DIGITAL TECHNOLOGY SHAPING GREEN AND SUSTAINABLE LIFESTYLES: EXPLORING ALIPAY ANT FOREST
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Data-Pop Alliance
Data-Pop Alliance is a collaborative laboratory created by the Harvard Humanitarian Initiative, MIT Connection Science, and Overseas Development Institute. DPA brings together researchers, experts, practitioners, and activists to change the world with data through three pillars of work: diagnosing local realities and human problems with data and AI; mobilizing capacities, communities, and ideas towards more data literate societies, and transforming the systems and processes that underpin our societies and countries. In 2016, Flowminder Foundation joined as the fourth Core Member.

Green Digital Finance Alliance
The Green Digital Finance Alliance is a unique public private partnership co-founded by UN Environment and ANT Financial Services launched in Davos in 2017 to leverage digital technologies and innovations to enhance financing for sustainable development. The GDFA catalyzes market innovation and policy action that leverages digital finance to, on the one hand, address the barriers to scaling sustainable finance and, on the other hand, promote innovation that unlocks sustainable investments in the real economy.

UNEP Inquiry
The Inquiry into the Design of a Sustainable Financial System has been initiated by the United Nations Environment Programme (UNEP) to advance policy options to improve the financial system's effectiveness in mobilizing capital towards a green and inclusive economy—in other words, sustainable development. Established in January 2014, it published the first edition of ‘The Financial System We Need’ in October 2015, with the second edition launched in October 2016. The Inquiry has worked in 20 countries and produced a wide array of briefings and reports on sustainable finance.
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Introduction

Recent climate emergencies paint a clear picture: a world in need of urgent action. With global temperatures already 1°C above pre-industrial levels, and with no clear ‘one-size fits all’ mitigation measures, it is not only necessary, but required, to mobilize widespread individual behavioral changes towards more sustainable lifestyles. Digital platforms are uniquely poised as mechanisms to help achieve this change, particularly as they can incentivize widespread action and nudge individuals towards more sustainable, larger-scale behavioral changes.

Alipay Ant Forest, launched by Ant Financial in 2016, is a green initiative embedded on Alipay’s digital lifestyle platform that is doing just that. By providing users with a tool to help measure their personal carbon footprints, recording avoided emissions derived from individual behavioral changes. Alipay Ant Forest is incentivizing citizens to become active agents in nature-based and individual behavior solutions to combat climate change. To date, this mobile based innovation has over 550 million users who have participated in the green initiative to accumulate virtual points, which in exchange, have led to planting more than 122 million real trees in northwestern China, spanning an area of over 1.68 million mu.

This innovative application is showing how green digital technologies can increasingly play an important role in helping countries achieve their emissions reduction targets - indeed, while policies and locked-in industry infrastructure may take decades to change, individual behavior shifts can begin immediately. While people-based actions for climate mitigation cannot, by any means, substitute much needed industry and economy-wide efforts, they can significantly contribute to these efforts through mobilizing tangible and widespread collective impacts. In fact, unlocking bottom-up citizen action for climate change mitigation may be the avenue needed to help governments run the “last mile” and reach the last percentages needed to achieve carbon neutrality by 2050.

This report analyzes Alipay’s Ant Forest trajectory as a green digital innovation that has achieved exponential growth over the past three years. It first describes the green initiative and how users have interacted with the platform to accumulate green points and plant virtual, and real trees. It takes stock of the impact Alipay Ant Forest has already achieved in China, and then explores Ant Financial’s vision of expanding these impacts on poverty alleviation through conservation efforts, otherwise coined as “ecological poverty alleviation”. The second section unpacks different policy and regulatory enablers that have made an application like Alipay Ant Forest both relevant and necessary within China’s domestic context and points out to interesting take-aways for international policymakers. Last, the report models the implications that scaling a platform like Alipay Ant Forest could catalyze in additional countries, in terms of potential market size, and emissions avoided through individuals’ behaviors. This analysis estimates that up to 8.6% of emissions tied to public transportation could be avoided in the seven countries modeled over the 2020-2030 period.
I. The case of Alipay Ant Forest: mitigating climate change through individual behavior changes

A. How does Ant Forest work?

Alipay’s Ant Forest is a green initiative that aims to unlock the power of individual behavior change and bottom-up approaches for climate change mitigation and poverty reduction. The platform was launched in 2016 and has since become China’s largest digital innovation aimed at reducing carbon emissions, promoting reforestation, and advancing poverty alleviation efforts. Through an interactive interface embedded in Alipay, the world’s leading open digital lifestyle platform, users gain “green points” by opting for green behaviors, understood as eco-friendly behaviors that result in avoided carbon emissions (Ant Financial 2019). Users plant and nurture a virtual tree with earned green points, which Ant Financial will then plant in real life. In the last three years Alipay Ant Forest has been online, it has attracted over 550 million users, roughly around 7% of the world’s population.

