A Work Project, presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

Development of a Premium Carbon Credit Product Expansion in the Context of Pachama, to Create Social and Environmental Impact.

Lucy Jane Stephenson

ID: 49060

Work project carried out under the supervision of:

Utku Serhatli

14.12.2022

Abstract:

The Voluntary Carbon Market is an exciting place for innovation and development due to commitments from COP26/27 and the Paris Agreement, pushing funding and impact pressure into the industry. Pachama's mission within this marketplace is to generate high quality and highly credible carbon credits, that ensure longevity and maximum carbon sequestration for their customers' offsetting needs, through satellite data and imagery. The next step for Pachama, to generate more impact beyond carbon benefits, is to generate social and environmental benefits simultaneously, with their original's projects. Through a detailed analysis of standard reporting as well as impact reporting, this thesis aims to set a business case and strategy for Pachama's product expansion into premium carbon credits. Specifically looking into the criteria which Pachama should focus on as a baseline for project design and development.

Keywords: Nature-Based Solutions, Carbon Credits, Voluntary Carbon Market, Pachama, Sustainability, Premium Carbon Credits, Social Development, Environmental Benefit, Impact Assessment

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

1. Introduction

According to the Paris Agreement, we must keep the world temperature rise within 1.5°C, to prevent irreversible and dire impacts of climate change. This would include increasing renewable energy, improving efficiency of energy and resources and avoiding deforestation. As outlined by the World Resources Institute, those efforts are not enough (World Research Institute 2022). We need to actively remove CO2 from the atmosphere to reach climate goals. The initiatives and commitments companies' make can be as large as fully developing sustainable and responsible supply chains, or as small as encouraging employees to take public transport. However, what many companies are turning to, is investing in innovation for possible future solutions to pressing issues, such as forest projects, carbon removal technologies, or renewable energy sources. Allowing companies to invest in offsetting their emissions can generate a direct and immediate response in some cases, which is where the Voluntary Carbon Market (VCM) emerged.

The VCM was started in the early 1990's, established for the voluntary offsetting of emissions by corporations. It grew slowly, and accelerated its growth and global acknowledgement by 2017, with more than doubling in size over the subsequent 5 years until 2022. This was driven by agreements such as the Paris Agreement and conferences like COP26, and many more programmes, initiatives and social pressure have driven it also (Lipton 2021). Carbon markets have two categories: The Compliance Market (CM) and the Voluntary Carbon Market (VCM). Compliance markets are governed from mandatory national, regional, or international carbon reduction regimes. The VCM emerged for those organizations that have willingly chosen to engage in carbon reduction in the atmosphere and are usually purchased in accordance with greater public relations efforts by a company or organization, to present themselves as a climate actor and supporter (Cage, et al. 2019). Voluntary carbon credits, defined as a voluntary compensation to neutralize emissions, cannot be used in the CM, leading to them holding a lower price point (Blaufelder, et al. 2021). These credits tend to differ in

price, depending on the project type, location, verification and even co-benefits. Due to the nature of the VCM, compared to the compliance market, there is greater ability and desire for experimentation from carbon offset project developers and customers. The VCM has the advantage of having lower transaction costs than compliance credits, allowing for the monetary flexibility to innovate.

In response to the flexibility, additional certifications of forest carbon projects have been developed, such as the Climate, Community & Biodiversity Standard and Social Carbon Standard, which ensure robust design for local community and biodiversity co-benefits. Premium Carbon Credits or Co-Benefit Carbon Credits are defined as credits that go beyond direct emissions avoidance or carbon removal and additionally generate positive impacts for environmental, social and economic sustainability (Cage, et al. 2019). Premium Carbon Credits generally seek to protect biodiversity, generate economic development in affected communities and enhance educational opportunities to name a few. These co-benefit carbon credits wear different names and within this thesis we will call them 'premium carbon credits'. Essentially, a premium is paid on the carbon credit, to generate the funds to invest in non-carbon impact adjacent to forest carbon projects. As a for-profit company in the Greentech space, the business case for premium carbon credits comes from the need to generate profit as well as the desire to simultaneously make a far reaching and long-term impact.

Pachama is a technology powered project development company, based in San Francisco, and operating entirely remote, specialized in developing high quality supply of nature-based solutions for forest restoration and preservation. They develop projects in Mexico, USA and Brazil currently, with partners, developers and customers all across the globe with plans to expand projects globally in the future. They use state-of-the-art methodologies including Artificial Intelligence. Products that allow for extremely accurate baseline and carbon monitoring for assessing highly accurate additionality of existing projects and new original projects.

Pachama holds a high-quality standard within the VCM; making sure that they are confident that any credits issued and sold, represent the communicated amount of carbon captured for their customers offsetting. This ability to assess highly credible additionality of carbon sequestration, makes Pachama hold a premium position and price point, as there is a premium paid for their price guarantee. In developing this thesis and understanding the development of co-benefit additionality, Pachama will need to transfer this high standard of assessment of carbon into honing a impeccably high standard of assessing impacts, to justify the premium prices for credits to their customers in the long run. To understand the context of the sustainable development goals, it is important to understand that climate action especially, has strong synergies and trade-offs within all of the 17 goals (Lipton 2021). Co-Benefits in premium carbon credits need to be aligned with all goals, to achieve climate mitigation and non-climate objectives in the long run. Developing and conserving forests and their foundations can and will affect all 17 goals if done well, and with longevity in mind. At COP26, a yearly summit for climate action toward the Paris Agreement, nature-based solutions were at the forefront of discussions, as it was surveyed that "92% of countries' new nationally determined contributions (NDCs) to the Paris agreement on climate change now include measures to tackle nature loss" (United Nations 2021). To make these targets lasting and impactful, the whole scope of sustainable development indicators needs to be addressed through co-benefit focus.

