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ACCELERATING THE TRANSFORMATION OF ORGANISATIONS TOWARDS SUSTAINABILITY THROUGH CARBON CREDITS AND OFFSETS

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Abstract

One of the most important issues to keep the planet and us in a safe space is to reduce global CO2 emissions. The responsible use of carbon credits can contribute to this decarbonisation race. The aim of this paper is to explore new ways in which carbon credits and offsets can be integrated into the business model innovation process of organisations in order to balance and increase their overall social, environmental, and economic performance. The research methodology selected was Design Science. A tool, turned into questions, was designed and tested. From the results, the Co-benefit concept emerged. This is any other social, environmental or economic value created through a carbon credit project, separate from offsetting via reduced, avoided or removed CO2. It can also be understood as a side effect, consequence or extra effect of a carbon project. To innovate as desired using carbon credits it is necessary to identify and assess the intrinsic and Co-benefit values created in carbon credit projects and evaluate, innovate and think of creative ways so the company itself, other companies, clusters, communities and the environment can capture some of that created value. Companies can start looking proactively for Co-benefits in other innovations and activities, not just carbon credits, to remain profitable, or even generate more revenues, while contributing in new ways to People and the Planet.

Key words: Design science, carbon credits, innovation, sustainability, business models, Co-benefits, decarbonisation.

INDEX

INTRODUCTION

The Planetary Boundary framework is a science-based analysis of the risk of human actions destabilising the earth system at a planetary scale (Steffen et al., 2015). The transgression of these limits thus is creating substantial risk of destabilising the Holocene state in which modern societies have triumphed (Steffen et al., 2015). This means that in order for humankind to prosper on this planet, it is necessary to operate in a safe space (Edwards, 2021). Climate change and biosphere integrity are recognized as core planetary boundaries based on their fundamental importance (Steffen et al., 2015). The control variable for climate change is the atmospheric carbon dioxide (CO2) concentration, parts per million. Therefore, one of the most important issues to keep the planet and us in a safe space is to control and reduce our global CO2 emissions and CO2 equivalents.

This is a gigantic problem because as of today a country's economic development is linked to its energy production and consumption, closely related to CO2 emissions (Cheng, Sinha, Ghosh, Sengupta, & Luo, 2021). Furthermore, all humanity faces challenges as a result of rising energy demand and climate change (Chen, Zhao, Lai, Wang, & Xia, 2019). According to the Global Energy Statistical Yearbook, global energy consumption reached 14391 Megatonnes (Mt) of oil equivalent in 2019, growing at a 2.3 percent annual rate, the fastest rate in the decade, while global CO2 emissions from fuel combustion increased by 1.9 percent to 32915.9 Mt in 2018 (Aslan, Destek, & Okumus, 2018; Huang et al., 2019). However, this rising danger is not only linked to energy, economic growth overall resulted in approximately 36 billion Tonnes of carbon emissions each year, with an average of 4.8 Tonnes per capita (Huang et al., 2019).

There are significant tensions among CO2 emissions, the environment, and the, for the moment, inexhaustible ambitions of companies and countries for economic growth. Still, global

decarbonisation goals have been set to try to avoid the disastrous consequences mentioned above. Keeping global warming below 2 degrees Celsius, preferably 1.5 degrees Celsius, and achieving carbon neutrality by 2050 (Safi et al., 2021) are the most representative ones. In order to meet these goals, a challenging technological, economic, and cultural decarbonisation transition in a race against time is necessary (Di Febo, Ortolano, Foglia, Leone, & Angelini, 2021; Edwards, 2021; Safi et al., 2021).

To assist and accelerate this transition, global CO2 emissions can also be offset through various techniques (Di Febo et al., 2021). This is where the carbon credits industry comes in, as an aid to speed the transition and dreams of overall carbon emission reduction. Each credit – which corresponds to one Metric Tonne of reduced, avoided or removed CO2 or equivalent GHG[1] – can be used by a company or an individual to compensate for the emission of precisely one Tonne of CO2 or equivalent gases. When a credit is used for this purpose, it becomes an offset and it is no longer tradable (Favasuli & Vandana, 2021).

However, the existence and use of carbon credits create new challenges of their own, closely related to the tensions noted early. First of all, companies may use them as a way to clean up their image or buy their redemption (Guix, Ollé, & Font, 2022; Mateo-Márquez, González-González, & Zamora-Ramírez, 2022), as a modern version of the purchase of indulgences from the Middle Ages. This could happen if a company maintains or increases over time polluting core industrial production processes, and at the same time tries to show that it cares about the environment by purchasing and promoting CO2 emission neutralisation. The second challenge is that carbon credits may become a distraction from what really matters: having an operations decarbonisation plan (Mateo-Márquez et al., 2022). Organisations that

spend a lot of effort and resources on offsetting their emissions externally, while neglecting to examine and analyse their own processes, are a good example.

In order to address these challenges, it is important to educate companies and customers to understand that offsets should not be treated as the ultimate solution. It is true that they can be part of the answer, but they need to be seen as a means to offset today's hard to avoid emissions, as a way to make the transition less harmful to the environment, and as a tool for raising awareness of the major environmental problem we face. We can consider these three ideas as the responsible use of carbon credits, while contributing to the decarbonisation race. A good example can be a company that has a detailed and realistic plan to reduce CO2 emissions in its own operations. This plan may have milestones for 2030, 2040 and eventually reach near zero by 2050. As the company gradually implements its emission reductions, it can neutralise its remaining CO2 emissions for the year with carbon credits.

Going one step further, extensive literature has explored corporate sustainability strategies that are challenged to recognise both, economic sustainability as well as social and environmental sustainability equally (Parnell, 2008). In this literature social and environmental initiatives are not considered as expenses or just good intentions, decoupled from the company's business model. To achieve this specific integration is the target and purpose of a Business Case for Sustainability (Schaltegger, Freund, & Hansen, 2012). The former concept proposes that a business case for sustainability can be created by addressing six core business case drivers. They furthermore argue that to strategically create business cases for sustainability, innovation in the business model is required.

This study recognises the potential positive environmental impact of the responsible use of carbon credits and is inspired by the Business Case for Sustainability. As a result, the aim of this research is to explore new ways in which carbon credits and offsets can be integrated into the business model innovation process of organisations in order to balance and increase their overall social, environmental, and economic performance. This brings us to the research question:

How can we use carbon credits and offsets to accelerate the transformation of organisations towards sustainability?

If opportunities are creatively identified and designed, it is expected that the incorporation of carbon credits can also increase business profits and support the design of more equitable societies. This can enable markets to allocate carbon more efficiently and also to allocate it to the most efficient uses. Also, serve as a motivation for more organisations to use carbon credits in a responsible and strategic way, adding more allies to the race against the doomsday clock.

This study uses the concept of the Triple Bottom Line or 3Ps: People, Planet and Profit. People is related to the social impact an organisation can have, Planet to the positive impact generated for the environment, and finally Profit stands for the idea that without a good way to capture value and build a company that can sustain itself over time, the possible long-term sustainability of the organisation is compromised (Elkington & Upward, 2016). What is sought is to always keep in mind the "P" for Profit when looking for positive social or environmental impacts. Doing this, carbon credits are not just a cost to achieve a positive environmental impact, counteracting emissions. They can be much more.

There are four expected contributions. First, and most important, demonstrate that the interests of communities and the planet can and should be aligned with the interests of companies. This is the anchor of the paper when looking for innovative ways to use carbon credits and their role in organisations. Second, it is practical for managers in companies that are interested in starting to work with carbon credits and may need some extra (Profit) motivation for using them. Third, try to increase the demand and responsible use of carbon credits, which may ultimately have the positive results mentioned above. Finally, stimulate the conversation and motivate other academics to research new paths in which carbon credits can be used to innovate and improve the sustainable performance of companies.

In the literature review, a framework explaining the acceleration process will be shown. In the methods section, a Phase 1 Design Science process (Holmström, Ketokivi, & Hameri, 2009), together with the approach to be followed, will be presented, including how it will serve as an instrument to find the first insights on how to answer the research question. The results section shows the outcomes of the creative exercise, conducted through the tool converted into semi-structured interview questions with sustainability and carbon credits professionals. Finally, the discussion section explains the main conclusions, recommendations, limitations, and future research suggestions.