Alipay Ant Forest is open to the public and anyone can download the platform and join. This green initiative encourages users to engage in low-carbon activities in their daily life, such as paying utility bills online and commuting to work by walking or cycling rather than driving. These behaviors are counted and converted into “green energy” that users can then spend to grow virtual trees in the platform, which is embedded within the Alipay app. Simply put, actions that are green, are then rewarded with points proportional to the carbon footprint avoided by these activities (Ant Financial 2019). This represents a significant innovation in the field of carbon accounting, as the impact of carbon emissions is usually measured from a production standpoint, assessing the amount of CO2 released into the environment at the point of emissions (Moran et al. 2018). Alipay Ant Forest’s platform could be the first step towards individual carbon accounting (ESC, 2018).

As these points accumulate, users can plant and water their virtual tree, as well as interact with friends to gain more points. A key incentivize for Alipay Ant Forest users is the application’s interactive “game-like” design: users can water their friends’ trees and donate their points to help them grow, or conversely, collect from friends if their points are not collected on time. To an extent, the platform “gamifies” the positive externalities of green behaviors by persuading individuals to become increasingly conscious and attentive to their points. This involves a different, albeit effective strategy, whereby an intangible incentive (green points) is made tangible by Ant Financial, leading to a feeling of self-efficacy.
regarding climate mitigation measures (Lehner and Simlinger 2019). The user bears no cost in gaining the points, other than the one associated with their green consumption patterns.

Once the virtual tree is fully grown after sowing, watering and caring for the tree, Ant plants a real tree in partnership with the Society of Entrepreneurs and Ecology Foundation (SEE) and other NGOs in desertified areas of western China. To date, Alipay Ant Forest has recorded strong results, demonstrating the possibilities that nudging individuals towards more sustainable behaviors may have towards climate mitigation. Six months after the platform was launched, it was already used by 200 million people. By March 2020, this number has grown to more than 550 million users (Ant Financial 2020). As Ant Forest continues to grow, Alipay is leveraging the popularity of its platform to scale its green initiative beyond emissions reduction to promote and fund poverty alleviation measures in China.

### B. Impacts to Date: Exponential Growth and Environmental Focus

#### 1. Avoided carbon emissions

Alipay Ant Forest is a tool to promote citizen engagement in climate change mitigation by promoting low-carbon lifestyles among its users. Initially, the platform presented nine activities that granted individuals ‘green energy points’, tapping into two types of emission reduction possibilities: transportation and paper use.

<table>
<thead>
<tr>
<th>Activity</th>
<th>CO₂ Emissions (g)</th>
<th>Category</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-line mobile payments (e.g., buying movie tickets and train tickets online)</td>
<td>5</td>
<td>Walking</td>
<td>NA</td>
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<tr>
<td>Online payment of utilities (water, electricity, and gas bills)</td>
<td>262</td>
<td>Making appointments online (i.e., payment of traffic violation fines)</td>
<td>NA</td>
</tr>
<tr>
<td>Public transportation</td>
<td>80</td>
<td>Electronic Toll Collection payment</td>
<td>NA</td>
</tr>
</tbody>
</table>

1. Alipay Ant Forest rewards actions belonging to two distinct categories: emissions avoided in the transportation sector, mainly by reducing fossil fuel consumption, and emissions avoided by opting for paper alternatives, particularly the “reduction of industrial energy consumption during the use and production of paper”. Nine different activities were chosen that could be accounted for within these categories, for example, the online payment for water supply, electricity and gas bills belongs to both categories, walking on the other hand, only on the transportation category. Based on these calculations, Ant Forest has a data acquisition algorithm that ensures that necessary data for every participant behavior is measured and awarded, with prior consent of users. Ant Financial recognizes that this calculation methods provide a good foundation for measuring individual carbon emissions avoided, not reduced, as it only measures behaviors that are rewarded and not the net reduction of emissions by users.

