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PREFER SLOW MOBILITY AND GET REWARDED! CREATING A SUSTAINABLE DIGITAL ECOSYSTEM

Solène Juteau

Working Paper

Abstract

While experts converge on the necessity of ecological sobriety to fight climate change, our case study aims at presenting an organization intent on building a new digital ecosystem to curb and reward low-carbon behaviours. An exploratory case study following the idea of the creation of a startup organization offers the right empirical illustration of a digital ecosystem's emergence and creation. The results indicate that leveraging digital technologies can lead to a digital ecosystem engaging organizational members toward ecological sobriety. The emergent digital ecosystem offers a new outlook on IT for Green, on innovating with disruptive technologies and on actions needed to curb carbon emissions.

Keywords: Sustainability, Digital business ecosystem, Case Study,

1 Introduction

As the only sector doubling the curve of GHG emissions in a decade (Pitron, 2021), digital technologies also have a paradoxical responsibility toward ecological sobriety. However, digital technologies also are a great source of innovation (Baudier et al., 2022) and may paradoxically be leveraged in order to support and trigger more ecological sobriety (Bohas & Poussing, 2016). A digital ecosystem puts forth innovative governance practices between organizations and people. As networked entities, digital ecosystems also rely on heterogeneous technologies, further increasing the innovative impact of their activity. We wonder how innovating with digital technologies can bring forth pathways toward more ecological sobriety, face the paradoxical responsibility of engaging people to consume less.

How can the emergence and evolution of a digital ecosystem sustain organizational and institutional carbon footprint reduction leveraging digital technologies?

To answer this question, we rely on a case study of an organization creating and developing a digital ecosystem rewarding low-carbon mobility transportation.

Exploratory research is called for concerning platform development role into the evolution of DBE (Senyo et al 2019, Sutherland & Jarrahi 2018). Also of interest is the integration of new technologies as blockchain into DBE, especially if it covers governance and regulation into Internet-driven DBEs. Our research is extremely timely in these aspects, as it aims at answering these gaps through our case study.

We extend digital business ecosystem literature studying the creation and emergence of a digital ecosystem (Senyo et al., 2019) in phases : first, leveraging IoT and platform architecture and second, leveraging decentralized blockchain-based business ecosystem for more transparency and security. Practitioners will be particularly interested in the particularly unique use of digital business ecosystem leveraging disruptive technologies towards ecological sobriety.

We first present the theoretical background, then expose our methodology. We then move on to the main results and discuss them.

2 Literature review

2.1 Digital business ecosystems

Business ecosystems emerged with Moore (Moore, 1993) from a biological metaphor and were extended to digital ecosystems when digital technology was acknowledged to play a dominant role between members of the ecosystem (Senyo et al., 2019). Digital ecosystems are defined as a community of individual, organizational, and networked entities that co-create value through information and communication technologies, also known as ICTs (Jacobides et al., 2018; Senyo et al., 2019). Participating members are linked together by activities that can be developed thanks to the characteristics of involved technologies. Without these technologies, these activities could not have emerged, however ecosystem participating members, and technologies, cannot be seen separately, it is the whole system, the relationships and the members that actively create the innovating collaborative environment (Pappas et al., 2018; Spagnoletti et al., 2021; Subramaniam, 2022). A perspective on digital ecosystem will favoring a lens seeing the ecosystem as whole is missing from the literature (Senyo et al., 2019). Digital ecosystems are particularly relevant when studying the current extension of sharing economy literature (Sutherland & Jarrahi, 2018).

2.2 Disruptive technologies

Disruptive technologies are known as such because on the more technical aspect, they disrupt the way businesses are formed (Gupta & Bose, 2022), create value (Henfridsson et al., 2018), exchange information and goods along the supply chain (de Reuver et al., 2018), promote digital ecosystems formation (Senyo et al., 2019) and platformization (Gawer, 2009). On the social side, disruptive technologies also alter how relate to authority, what we consider legitimate (Drechsler et al., 2020; Hinings et al., 2018), how workers symbolize their organizational identity (Eriksson & Ågerfalk, 2022), where and how they work (Holmström, 2018) but also how organizations interact with stakeholders (Tapscott & Tapscott, 2017).

