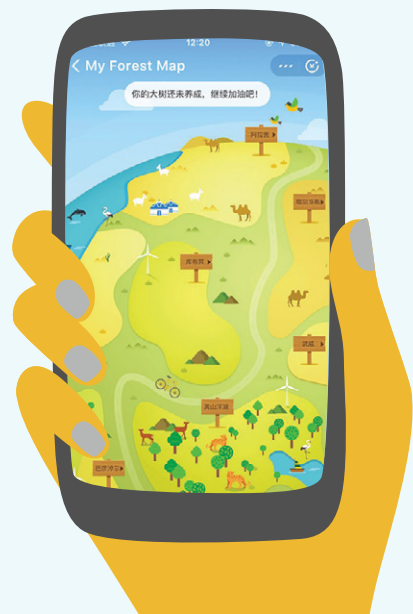
A structural equation model was designed to evaluate the dimension that would be statistically most important both to stimulate initial engagement and for follow-on willingness to engage with the Central African deforestation problem.

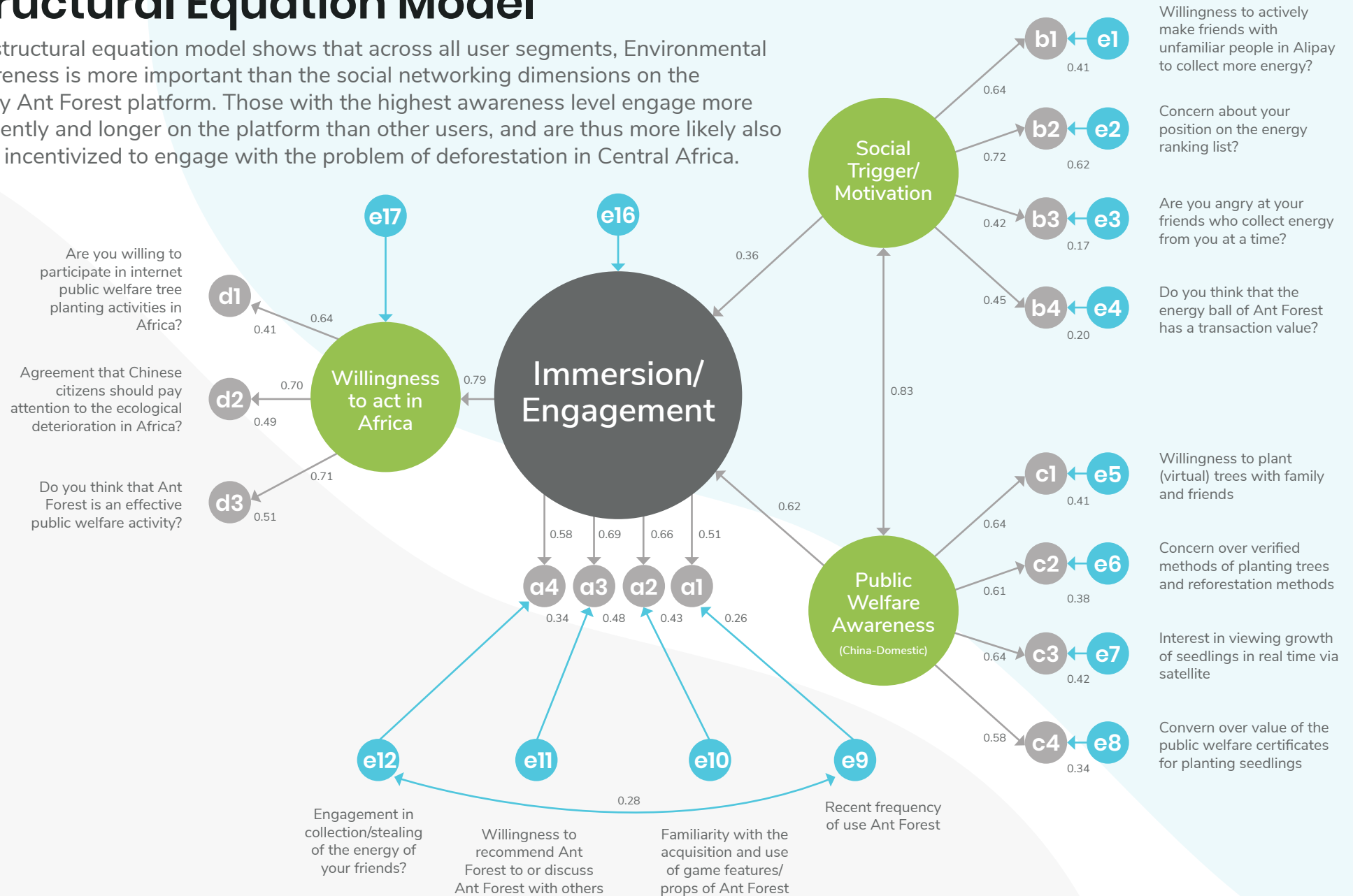Then the research sought to understand at a more granular level which specific behavioral triggers on a digital platform would be the most likely to generate user desire to engage. During this finer analysis, 14 behavioral triggers were evaluated, and data was harvested via in-depth interviews:

1

Health situation. Using an app that rewards a carbon-light lifestyle can result in positive health outcomes for the user (e.g., if driving is replaced by walking).