2. Tenhunen and Penttinen (2010), for example, assess the carbon footprint of paper vs. electronic invoicing, and detect a percentage of carbon emissions avoided by switching to e-invoicing.
In 2018, Alipay Ant Forest expanded to include nine new low-carbon scenes, including the exchange of second-hand goods through platforms like Xianyu, bicycle ride-sharing, consumption of energy-efficient appliances and online registration, among others.

For each activity, a baseline scenario “that reasonably represents greenhouse gas emissions that would occur in the absence of the activity” was identified, according to Alipay Ant Forest’s calculation methodology. The difference between this baseline and the emissions of encouraged activities allows the calculation of carbon emissions being avoided. These calculations were done with the support of the China Beijing Environment Exchange, and are based on existing methodologies such as the Clean Development Mechanism and the Chinese Certified Emission Reduction (CCER).

2. Afforestation activities

In addition to encouraging green lifestyles, Alipay Ant Forest conducts large-scale tree planting activities, long considered a priority in China. As of March 2020, 122 million trees have been planted in partnership with local non-profit organizations as a result of Ant users’ carbon reduction activities (Xuanyi 2020).

Additionally, as of October 2018, and in partnership with the National Forest and Grassland Administration and the China Green Foundation, users can receive an official certificate and count their fully-grown virtual trees towards the country’s legal obligation for citizens “to plan three trees each year” (CHINA Plus 2018).

Ant has further leveraged the popularity of their afforestation efforts by making them even more tangible to users by installing remote sensing cameras in the areas where trees are planted. Users’ access to these images, as well as to satellite imagery, not only confirms Ant’s pledge to plant the virtual trees in real life, but it makes reforestation activities a tangible effect of user’s behaviors.

**UN Champions of the Earth**

In September 2019, Ant Forest was recognized with the “Champions of the Earth” award, the United Nations highest environmental honor. Under the “Inspiration and Action” category, Ant Forest was highlighted as a green initiative that “fundamentally [redesigns] how we interact with the planet” by leveraging technology to harness positive change (Inger Andersen, Executive Director UNEP). Particularly, the award praises Ant Forest as China’s ‘largest private sector tree-planting initiative’.

Source: “Chinese Initiative Ant Forest wins UN Champions of the Earth award”, UNEP (19 Sep 2019)

In turn, this contributes to user’s loyalty and awareness of the fact that their virtual trees are in fact being planted. By giving users a concrete milestone in their quest towards sustainability - the possibility of planting a tree - people can feel they are not merely interacting with a digital platform, but actually contributing to making China greener.

Image 2 – Alipay Ant Forest: From Seedlings to Trees via Satellite Imagery

Source: Provided by Ant Financial

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3  Xianyu is an online marketplace for the exchange of second-hand goods.

4  China Green Foundation, SEE Foundation, ELION Charitable Foundation, Alashan Ecological Foundation
C. Further Impacts: Ant’s contribution to Ecological Poverty Alleviation

Alipay Ant Forest has gradually expanded beyond environmental protection, branching into more areas of social impact. It is currently testing whether its mobile platform could promote poverty alleviation measures by leveraging the environmental biodiversity of the areas where current afforestation programs take place in. The initial idea is to work alongside local communities living in the protected areas to advance sustainable rural development activities, such as the commercialization of eco-products, and to promote sustainable use of resources through conservation and research activities. To this moment, it has led to the creation of 400,000 ‘green’ jobs, through two models of economic poverty alleviation: “public welfare protected areas” and “ecological economic forests” (UNFCCC, 2020).

Pingwu County Pilot - Commercialization Avenues for Small-Scale Honey Farmers

An example of Ant’s incursions into economic poverty alleviation include the Pingwu County pilot, a rural cooperative in West China that was established in 2018 for the environmentally-friendly production of honey. For this pilot, Alipay Ant Forest offers users the possibility to protect one square meter of land with their green energy points and also helps local farmers sell sustainably produced honey through Taobao, an e-commerce Marketplace. To date, Taobao has hosted more than 150,000 livestream sales, where sellers show customers through live video their products for marketing and commercialization purposes for agricultural workers, enabling the development of new services to connect interested buyers with sellers in rural areas (Chou 2019b). Eco-friendly products could also find sales channels through Alipay Ant Forest and reach more potential buyers.