While working with Pachama on strategy and expansion planning since June 2022, great insight into the VCM and understanding of processes to originate carbon forest projects were developed. When considering all the developments in the industry, and the desire to generate additional non-carbon benefits within forest carbon projects, there are some factors that determine the ability for Pachama to fully implement these premium carbon credits. The concept of willingness to pay and follow through to purchase are pivotal to understand, to estimate the adoptability of additional efforts and investments by present and future customers of Pachama. From this, a hypothesis and two sub questions have been generated, to guide the

analysis and identification of solutions to the answer: What is the primary strategy for Pachama implementing premium carbon credits into their operations? And more specifically, what do peers, partners, and customers value in co-benefit reporting and along what criteria should projects be designed for greater standardization? And especially, how do we prove additionality (impact) of non-carbon investments in forest carbon projects and how is it best measured?

In this thesis the first steps in understanding operational expansion to premium carbon credits are analyzed and the pre and post project development aspects are investigated. The findings of this thesis verify the prior assumptions that the CCB standard in accordance with the currently used VCS carbon credit certification is the most thorough and accredited standard to design carbon forest projects by, to generate the greatest and most credible impact.

The VCM Marketdata, analyzed later in this report, shows the increase in price of CCB standard credits following 6 years of data tracking and exemplifies the quality and continuous development of the standard. Impact is multi-disciplinary and multi-functional, and we must prioritize criteria before project development and implementation; this thesis has developed the most pivotal criteria that reflect Pachama's desires and values for impact as well as partner and customer values for impact simultaneously. Social impact generation is the most prioritized by institutions, governments, and private entities, reflecting the improvement of most SDG development goals when social development is heavily supported and invested in for additional non-carbon benefits.

2. Literature Review

2.1. Climate Finance Activation for Projects

To lay a path for carbon emission mitigation and sustainable growth transitions, a crucial aspect in business is generating climate finance. Carbon forest projects of any size require crucial large-scale investments with long-term financing. The co-benefits market within climate finance is inadequately explored, and direct impact emission mitigation investments are put in focus. Policies navigating toward enhancing climate finance can be biased due to the poor

comprehension of trickle-down effects and additional benefits that are not inherently tackled in the project. Lou, Hultmann, Patwahrdan and Qiu state in their research paper that the mobilization of financing is limited, especially in the private sector where social governance topics are less poignant, and ultimately reducing the ability to generate projects with co-benefits for local community enhancement (Lou, et al. 2022).

To enable climate financing, there needs to be firstly: greater development of the further impact of any project on communities, environment, and culture. Financing in the corporate carbon climate doesn't just activate project development and implementation, but also verification, standards, and monitoring. The report found that projects with a high likelihood of delivering quality co-benefits received a 30.4% higher price and therefore significantly higher financing rewards (Lou, et al. 2022). Their analysis supports this thesis' assumption, that the market value for co-benefits is significant, and the clean development mechanism, along with SDG alignment is the most accurate basis for econometric analysis. The author Amit Bouri builds on Lou, Hultmann, Patwahrdan and Qiu and outlines the need for standardization and increase of reporting, accounting, and financing and that these must evolve in tandem (Bouri 2011). This development is evident through the development of impact accounting frameworks, such as Impact Reporting and Investment Standards (IRIS), where the Global Impact Investing Network has lead the effort in raising capital for financial and non-financial reporting standard development.

While the standards are developed as free public goods, the ability to better articulate meaningful impact is considered priceless for the future of sustainable development. Bouri deciphers that sharing and collaborating which is enabled through well financed and developed tools, leads to co-investment deals that help enterprises in the social and environmental field to achieve sustained impact (Bouri 2011). Diversity of investors through collaboration and frameworks that can be applied to various projects along the SDG goals, will accelerate greater financing through well-balanced information and data sharing in the future.

2.2. Categorization and Prioritization of Benefits

Ultimately, the decision for prioritization of co-benefits cannot be developed along a tool or a framework due to the diverse and unique nature of every project. Pachama and their partners, customers and project developers have a unique vision for credibility, quality, and technological advances in the carbon field. They understand the need for economic and social development to uphold carbon forest projects and ensure safeguarding climate worsening through carbon in the atmosphere in the future.

'Lessons from Australian Environmental Impact Assessment' by Sophie Riley outlines that the need for sustainable development to be fully operational to generate effective environmental impact is entirely true (Riley 2016). She outlines the usage of models for trade-offs and decision making and offers the valid idea generation of using civic science, as a tool for effective impact development that needs to be legislatively based. This challenges the context of Brazil as a study focus, due to the lack of policy and legislative civic duties by the government. However, what is satisfactory through Riley's research, is that private entities have the foundations and presence to overtake that role from legislative bodies and implement civil rights and societal development as key sustainable development goals within businesses (Riley 2016). Pushing private entities to take the legislative role will require backing from the industry players as well as conservation and sustainable development organizations and NGOs.