2

Environmental situation. If a user lives in an area marked by environmental degradation and/or pollution shifting to a greener lifestyle can be triggered.

3

Entertainment and socializing. The fun style and chance to interact with others can be a trigger to engage on the app.

4

Curiosity and education. Interested in acquiring the learnings from using the app.

5

Globalization. Motivated by an understanding that climate change and deforestation have global effects that can impact directly on the user's life.

6

Fun interaction of carbon footprint and tree-planting. Motivated by a compelling fun function related to carbon footprint and/or tree planting.

7

Interactive social elements. Motivated by the social networking, cooperation, competition, and/or other community and competition elements.

8

Sense of honor and reputational enhancement. Motivated by a desire to see oneself and to be seen by others as making a positive contribution to society.

9

Zero transaction cost. Using the app because there are no costs to the user.

10

Incentive level. Engage because one can potentially gain access to advantages.

11

Credibility of carbon footprint calculations and of tree-planting programs**.**

12

Data privacy protection. Motivation or lack thereof because behavioral data analysis and translation into personal carbon footprints require algorithms based on access private data.

13

Interest in nature and biodiversity. Motivated by the ability to contribute to positive impacts on nature.

14

Social responsibility.

Tech for Trees
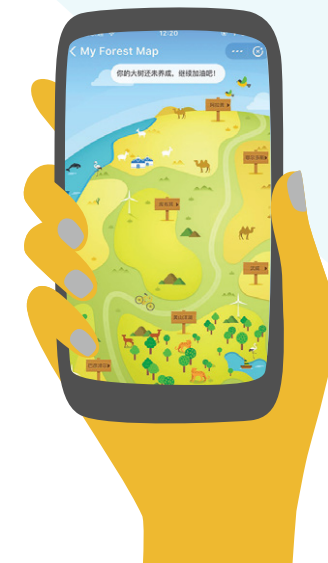
Structural Equation Model

The structural equation model shows that across all user segments, Environmental Awareness is more important than the social networking dimensions on the Alipay Ant Forest platform. Those with the highest awareness level engage more frequently and longer on the platform than other users, and are thus more likely also to be incentivized to engage with the problem of deforestation in Central Africa.

Social Trigger/Motivation

b1 ← **e1** — 0.64, 0.41 — Willingness to actively make friends with unfamiliar people in Alipay to collect more energy?

b2 ← **e2** — 0.72, 0.62 — Concern about your position on the energy ranking list?

b3 ← **e3** — 0.42, 0.17 — Are you angry at your friends who collect energy from you at a time?

b4 ← **e4** — 0.45, 0.20 — Do you think that the energy ball of Ant Forest has a transaction value?

0.36

Immersion/Engagement — **e16**

0.83

Willingness to act in Africa — **e17**

d1 — 0.64, 0.41 — Are you willing to participate in internet public welfare tree planting activities in Africa?

d2 — 0.70, 0.49 — Agreement that Chinese citizens should pay attention to the ecological deterioration in Africa?

d3 — 0.71, 0.51 — Do you think that Ant Forest is an effective public welfare activity?

0.79

0.62

Public Welfare Awareness (China-Domestic)

c1 ← **e5** — 0.64, 0.41 — Willingness to plant (virtual) trees with family and friends

c2 ← **e6** — 0.61, 0.38 — Concern over verified methods of planting trees and reforestation methods

c3 ← **e7** — 0.64, 0.42 — Interest in viewing growth of seedlings in real time via satellite

c4 ← **e8** — 0.58, 0.34 — Convern over value of the public welfare certificates for planting seedlings

a4 — 0.58, 0.34
a3 — 0.69, 0.48
a2 — 0.66, 0.43
a1 — 0.51, 0.26

e12 — Engagement in collection/stealing of the energy of your friends?

e11 — Willingness to recommend Ant Forest to or discuss Ant Forest with others

e10 — Familiarity with the acquisition and use of game features/props of Ant Forest

e9 — Recent frequency of use Ant Forest

0.28

Tech for Trees

12

In addition to its capacity to build citizens' awareness of environmental problems, Alipay Ant Forest's potential lies in its capacity to continuously deliver fresh insights, thus keeping users informed and inspired while simultaneously nurturing their belief in the possibility of making a direct positive impact on the environment—and letting them see that impact. ***Proof of the users' impact on the deforestation problem appears from the analysis to be the most important behavioral dimension to motivate Chinese users to engage with the problems of deforestation in Central Africa.***