Linking biodiversity conservation with poverty alleviation presents a global challenge; a recurrent debate in the environmental sector, and a latent concern of developing countries, has been how to overcome the apparent dichotomy between conservation and economic development. While no causal link has been widely acknowledged between biodiversity degradation or conservation and poverty, the international community has established as a goal that biodiversity conservation efforts should also contribute to overall poverty alleviation (Convention on Biological Diversity, 1992 & Millennium Ecosystem Assessment, 2005). Indeed, recent measurements suggest that areas within China with more than 30% of forest cover have a 20% lower GDP per capita than the national average (Zheng et al. 2019). At the global level, although with some exceptions, it seems to be the same: “there is mounting evidence to suggest that, at a variety of scales and in many different ways, biodiversity and poverty do coincide” (Secretariat of the Convention on Biological Diversity 2010).
Sea buckthorn is an authentic Chinese native plant. 80% of sea buckthorn forests are distributed in 12 provinces (regions) of China, especially in key areas such as Hebei, Inner Mongolia, Shanxi, Shaanxi, Gansu, and Qinghai. A three-year-old *Hippophae rhamnoides* root system can extend up to 5-6 meters. The area of sand fixation and soil retention exceeds 10 square meters, which can reduce surface water and soil loss by 75% and reduce wind erosion by 85%.

Conservation practitioners and researchers have been working to imagine new instruments and models to foster conservation while also supporting the economic development of the inhabitants of biodiversity rich areas. Several initiatives have emerged within China to attain this objective, such as non-timber product commercialization, community forestry, nature-based tourism, payment for ecosystem services, protected area jobs, and agroforestry (Secretary of the Convention on Biological Diversity 2010; Fatoumata Diallo 2019). The possibility of leveraging innovations based on digital technologies towards the eradication of poverty, such as Alipay Ant Forest’s vision on ecological poverty alleviation, present the opportunity to improve the lives of people in areas where Ant conducts its efforts.

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Eco-economic forest model: growing rich forests on the red ground

Another new model being explored by Ant is the eco-economic forest model. Under this proposition, the objective is to plant forests with ecological and economic value for poor areas in the Central and Western regions. The model starts with large-scale planting of sea buckthorn (*Hippophae rhamnoides*) and abides by the principle of “adjusting to local conditions and suitable trees”. On one hand, this type of tree contributes to wind and sand prevention and helps conserve water and soil, contributing to the ecological sustainable development of this regions. On the other hand, the commercialization of products based on sea buckthorn – particularly of its fruit, which is rich in vitamin C and can be used to produce and process high-end food and health products – creates jobs for people in need. The output value of an acre of sea buckthorn land is as high as 1,000 yuan, and the income of farmers in poor areas harvesting sea buckthorn is more than 5 times higher than that of sowing land. The re-investment of a portion of the revenues from these products contribute to the protection and conservation of these forests. Thus, in this way, this model promotes development in poor areas, while prioritizing ecological protection in a virtuous circle of economic development.

On November 19, 2018, the first eco-economic forest species went live on Alipay’s Ant Forest. 3.14 million users exchanged green points to grow more than 23,500 mu of sea buckthorn in a day. On December 19, 2019, the first ecological product “MA Sea Buckthorn” beverage, developed on the basis of this model, was officially launched for sale, with 100,000 pieces sold in more than 100 minutes. Each bottle of “MA sea buckthorn” priced at 9.9 yuan, except for the cost of raw material harvesting and manufacturers’ production and processing, the rest will all be donated to the special fund established by the China Foundation for Poverty Alleviation for ecological and environmental protection in the central and western regions and poverty alleviation.
II. Making it happen: institutional and policy enablers for citizen action towards carbon reduction

Besides the unique design and features of Alipay Ant Forest, China’s growing leadership in environmental protection have made the application not only relevant, but seen as a necessary and worthwhile endeavor to combat climate degradation. The country’s consolidated efforts to achieve greener development for China have materialized through guidelines, regulations and strategic policies aimed to incentivize and align changes amongst the private sector, local governments and national ministries towards greener growth. Amongst priority objectives of Chinese environmental policies are emission reduction, natural resources conservation, renewable energy resources, and the promotion of a circular economy (The State Council of the People’s Republic of China 2016).