2.3. Challenges in the Measurement of Impact

Co-benefits in climate change mitigation are rarely measured with quantitative frameworks, as the methodologies for integration and evaluation are not standardizable. Usually, specific measurement and impact definition is left to project developers, as these integrate co-benefits from the foundation of the project. 'Measuring Co-Benefits in Climate Mitigation' by Ürge-Vorsatz, Tirado-Herrero, Lecocq and Dubash outlines a multi-objective and multi-impact framework, to encompass the diversity and radical expansion of co-benefits in various projects (Ürge-Vorsatz, et al. 2014). The interesting aspect they explore is the qualitative and advanced

strategic thinking that is achieved through aggregation and comparison of findings to cover all dimensions and phases of impact in the short and long-run. What the literature proves, is that measuring and quantifying qualitative impact into economic value leads to the greatest acceptance and understanding of impact. There are major challenges in measuring social and environmental impact; lack of standardization and guidelines for pre-planning and post-monitoring of project development enables incoherent tracking against a uniform standard (Ürge-Vorsatz, et al. 2014). Especially developing a economic or market value for an aspect of developed impact has not been developed or fully accounted for in literature and stakeholder assessments.

Stefano Rumi and Balashankar Mulloth studied the Social Impact Assessment Toolbox in their research into challenges in measuring social value creation, to investigate which direct and indirect challenges enterprises encounter due to the lack of standardized impact measurement and reporting tools (Rumi und Mulloth 2022). The challenges imply that collaboration is stumped, due to ineffective ways to generalize findings to other entities in a subjective manner. Enterprises striving for social and environmental benefits will have a subconscious desire to have positive outcomes, which may cause a development of bias toward impact measurement, if frameworks are self-developed (Rumi und Mulloth 2022). This uncertainty causes, for example, carbon companies to deter from developing beyond carbon, as additionality is hard to prove, therefore is unlikely to render profits.

3. Methodology

The development of this work project was done alongside integrated business research, in the context of Pachama. The purpose is to uncover the business case for the operational expansion into premium carbon credits in the Brazilian market with respect to reporting and impact measurement. After having defined and understood the scope of research, a thorough literature review with profound comprehension of the structure of the marketplace and industry was undertaken.

3.1.Internship with Pachama

Since the beginning of June 2022, I have worked alongside the Pachama Origination team, which develops original forest projects for carbon crediting. My role here was to develop a report for the understanding of the current market situation and peer evaluation for Brazil, Mexico and the USA, which ultimately comprised of thorough 65 pages of analysis. During this time, an understanding of the processes of forest carbon projects, and the politics and policies that dampen the desired large, global, developments was established. Correspondence and hands on work with Pachama and its marketplace experts has opened greater ideas for discussion, as someone unbiased in the operation of their business. Consultations and integrated role investigations with experts at Pachama led to the understanding of Pachamas' role within the market and in the future of premium credits. To integrate a long-term vision for Pachama within the VCM, thorough industry and policy analysis were conducted with project developers in Brazil, to understand the changing landscape and the need to acclimatize. The expert consultations, analysis and recommendations of this thesis answer the research question in great depth, while providing Pachama with a reference for future development.

3.2. Historic Market Data

Once thorough understanding of the ideologies behind premium carbon credits were established, a simple quantitative model was set up, to visualize and hypothesize the financial viability for Pachama to expand operations. Historic Market Data was utilized to develop a pattern of prices to reflect the trends in 'willingness to pay' for premium carbon credits, specifically for CCB certification credits.

3.3. Brazil in Focus

Brazil is one of the three focal areas for Pachama's origination projects, and the country has one of the most pivotal roles in carbon and forest development. Brazil is the 4th largest emitter of CO2 in the world, making them extremely liable for developing impactful and manageable strategies for avoided emissions and carbon capture. Deforestation in particular accounts for

55% of total emissions in Brazil (Matzinger 2018). Each year 1.2GtCo_2e (gigatons of CO2) are emitted, with that number rising to 1.5GtCo_2e in 2021, through burning and clearing of rainforest to make way for agricultural land, to provide charcoal for the steel industry or to harvest raw materials for wood products (Matzinger 2018). For these reasons I have chosen to focus on Brazil in my development of criteria and impact selection.

4. Market Situation Analysis

4.1. VCM Market Potential

The VCM (Voluntary Carbon Market) grew by 190% in 2021, to just under US $1 billion. Trove research intelligence forecast the VCM to grow a further 50-80% in 2022, attempting to reach a value of between US $1.5 to US $1.7 billion in total (Trove Reserach; University College London 2021). This was driven by an acceleration in the volume of nature-based solutions and the according rise in prices, as well as other non-carbon related solutions to environmental and social benefits, like cookstoves and water purification devices for rural developing communities. The VCM is being innovated day for day, with new technologies for generating the most reliable credits, to new developments in standards for quality and non-carbon additionality (SouthPole 2022). With the value of the VCM increasing so rapidly, it is a viable area for non-mandatory investment from companies, governments, and other clients to offset and develop alongside for long-term growth and climate change mitigation.

The considerable growth is also due to most firms outlining and pursuing net zero practices, with South Pole having estimated 92% of firms having diligent commitment plans. Looking at this evidence, we can summarize that the necessity and appeal is available; that companies, corporations and governments do already and will in the future commit to emissions reductions and more importantly, carbon projects (SouthPole 2022).