Innovating can take several forms, activating business models, processes or management practices. In a digital context, digital innovation needs to be considered as a part of whole, in particular, digital technologies possibilities and constraints need to be explicitly taken into account (Nambisan et al., 2017). Disruptive technologies cover a broad array of digital technologies with specificities that go beyond traditional organizational boundaries and alter organizational identities. Their specificities trigger and facilitate what is known as digital transformation (Nambisan et al., 2017). However adopting a digital transformation approach needs to be done taking into account the systemic effects between individuals and technologies (Bijker & Law, 1994), favoring an ecosystem outlook (Subramaniam, 2022).

2.3 Sharing economy

The sharing economy perspective is not new but has similarly been extended by reflections on the effects and possibilities brought by information and communication technologies. While the research remains exploratory, the ensemble perspective delivered by a socio technical approach is the most promising (Dillahunt et al., 2017) but is still very much lacking while business model and computer science sharing economy applications have taken up (Sutherland & Jarrahi, 2018). Empirical research is needed to understand how technology mediates and is embedded in larger social contexts (Nelson et al., 2017), or societal challenges like sustainability issues (Sutherland & Jarrahi, 2018).

2.4 Understanding ecosystems from multiple perspectives

As technical artifacts showcasing modular characteristics, digital technologies can be recombined and arranged according to the needs of their users or of ecosystem designers (Holmström, 2018; Nambisan, et al., 2017; Spagnoletti, et al., 2015). The modularity enables to give rise to ecosystems mediating data and information.

The dependencies, value co-creation strategies, network externalities or governance practices are shaped and enabled by the relationships and mediations enabled in ecosystem. As networked entities, digital ecosystems rely heavily on the nature of the relationships enabled by the technical architecture.

To better understand how technology mediates and is embedded in larger social contexts, one needs to first explore the specificities of each technology.

Internet of Things, or IoT, “ allows information to be exchanged between the product and its operating environment, its maker, its users, and other products and system” (Porter & Heppelmann, 2014, p. 6). Data is exchanged thanks to incorporated captors, labels or ‘puce’. Once they can communicate, disruptive technologies appear to be enmeshed: at the core of the system, advanced capabilities of these objects can exist outside the product. These capabilities can become very advanced and leverage other disruptive technologies like AI, blockchain, smart contracts, cloud computing.

IoT enable four activities, made possible by the combination of connectivity and intelligence: monitor, control, optimize and autonomize (Porter & Heppelmann, 2014).

Blockchain technology provides access to and warrants the authenticity of large amounts of data inside and outside the organization (Baudier et al., 2022). Blockchain supports AI to provide more insights, manage model sharing and data usage, and create a data economy (Casino et al., 2021).

Two different approaches cover the crossing of technologies and ecology research streams. Green IT focuses on the ecological impacts of digital technology while IT for Green refers to an application of digital technology with an ecological sobriety intention (Olawumi & Chan, 2022).

3 Methodology

3.1 Case study

To study the question of the emergence and creation of a new digital ecosystem to sustain and reward the development of low carbon mobility, we chose to rely on a qualitative methodology (Myers, 2019), the exploratory case study (Baskarada, 2014). Indeed, cross referencing both low carbon mobility and digital ecosystem places our research as exploratory, since it has not been researched before. The initiative of rewarding low carbon mobility is disruptive and underexplored. Relying on the creation of a new digital ecosystem is made possible through disruptive digital technologies. Because of the importance of the evolution across time, our research also needs to be longitudinal to reflect the different phases of the development (Van de Ven, 2007).

3.2 Data collection

We collected data from the beginning of the idea in 2019 throughout the creation and development of the case organization until 2022. We collected data mainly through bi-monthly interviews with the case organization founder, also relying on internal confidential documents like pitch decks and slide presentations, external press releases, email exchanges, market studies or organization presentations to prospective partners. We also observed during 40 hours pitch interviews with prospective partners and customers, temp workers management meetings for external consulting missions or internal meetings. Data analysis consisted in an events-based analysis (Hussenot et Missonier).

3.3 Case setting

The case organization, C02mmon is a startup aiming to incentive low carbon mobility through rewards that can be redeemed within an ecosystem of partners. C02mmon rewards individuals who favor low carbon mobility that can be tracked and measured through their application in a first stage. Every time a user avoids high carboned mobility transportation and prefers a low carboned mobility, he will earn greencents. The reward, greencents, can be redeemed through an ecosystem of partners. In exchange, partners such as restaurants, shops, cities or companies use the membership to the ecosystem as Marketing tool. Indeed they benefit from their public participation into a promoting sustainability ecosystem. Also, they will be charged much less when receiving greencents than when emitting them, further encouraging them to commit to the digital ecosystem. In addition, C02mmon will charge partners for using the system for official, financial, tax, HR or marketing purposes through the rewards and certificates it emits, by accepting and being visible in the application to attract new or existing customers interested by sustainable initiatives. Another phase is planned to develop a decentralized functioning of the ecosystem.