LITERATURE REVIEW

The Business Model

In order to see how carbon credits can be used by organisations, it is necessary to understand how these organisations work. This is precisely what the theory of business models is for. A business model is a conceptual tool that can be used for analysis, comparison, and

performance assessment, management, communication, and innovation to better understand how a company operates (Osterwalder, Pigneur, & Tucci, 2005). Business models are focused on how a company defines its competitive strategy through the design of the product or service it provides, how it charges for it, what it costs to produce, how it differentiates itself from competitors through the value proposition, and how it integrates its own value chain (Rasmussen, 2007).

Innovation in Business Models

This study aims to work with carbon credits in a different way. As previously mentioned, considering the three dimensions People, Planet and Profit, that together bring us closer to Sustainability (Elkington & Upward, 2016). When different paths are taken to achieve new desired outcomes, companies need to change. Companies need to innovate. Business model innovations for sustainability are characterised as changes in the way an organisation and its value network create, deliver, and capture value, or changes in their value propositions, that have a substantial positive and/or reduced negative effect on the environment and/or society (Bocken, Short, Rana, & Evans, 2014).

Business Model for Sustainability and Carbon Credits

When companies consider not only their economic performance, but also the previously mentioned social and environmental performance, the Business Model for Sustainability arises. The business model for sustainability helps describe, analyse, manage and communicate (i) a company's sustainable value proposition to customers and other stakeholders, (ii) how it creates and delivers this value, and (iii) how it captures economic value while maintaining or

regenerating natural, social and economic capital beyond its organisational boundaries (Schaltegger et al., 2012). Corporate sustainability initiatives are challenged to take into account economic, social, and environmental sustainability (Parnell, 2008).

The present study seeks to add to this challenge the creative use of carbon credits and offsets. There are different ways to utilise and innovate within the carbon credit industry. These are the trade of carbon credits, capturing, reducing and avoiding CO2, generation of carbon credits in house, investing and financing, and adding them to the supply chain of the company.

Core Business Case Drivers

In light of this last point, the Core Business Case Drivers, detailed in **APPENDIX A**, are considered. They are Cost reduction, Risks reduction, Sales and profit increase, Reputation and brand value increase, Increase attractiveness as an employer, and Increase capability to innovate (Schaltegger et al., 2012). They are relevant because their goal is to strike a balance between the economic side, and the social and environmental one, subject of the paper. These core business cases drivers help interested parties to consider the "P" of Profit every time social or environmental improvements are sought, so that sustainable innovations can be interpreted as investments and not only as expenditures. Thus, social and environmental actions properly planned and implemented will end up generating or boosting economic performance (Schaltegger et al., 2012).

Business Case for Sustainability

Building on the previous concepts, the Business Case for Sustainability appears. The latter addresses the importance of tying proactive and innovative environmental and social

activities to the company's economic performance (Core Business Case Drivers), as well as how these relationships might be controlled, improved, or reinvented to increase economic success through voluntary social and environmental activities (Schaltegger et al., 2012). Carbon credits are considered as one of the voluntary social and environmental activities.

At this point in the literature, it is essential to remark that companies are missing out on potential from sustainability. According to theoretical and empirical studies, most organisations appear to have the potential for one or more business cases for sustainability (Schaltegger & Wagner, 2006), but they do not take them into account or consider in a manner which is proportional to all the possible advantages they are capable of delivering. This potential is frequently overlooked due to skewed accounting and management information systems and other organisational rigidities. As a result, management faces a difficulty in figuring out how to turn prospective business propositions into reality through proper sustainability management (Schaltegger & Burritt, 2000; Steger, 2004; Wallmann, 1995). This situation emphasises that sustainability requires the creation of a business case. That's why the present research is being done: to raise awareness of possible paths of sustainable innovation using carbon credits and offsets as a link to generate social, economic and environmental value.

Strategic management is required to discover, construct, and deepen the linkages between non-monetary social and environmental activities on the one hand, and business or economic performance on the other, in order to provide a business case for sustainability (Schaltegger et al., 2012). The essential question, and the foundation for any management of a business case for sustainability, is how profit-generating societal and environmental activities, rather than cost-cutting measures, may be discovered and integrated into a company's basic business

approach. This is where the management of a sustainability business case intersects with strategic sustainability management and business model innovation (Porter & Kramer, 2011).

Degrees of change

In order to understand the work to be done, it is necessary to detail that there are different levels of innovation in business models. They can range from little modifications to complete overhauls, depending on more or less incremental or radical innovation (Mitchell & Coles, 2003; Schaltegger et al., 2012). **APPENDIX B** shows in detail the four stages selected for this paper, in accordance with the former mentioned authors. They are Business model adjustment, Business model adoption, Business model improvement, and Business model redesign (Schaltegger et al., 2012).

Social-ecological flourishing

This study also recognises the importance of the typology of enterprise-level strategy that is developed and which radically reconceptualises enterprise growth as a development activity that is primarily concerned with social-ecological flourishing (Edwards, 2021). The core idea here is that economic profit is seen as a means or dependent on social success, and social success as dependent on environmental balance and conservation. In this typology, profit can be achieved through the generation of positive social or environmental impacts, considering the economic dimension embedded in the social dimension, and the social dimension embedded, as well, in the environmental one (Edwards, 2021).

Any rethinking of sustainable economic growth should contain three fundamental parts of steady-state, degrowth, and other post-growth options (Hinton, 2021). First, the common

assumption that continual, exponential growth is a central or even desirable aim for business needs to be replaced immediately (Edwards, 2021). This is why it will also be shown below that carbon credits can be used for projects with high social or environmental impact, without necessarily generating significant economic gains. Second, any alternative must acknowledge the realities of global environmental boundaries (Edwards, 2021), as presented at the beginning of the introduction. Third, such alternative perspectives must include social and ecological well-being and lead to regenerative forms of social and ecological thriving and success (Edwards, 2021). The latter highlights the idea that carbon credits can become means to a greater end.

Sustainable Carbon Innovation Framework

This literature review has provided all the components that serve as inspiration for the tool sketched and the exploration performed with the interviewees. This tool, based on the framework presented in Figure 1, consolidates these elements and presents them to its users in a simple way that motivates and enhances conversation, with the ultimate goal of using it as an idea generation board. Business cases for sustainability work together with sustainable strategies, degrees of business model innovation, and business case drivers.

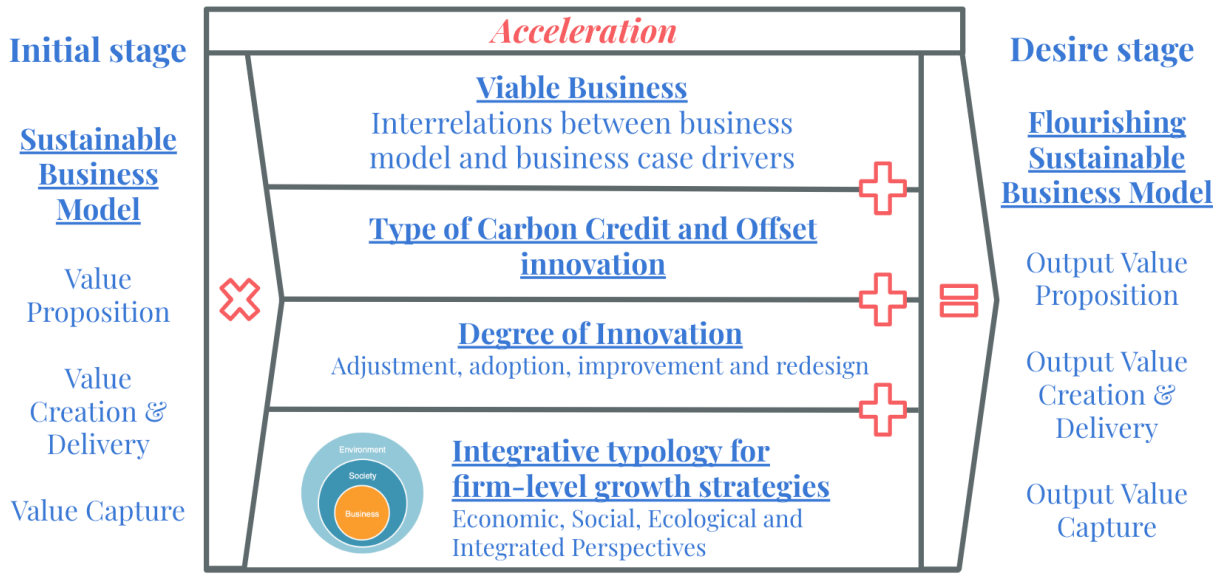

Figure 1: Sustainable Carbon Innovation Framework

This approach is designed to assist practitioners and researchers in determining how a certain sustainable strategy must be linked with some level of business model innovation. These factors will be merged in the methods section to explore how to innovate using business cases for sustainability, with carbon credits and offsets as protagonists in the business model innovation process.

