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Business Models Embedding Ecosystem Services to tackle Climate Change

The case of Digital Climate Solutions

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Purpose

This research explores Business Models for Sustainability (BMfS) developed by emerging enterprises that use digital technologies (DT) and ecosystem services[1] (ES) as part of their value proposition and that were born with the purpose of addressing climate change issues (climate native companies).

One of the first academic articles referring to BMfS was in 2008 by Stubbs (Stubbs, 2008), where a sustainable business model was defined as "a model where sustainability concepts shape the driving force of the firm and its decision making". Under BMfS, sustainability is considered part of the business strategy itself, not as add-on (Stubbs, 2008). According to Dyllic (2016), a truly sustainable business reflects on questions that go beyond traditional considerations. In fact, it reflects on questions, such as: "How can business contribute with its products and services to resolve pressing sustainability issues in their societies?" (p.165).

In line with this, the rapid development of DT in the last decade has empowered new business solutions with the potential to significantly contribute to the challenge of climate change (CC). According to Gregori and Holzman (2020), DT contribute to the development of new value propositions that combine environmental, social and economic value. Digitalization is also seen as a 'problem solver' for CC (Lenz, 2021) and can contribute to the development of smart solutions to many environmental problems related to CC in sectors, such as: health, farming, food security, manufacturing, among others (Eteris, 2020).

According to George et al. (2019), entrepreneurs are already employing DT to address key sustainability challenges, not only through technology innovations, but also through the development of business models (BM) that provide a new purpose to the innovations. They state that management scholars are yet to embrace the urgency of CC and sustainable development in their work, identifying as one of the main avenues for future research the need to investigate

[1] According to the Millennium Ecosystem Assessment (2005), ecosystem services can be defined as the benefits people obtain from ecosystems. These include provisioning services; regulating services; supporting services; and cultural services.

innovative BMfS. In particular, there is a need to understand how ecosystem services can be part of the value creation of these BMfS, as stated in the call for this Conference.

The research questions addressed in this research are: *How are new business models for sustainability based on Digital Climate Solutions (DCS) supporting and advancing climate change actions? and How are natural ecosystem services part of these new business models' value proposition?*

Design/Methodology/Approach

This empirical research is based on multiple case studies. This method offers the opportunity of a holistic view of a process (Gummesson 1991, in Patton and Appelbaum, 2003), and also allows an investigation to retain the holistic and meaningful characteristics of real-life events (Ying 1984, in Patton and Appelbaum, 2003). The justification for cases studies also rests on the phenomenon´s importance and the lack of visible theory and empirical evidence (phenomenon-driven research questions).

With this aim, semi-structured interviews are primary sources of data. A questionnaire addressing aspects of company strategy, KPIs and BM design was developed aimed at CEOs and founders of the companies (near 20 questions in total) in an interview lasting 45 minutes conducted via Zoom. The type of questions included: market need being addressed, main innovation being proposed, value proposition and value capture mechanisms, CC objectives and KPIs, description of the DT and NCS components, among others.

These companies are mainly start-ups, with an average of 10 employees, from the UK and Europe, and were selected based on recommendations and referral by related official programs (e.g. Net Zero program, EIT Climate-KIC) and other sources (e.g. Tech Nation program, web searches, experts on the field). Secondary data was also collected from publicly available reports, websites, newspaper, journal articles, and internal company documents. In addition, a desk-based research of companies in the UK Tech Nation Program was conducted together with the review of other outstanding DT companies of interest, to understand and compare their value proposition in relation to digital technologies and ecosystem services.

The framework for analysis is based on the systems dynamic's perspective, particularly looking at causal-loop diagram, as presented in Casadesus-Masanell and Ricart (2010).

Findings

As this is an on-going investigation, the following are preliminary findings mainly based on a sub-set (desk analysis). Thus, two types of value propositions were found: mitigation and adaptation value propositions. From the group of 60 climate tech companies that are part of the UK Tech Nation Program, around 90% of the companies focused on mitigation value propositions.