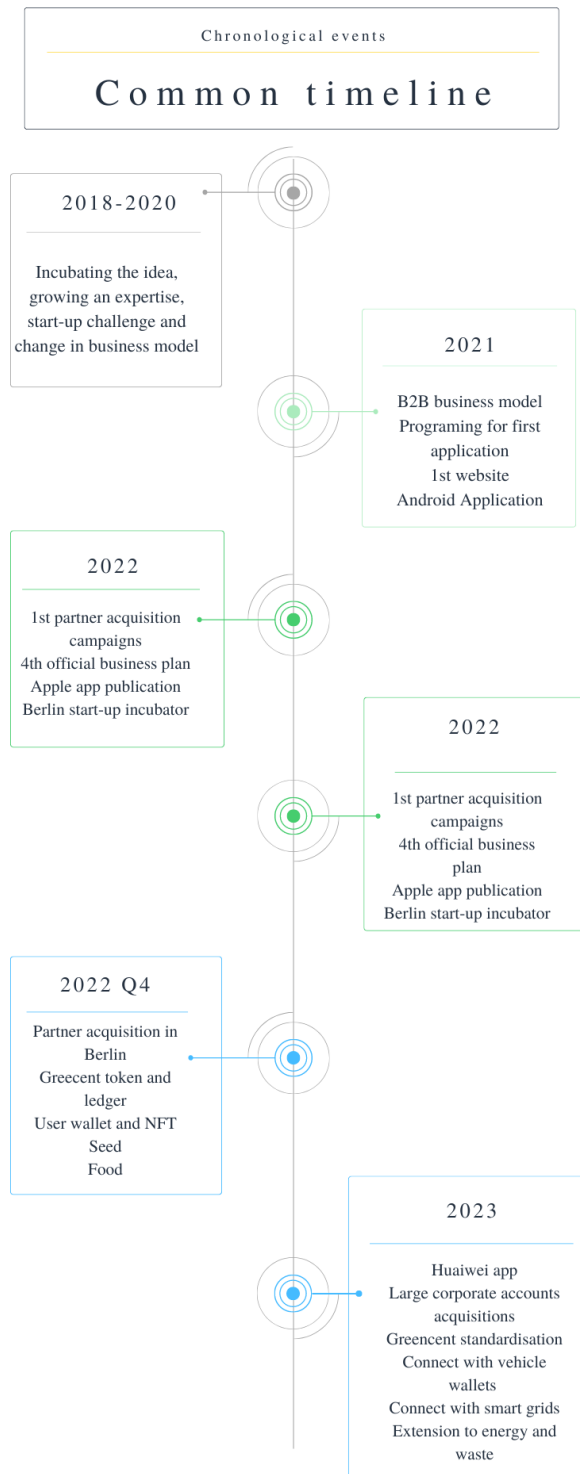


Figure 1 : chronology Common

2018	Idea : : Initial founder's first book on digital currencies and registers is published in France
2019	the Wirecard Innovation Challenge 2019 first as an evaluator, then as a com-

	petitor with Tailored Contribution Systems, a proposition for a new generation VAT based solely on the carbon footprint of individual components and ingredients of products, as can be seen in this article. TCS relies on governmental stable digital currencies which are dedicated to a specific ingredient/component and to levying corresponding taxes when the product is purchased.
2020	Wirecard finale : advice to turn the tax into an ecosystem Meeting with cofounder via Startup online, an event for founders organised by an Austrian incubator (Zero21) 1st business plan (B2C business model) Talks with an Italian public incubator from Rom about a possible investment of €100k, but they choose to invest in other projects. 1st website published based on WordPress.
2021	B2B business model adoption Programming for first application Reflection around IoT (movement measurement algorithm) Android application publication
2022	first partner acquisition campaign in Paris Other partner acquisition campaigns in Munich 4 th business plan Apple app publication Leipzig refusal Berlin success

3.4 Case results

3.4.1 A process for an emergent digital business ecosystem involving disruptive emergent technologies

Phase zero : incubating the idea

2018: Initial founder's first [book](#) on digital currencies and registers is published in France, in which Initial founder mentions the concept of dedicated currencies and tax rates correlated to the environmental impact of products.