METHODS

Research Method

Although the theory on innovation in sustainable business models has been analysed, and there are many authors who deal with this topic, no previous connection has been found between this idea and the use of carbon credits. This implies that the exploration of a new set of ways in

which carbon credits can be used for organisations, is a nascent theory that is related with topics for which little or no previous theory exists (Edmonson & Mcmanus, 2007).

Carbon credits as an element for innovation in sustainable business models have attracted little research nor formal theorising to date. Therefore it is necessary to apply an inductive approach where theory and generalisations are a result of the investigation rather than something that precedes it: categorization and concepts emerges from the collection and analysis of data (Bryman, Bell, & Harley, 2019). Understanding and creating insight about an unique or unusual phenomenon, delving into a paradox, and explaining the occurrence of a surprising and new event are all part of this inductive theory formation process (Edmonson & Mcmanus, 2007). In our case, this new and unusual phenomenon is the use of carbon credits in the particular manner previously mentioned.

If a quantitative strategy is conducted for nascent theory, where there has been little or no previous work on the constructs and processes under consideration, the results may be prone to detecting connections between constructs and novel measures by accident, and can be misleading (Edmonson & Mcmanus, 2007). Added to that, our purpose is to discover and explore elements that aren't yet completely understood. On the other hand, there is a possibility of emergent constructs with statistically problematic constructs if a mix of quantitative and qualitative methods is used (Edmonson & Mcmanus, 2007). Therefore, it was decided to follow the recommendation of the Methodological Fit as Mean Trendency (Edmonson & Mcmanus, 2007), which suggests that a qualitative strategy is the greatest fit for emergent theories.

In order to answer the research question *How can we use carbon credits and offsets to accelerate the transformation of organisations towards sustainability?*, a framework has been elaborated based on existing literature, which intends to use carbon credits as a protagonist and

catalyst in the process of sustainable innovation in business models. It is expected that by defining an “Initial State” and passing it through the “Acceleration” phase, the four elements: viable business, type of carbon credit Innovation, degree of Innovation, and integrative typology for firm-level growth, combined, will help to generate new “Desire States". Carbon credits are at the centre of this acceleration with economic, environmental, and/or social impact.

The various combinations and interesting ideas that arise when diverse options interact in the four elements of the “Acceleration” phase may be in themselves the answers to the research question. However, it is also necessary to determine if the mental process inspired in the framework followed, is actually helpful. Considering that we also need to understand if the framework steps and parts are valuable as a tool for answering the research question, the selected research methodology is Design Science, specifically, Holmström et al.´s (2009) Phase 1 Solution Incubation.

Precisely, in Design Science´s phase 1, solution designs are preliminary steps or indications to follow in order to find solutions. They are incomplete, but detailed enough to be implemented at least in a test environment (Holmström et al., 2009). Therefore, this test environment creates the perfect space to elaborate the first new concepts of how to innovate in business models using carbon credits and also evaluate in a preliminary state if the steps developed in the framework are worthy. This of course opens the door to further validate the solutions and refine the model considering strengths and weaknesses, through the next phases of Design Science. These are not implemented in the present study due to time and complexity limitations (Holmström et al., 2009).

Design Science research creates novel and effective artefacts that are demonstrated to improve managers’ capability to change current states into desired ones (March & Vogus, 2010).

The selected methodology encourages the possibility of doing research that generates both generalisable knowledge and applications (March & Vogus, 2010). It helps to close the gap between relevance and rigour (Holmström et al., 2009), actively seeking to develop solutions, not merely explanations (March & Vogus, 2010). We seek to reinterpret carbon credits as a means to a greater end. The experimentation that phase 1 of Design Science allows helps us to lay the groundwork with a preliminary framework and at the same time, from its inception, begins to give us valuable practical insights.

Procedures

The first step was to convert the Sustainable Carbon Innovation Framework into a roadmap board (or tool) that can be filled in by answering a series of questions corresponding to each of the various options that interact. The initial tool can be found in **APPENDIX C.** As it can be seen, each of the elements of the framework has been turned into a section to be filled in by those who use the tool. As a guide to answer each section there are specific questions and indications.

An initial test of the tool was carried out with the company Neutral.eco. Neutral.eco is a smart and user-friendly trading platform for buying and selling voluntary CO2 credits. It was founded by four enthusiastic and driven entrepreneurs from the city of Leeuwarden in The Netherlands with the mission of "making an impact in the transition to a sustainable and CO2-neutral economy". With Neutral.eco they want to contribute to the reversal of climate change by stimulating the trade in carbon credits. They are currently in the development and design phase of their business and one of their main concerns is precisely understanding what factors do companies take into account in order to make a carbon credit buying decision, while at

the same time being able to improve their sustainable performance. Reason why they were involved in the study. A picture of the worktable can be seen in Figure 2.

Figure 2: Neutral.eco worktable

The most important conclusion from this initial test was that while the tool was useful, it took a long time to understand it, digest it and then do the exercise of talking among the participants and filling it in. The exercise took approximately 3 hours and had no exploitable results. Considering this, the decision was made to adapt the tool to a series of questions that could be asked in a semi-structured interview with an average duration of 30 minutes to one hour.

The adapted questions can be found in **APPENDIX D.** Here we can see a version for common service or product companies that may or may not incorporate carbon credits. The second version is for consultancies or organisations already having as a core of business carbon credits. This process of adapting models to questions can be found in the publications of various authors, for example, Bocken's Value Mapping Tool (Bocken, Rana, & Short, 2015) and Joyce and Pacquin´s Triple Layer Business Model Canvas (Joyce & Paquin, 2016). The next procedure was to start with the data collection.

Data collection

The data collection process was done through 10 semi-structured interviews with sustainability and carbon credit experts in the Netherlands. The executives of the companies and organisations interviewed were chosen in teamwork with Neutral.Eco. The relationship between Neutral.Eco and these professionals appears because they are potential clients or because they are within the informal network of the founders. They already show some previous interest in carbon credits or are in institutions that regulate, study or advise on them. The final criteria for selecting them was that they are leaders in sustainability positions in their organisations or that their work involves responsibilities directly associated with carbon credit projects or consultancy.

These different professionals answered the questions inspired by the framework and at the same time, according to each experience, gave opinions on the use of the tool. The semi-structured approach was chosen because the goal is to highlight an open view of the research process, allowing for more flexibility in the themes and implications tackled. It was especially important in this procedure to allow respondents to explore their previous experiences and put their knowledge into practice. It was appropriate to keep an open mind, so that perceptions can emerge from the data inductively, as well as because this method of gathering

data is an effective strategy to obtain profound insights into a topic and fully comprehend a phenomenon (Bryman et al., 2019).

Some questions were modified and adapted from one interview to the next. This was done both for the valuable inputs that were found in previous interviews and to make the best possible use of time according to the different areas of expertise of each interviewee. According to Eisenhardt (1989), it is possible to alter the data collection process if a new data collecting opportunity or a new line of thought occurs throughout the study. The final number of interviews was 10, as this number made it possible to reach a saturation point of information (Eisenhardt, 1989). The information that was given in the final two interviews only confirmed and repeated what was discussed in the first ones.

Data analysis

Recognizing the limitations in Design Science Phase 1, a grounded theory data analysis strategy was followed. Theory derived from data that was collected and analysed in a methodical manner during the research process. Data gathering, analysis, and eventual explanations all had a close relationship in this process (Strauss & Corbin, 1998). The analysis and co-framing was done using first-order concepts, second-order categories to finally construct substantive theory, related to the theory in a given empirical instance or substantive area (Strauss & Corbin, 1998). It should be noted that the coding and analysis was done using the "Acceleration" section of the framework as the protagonist. Going through the tool, together with the answers, allowed to get initial ways to answer how to innovate in a sustainable way using carbon credits.