4.2. Risks to Developments in the Industry

One of the biggest risks is the risk of impact reversal, which can be broken down to the intentional and unintentional release of carbon back into the atmosphere through the degrading

effects of climate change, such as storms, fire, land-usage, and others (Jackson und Galik 2009). Another risk is the monitoring and presence of governmental bodies in enforcing policies related to land protection and carbon project development.

A large risk, when respecting the survival and well-being of small-scale landowners in Brazil, is uncertainty and unlawful distribution and resignation of predetermined landowner rights. The lack of a comprehensive and inclusive national database of land ownership (i.e., a land registry) has impacted the ability to accredit deforestation to specific landowners (European Union 2022). In each project, management strategies for items such as incorporation of partners and implementors, manipulation of forest structure, age and composition, forest land use and monitoring of carbon and non-carbon benefits can reverse risk and increase carbon sequestration if developed correctly.

4.3.Brazilian Policy Analysis

Under the Bolsonaro presidency there has been continued and amplified degradation in the Amazon, contrary to what Bolsonaro is preaching about the impact of his falsified efforts to preserve. Lack of governance and credible policies is a bottleneck in the political agenda that needs overcoming through a new presidency, however private entities have taking it upon their selves to make a mark on the Amazon Forest, which is now only about three quarters of its original area. Civil society and private efforts have emerged to fill this gap in incentives and policy legislation and have developed to govern in place of public authorities, such as the Pact for Restoration of the Atlantic Forest as well as the Restoration and Reforestation Observatory (Matzinger 2018).

4.4. Pachama in the Marketplace

Pachama is positioned as a market leader in innovation and in quality of credits developed. Formally, they are a technology company that leverages their skill of AI and satellite imagery to gain comprehensive insights into the most adequate and impactful storage of carbon in soil and forests.

Their standing in the market allows for great space for further innovation and is an opportunity for Pachama to become a market leader and example for other peers to follow. The opportunities in developing premium carbon credits are vast, including the ability to implement projects with greater long-term success through social and ecosystem benefits that will generate more value for buyers. Market value for Pachama's credit prices will in turn also increase, as awareness of the quality and premium is increased. As a general opportunity in the interest of all parties that take a stand in fighting climate change, developing this area within Pachama, will increase understanding and pressure for social and environmental implications of carbon projects and ways to increase co-benefits in ecosystem services all together.

4.5.Research Questions in Focus

Based on what is needed in a business environment, and the underdeveloped nature of premium carbon credits within the VCM, determining the viability for Pachama's expansion into this area of operations, is integral. The issue today, is the lack of standardization of methodologies to develop premium carbon credits, which leads to a consequent lack of adoption (Rumi und Mulloth 2022). A well-known anecdote to success in standardization is Toyota Productionsystems (TPS) use of standardized work and lean manufacturing. It was their key to maintaining stability in their manufacturing process with the just-in-time methodology, allowing for less risk in business areas such as inventory and forecasting, continuous improvement and effective problem solving (Syed 2009). When each project needs to completely start from anew, based on specific project boundaries, the extent to which impact can be created is not exhausted. Thus, to guide Pachama in designing the case for premium carbon credits, the following questions ought to be answered: *1) What do peers, partners, and customers value in co-benefit reporting and along what criteria should projects be designed for greater standardization? And 2) How do we prove additionality (impact) of non-carbon investments in forest carbon projects and how is it best measured?* This thesis will dissect these questions and propose valid and reasonable recommendations for Pachama to consider and use

as a strategic guide to design their product expansion of premium carbon credits into their portfolio.

5. Research Findings: Question 1

5.1. Standards for Carbon Credits and Co-Benefit Standard Options.

There are multiple standards for registering carbon projects, including Verified Carbon Standard by Verra (VCS), Gold Standard, Climate Action Reserve (CAR) and Clean Development Mechanism from UNFCCC (CDM). These standards have developed methodologies to verify different types of carbon projects across the globe, including waste management, renewable energy, energy efficiency, and Agriculture, Forests and Other Land Use (AFOLU) (Piel und Knöpfle 2022). Within AFOLU, which Pachama operates in, there are forest carbon project types such as Afforestation, Reforestation and Revegetation (ARR) and Reducing Emissions from Deforestation and Forest Degradation (REDD+). Under REDD+ there are different project types such as Avoided Unplanned Deforestration (AUD) and Avoided Planned Deforestation (APD). Pachama develops ARR and REDD+ projects and registers under the Voluntary Carbon Standard (VCS) by Verra as well as the Gold Standard, as these two are the most developed and utilized standard developed alongside Paris Climate Agreement and COP 26/27 outcomes (Piel und Knöpfle 2022). Once a carbon credit is verified under the VCS standard, an extension of co-benefit investment and impact can be attained.

The three standards for co-benefit standards that are widely publicized and utilized are the Climate, Community and Biodiversity Standard (CCB), the Sustainable Development Verified Impact Standard (SD VISta) and the Social Carbon Standard (SCS). All standards assess the additional impact of projects beyond carbon capture and are third party verifications, which is incredibly important for credibility and accountability (Verra 2022). Due to the rising attention paid to social and economic aspects within the Sustainability spectrum, specifically in carbon offsetting and reforestation, the VCS expanded the CCB Standard as well as the SD VISta standard for verification of impact. The CCB is only applicable to AFOLU projects, where net

positive impacts on environment and community want to be proven. CCB also is affiliated with large and highly developed conservation groups: The Nature Conservancy, Rainforest Alliance, Wildlife Conservation Society and Conservation International, meaning that high quality governance and design of the CCB are continuously being developed with these affiliations (Verra 2022).