Mitigation value propositions include offerings related to energy efficiency, new materials, waste management, electric transport, carbon sequestration, among others. In particular, examples related to ecosystem services include the restoration of habitats, insect's

bioconversion capabilities, and the provision of information to invest in sound carbon offset projects, with the visualisation of the impact of the investments, and monitoring over time. Adaptation value propositions include services to identify, prevent, anticipate, and mitigate the impacts of CC on companies' assets.

75% of these companies are CC natives (i.e. companies that were created with the aim of tackling CC), 70% of them have DT as part of their value proposition, while 5% of these companies have ES as part of their value proposition. In terms of targeted sectors, the most commonly mentioned are: transport, energy, construction and food, although very often these companies declare to be agnostic to sectors (implying that their value proposition is wide reaching).

DT embedded into the BM that were studied include: Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), blockchain, satellite images, among others, and their business models (BM) usually consider a combination of these technologies. Some of these companies improve the CC decision-making process for their clients (e.g. deciding on a portfolio for carbon offsetting), others deal with CC risks (insurance, smart contracts, climate intelligence) while others attempt to directly contribute to carbon sequestration through the restoration of ecosystems or the promotion of tree planting. Figure 1 is a preliminary and simplified model of the value creation of a DT climate native company. It is a search engine which main aim is to contribute to address CC by using the natural capacity of trees to capture CO_2 from the atmosphere.

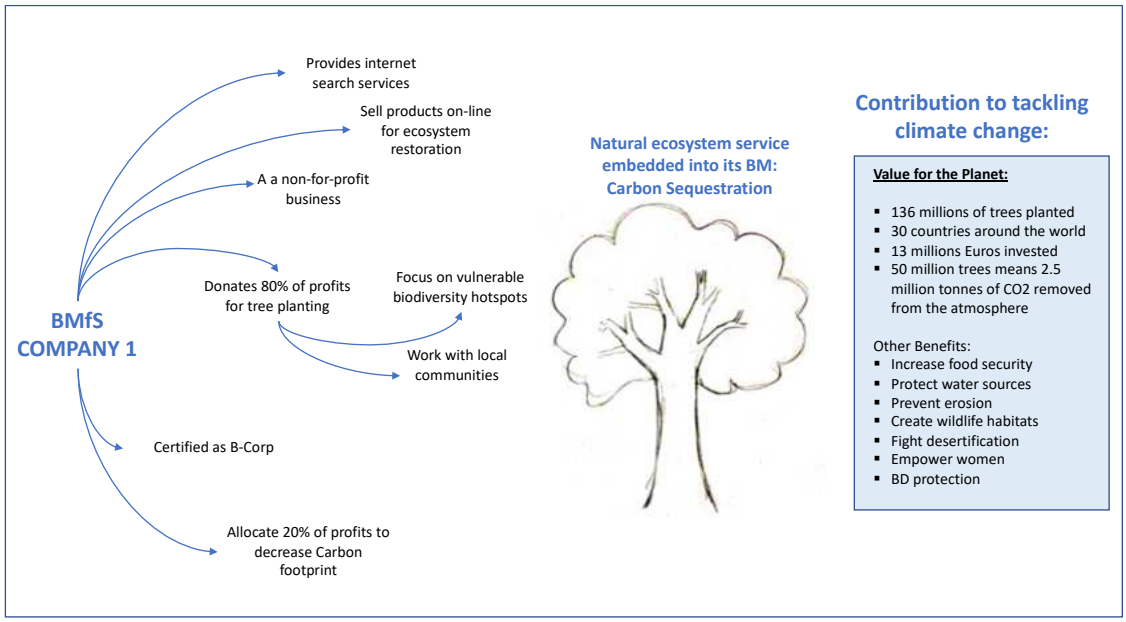

Figure 1: Simplified business model of a climate native company that considers natural ecosystem services in their value proposition.

The barriers to further DCS include: the need to build credibility and climate literacy, the ability to collect the best possible data, the uncertainty inherent to this complex challenge, plus aspects of data protection, and confidentiality.