The transcription process was done using Otter.ai. The coding and results analysis was done manually in Excel. This was done in order to have more familiarity with the data while

working and thus foster a space where it was more fruitful to connect, find relationships and infer about the data. New codes were created and past codes were validated while going through the different interview transcriptions, until achieving saturation.

Credibility has been maintained by ensuring that research is conducted in accordance with accepted research practices and using respondent validation, also known as member validation (Bryman et al., 2019). Transferability is one of the limitations of the present study because qualitative research typically entails the intensive study of a small group, or of individuals sharing certain characteristics. The findings from the tool and the 10 experts in sustainability are oriented to the contextual uniqueness and significance of the aspect of the social world being studied. The contextual distinctiveness and significance of the part of the social world being researched are the focus of qualitative results (Bryman et al., 2019). On the other hand, we can consider as a strength the attempt to make a rich and deep description.

The auditing approach was ensured considering that complete records of all phases of the research process, such as problem formulation, research participant selection, interview transcripts, and data analysis decisions, are kept in an easily accessible format (encrypted Google Drive), ensuring dependability and demonstrating that the research is appropriate (Bryman et al., 2019). Finally, Confirmability was considered by acknowledging that in business research, perfect objectivity is unlikely. However, the current study aims to show that sustainability can be accomplished in innovative ways. In order to do so it is particularly relevant that opinions and preferences have not influenced the research's conduct or the conclusions drawn from it (Bryman et al., 2019).

Ethical considerations

All ethical considerations in the present study have been assessed in accordance with the code of ethics of the University of Groningen.

RESULTS

The Results section has been divided in two parts. The first one, “First insights”, is related to the various combinations and ideas that arose through the interviews (The answers). The second part, “The Tool”, includes interviewees' opinions and comments on the elements of the tool (How to get the answers). In both cases the intention is to find *How can we use carbon credits and offsets to accelerate the transformation of organisations towards sustainability?*.

First insights

By discussing initial and desired states and then taking the conversation to different ways in which carbon credits could be included in sustainable business model innovation, five Second Order Themes were elaborated. They are detailed in Table 1. Each theme includes to a greater or lesser extent the use of the various elements of the framework. It is valuable to differentiate between them because they allow distinct levels of approach and exploitation of potential opportunities to be considered.

In order to understand Table 1 better, it is necessary to refer to a new concept found through the interviews: the Co-benefit. This new element emerged from the interviews, and has not been associated with the literature, framework, or design science in this study before. A **Co-benefit** is any other social, environmental or economic value created through a carbon credit

project, separate from offsetting via reduced, avoided or removed CO2. It can also be understood as a side effect, consequence or extra effect of a carbon project.

Second order Theme	**Explanation**
Core Business Case Drivers and Carbon Credits	Most basic relationship between the carbon credits and the framework. Here only the "Viable business" element of the "Acceleration" phase is present. Normally only linked to the purchase of carbon credits to be used as offsets. It is still important to consider this theme because it effectively demonstrates that the six core business case drivers can be addressed as reasons why to buy carbon credits. The "Viable Business" section only considers the six core business case drivers. They are Cost reduction, Risks reduction, Sales and profit increase, Reputation and brand value increase, Increase attractiveness as an employer, and Increase capability to innovate. In short, as noted, they are the reasons why companies allocate resources to activities and projects. In this theme, neither companies nor communities capture the value created by Co-benefits. In this case, only part of the intrinsic value

	created by the carbon credit project is captured by companies through one or more of the core business case drivers.
Co-benefits Serving the Acceleration	In this theme, all four elements of the "Acceleration" phase can be used. The company in this case finances or implements a carbon credit project in-house or externally. It benefits by capturing some of the intrinsic value that the carbon project creates. However, the main difference is that the company now is able to capture also some of the value created from the Co-benefit. The gateways to capturing the value created by the Co-benefit are the six core business case drivers. The degree of innovation and the potential for social-ecological flourishing is related to the ability of the company to capture the value created through the Co-benefit.
Community Based Projects	Similar to the previous one, with regard to the framework, but have a special focus on generating a positive impact on the society. In this theme, the value created through Co-benefits is not necessarily or exclusively captured by the company that finances them. By implementing appropriate and innovative actions, in-need communities can also capture part of the value created through the Co-benefits.

	This model can also work for NGOs, government bodies or companies linked to social-ecological flourishing, where the final goal is not to generate large profits, but to achieve important social and environmental impacts. For better results, the overall value (Co-benefits + Offsetting) should be higher or equal than the cost of doing the carbon credit projects.
Community & Industrial Symbiosis[2]	Exploits the idea of carbon credit production or carbon reduction, capture or reprocessing, as an element within an Industrial Symbiosis cluster. Due to various forms of carbon generation, the actor Community is added in the name because they themselves can contribute with waste and activities that can be used as a resource by other industries and at the same time, these communities can be benefited from goods and services such as energy or resources, such as fertilisers. In this theme, the carbon credit Co-benefits create value that can be captured and exchanged by diverse industries and communities that are traditionally separated in a collective approach for competitive advantage, involving the physical transfer of materials, energy, water and by-products.
Direct Carbon Business Model	In this theme the value proposition of an organisation is carbon credits. It can be considered as the ultimate re-design for many companies or the

	door for new sustainable start ups, which can earn money or sustain themselves by generating a positive social and environmental impact from the heart of their value proposition. It may also apply that the value created from the carbon credit project Co-benefit becomes the company's value proposition.

Table 1: How to use carbon credits and offsets to accelerate the transformation of organisations towards sustainability

APPENDIX E presents a long list of proposals and ways to use carbon credits discussed with the interviewees. They are grouped in Second and First Order Themes. Also examples are presented in the form of a quotation or more detailed explanation to clarify the ideas. These insights can be considered as the desired practical applications and solutions mentioned earlier. The most innovative and interesting ways of using carbon credits that were found are detailed below.

Co-benefits Serving the Acceleration

Co-benefits are used to secure, generate or buy with a competitive advantage a resource that the organisation needs. One specific example is: chocolate or coffee companies develop a carbon credit project, where in the shade of the trees they plant crops that they themselves used after to produce their products.

Community Based Projects

Co-benefits secure or generate resources that in-need communities can use or sell. Continuing with the coffee companies example, these organisations may invest in carbon credits with farmers in order to have projects that reduce the amount of CO2 emitted for them. Those projects can also be another way to increase the money income of those farmers, who could be in charge of the management, growing and sale of crops. The goal is to enable others to capture the value of Co-benefit.

Community & Industrial Symbiosis

Bottom of the pyramid business model or partnerships between companies and communities on a voluntary basis. It could be theoretically possible to finance sanitation or energy generation and distribution projects with carbon credit projects. The bio waste that communities generate can serve as a resource.

The Tool

Table 2 details the main perceptions and comments of the interviewees on the process followed to arrive at the ideas mentioned in the previous section. This relates to phase 1 of Design Science and gives initial impressions of the usefulness of the tool as a means of devising new ways of employing carbon credits within the sustainable innovation process.

Participant	**Perception**	**Commentary**
Participant-A	Helps to think in new ways.	*"I think it's, it can be good because I think it's helped me to think in a way that I haven't thought about before".* *"It's interesting to also see it from different points of view. So more also about what it can bring a company otherwise then new sales for example. And that's nice".*
Participant-G	Using the framework can become a distraction from what really matters: a decarbonisation plan.	*"All those things that you just mentioned, about reputation, etc, etc, could be out of the window, you know. You have to be careful if you want to reach all these goals. And you know, you should do like I said before you should put together a credible decarbonisation plan"*
Participant-I	Finds value in innovating to bring carbon credits closer to the heart of the business model.	*"I found that like, really interesting, and a kind of actual general rule in order to develop carbon credits in an appropriate way".* *"Like, rather than seeing it as a side thing of like the site burden, the responsibility of being sustainable, it needs to be in the core of the operations"*
Participant-	It is useful, but it must	"[About The framework] *Yeah. Especially if it's part*

J	be part of an overall environmental strategy (decarbonisation plan).	*of a full strategy of a company, a company can have a full strategy about climate change policies, you need to take responsibility, you need to calculate a carbon footprint, give it a price. And therefore carbon credits can help because it shows what your emissions are"*

Table 2: Design Science Phase 1 Tool Impressions

DISCUSSION

Conclusion

The research question of this article was *How to use carbon credits and offsets to accelerate the transformation of organisations towards Sustainability?* To answer this question, a framework was developed. This model proposed that organisations should go through an "Acceleration" phase that facilitates finding innovative ways to use carbon credits. In the "Viable Business" element the core business case drivers presented six forms or gateways in which companies can capture the value created through carbon credit projects.