October 2019 - January 2020: Initial founder takes part in the [Wirecard Innovation Challenge 2019](#) first as an evaluator, then as a competitor with Tailored Contribution Systems, a proposition for a new generation VAT based solely on the carbon footprint of individual components and ingredients of products, as can be seen in this article. TCS relies on governmental stable digital currencies which are dedicated to a specific ingredient/component and to levying corresponding taxes when the product is purchased. Initial founder won the contest against 60 competitors but could never enjoy his prize because of the pandemic! The event (SXSW) and the flight to the event were cancelled. See [here](#) for more information.

January - June 2020: During the finale of the Wirecard Innovation Challenge in Munich in January 2020 and at the beginning of his collaboration with Wirecard toward the implementation of TCS, several people advise Initial founder to turn his idea of a tax into a reward, which he does in February,

after having contacted and received a negative answer from the EU about his idea of a VAT based exclusively on the carbon footprint of ingredients and components. Wirecard pays for a graphic designer and a consultant to accompany Initial founder. He also starts discussing with iExec, a figure-head of the French blockchain scene, about the adaptation of TCS into a congestion charge called [Ignite](#).

June 2020: Initial founder participates in Startup online, an event for founders organised by an Austrian incubator (Zero21) and meets Cofounder. Since they have a very similar concept, they decide to unite their forces. Initial founder accepts to use the name "Common" and has been working with Cofounder ever since.

November 2020: Initial founder creates the first business plan for Common, which describes the B2C business model Common was then developing. Initial founder and Cofounder talk with an Italian public incubator emanating from the Lazio region (Rome) about a possible investment of €100k, but they choose to invest in other projects. Our first website is published; it is developed by Initial founder and based on WordPress.

January - March 2021: Initial founder and Cofounder participate in eBridge, an acceleration program led by the Munich University of Applied Sciences (Hochschule München), get a dozen of coaching sessions and a prize at the final pitch session, see attachment. They also recruit two additional team members, Youjin and Michael: Initial founder and Cofounder are not alone anymore. All work with the French start-up [Rob](#) on the second version of the Common website.

April - June 2021: Common adopts a B2B business model. A new business plan is published in June. They participate in MGIS, an acceleration program led by the three main universities from Munich. They part ways with Michael and Youjin in June.

Phase 1 creating the greencent ecosystem : a centralized multi-sided platform based on IoT and an application

After a period of incubation, Common adopts a business to business model. They develop an app and recruit programmers to do so.

August 2021 Common starts testing the first version of the app developed by 1st programmer; two interns work with 1st programmer on the movement measurement algorithm.

September 2021: 1st programmer publishes the app on [Android](#); they recruit 3rd programmer to work on the Apple version. 3rd programmer is a student in computer science at the RWTH (Aachen).

October 2021: the third version of the business plan is published. Common participates in a contest called M-Sec with a Japanese city (Fujisawa) to use Common for garbage collection as well as a [Horizon tender](#) with partners from several European countries (France, Slovenia, Italy, Austria).

November 2021: Common is a finalist of the [Circular Urban Challenge](#) in Spain. Initial founder presents Common physically in Logroño, La Rioja.

In March 2022, a first customer acquisition campaign is led with students in Paris.

In April 2022, a fourth version of the business plan is published.

May 2022: A Social media manager joins Common; she takes over our social media communication.

June 2022, talks with the city of Leipzig (600,000 inhabitants) to implement Common into their public transportation system fail. Leipzig chooses another startup: Ryde up.

But in August 2022 Common is chosen by the city of Berlin for an intensive incubation program with financial support for the three associates.