China’s recognition that its transformation towards an “ecological civilization” requires economic and social transformation, and that economic growth and environmental protection can go hand in hand, has driven a national change strategy through structural adjustments to achieve green growth. From declaring an internal war on pollution, establishing green finance as an international priority during its presidency of the G20, and becoming one of two countries contributing the most to greening efforts worldwide, China, in spite of being the largest greenhouse gas emitter globally, is pursuing tangible changes and innovations to remedy and combat climate change.

While there is no specific empirical way to prove whether a particular policy has had a significant effect on aiding Alipay Ant Forest’s success, this section covers the policy, regulatory and institutional enablers in the fields of green finance and green fintech that have shaped China’s green development, and thus the normative backdrop in which Alipay Ant Forest has achieved the impact described in earlier sections.

A. Green Finance

Green finance, officially defined as “financial services provided for economic activities that are supportive of environment improvement, climate change mitigation and more efficient resource utilization”, is one of the areas where government directives have played an important role in incentivizing sectoral change towards climate mitigation (“Guidelines for Establishing the Green Financial System” 2016). National commitments to green the economy have driven innovation-based transformations, often precipitating change upon companies and organizations, others working alongside relevant actors to carve a path towards change.

Elevating green finance as a key policy commitment (see figure 2 below for a timeline of actions) has made possible the development of a financial market cognizant of environmental and social risks. In fact, China is the first country in the world with a clear national policy directive to “create an all-encompassing green financial system” capable of bridging the funding gap needed to achieve green development (“Establishing China’s Green Financial System” 2017). Furthermore, the ability to put in place pilot projects on green finance further confirms the government’s intentions to continuously find ways to promote green finance.

Green Finance Pilot Zones

In 2017, the State Council announced it would set up five pilot zones to test green finance reforms and innovations in the provinces of Zhejiang, Jiangxi, Guangdong, Guizhou, and Xinjiang. Different ministerial agencies were tasked to develop a plan for these areas, including modern agriculture and clean energy through green finance, infrastructure in big data information sharing, ecological environment and poverty alleviation through green finance (Paulson Institute 2019). These pilot zones provided institutions with a range of incentives to test whether new or existing mechanisms could be successful in financing and advancing various climate mitigation strategies (Reuters 2017).
According to the Paulson Institute (2019), it is expected that the innovations tested during the pilots will be applied nationally “to unify green finance standards and improve the commercial sustainability of green finance”. To date, the most “fruitful case” is that of the Zhejiang province pilot for its “key success pillars in place including a sound governance system to encourage green finance development, a growing demand for green industry and an established working relationship with China’s Green Finance Committee for technical support”. These pilots were extended into a second phase in 2019, after initial successful results (Jia 2018).

**B. Green FinTech**

China’s top-down approach to engineer a green economy has also coincided with the development of the fintech (short for financial technologies) industry, defined as “companies that combine financial services with modern, innovative technologies” (Dorfleitner et al. 2016, 2017). According to the Digital Disruption (2016) report, fintech companies thrive in China due to the high penetration of digitization, quick growth of internet users, and prudent yet inclusive regulatory frameworks than in other countries. In fact, China is home to four of the five largest fintech companies in the world (Gulamhuseinwala, 2016). In a context of high political support for internet-based finance (Ngai et al. 2016), Chinese technology giants have created “all-encompassing platforms with the aim of embedding their services – financial and non-financial solutions – into customers’ lives”. (“The Rise of FinTech in China” 2016). As they dive into new technology frontiers like blockchain or artificial intelligence, fintech companies are also starting to explore how they could contribute to green finance. Recent pilots around the world are showing how this sector has the potential to develop new business models that “can both reduce the cost and improve the prospects of achieving the objectives of the Paris Agreement and the SDGs, [...]”, including supply chain
transparency, identity and financial inclusion, property rights, expansion of renewable energy, decentralization of electrical power systems, carbon credit trading and improved access to climate finance” (Nassiry 2018).

In fact, Ant Financial can be considered as a fintech company that has both contributed to the expansion of financial services for customers, but has also played an important role in shaping and innovating the current green finance environment (Qi 2018). Drawing from this mix of green financial system guidance and fintech promotion, China has managed to create an appealing environment for innovation on green fintech. Yet it is expected for the regulatory environment to evolve in the near future for this new industry (Ngai et al. 2016).