Based on the framework, a Design Science´s phase 1 tool, which was then adapted to questions, was elaborated. As expected, the steps and indications were incomplete, but detailed enough to be implemented in a test environment. According to the analysis and comments about the tool, this first version has proven to be useful in opening initial new avenues of conversation and innovative ways of looking at carbon credits. To think outside the box. It has also

highlighted the previously stated importance that this model should always be considered within an overall decarbonisation plan.

By using the framework, a new key concept emerged, the Co-benefit. A Co-benefit is any other social, environmental or economic value created through a carbon credit project, separate from offsetting via reduced, avoided or removed CO2. It can also be understood as a side effect, consequence or extra effect of a carbon project. This introduces a key new idea: carbon credit projects can create two types of value: Intrinsic Value and Co-benefit Value. The five Second Order Themes show us different ways in which the value created by Co-benefits can be captured not only by companies, through the six core business case drivers or new value propositions, but also by communities and (Industrial and/ or Community) clusters.

This new key idea proposes three changes to the Sustainable Carbon Innovation Framework. The first is to invite organisations to innovate, develop and invest in carbon credit projects that create both Intrinsic Value and Co-Benefit Value. The second is that when considering these projects, companies should not only think about capturing the two types of values created for themselves, through the six core business drivers. But also think about how to enable other organisations and communities to capture part of the values created. Finally, the framework presented as Desire Stage, the Flourishing Sustainable Business Model. Taking into account that the value created can be captured by various actors, it has been decided to change the name to Flourishing Ecosystems, where various stakeholders can and do benefit from the values created. A new version of the framework that considers these three changes is presented in Figure 3. The numbers in the Flourishing Ecosystem section correspond to the different actors that can be beneficiated through different processes of "Acceleration".

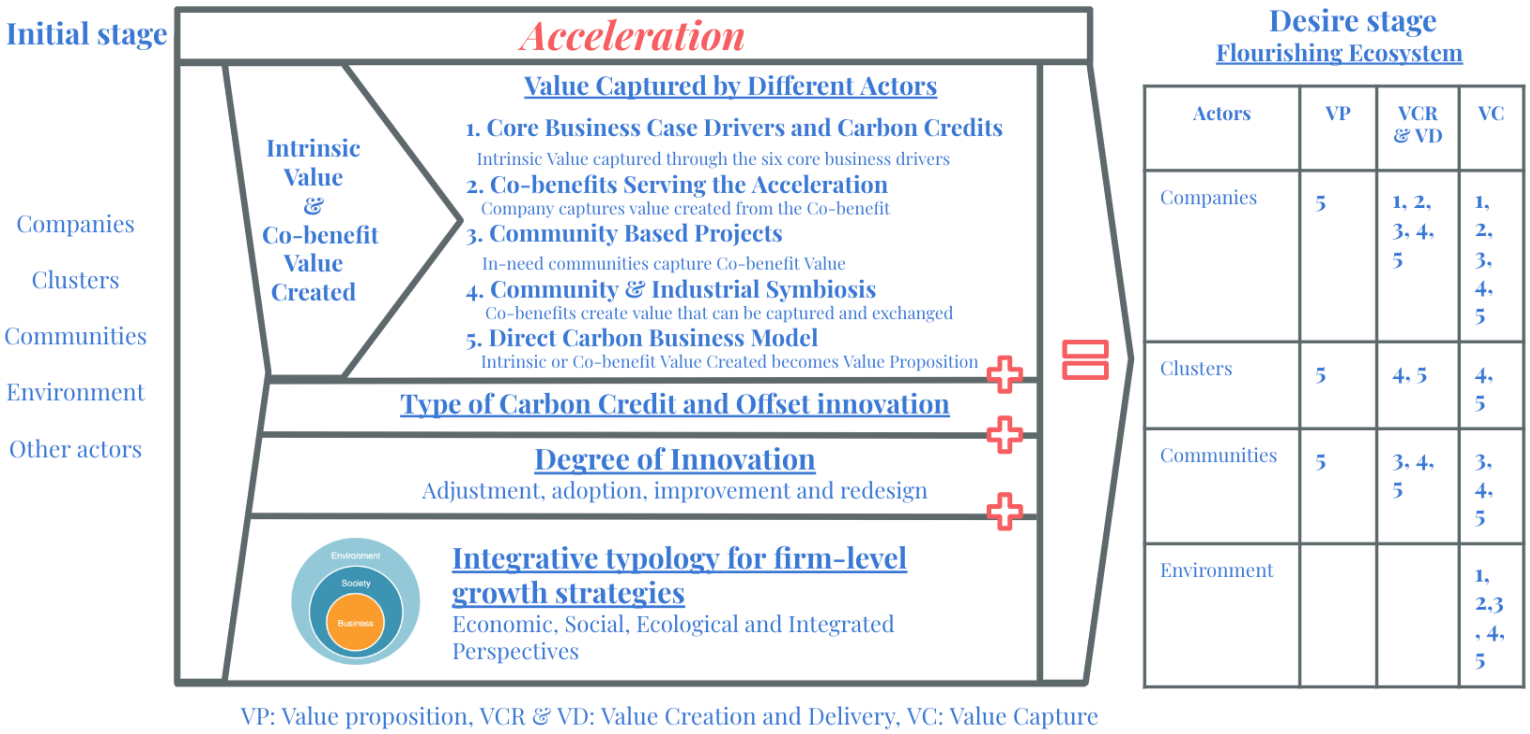

Figure 3: Carbon Credits Co-benefit Value Creation and Capture Framework

The aim of the paper was to look for new ways in which carbon credits and offsets can be integrated into the business model innovation process of organisations in order to balance and increase their overall social, environmental, and economic performance. The conclusion reached is that in order to achieve this, it is necessary to identify and assess the Intrinsic and Co-benefit Values created in carbon credit projects before and as they are implemented. The next step is to evaluate, innovate and think of creative ways so the company itself, other companies, clusters, communities and the environment can capture some of that created value. The gateway for companies is the six core business case drivers. For communities and other companies, the path is creativity and collaboration. Finally, a well-executed carbon credit project will always have a positive value that can be "captured" by the environment.

Recommendations

A New Carbon Credit Discourse

Businesses globally have a responsibility and obligation to act now to reduce the carbon emissions that their operations generate. It is essential to always consider that, as long as there is still demand from carbon emitting services and products, there is always going to be a company willing to pollute and justify their existence. We must act and react now: Climate Crisis is a global problem. One of the ways in which this reduction can take place is through carbon credits. However, for many sustainability specialists and academics, carbon credits are perceived as a problem because companies misuse them (Mateo-Márquez et al., 2022). As mentioned in the introduction, companies may use them as a way to clean up their image or buy their redemption. Also carbon credits may become a distraction from what really matters: having an operations decarbonisation plan.

The results and conclusions of the present study have the potential to change this negative discourse around carbon credits. As shown by examples and through the idea of Co-benefit, if carbon credit projects are implemented in the right way, they can have the potential to contribute to societies and companies, while capturing, reducing or avoiding carbon emissions. Of course, they must be used responsibly and transparently, with the right intentions. But, fulfilling these conditions, with the proper tools and a lot of creativity to innovate, carbon credits can find a new justification to exist.

Innovating to help others capture value

Existing knowledge and research in business model innovation and sustainability studies the importance of and proposes paths to make changes in the way organisations and their value

networks create, deliver, and capture value, achieving a substantial positive and/or reduced negative effect on the environment and/or society (Bocken et al., 2014). The idea of Co-benefit can be useful for this literature and for practitioners seeking sustainability.

Companies can start looking proactively for Co-benefits in other innovations and activities, not just carbon credits, that have a positive social and/or environmental impact and were previously perceived as expenses, with no returns for the company. These innovations and activities can be inside or outside their operations. After that, companies can use Schaltegger et al. (2012)´s six core business case drivers as gateways to capture part of the value created through the Co-benefits. In this way, companies and other organisations can remain profitable, or even generate more revenues, while contributing in a new way to People and the Planet.