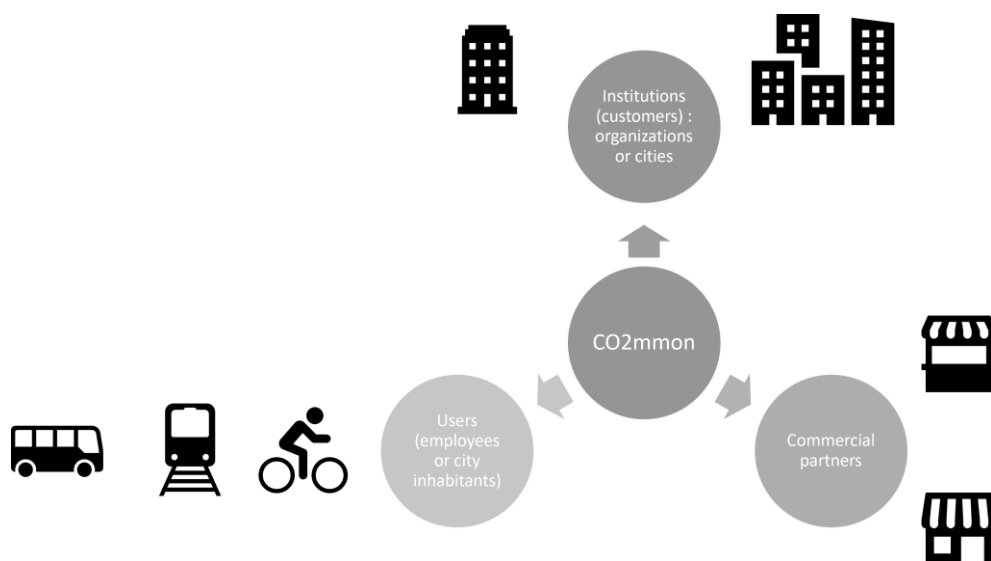


Figure 2 Centralized multi-sided platform

Common sell partners access to the greencent system they created and manage, as well as the services provided by the Common app, most notably measurement services, which enable users to be rewarded from this system through the activities they perform.

Common charge partners for using the ecosystem for official, financial, tax, HR or marketing purposes through the rewards and certificates it emits, by accepting greencents as a means of payment and being visible in the app to attract new or existing customers. Common charge them a monthly fee or a fee per greencent depending on their decision (see business model part). As partners give away something in exchange for greencents, they are charged much less when receiving greencents than when emitting them.

The validator system :

Common and the greencent system are two different entities: - In the greencent system, greencents are allocated to users according to the “1 greencent for 1 kg of non-emitted CO2” principle. The system receives raw, anonymised data from so called validators and converts this data into greencents. If it receives for example “user xyz performed 23 km by bus”, then it would allocate 0.7659 GC to this user. The greencent system will be decentralised and conceived to be used by validators measuring various activities in various countries. - Validators are centralised, identifiable entities recruiting, onboarding and managing users and partners, and measuring user activities in specific areas and on specific territories, for example energy consumption in Belgium. They are all connected to the greencent system, to which they constantly send raw, anonymised data on user activity which the system converts into greencents as described in the previous point. Common is a validator of the greencent system in France, Germany and Hungary for mobility and food (hospitality).

Phase 2 API implementation

Common plans to implement an API to better track movement services. Doing so, they plan to become a true data provider. The objective is to develop an API protocol to let Common connect easily with other apps. For example, in mobility, connecting directly with the public transportation app or the app of an e-scooter provider such as Bolt or Lime will enable them to get the data first hand. For the hospitality sector, shops and supermarkets, connecting Common directly with their cashing system, implementing Common as a loyalty system based entirely on the CO2 footprint of goods and meals bought by users. The price of goods and services isn't taken into consideration at all.

There are a great deal of private and public organisations who are already capable of measuring activities and managing customers: let's enable them to connect easily to the greencent system in order to expand rapidly and establish the greencent as the currency representing the environment in digital payment systems of the near future.

Validators will measure specific activities on specific territories and report their measures in a standardised and anonymised way to the greencent system

Measure at least one specific activity on one specific territory in terms of CO2 savings
Apply the greencent allocation rules of the system, for example currently 0.1303 GC per km of cycling
Get reference figures specific to their territory and their partners, for example the CO2 footprint of tramways of a city which belongs to their territory
Acquire and manage users, which they could have had before joining the greencent system
Provide them with measurement services as well as offers to spend their greencents through an app which must be free to download and use for users
Deliver the greencent system with raw and anonymised data on activities performed by their users

Table 1 Criteria for validators

Reference figures to calculate rewards

Activity	Mobility	Food (hospitality)	FMCG
Reference measure	Ride of one person in a car in urban areas	Average of the category (for example: main dishes) at the restaurant where user is ordering	Average of the category (for example: cereals or jeans) in the user country
Activity	Internet usage	Waste	Energy consumption
Reference measure	Average monthly Internet related CO2 footprint per capita in the user country	Average monthly waste related CO2 footprint per capita in the user country	Average of the CO2 footprint of a kwh in the user country

Table 2 Reference figures to calculate rewards

Phase 3 decentralising the greencent ecosystem via a token adoption & 4 delegating the validator system with a blockchain technology

Common intends to establish the greencent system as a decentralised system. They plan to base on an existing cryptocurrency ecosystem such as the iExec ecosystem or the Flow service. They will use the Proof of Stake algorithm to continue to be in line with their sustainable goal. Indeed, contrary to Proof of Work algorithm, popularized by Bitcoin, Proof of Stake algorithm warrants authenticity with lesser energy consumption.