Understanding this enabling environment is crucial to fully capture, besides the appeal of the Ant Forest platform, how and why this platform is an important endeavor of Ant Financial’s. Particularly, taking a look at how over the past four years different guidelines, regulations and strategic policies have been introduced, and how private companies and individuals alike can contribute towards nationwide priorities.
III. Scaling abroad? The potential for citizen action towards carbon reduction in other markets

In June 2019, the first platform designed and based on Alipay Ant Forest, “GCash Forest” was launched in the Philippines. With the goal of combating deforestation, and similarly, offering energy points by rewarding a given set of behaviors, GCash, a leading mobile wallet in the Philippines is leveraging the Alipay Ant Forest model to incentivize individual behavior changes for climate change mitigation. This first endeavor outside of mainland China signals to the scalability of Alipay Ant Forest; a model that if widely replicated, could result in important citizen-led climate mitigation actions. Given Alipay Ant Forest’s trajectory and results to date, it is worth examining the impact that could result from scaling this initiative to other countries in the world. To do so, a multiple regression model was built to estimate the potential market size and results of a platform like Alipay Ant Forest in seven other countries: India, Germany, Brazil, Japan, South Korea, the United Kingdom and the United States. This model estimates the market size, potential emissions avoided as a result from individual behavior changes (see Annex 1 “A study of impacts - methods and limitations for modeling” for a detailed description of the methodology). Providing a preliminary estimate on the impact that scaling green initiatives like Alipay Ant Forest to other countries of the world could have - both in terms of number of users and avoided emissions - highlights the potential of digital platforms for individual-based climate mitigation measures.

A. Estimating Market Potential

In under ten years, it can be estimated that the market size for an innovation such as Alipay Ant Forest, would roughly be equal to 1,003 million users under the “trend” scenario, 1,058 million users under “optimistic”, and 945 million users under the “conservative” scenario - these three scenarios were constructed to describe at, above and below the baseline calculated. In any of these cases, the market size is roughly equivalent to three times the current population of the United States, a sizeable number of individuals that would voluntarily change their behaviors in order to reduce their carbon emissions and contribute to tree-planting activities. All else equal, the yearly rate of growth would be 7 million new users.

In fact, as can be seen in Figure 4 below, the largest share for new, potential users of a platform geared towards incentivizing citizen action for carbon reduction could be concentrated in India, Brazil and the United States.

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6 It is worth noting that the countries in the study were chosen given their status as large greenhouse gas emitters, regional diversity, variety in development level, and availability of carbon emission data, providing thus an interesting panorama for what scalability of a green mobile initiative to promote citizen action could look like in other places of the world.
B. Estimating emissions reduction potential

According to Alipay Ant Forest’s pilot results, users avoided 4.9 kilos of CO2 equivalent missions per person, per year, as a product of the green behaviors they adopted. This is equivalent to 0.064% of per capita emissions in China or to 0.086% of per capita emissions in China’s transportation sector\(^7\).

Under this baseline scenario and based on population projections for the countries studied, it was estimated that for the period from 2020 to 2030, 8.4 million tonnes of CO2 emissions could be avoided in these countries, with an average annual value of 0.8 million tonnes\(^8\) (see Figure 5). It is worth noting that this model only takes into consideration the behaviors and number of users under limited low-carbon activities during the first nine months\(^9\) since Alipay Ant Forest’s launch, reason why these estimates may be underestimating the magnitude of potential avoided emissions.

<table>
<thead>
<tr>
<th>Year</th>
<th>Brazil</th>
<th>Germany</th>
<th>India</th>
<th>Japan</th>
<th>South Korea</th>
<th>United Kingdom</th>
<th>United States</th>
<th>Total Emissions Reduction</th>
</tr>
</thead>
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<tr>
<td>2020</td>
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<td>28,056.17</td>
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<td>118,725.50</td>
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<td>1,221,980</td>
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<td>188,831</td>
<td>4,057,313</td>
<td>8,410,405</td>
</tr>
</tbody>
</table>


\(^8\) This uses the factor of 0.064% reductions per capita, modeled based on Ant Forest baseline during its pilot phase.

\(^9\) At this time, green energy points were awarded for only nine actions, including; electronic payment of metro tickets, electronic toll collection, hospital registration fee, electronic train tickets, electronic payment of household utilities, electronic payment of movie tickets, traffic fines and penalties, other offline payments and walking.
Furthermore, given that most of the actions awarded through Alipay Ant Forest relate to shifts in transportation patterns, one can view these emission reductions in light of the volume of emissions corresponding to local public transport in each of the countries. In order to do so, research was undertaken to identify the percentage of total national emissions generated by public transportation in order to calculate the number of CO2 emissions generated per passenger in one year. This calculation was done under two scenarios: 1) assuming single and, 2) assuming roundtrip travel per capita on every day of the year.