The other recommendation for business model innovation is that companies and other organisations can look for more activities and projects, not just carbon credits as stated before, that generate Co-benefits and promote creative and innovative ways for in-need communities, other businesses, and the environment to capture part of that value.

This idea also goes hand in hand with and contributes to Edwards (2021)´s rethinking of sustainable economic growth. Value propositions, innovations in business models, and collaborations between companies and communities, where the Intrinsic and Co-benefit value created by the activity is sufficient to finance the organisation that executes them, may leave the space free for Intrinsic and Co-benefit value to be captured by other actors. This supports organisations where continual and exponential growth is not a central or even desirable aim, acknowledges the Planetary Boundaries, includes social and ecological well-being, and leads to regenerative forms of social and ecological thriving and success.

Limitations

Global South

It is important to consider that the interviews that have generated all the material of the results and conclusions have been done with professionals and academics with experience and knowledge in Europe, specifically in the Netherlands. The first limitation is to note that many creative ideas and insights on how to use carbon credits could have been found by interviewing people in other parts of the world. More emphatically, it is key to highlight the limitation of not having interviewed professionals with extensive experience in the Global South and developing countries. The unique insights and challenges presented by these places can add much more to the study and open up avenues not explored.

Putting innovations into practice

It is important to consider that many of these ideas are hypothetical and that a specific and in-depth business case analysis is needed to determine and know if the ideas presented are indeed economically, environmentally, technically and socially viable.

Phase 1 of Design science

Finally, it is essential to consider that the ideas were generated through a phase 1 Design Science tool. The tool requires much more testing and validation to really consider its results and accuracy.

Future research

Carbon-negative Companies

If we combine and learn from the best of the Five Second Order Themes: Intrinsic Value captured through the six core business drivers, Company captures value created from the Co-benefit, In-need communities capture Co-benefit Value, Co-benefits create value that can be captured and exchanged, and Intrinsic or Co-benefit Value Created becomes Value Proposition, we could eventually allow a new type of player to be born in different industries: Carbon-negative Companies. These companies would capture or reduce more carbon than they generate through their operations, services or product sales. A future avenue to investigate could be precisely this new type of company and the conditions that must be met to achieve them, as well as examples, first industries capable of achieving this, and the technology and business models needed.

Design Science Phase 2

In the present study we have carried out part of phase 1 of Design Science: Solution Incubation. This initial phase is done to develop an initial solution design. In this phase there are three sub-activities: (i) Exploration of parallel knowledge domains, (ii) Cross-disciplinary abductive reasoning, and (iii) Identification of interesting objectives, situations and possible solutions (Holmström et al., 2009).

It could be interesting to take the *Carbon Credits Co-benefit Value Creation and Capture Framework* and use it as a basis to initiate a Design Science phase 2. This phase is called Solution Refinement and what is sought is the refinement of the initial solution design and "solving the problem". Its sub-activities are (i) Implementation of solution designs, (ii)

Confirmation of intended consequences, (iii) Cooptation of unintended consequences, (iv) Iteration between solution designs, implementation and evaluation, and (v) Inductive and deductive reasoning (Holmström et al., 2009). The results of this phase could generate interesting and creative new insights on how to use carbon credits, as well as a deeper understanding of the reach and potential of carbon credit Co-benefits. Collaboration and exchange between communities and companies could also be emphasised.

NOTES

1. GHG emissions are often measured in carbon dioxide (CO2) equivalent. To convert emissions of a gas into CO2 equivalent, its emissions are multiplied by the gas's Global Warming Potential (GWP). The GWP takes into account the fact that many gases are more effective at warming Earth than CO2, per unit mass (IPCC, 2007).

2. Industrial Symbiosis (IS) has been defined as engaging traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and by-products (Wadström, Johansson, & Wallén, 2021). IS is sometimes intertwined with sustainable bio-economy, where businesses and their waste streams are connected in networks to achieve circularity. The concept has been brought to attention in the 1980s, while more recent research is done to study the innovation drivers. Eco-Industrial Parks are related to IS as well. These parks consist of interconnected businesses that exchange resources and waste (Zhang, Zheng, Chen, Su, & Liu, 2015).

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APPENDIX A

Core Business Case Drivers (Schaltegger et al., 2012)

Core Business Case Driver	Description
Cost reduction	It is the most direct link to profit oriented intentions. Examples include energy savings, the reduction of material flows or cleaner production, and buying resources at better prices.
Risks reduction	This is related to minimising contingencies. Also potential and present costs of remediation. For example, the reduction of technical, political, societal and market risks as a result of good sustainability management.
Sales and profit increase	It is linked to the way companies design and implement strategies to increase sales and margins.
Reputation and brand value increase	It involves increasing the perceived image of brands and companies. We can understand them as generating legitimacy and shaping the right to exist of organisations.

Increase attractiveness as an employer	It is about generating the right conditions within the company to attract and recruit talent, as well as to improve its induction and development.
Increase capability to innovate	Among other ways, this can happen if companies, thanks to new strategies, encourage new forms of thinking or when they gain access to new sources of information.

APPENDIX B

Four stages of business model innovation (Schaltegger et al., 2012)

Stage	Degrees of change in the Business Model
Business model adjustment	Refers to changes to simply one (or a few) business model elements, omitting the value proposition; for example, changes to customer connections, company infrastructure, or the financial pillar alone are improvements.
Business model adoption	Refers to improvements that are primarily focused on matching the value propositions of rivals. The objective is to stay ahead of market expectations and competition. This necessitates product and/or service adoptions, as well as aspects of the customer relationship pillar and company infrastructure, as these pieces might be part of the value offer (Osterwalder, 2004)**.**
Business model improvement	When significant sections of the business model features are modified. To replace an old model, a large number of aspects must be changed at the same time, such as customer

	relationship methods, infrastructure elements such as the business network, and financial logic. The value proposition, on the other hand, remains unchanged.
Business model redesign	Refers to a wholly new value proposition. A true redesign changes the underlying business logic and introduces new goods, services, or product-service systems (Devisscher & Mont, 2008).

APPENDIX C

Initial Tool

<table>
<tr><th>Initial Stage</th><th>Acceleration</th><th>Desire Stage</th></tr>
<tr><td>Sustainable Business Model</td><td rowspan="2">Viable Business
The first step is to go through the "Viable Business (Interrelation)" table, from cost and VP onwards in a systematic way, and think of ways in which carbon credits (sale, purchase, generation, financing) could be applied. As you review and come up with ideas, write them down in this section under an identifier number. Consider that the priority is to generate "profit" through positive environmental and/or social impact.</td><td>FlourishingSustainable Business Model</td></tr>
<tr><td>Input Value Proposition
Each sheet will contain a particular company or organisation. It is recommended to think and write only a few sentences related to a company that is a potential client of neutral.eco or whose business model is familiar to you.</td><td>Output Value Proposition
In this section consider the main changes that have been made in this part of the business model, thanks to the innovations through carbon credits that have been used.</td></tr>
<tr><td rowspan="2">Input Value Creation & Delivery
Each sheet will contain a particular company or organisation. It is recommended to think and write only a few sentences related to a company that is a potential client of neutral.eco or whose business model is familiar to you.</td><td>Type of Carbon Credit and Offset innovation
In this section we will specify and develop how each alternative uses carbon credits. Do they buy and sell them? Do they produce them themselves? Do they outsource it to someone in their supply chain or to other stakeholders? do they finance it as investors?</td><td rowspan="2">Output Value Creation & Delivery
In this section consider the main changes that have been made in this part of the business model, thanks to the innovations through carbon credits that have been used.</td></tr>
<tr><td rowspan="2">Degree of Innovation
Think and elaborate on the level of change that would happen in the business model. Is it a Business model adjustment, adoption, improvement or redesign?</td></tr>
<tr><td>Input Value Capture
Each sheet will contain a particular company or organisation. It is recommended to think and write only a few sentences related to a company that is a potential client of neutral.eco or whose business model is familiar to you.</td><td rowspan="2">Output Value Capture
In this section consider the main changes that have been made in this part of the business model, thanks to the innovations through carbon credits that have been used.</td></tr>
<tr><td>Integrative typology for firm-level growth strategies
In this section think about, mark in which typology (from 1 to 7) your innovation would be contemplated. After that, elaborate on your answer. Consider that the “best” innovations are those that are closest to 7. Give special review and consideration to those who are benefiting from this new project. Are societies benefiting? communities? animals? the environment?</td></tr>
</table>