At that stage, users will be equipped with a wallet and Common will develop a protocol to enable organisations to become validators

As soon as every vehicle is equipped with a wallet and every good and meal has a digital identity on a digital register, Common plans to be connected with these and truly evaluate the carbon footprint needed for measure. Common will connect through the user wallet and the vehicle wallet with buses, subways, trains, e-scooters etc. in a couple of years, so we will know for sure 1) in which vehicle our user is currently traveling, 2) how much CO2 this vehicle emits per km and possibly 3) how many

people are currently in the same vehicle, enabling them to calculate the reward in a very accurate and transparent way.

4 Discussion

We wondered how the emergence and evolution of a digital ecosystem could sustain organizational and institutional carbon footprint reduction leveraging digital technologies. To answer this question, we relied on a case study of an organization creating and developing a digital ecosystem rewarding low-carbon mobility transportation. Exploratory research had been called for concerning platform development role into the evolution of DBE (Senyo et al 2019, Sutherland & Jarrahi 2018).

Our case study and findings illustrate how the process of creating a Digital Business Ecosystem integrates the phase of a multi-sided platform to establish legitimacy and build a Business to business ecosystem that brings value to all partners and users. The multi-sided platform phase is important to build the legitimacy, bring together the ecosystem and bring value to all partners and users before going to a more complex phase. Acting as an anchoring organization, validating the data, implementing dual accounting, training partner organisations and educating to a CO₂ accounting represents a transitional phase. To fully build up awareness, practices and expertise, the anchoring organization, acting as a platform, first centralize the legitimacy, the expertise, knowledge and strategic vision. The platform also carries the responsibility for reference figures, movement tracking and true CO₂ weight and gains.

Platform development and management (Sutherland & Jarrahi 2018). Benefits of platform development come from network externalities, the capacity to scale and reach, which are echoed in our findings. In the creation of DBE, the need for legitimacy will go through scaling and reaching. Visibility is an accelerating factor. Getting known, and committing partners and users is a difficult first phase in the creation. While usually, when creating a business, an organization will look for a customer base, will share content and use marketing tools, among which some are going to be digital. In the case of the creation of an ecosystem, there is an added need to convince the value brought by the new ecosystem, on top of creating a sound business model. While transactions have also been outlined as central in platform research (S&J 2018), our findings show how the evaluation, confrontation to a reference figure and truthfulness of data is central to the reflection underlying the digital technologies evolution process. Indeed, the integration of blockchain technology puts forward the will to decentralize the responsibility scale and reach rapidly to better automatize transactions and validate them through APIs with other Internet-based applications.

The control and governance of the service is central to understanding the integration process of digital technologies.

The integration of new technologies as blockchain into the DBE comes later. Governance and regulation have been outlined as central in the first transitional phase.

The transition from a native external application and service, centralized by an external organisation through a platform organisation to a fully decentralized digital ecosystem suggests sharing economy platforms could be a transitional phase towards a digital decentralized ecosystem, where certificates are emitted by partners aiming to reward individuals who prefer low carbon emission mobility over other types of mobility.

As our case shows, to fully muster a digital ecosystem, an anchoring organisation is necessary before evolving towards more decentralized, waiting for practices and expertise to be transferred to participating members.

5 Conclusion

This paper discussed the launch of a digital ecosystem, committed to support and reward low carbon footprint mobility of individuals and grant higher visibility to organisations who commit to this emergent ecosystem. This digital ecosystem is birthed out of sheer will of a start-up organisation that transitions from leveraging IoT and mobile phones to fully activate a digital ecosystem relying on a digital currency and blockchain certificates.

Exploratory empirical research is needed to provide an illustration of the platform and digital ecosystem creations (Holmström, 2018; Subramaniam, 2022; Tan et al., 2009). Our research suggests platform could be a transitional phase towards a digital ecosystem leveraging innovative disruptive technologies. We also extend previous research on digital ecosystems (Senyo et al., 2019)

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