More than 70% of forest carbon projects that are developed under the VCS, also pursue certification with CCB (United Nations 2021). The SD VISta standard works primarily in accrediting and recognizing projects that were developed according to specific Sustainable Development Goals (SDGs). Lastly, the Social Carbon Standard develops many varieties of projects, while CCB focusses on forestry projects exclusively. The different types SCS focusses on can range from energy projects to fuel switching projects.

The Intergovernmental Panel on Climate Change (IPCC) considers co-benefits to be the positive outcomes of carbon mitigation policies or measures, on a subject that had not been intended to be affected (Lou, et al. 2022). However, further research considers co-benefits to be intended and unintended positive and/or negative outcomes from projects and programmes. Interest in the inclusion of premium carbon credits has peaked, according to Gabe Chapin, project supply lead at Pachama, but the issue is not necessarily the generation of premium credits, but the buyer's perspective pre and post purchase.

5.2.Comparison

When looking at the way each standard ranks in comprehension, efficiency, and diligence, the CCB has been proven to surpass both SD VISta and SCS in terms of cohesiveness with Pachamas values especially. The CCB, SD VISta and Social Carbon Standard (SCS) all have broad geographic and project type covering, the standard is functional and applicable in project operations and is a third party add on verification to a previously defined carbon standard (Zwick 2008). The CCB programme and SD VISta programme, however, can be used on their

own or also in combination with VCS programmes, exemplifying their flexibility and cohesiveness with all types of impact measurement.

The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, developed a report for the International Climate Initiative that developed a framework for the evaluation of the most stringent standards for co-benefit carbon projects (Schmidt und Gerber 2016). The evaluation was developed through scoring each standard by the following criteria: climate integrity including additionality, permanence and leakages, biodiversity conservation including biodiversity impacts, human and community rights which includes community impacts & recognition of human rights and coherent processes, stakeholder participation and sustainable community development and project viability & UNFCCC/ jurisdictional compatibility.

As a co-benefit standard is an add on, the CCB and SCS, unfortunately not the SD VISta, were assessed in coordination with a carbon standard. The results were that VCS+CCB standard combination reach the highest score of 94%, followed by ACR+CCB with a total percentage score of 88%. Verra+SCS only reached 70% and ACR+SCS landed at a 64%. What can be deduced however, is that using the VCS+CCB and complementing this with the SD VISta, if Sustainable Development Goals are met simultaneously, is the most representative and comprehensive way to verify social and environmental impact (Schmidt und Gerber 2016).

5.3. Data Support for Quality Increase of CCB

Using historic and present OPIS market data, with frequent benchmarks of REDD+ and CCB credit pricing, an average price of yearly premium carbon credits has been determined. Appendix 4. shows the table of average prices for June, July, August, and September for each year from 2017 to 2022. From 2017 to 2022, the average price of REDD+ (Reduction of Emissions from Deforestation and Degradation) and CCB combined credits has increased by approximately USD 3.50, from USD 11.01 to 14.53$, which coincides to a 32% rise in price over 5 years (OPIS 2022). This upsurge indicates the increasing willingness to pay a premium

by customers in the VCM. It also demonstrates the steady yearly increase in premium price for CCB credits, reflecting the increase in quality of the CCB project verification and design principles (Zwick 2008). This aligns with the assumption that, year for year, the standard develops and improves with greater attention to size, diversity, and wide-reaching impact for verification. What is also evident is that the supply of CCB credits has not increased to a large extent, as the price would have not risen to such an extent if there had been an abundance of supply for REDD+ and CCB credits (OPIS 2022).

5.4. Most Pivotal Factors to Pachama, Partners and Customers

The values and needs of each stakeholder are different, in Appendix 1, an understanding of stakeholders and their involvement in a forest project are outlined, generating a general understanding of their needs and expectations. Each project has a unique context and dependent upon factors such as location, project type, activities, partner experience, economic, political and social context amongst other factors, we must foster a guide by which aspects in projects can be assessed. It is true that each project will require different methodologies and diagnostics, but the definition of criteria important to Pachama will allow for specific indicators to become standard practice and impactful to stakeholders in the long-term.

In Appendix 2 and 3, criteria have been developed that coincide with Pachama's values and prioritizations for social and ecological development in projects; as well as developing criteria that are believed are most relevant to customers, based on an analysis of 3 previously certified Brazilian CCB projects from different developers*, the Valparaiso Project, the Envira Amazonia Project, and the Brazilian Amazon APD Grouped Project* (Verra Registry 2022). The criteria have also been ranked in order descending order in terms of ease of implementation and relevance. This thesis intended to gather an understanding of market value for the criteria, to comprehend what customers expect as a return from their premium investment. We want to comprehend what impact criteria are the most poignant and can be developed the most accurately for each project, to bring every type of value possible, to stakeholders. Here, the

incorporation of criteria in previously verified projects has signaled high value and relevance for the market, partners, and customers.