APPENDIX D

Interview Questions

THEME	QUESTIONS FOR COMPANY	QUESTION FOR COMPANIES THEY WORK WITH
Introduction	Thank you for participating in this research. This is a future-looking research project with companies to help them recognize opportunities and paths of how they can use carbon credits and offsets to accelerate their transformation towards sustainability. We are going to follow a series of steps and try to recognize in the organisation potencial sustainable innovations through the use of the purchase or creation of carbon credits. Before we start, I would like to ask you: do you agree to this interview being recorded? So, shall we begin? Extra: Ask for the consent form	Thank you for participating in this research. This is a future-looking research project with companies to help them recognize opportunities and paths of how they can use carbon credits and offsets to accelerate their transformation towards sustainability. We are going to follow a series of steps and try to recognize in the organisation potencial sustainable innovations through the use of the purchase or creation of carbon credits. **The intention of interviewing you is to use your knowledge and experience with Carbon Credits and different organisations that are already using or wish to use them.** Before we start, I would like to ask you: do you agree to this interview being recorded? So, shall we begin?
Initial State, Input Explore and get to know the current	I would like to start talking about your organisation, very brief, 2 **1. Can you explain to me your value proposition?**	Extra: Who are the normal customers? I would like to start by talking, very briefly, about the organisations you work with today, let's think about the average company that you have contact

business model of the company, their sustainability objectives and their present use of carbon instruments.	***Prompts:*** *a. What value is provided and to whom?* *b. Product/ Service they provide* *c. How they established relations with customers* *d. What value do you provide to customers, society and the environment?* **2. How do you create and deliver value?** ***Prompts:*** *a. How is value provided?* *b. Tell me more about your:* *i. Activities* *ii. Resources* *iii. Distribution channels* *iv. Partners and suppliers* *v. Technology and product features* **3. How does the organisation make money and capture other forms of value?** ***Prompts:*** *a. Cost structure and revenue streams* *b. Value capture for key actors incl. Environment and society* *c. How can you grow?* **4. What are your organisations' sustainability goals?** - Depending how the conversation flows **5. How does your organisation understand and use carbon credits?** - Depending on how the	with. 3 **1. Can you explain to me some of their value propositions?** ***Prompts:*** *e. What value is provided and to whom?* *f. Product/ Service they provide* *g. How they established relations with customers* *h. What value do you provide to customers, society and the environment?* **2. How do they create and deliver value?** ***Prompts:*** *c. How is value provided?* *d. Tell me more about your:* *i. Activities* *ii. Resources* *iii. Distribution channels* *iv. Partners and suppliers* *v. Technology and product features* **3. How does their organisation make money and capture other forms of value?** ***Prompts:*** *d. Cost structure and revenue streams* *e. Value capture for key actors incl. Environment and society* *f. How can you grow?* **4. What are their normal organisations' sustainability goals?** - Depending how the conversation flows

	conversation flows or in acceleration.	**5. How do those organisations normally understand and use carbon credits?** - Depending on how the conversation flows or in acceleration.
Acceleration Gain insights on how companies would be able to innovate in their specific business models and industries through carbon credits, using a series of semi-structured questions related to sustainable business model innovation and the business case for sustainability.	The objective of this research is to imagine carbon credits as more than a cost to achieve a positive environmental impact. We are going to think of new creative ways to use Carbon Credits to also generate a positive impact for the company's "classic business" numbers. 6. Organisations can be related to Carbon Credits and Offsets by buying them to compensate for emissions, they also can trade it as intermediary, "produce" them in their operations or in the supply chain, or even they can act as investors. ***Prompt:*** *Give example Carbon Credits and mountains, Coca Cola and water or Mining companies and community base projects.* ***6.1.1. Considering these different ways of being related to Carbon Credits, could you think of ways to reduce costs in your operations using them?*** ***Prompts:*** ○ *Consider energy costs*	*Extra questions (if needed):* - *What are the arguments you give first?* - *Can you believe that companies can produce carbon credits in house?* - *Have you seen companies financing Carbon Credit projects?* - *Are you familiar or know about Community base carbon credit projects?* The objective of this research is to imagine carbon credits as more than a cost to achieve a positive environmental impact. We are going to think of new creative ways to use Carbon Credits to also generate a positive impact for the company's "classic business" numbers. 6. Organisations can be related to Carbon Credits and Offsets by buying them to compensate for emissions, they also can trade it as intermediary, "produce" them in their operations or in the supply chain, or even they can act as investors.

	○ *Cost-efficient contracting relationships* ○ *Closed-loop service systems,* ○ *Costs of new products and services that can be lowered through partnerships and Balancing cost reductions for customers and cost structures of new products and services to increase profitability* **6.1.2. With the ideas discussed in this section, let's reflect together on what your new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a	***Prompt:*** *Give example Carbon Credits and mountains, Coca Cola and water or Mining companies and community base projects.* ***6.1.1. Considering these different ways of being related to Carbon Credits, could you think of ways to reduce costs in their operations using them?*** ***Prompts:*** ○ *Consider energy costs* ○ *Cost-efficient contracting relationships* ○ *Closed-loop service systems,* ○ *Costs of new products and services that can be lowered through partnerships and Balancing cost reductions for customers and cost structures of new products and services to increase profitability* **6.1.2. With the ideas discussed in this section, let's reflect together on what their new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset

	positive social and/or environmental impact while remaining profitable? **6.2.1. *Could you think of ways to* reduce risks *in the business using them?*** ***Prompts:*** ○ *Lowering societal risks through products and services can create value to certain customer segments* ○ *Service-relationships reducing sustainability risks for customers result in higher customer loyalty* ○ *Resources, activities,* ○ *and partnerships set-up in order to minimise internal and external risks* ○ *Improved risk and credit rating resulting from lowered sustainability risks* **6.2.2. With the ideas discussed in this section, let's reflect together on what your new business model would look like with that change?**	innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? **(F)** ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? **(G)** **6.2.1. *Could you think of ways to* reduce risks *in the business using them?*** ***Prompts:*** ○ *Lowering societal risks through products and services can create value to certain customer segments* ○ *Service-relationships reducing sustainability risks for customers result in higher customer loyalty* ○ *Resources, activities, and partnerships set-up in order to minimise internal and external risks*

	■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? ***6.3.1. Could you think of ways to increase sales and improve profits using them?*** ***Prompts:*** ○ *Environmentally and socially superior products and services require modified or new VPs to turn into sales and profits* ○ *Higher customer retention and customer value as a result of sustainability-oriente*	○ *Improved risk and credit rating resulting from lowered sustainability risks* **6.2.2. With the ideas discussed in this section, let's reflect together on what their new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? ***6.3.1. Could you think of ways to increase sales and improve profits using them?*** ***Prompts:*** ○ *Environmentally and socially superior products and services require modified or new*

	d, service-intense relationships ○ *New products and services may require strategic partnerships (e.g., coopetition) to overcome market barriers* ○ *New products and services and/or new customer relationships contribute to diversified revenue streams* **6.3.2. With the ideas discussed in this section, let's reflect together on what your new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while	*VPs to turn into sales and profits* ○ *Higher customer retention and customer value as a result of sustainability-oriented, service-intense relationships* ○ *New products and services may require strategic partnerships (e.g., coopetition) to overcome market barriers* ○ *New products and services and/or new customer relationships contribute to diversified revenue streams* **6.3.2. With the ideas discussed in this section, let's reflect together on what their new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or

	remaining profitable? **6.4.1. *Could you think of ways to* Improve the reputation and brand value *using them?*** ***Prompts:*** ○ *Sustainability as distinctive element of good corporate reputation* ○ *Sustainability as marketing feature of the brand increasing customer loyalty* ○ *Strategic partnerships with sustainability leaders can increase reputation and brand value* ○ *Sustainability performance leading to a good rating and the consideration in sustainability indices and funds* **6.4.2. With the ideas discussed in this section, let's reflect together on what your new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used?	environmental impact while remaining profitable? **6.4.1. *Could you think of ways to* Improve the reputation and brand value *using them?*** ***Prompts:*** ○ *Sustainability as distinctive element of good corporate reputation* ○ *Sustainability as marketing feature of the brand increasing customer loyalty* ○ *Strategic partnerships with sustainability leaders can increase reputation and brand value* ○ *Sustainability performance leading to a good rating and the consideration in sustainability indices and funds* **6.4.2. With the ideas discussed in this section, let's reflect together on what their new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used?