Drawing these comparisons makes clear that the modal shifts encouraged by Alipay Ant Forest represent a significant proportion of annual emissions per passenger tied to public transportation emissions. Particularly for the United States and Brazil, it can be noted that the emissions avoided because of platforms like Alipay Ant Forest, constitute a significant share of public transportation emissions. This comparison signals to the fact that simple shifts in behavior patterns, particularly in carbon intensive industries (as is transportation) do significantly impact national emissions, but this impact is even more obvious when looking at specific sectors.

Figure 6: Modal shift measures: Alipay Ant Forest emission reductions as a proportion of public transportation related emissions (per capita, annual)

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Brazil</th>
<th>Germany</th>
<th>Japan</th>
<th>South Korea</th>
<th>United Kingdom</th>
<th>United States</th>
<th>China</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single trip</td>
<td>9.20%</td>
<td>1.10%</td>
<td>5.10%</td>
<td>1.10%</td>
<td>1.80%</td>
<td>9.90%</td>
<td>2.10%</td>
<td>4.30%</td>
</tr>
<tr>
<td>Round trip</td>
<td>18.30%</td>
<td>2.10%</td>
<td>10.10%</td>
<td>2.20%</td>
<td>3.60%</td>
<td>19.80%</td>
<td>4.20%</td>
<td>8.60%</td>
</tr>
</tbody>
</table>

For these calculations, the emissions per passenger trip in public bus transportation were taken, when available. This choice was made in light of the volume of emissions that this mode of transportation represents in China, as well as on the modal shift measures in transportation awarded through Ant Forest. However, it is worth noting that the magnitude of these percentages depend on the extent to which buses are the main modes of transportation in countries’ public transportation schemes.
IV. Main Findings

Green mobile platforms are poised as powerful mechanisms to inform and encourage citizen action towards carbon reduction. Alipay’s Ant Forest has incentivized over 550 million people to adopt greener, more sustainable behaviors and to become active agents of nature-based solutions through its mobile platform, resulting in avoided emissions estimated at over 11 million tons of CO₂ (Xuanyi 2020). Providing individuals with tangible and visual information on the carbon emissions associated with everyday activities has a positive impact in encouraging green behaviors.

Digital technologies are providing new avenues for citizens to become active agents for nature-based solutions to climate change. Alipay Ant Forest’s interactive design for environmental protection play a crucial role in breaching the attitude-behavior gap to generate individual actions for climate change mitigation. Behavior change is more likely when individuals feel their actions have a visible and tangible impact. Alipay Ant Forest users’ ability to see their trees grow amidst a forest planted by other users, contributes to the recognition that individual actions are significant, but also, that seemingly isolated actions contribute to larger collective impacts.

There are opportunities to bridge the dichotomy between conservation and poverty reduction in China by leveraging private sector innovations towards social good. Mobile applications, amongst these green fintech applications, have the opportunity to contribute to the economic empowerment and ecological conservation of rural communities by enabling and providing access to the digital market and their user base. As a point of convergence for actors interested in pairing environmental protection and poverty alleviation, platforms like Alipay Ant Forest have the potential to link individuals who want to support biodiversity conservation efforts, with rural communities looking for commercialization avenues for sustainable products.

The overall enabling environment towards innovation in China, characterized through its multiple policies focused on greening the financial sector, have developed the conditions for green fintech to emerge at scale in China. A policy approach defined by direct guidance to financial sector players, and government-sponsored experimentation via green finance pilot zones has contributed to China’s leadership in green finance. China’s fintech sector has emerged from an enabling environment, contributing to the consolidation and growth of multiple fintechs, amongst these green fintechs.