Relevance/Contribution

This research contributes to the debate at the intersection between Climate Change and Digital Technologies (the Sustainability and Digital Imperatives) from a system dynamic perspective. It provides an insight on how DT are enabling new value propositions that incorporate ecosystem services as part of innovative business models for sustainability. Figure 2 shows a general preliminary framework to understand this dynamic.

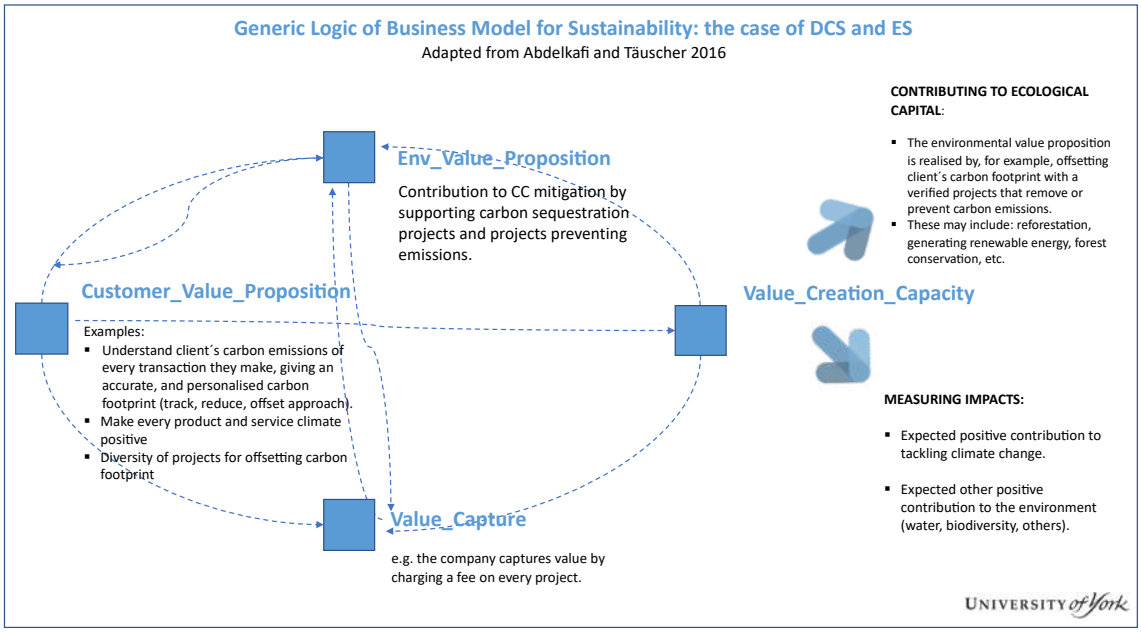

Figure 2: Generic Logic of BMFS: the case of DCS and ES.

The theoretical framework emerging from case-based research can advance and stimulate new approaches to inspire entrepreneurs, businesses, and institutions to make further progress in DCS and ecosystem services. It can also support decision makers, managers and entrepreneurs, in understanding how the business model and its value proposition can benefit the natural environment.

In particular, this is a contribution to Theme 1 of this conference ("Exploring the system level"), specifically to the question: *How can we design new business models to support value capture from ecosystem services?*

Preliminary Conclusions

Under the systems dynamic's perspective, this research is showing the interaction between innovative BMfS, their value creation and value proposition, the role of ES within this BM, and the expected benefits for the environment (particularly regarding CC), thus contributing to the research gap initially stated.

In addition, it seems clear that emerging enterprises face numerous challenges and opportunities in relation to this ambition to contribute to tackle CC though DCS and innovative BM.

Limitations of these findings include the fact that this research is still ongoing, so it is expected that new information and data will become available. In addition, the amount of companies to be interviewed (between 10 and 20) may be considered to some extend limited.

Finally, it is considered that there is a great potential to conduct further research on the interaction between these concepts in order to improve the understanding of the system and contribute to both management theory and practical recommendations for policy makers, managers and entrepreneurs.

Keywords:

Business Models for Sustainability, Climate Change, Digital Technology Solutions, Ecosystem Services, Case studies, System Dynamics.

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