	■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? **6.5.1. *Could you think of ways to* be more attractive as an employer using them?** ***Prompts:*** ○ *A companies' offerings and VPs allowing for personal identification to attract employees* ○ *Better customer service as a result of higher employee motivation* ○ *Attractiveness as principal can enhance the quality of activities, resources, and partnerships* ○ *Reduced costs for HR acquisition, less fluctuation costs and*	■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? **6.5.1. *Could you think of ways to* be more attractive as an employer using them?** ***Prompts:*** ○ *A companies' offerings and VPs allowing for personal identification to attract employees* ○ *Better customer service as a result of higher employee motivation* ○ *Attractiveness as principal can enhance the quality of activities, resources, and partnerships* ○ *Reduced costs for HR acquisition, less fluctuation costs and lower compensation costs* **6.5.2. With the ideas discussed in this section, let's reflect together on what**

	lower compensation costs **6.5.2. With the ideas discussed in this section, let's reflect together on what your new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? **6.6.1.*Could you think of ways to develop or increase the capabilities of innovation in the organisation using carbon credits?*** ***Prompts:*** ○ *Unfolding the full sustainability-potential of innovations*	**their new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable? **6.6.1.*Could you think of ways to develop or increase the capabilities of innovation in the organisations using carbon credits?*** ***Prompts:*** ○ *Unfolding the full sustainability-potential of innovations enables modified or new VPs* ○ *Innovative products and services creating solutions to sustainability problems, improving customer retention*

	enables modified or new VPs ○ *Innovative products and services creating solutions to sustainability problems, improving customer retention* ○ *To allow for innovations to unfold may require new activities, resources, and partnerships* ○ *Higher innovation potential and expectations for profitable innovations leading to an increase of shareholder value* **6.6.2. With the ideas discussed in this section, let's reflect together on what your new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a	○ *To allow for innovations to unfold may require new activities, resources, and partnerships* ○ *Higher innovation potential and expectations for profitable innovations leading to an increase of shareholder value* **6.6.2. With the ideas discussed in this section, let's reflect together on what their new business model would look like with that change?** ■ How would the Type of Carbon Credit and Offset innovation be used? ■ The changes would generate BM adjustment, adoption, improvement or redesign? ■ Using this idea, how can we have a positive social and/or environmental impact while remaining profitable?

	positive social and/or environmental impact while remaining profitable?	
Desire State, Output Explore what significant changes in the company may have occurred after having carried out this innovation process in its Value Proposition, creation, discovery and Capture.	Considering the main ideas discussed and the possible changes that could have been made in the business model…. **7. Do you think we can identify a relevant change in the organisation's Value Proposition?** **8. Do you think we can identify a relevant change in the organisation's Value Creation & Delivery?** **9. Do you think we can identify a relevant change in the organisation's Value Capture?**	Considering the main ideas discussed and the possible changes that could have been made in the business model…. **7. Do you think we can identify a relevant change in the organisation's Value Proposition?** **8. Do you think we can identify a relevant change in the organisation's Value Creation & Delivery?** **9. Do you think we can identify a relevant change in the organisation's Value Capture?**
Reflection on the previous 3 Steps Determine if ordering the thought process in this way and asking these questions with the particular	We have used 6 business cases that give companies ways to innovate, and we have tried to combine them with carbon credits to seek sustainable innovations. **10. Do you consider these particular steps helpful?** ***Prompts:*** • *What was helpful?* • *What can be improved?* • *Any other comments?*	We have used 6 business cases that give companies ways to innovate, and we have tried to combine them with carbon credits to seek sustainable innovations. ***Extra: Can you think in other ways in which companies can be beneficiated by planting trees and generating Carbon credits?*** **10. Do you consider these particular steps helpful?** ***Prompts:***

concepts was helpful. We will seek to understand what is good and what can be improved.		• *What was helpful?* • *What can be improved?* • *Any other comments?*

APPENDIX E

Desired applications and solutions

Second order Theme	First order Theme	Examples
Core Business Case Drivers and Carbon Credits	**Risk Reduction, Increase Sales:** increase the chances of being hired - or reduce the risk of being fired - in public or private tenders where the CO2 emissions emitted are valued.	*"As a result of that* [Buying carbon credits]*, you will become more attractive as a company for the market, your market profile is better, you can use it as a marketing tool, because you are in the newspaper, and that is free advertisement. So you also become better positioned in the market as a supplier of your services and goods. And that will eventually lead to more efficient processes"*
	Reputation and Brand Value, Risk Reduction: use carbon credits to neutralise the emissions of services or products. Can be paid for by company or by clients, as airlines do with their flights.	
	Cases where one or more of the six core business drivers were mentioned: (i) Use carbon credits as a tool to attract and motivate employees, (ii) Use Carbon Credits as a tool to reduce legal, reputational and financial risks, and (iii)	

	other combinations of the six.	
Co-benefits Serving the Acceleration	Co-benefits are used to secure, generate or buy with a competitive advantage a resource that the organisation needs.	(i) Soda companies using carbon credits, through trees, to generate and secure water, which they then use in their operations. (ii) Chocolate or coffee companies develop a carbon credit project, where in the shade of the trees they plant crops that they themselves used after to produce their products. (iii) The Co-Benefit allows the generation of new construction materials. (iv) Purchase and use in the company's own operations more economical green energy.
	Finance part of the company's obligations through carbon credits.	Mining company that, as part of its environmental remediation plan, implements a large tree and carbon credit project. The costs of remediation could decrease

		due to the use of carbon credits. The Co-Benefit is the reduction of costs while fulfilling a legal obligation.
	Use Carbon Credits to generate a snowball of change and innovation.	(i) When a company starts using carbon credits, it also starts using more data, and improves overall measuring. That can generate an effect to use more data in other aspects of the company. That new use can motivate change. (ii) Companies are motivated by new forms of innovation, which generates more incentive to look for new ways to be innovative. Once the company started looking into it, they suddenly got excited about the innovation happening in other industries. (iii) Space for experimentation and innovation in agriculture, using the carbon credit projects

		as a financer for experimentation with different crops.
	System buy one, give one in products but with trees and carbon credits. Marketing / Reputational tool.	Buy a jacket and plant a tree.
Community Based Projects	Extractive Companies using carbon credits in order to help developing communities and improve relations.	Mining companies financing carbon credits projects to support farmer communities, helping them develop a sustainable income.
	Co-benefits secure or generate resources that in-need communities can use or sell.	(i) Coffee companies invest in carbon credits with farmers in order to have projects that reduce the amount of CO2 emitted for them. Those projects can also be another way to increase the money income of those farmers. The goal is to enable others to capture the value of Co-benefit.

		(ii) Develop projects of farming in other lands, partially financed with carbon credits. (iii) In agriculture and farming, you can have carbon credit projects in order to increase the health of the soil and reduce feed supplements for cows. In both cases it is possible to increase the production of others. (iv) While enabling communities in need to capture some of the value created by Co-Benefits, they can be empowered to enhance capacities and positively impact the area in the future.
Community & Industrial Symbiosis	Bottom of the pyramid business model or partnerships between companies and communities on a voluntary basis.	(i) Sanitation projects financed using the waste as a resource (energy + carbon). (ii) Energy generation and distribution projects financed using the waste as a resource

		(energy + biogas). (iii) Circular energy systems, wastewater as a source of energy.
	Resource sharing	(i) Work with farmers in regenerative agriculture projects, increasing crop yields and healing nature. Produce and use organic fertilisers. (ii) Connect and share residual flows from communities in order to be used as energy (biogas). (iii) Large populations can be a hotspot for resources in community and industrial clusters.
Direct Carbon Business Model	Business Model: help farmers or others to get them an alternative revenue model, by starting sustainable projects and producing carbon credits out of these projects.	(i) Consultancy. (ii) Platform that plants trees. (iii) Support farmers in writing project plans and help them in selling the carbon certificates.

	Carbon capture from the air as the value proposition of a company.	
	Business model developing Carbon Credits: use technology and satellites to validate and verify legitimacy of Carbon Projects.	