Up to 8.6% of emissions tied to public transportation could be avoided in the seven countries modeled in this study if similar green initiatives were to be implemented over the 2020-2030 period. Exploring the potential impacts that scaling a platform like Alipay Ant Forest could have on additional countries makes clear the potential impact of green initiatives to incentivize individual actions for climate change mitigation. Particularly, this model estimates that the largest share of potential users of a mobile application to incentivize citizen action towards carbon reduction, could be concentrated in India and Brazil, and that over 600 million trees could be planted. However, to incentivize a shift towards lighter carbon lifestyles, there is a need to adapt the design of green initiatives to the specific behavioral patterns of citizens of each of the countries.
Annex A - A study of impacts: modeling methodology

The model is focused on providing a preliminary idea on the impact that scaling green initiatives like Alipay Ant Forest to other countries of the world would have - both in terms of number of users, avoided emissions, and reforestation potential. To estimate these figures, the model built extrapolates the results obtained during

scenario mimics Alipay Ant Forest’s user growth during its first six months as a baseline, while the “conservative” and “optimistic” scenarios are estimates on margins 5% greater and lesser than this baseline.

Second, to estimate the carbon emissions avoided by users in each of these countries, the model assumes a trajectory equal to that of Alipay Ant Forest during its first six months of operation. This baseline is understood on a per capita basis, and was extrapolated to the other countries of study assuming that it would be fixed throughout the years.

Limitations of the model

The model does not take into account the potential weight of extrinsic and intrinsic motivations to adopt environmental behaviors based on the national context, such as the impact of

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11 Due to data availability, disaggregated information was only available during the pilot’s six months. At this time, green energy points were awarded for only nine actions, including: electronic payment of metro tickets, electronic toll collection, hospital registration fee, electronic train tickets, electronic payment of household utilities, electronic payment of movie tickets, traffic fines and penalties, other offline payments and walking.

12 In this report fossil CO2 emissions include sources from fossil fuel use (combustion, flaring), industrial processes (cement, steel, chemicals and urea) and product use. Please note that in the analysis presented in this report no short cycle carbon CO2 is included in any sector for EDGAR data. EDGARv5.0 uses international activity data, mainly energy balance statistics of IEA (2017) for 1970-2015 to estimate CO2 from fossil fuel consumption. These emissions are extended (FT approach) to 2016 and 2017 using BP statistics. The respective sectoral break downs of emissions for 2015 are extrapolated to 2016 and 2017. Updates for 2016 and 2017 for cement, lime, ammonia and ferroalloys production are based on USGS statistics, urea production and consumption are based on IFA statistics, associated gas used from flaring from GGFR/NOAA, steel production from world steel and cement clinker production from UNFCCC (2018b). For the other sectors with lower contributions to the global CO2 emissions, the time series in EDGARv4.3.2 have been extended for the period 2013-2017 using proxy data and relative changes in activity data compared to 2012, reported in recent data sources.

13 The following datasets were used to build the model:
14 Total historical fossil CO2 emissions in MtCO2 by country from 1970 to 2017.
15 Total historical fossil emissions in MtCO2 for the transport sector by country from 1970 to 2017.
16 Per capita emissions expressed in tCO2/cap/yr from 1990 to 2017.
17 Smartphone penetration of each country expressed as a percentage for the years 2017 and 2013.
18 Smartphone purchases expressed as a percentage of the population using smartphones for 2013 and 2015.
Ant’s gamification effect as an incentive to utilize the app. Furthermore, the propensity to use social media and apps differs, and e-commerce and smartphone usage doesn’t fully capture this variance. In other words, the adoption of internet-based channels and media differ dramatically, particularly of mobile banking solutions. Accessibility, availability, and affordability of technologies, as well as cultural context, ought to be considered in order to achieve more nuanced results. The assumptions the model is based on are too broad to reach conclusive results, thus, this model only provides estimates both for market size and emissions reduced. Second, the model doesn’t take into consideration the intrinsic market development in each of these countries, but makes the assumption that the market size for green mobile initiatives would equal the market size of mobile payment applications generally. Although it is clear, to an extent, what drives a user in China to use Alipay Ant Forest, there is no way to predict whether individuals in other markets would be as enthused and engaged by a similar application. Both the pressing nature of climate change in China, as well as the “virality” caused by the gamification and social network features of the platform may not be as effective in other countries.

19 Relational data from Ant Forest’s emissions model.
20 This mathematical model was based on Eck et al. 2017 and Fox 2018. The adjusted R-squared for this model was 0.9865, indicating that 98.6% of global transportation emissions are explained by the emissions in the countries analyzed.
V. References


The International Institute for Sustainable Development, and Development Research Center of the State Council. 2015. Greening China’s Financial System. IISD.