5.5. Risks for not Developing Clear, Comprehensive Criteria

As project evaluators of vintage carbon projects, Pachama has assumed responsibility for evaluating credibility, reliability, and compliance with the high standard they hold. Now, to accurately develop a strategy that truly adds value to Pachama's originals' projects with social and environmental co-benefits, and to uphold this same standard, we need to ensure accurate monitoring and the likelihood of long-term success. The greatest success in this aspect will be generated from accurately setting criteria, indicators and understanding the value added to stakeholders. One risk of not developing an individualized criteria to a thorough extent is that Pachama would largely relying on our partner's social and environmental expertise and developing alongside their criteria. If their criteria are not as extensively developed, we risk tarnishing Pachama's reputation and credibility in generating highly reliable and well-developed credits.

Pachama's mission is to develop 100 million hectares of forest by 2030, which will only be achieved through partnerships and cooperation and therefore Pachama needs to outline their standards thoroughly. Another risk is project failure, as inadequate stakeholder engagement, alignment of values and incentives and therefore bad governance, projects lack longevity. If benefit sharing is not at the forefront of project development, stakeholders will start to act in their own interest to receive their maximum benefit and exploit the project – this can be reflected in the concept of the tragedy of the commons.

An additional risk, that is evident, is the negative effect on stakeholders and the environment that can be perceived through inadequate understanding and preparation of criteria with which to manage the projects. Every project could have different direct and indirect negative outcomes, such as social conflicts, food insecurity or watershed health (European Union 2022).

By accurately mapping the potential negative outcomes, these can be eliminated or paid close attention to in the project roll out for mitigation and management.

5.6. Conclusion for Selection of Criteria

A major drawback in all pure carbon standards, such as Verra and ACR, is the non-permanence of impact and project development post crediting period. Longevity is vital for the integration of co-benefits and carbon forest projects and adding the CCB standard to the Verra standard ensures this (SouthPole 2022). The developed criteria fit in the scope of CCB due to their interconnection and ability to promote direct and indirect, long-lasting socio-environmental impact, which will in turn lead to preservation of forest projects (Schmidt und Gerber 2016). To also identify the areas for SD VISta incorporation, the criteria exemplify the SDG indicators that fit to the developed criteria, but as evident, the SDGs don't always apply to the well-rounded criteria in every aspect (United Nations 2021). Under the CCB, it is the third-party auditors that approve projects to be accredited with a CCB verification. The lack of accrediting board within the CCB poses a potential risk and weakness to the credibility in the long-term; with even slight skepticism, the credibility of the CCB is put in jeopardy.

The SCS standard has simple and suitable guidelines for monitoring and focusing on 5 aspects of development. Unfortunately, for the scope of Pachama the SCS is underdeveloped and lacks flexibility in design of projects, and availability of discovering unique methodologies for implementation and impact, which the CCB allows for. The SD VISta standard does not acknowledge impact beyond SDGs and therefore leaves limited amount for innovation and expansive impact (SouthPole 2022). It becomes clear, when researching the Verra registry, that the SCS is not commonly used, and its scope does not coincide with the requirements of partners to develop their framework to a credible level. However, we recognize that our criteria development fits into the CCB design principles best, due to the nature of the understanding and the development with major social development in focus.

6. Research Findings: Question 2

6.1. Definition of Non-Carbon Impact

An environmental impact is defined by a change to the environment, whether positive or negative, that results in a change of the original state of that environment. In terms of impact from forest carbon project development, we assess impact as the positive or negative, direct, or indirect effect on carbon in the atmosphere, social and community development and natural ecosystem preservation (Ürge-Vorsatz, et al. 2014). There are multiple impacts that can be derived from activities to name a few:

- Environmental: Air quality, biodiversity, water quality, soil protection
- Social: Improved public health, gender equality, energy access, clean water access community engagement
- Economic: Job creation, educational opportunities, technology transfer, infrastructure, Inclusive economy

For the full scope of understanding the values and goals that Pachama has, an extensive prioritization of relevant criteria has been developed. For societal and community development there are many indirect impacts that Pachama needs to value to generate the highest level of sustainable and economic development in their project areas.

6.2. CCB Measurement for Impact

The CCB standard is a project design standard for early definition and development of robust and long-lasting project co-benefits; it is 3rd party verified which is incredibly important for credibility by partners, peers, and marketplace authority. It clearly outlines the requirement for social and biodiversity benefits to be clearly generated through the project and not from other factors, but it does not indicate how exactly to measure the impact (European Union 2022). This means the attribution of results to activities is vital in the initial steps – which is simultaneously the most intricate part of impact development. The more traditional approach

to attribution is quasi-experimental methodology or 'matching methods', in which baseline and project outcome (control and treatment) are compared for communities and individuals.

The CCB standard protocol has developed a biodiversity and social impact assessment framework for credit developers to use but are not exclusively confined to (The Offset Guide 2022). Additionally, the CCB standard does not incorporate a quantitative verification of non-carbon benefits but relies on qualitative only. The CCB fundamentally requires the congregation of overarching principles for development but does not specify measurement and impact guidelines. In the CCB design plan however, there are principles to monitoring, which describe steps to monitoring and reporting. Ultimately, the measurement follows the idea of the impact assessment framework 'Theory of Change'. This is ultimately a comprehensive description how a desired change happens in a specific context. The basis is the understanding of what type of activity will lead to the desired outcomes and simultaneously recognize preconditions for long-term success (Rogers 2014). A simple Input > Activity > Output model is used to visualize and describe impact. TOC criteria can be used as impact methodology alongside CCB framework and project design principles.