Interest in biodiversity and curiosity to learn about environmental problems in Central Africa are important triggers associated with the most important dimension (the "Environmental Awareness"). Translating these behavioral triggers into digital design options points, again, to a need for clear proof of impact on the ground, which is credible and visible and preferably linked to the user acquiring additional insights about the situation in Africa. In addition, the "Happy Warrior" male best user is motivated by the competitive element on the current Ant Forest platform, which could be translated into gamification of new knowledge about the environmental problems in Africa. The "Social Networker" female best user tends to be relatively more motivated by cooperation and collaboration, which means that sharing on environmental impacts or knowledge with peers may be an effective approach.

The importance of delivering credible proof of environmental impact points to a potential relevance of technologies such as blockchain for increasing the trust in the information shared from Africa. Additional technologies such as virtual and augmented reality, satellite images, and drone photos can help to further stimulate the "curiosity" behavioral trigger by presenting viscerally compelling information about the problem of deforestation. Alipay Ant Forest's current tactics for linking online activities with offline interactions (e.g., through tree planting days) could also be adapted into an engagement strategy for Central Africa through learning exchange field trips or meet-ups.

Tech for Trees

Conclusions and Next Steps

One key question the research did not explore was which specific aspects of the deforestation problem might activate the triggers the research identified. For example, are users most interested in engaging with knowledge around tree-planting specifically? Or are the iconic wildlife species of the Congo Basin, or the broader biodiversity of that region, more likely to motivate people to increase their awareness and thus to engage? The findings around these questions will likely be key to successful design of a citizen engagement digital tool targeting Chinese users.

Both in China and beyond, there is an acute need to help citizens relate to the problem of deforestation and biodiversity loss as main drivers of climate change and, even more important, to empower them to be part of the solution. Internet platforms such as Alipay Ant Forest are uniquely positioned to play a role in creating these avenues of action for hundreds of millions of citizens in China and potentially around the world. This study proves that a significant proportion of Alipay Ant Forest users are motivated to also create impact in Central Africa provided that the digital functionality is designed for those behavioral triggers identified as most important to different user segments.

Alipay Ant Forest is to date the only environmentally-aligned initiative born in a digital lifestyle app to achieve mass scale. With that one notable exception, digital technologies' enormous potential—which lies in the access they provide to entirely new sets of data and digital tools which could (as Alipay Ant Forest demonstrates) incentivize green behaviors—remains largely untapped. Hence, the existing international mechanisms for addressing climate change via reforestation finance and the upcoming Convention on Biodiversity could engage digital tech platforms to help innovate the way reforestation is financed.

Digital technology can crowd-in engagement from the ground up in ways that multilateral top-down approaches have not managed. However, it does require careful design to ensure that the solutions trigger the behaviors that will make people feel committed to the problem and thereby willing to invest time via engagement on a digital platform. Alipay's Ant Forest is the world's most scaled digital technology-for-forest initiative which makes it a significant platform to innovate financing of reforestation. It also serves as a demonstration that Internet-based platforms offer significant innovation potential to engage high numbers of citizens in creating a shared safe and sustainable future for all.

Tech for Trees

Notes on Methodology

CUFE researchers pursued a mixed (quantitative and qualitative) method approach, using a 25-question survey distributed online, followed by in-depth interviews to better understand the survey results. The sample was composed of the following three groups of users in China: 1) Existing Alipay Ant Forest Users (61.5%); 2) Former Ant Forest Users (10.5%); and 3) Never Been Alipay Ant Forest Users (28%). The total sample amounted to 1,005 surveyed across these three groups. The proportion of women was 61.5 percent of the total, and 76.7 percent of those interviewed were between the ages of 18 and 40. Most of the sample came from Eastern China and most had annual income below CNY 200,000.

The full technical report, *Research on Internet Public Welfare Behaviors*, includes the 25-question survey instrument, the statistical analysis reports, and extensive narrative interpretation of findings. It is available in English on the Green Digital Finance Alliance website at https://greendigitalfinancealliance.org/initiatives-publications/#publications.

ABOUT THIS REPORT

Tech for Trees is based on data developed by Prof. Bo Chen of the Central University of Finance and Economics (CUFE) in Beijing as part of a collaboration with the Central African Forest Initiative (CAFI) and the Green Digital Finance Alliance (GDFA). The GDFA prepared *Tech for Trees* and is solely responsible for any errors or omissions.

Tech for Trees