6.3. Baselining for Impact

In dealing with impact assessment processes there are key questions to be answered throughout the duration of the project development and implementation, a baseline establishes the 'before project' situation. There are many stages at which a baseline can be developed through stakeholder engagement. Local perspectives must be included in a baseline, as Pachama must be cautious of creating an unrealistic idea of a community they are not familiar with. A primary local diagnosis will set the initial understanding and the primary baseline. Again, in the project design phase a reassessment of baseline or 'without-project impact' data with the definition of goals and activities can be assessed. Throughout the implementation phase and the life-time phase there can be new data for future improvement gathered through the monitoring of activities, which can be used in the future to better estimate baselines. Each new

forestry project needs to be assessed based on the aspects that are relevant to that new generation and identify what changes take place for people and communities both directly and indirectly. These constitute:

- Clear identification of groups and people impacted in the immediate and long term
- What social impacts on their welfare are important and require assessment (prioritize)
- What dimensions and measures of welfare are relevant and need to be considered
- What biodiversity and ecosystem impacts are important and can be impacted through project design
- What questions about these dimensions must be addressed and assessed

6.4. Impact Measurement for Pachama

The projects used to investigate and develop criteria all measured impact through direct indicators and measurement, as well as the theory of change (TOC) framework. Within Social Impact Assessment (SIA) tools, the most prevalent in measuring stakeholder, social and environmental impact, vital foundations for Pachama, is IRIS+. IRIS, (Impact Reporting Investing Standards) is a globally accepted performance metric catalogue that is used to measure social, environmental, and financial success of impact investments, to grow credibility and evaluate current and future projects (Global Impact Investing Network 2019). IRIS' scope is adjacent to the UN's principles of impact investing and SDGs, which define a commitment for using standardized metrics and interlacing different targets in impact outcomes.

Hence, the use of IRIS allows investors to develop understanding for positive and negative effects of investments and in turn, negate the negative effects and optimize the positive effects. The IRIS model also coincides with the theory of change (TOC), where the CCB also is strongly reflected, which develops its fundaments in understanding the relationship between cause-and-effect actions, more specifically we can see how financial and organizational resources are hypothesized to be transformed into social and environmental impact results (Rogers 2014). In

fact, companies, and customers across the range of carbon developers are preferential to developing impact measurement along the theory of change model. The comprehension is high as it is a logical flow framework, often used in business and other industries as a standardized way to measure changes of various projects. The evaluation generates 400 metrics in social and environmental metrics that can be selected and appointed based on relevance to one's project, producing an accredited reference point developed by experts and used by multiple companies, enhancing the standardization of impact reporting, which is vital for credibility (Global Impact Investing Network 2019). What has become evident is that the criteria and metrics are non-prescriptive, giving way to applying the different dimensions to all types of projects and impact goals. This allows the diversity in projects to be reflected while still allowing for standardization.

Developing a more specialized metric to various product types, could allow for greater transfer of poignant information that would in turn allow for more rapid and targeted development of carbon forest projects. Simultaneously, developing indicators along the metrics is highly beneficial, as it allows for harmonizing policy objectives and management approaches, verifying effectiveness and ultimately enabling payments for ecosystem services and generating market advances. As Pachama develops similar objectives for various projects, a highly applicable exemplary metric standardization would allow for bottlenecks of uncertainty to be eliminated and project impact planning and measurement to be more concise. Specific Pachama Project – and look at how impact should be measured. And choose a framework to measure impact and how it goes together.

7. Recommendations

7.1. Use CCB standard with SD VISta

The developed criteria are designed along the principles of the CCB standard. The third edition CCB standard design guide to measuring impact is detailed and intricate enough to allow for in-depth and thorough analysis, deep diving into many components that will have long-term

positive effects. To remain CCB verified, project must be reassessed every 5 years (The Offset Guide 2022). To encourage Pachama credit buyers that their premium credits are high quality and credible, Pachama should tie together the SD VISta standard and the CCB standard for full coverage of specific indicators and SDG indicators.

7.2. Develop Partnerships with Implementation and Community Impact Partners

As the CCB does not have an accredited registry; but projects can be found over the Verra registry, Pachama could generate a registry for VCS+CCB offset credits to ensure collective impact action across the VCM. Developing partnerships with organizations that lead in social and environmental best practices and follow principles and indicators of SDGs for ecosystem services. For example, Mercado Livre is a large developer with Pachama in Brazil, and further partnerships should be established preferably with other project developers and implementors to generate larger projects with greater extent of monitoring. All partners and developers can come together to generate databases based on project country or biome.

7.3. Hire Non-Carbon Impact Team

If a premium will be charged, customers and partners need to have a tangible asset to justify the higher price; this can take the form of a team and project development assistant for prior and post assessment as well as continuous monitoring. An internal committee will ensure the criteria and frameworks are developed along Pachama's high standards and will account for premium pricing. The continuous monitoring and advanced development of future projects with learnings from previous projects will be highlighted through an additional internal team.

7.4. Keep Things Simple

While the recommendation is not to ignore the intricate hard to measure elements in social, environmental, and economic impacts, keeping things simple will allow for the greatest impact. When focusing on a larger simple impact, such as – developing education – economic prosperity, job creation, more sustainable practices and so on will all follow automatically as indirect impacts from a direct broader tackling of a prevalent issue.

7.5. Mitigating Shortcomings in Impact Measurement through Developing a Digitalized and Standardized Database

Digitalization with a project management tool will allow for greater tracking and faster responses in areas where there is especially high risk. It will allow for progress across nations and reactive forecasting of impact that can be developed for improved impact. It will allow for greater risk assessment and management of teams work and improve accountability and responsiveness to new issues that may arise throughout the project development.

Another way to mitigate shortcomings is to develop alongside the IRIS database, as it allows for comprehensive collaboration and information exchange with partners and peers in forest project development.

7.6. Poignant Selection of Social Criteria at the Forefront of all Operations

The three-criteria: gender equality; clean water supply and economic development should be put in the forefront of Pachama's communication efforts. To be held accountable for attempted development in these areas, it is possible to develop consistent and coherent feedback and monitoring for these criteria specifically. These are also criteria that can be held across all operational areas for greater control and understanding of how projects in regions change and how they need to be tackled differently. Additionally, these criteria are the most relevant to any type of project that is and may be developed with Pachama in Brazil.

7.7. Using a more Advanced Model than 'Theory of Change'

While IRIS+ does not necessarily need to be the impact measurement of choice; the classically used 'Theory of Change' framework, which is a simplified and highly situationally adaptable model, does not indicate well balanced impact measurement. Developing detailed indicators to monitor and a standardized measurement and tracking system specific for Pachama and their products is advised. These so-called Social Impact Assessment tools (SIA) can be developed and adapted to fit a more precise business and project model. These include tools such as the

Sustainability Balanced Scorecard (SBSC), Social Return on Investment (SROI) and Cost-Benefit Analysis (CBA).

8. Conclusion

In general, the CCB standard is being widely acknowledged as a major breakthrough in quality verification for co-benefit developments in forestry conservation projects. However, the value of biodiversity and social development will never fully be developed, as there cannot be a universal determination of value and relevance. What upholds as a conclusion for impact assessment for the entire market is that a standardized tool will generate the widest spread of impact, and with the developments in carbon market platforms, such as the Net Zero Marketplace developed by Salesforce in September 2022, credits will be easier to trade and develop, generating a need for accredited institutions to verify the credits of relevant players. Companies such as SouthPole, Sylvera and Climate Impact Partners, which develop nature-based solutions similar to Pachama, are collaborating through platforms such as the Net Zero Marketplace, generating a standardization across methodologies and access to the market for others. This is immensely pushing impact generation and innovation in the field, where any efforts beyond the bare minimum will be hugely recognized.

8.1.Wrap Up

It is a truism that carbon credits are not perfect, but they have the ability to be more than a tool for a company to offset their emissions rather than focus on reducing emissions directly. It is valuable to see the benefit that can be exploited through focusing on bigger issues and multiplying the impact across social and environmental factors. Throughout this research and my internship, I have found my view of the VCM and the efforts made for carbon sequestration and non-carbon impact development sway from slight skepticism to full support. This skepticism comes from the idea that carbon credits act as a scapegoat to companies and allow them to avoid changing their business activities, and quite possibly even emit more. Additionally, the full effect of a forest carbon project on carbon sequestration is only realized

after the forests are established, which in many cases can take upwards of 25 years. However, with Pachama working hard at reestablishing forests and redefining commitment and responsibility, the positivity of the industry and their actions is hard to fault. The development opportunities that Pachama has are vast, especially with the opportunity to lead and teach in the industry. The upper hand they have in quality assurance in crediting, gives them the accountability to be credible in the development of premium credits also, making it a no-brainer situation.

8.2. Limitations of Research

The limitations lay in the lack of poignant research into co-benefits in carbon sequestration projects. The underdeveloped frameworks in impact analysis allowed me to analyze and defer assumptions, but also limited me in finding truly effective and focused models for Pachama to operate with. A lack of competitors and peers acting in the market and being transparent about data, projects, and impact over time limited my critical analysis. Due to the carbon credit market, especially the VCM, still growing and evolving, there is not a large amount of historic, impactful data, from which to draw valuable assumptions and patterns. Market ready data is always kept private, especially in this industry, as competitors are attempting to keep their developments as a growth tactic for market leadership and first mover advantage. The market data for CCB price assessment has the limitation that there is no availability of average prices for all months from the past 6 years. The only available data is from June, July, August and September, decreasing the significance of the averages generated. The data allows for the assumption of an upward trend and increasing willingness to pay to be supported. This lack of significant and complete data is a common theme throughout the research for this thesis, leaving the assumption that data is kept private for companies to remain competitive. However, in tackling climate change, there should be no competitors, only cooperators. As this does not uphold in reality, the lack of data and collaboration within the VCM is disheartening for future development and transparency.

9. Bibliography

World Research Institute. 2022. *World Research Institute*. June. Accessed October 12, 2022. https://www.wri.org/initiatives/carbon-removal.

Cage, Patrick , Michael Gillenwater, Derik Broekhoff, and Tani Colbert-Sangree. 2019. *Carbon Offset Guide*. 13 November. Accessed October 12, 2022. https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/voluntary-offset-programs/.

Blaufelder, Christoph, Cindy Levy, Peter Mannion, and Dickon Pinner. 2021. *A blueprint for scaling voluntary carbon markets to meet the climate challenge*. New York: McKinsey Group .

Lipton, Garbielle. 2021. *Landscape News* . 11 November. Accessed October 12, 2022. https://news.globallandscapesforum.org/55761/nature-has-its-moment-at-the-center-of-cop26-discussions/.

United Nations. 2021. *Nationally determined contributions under the Paris Agreement* . Synthesis Report, Glasgow: UNFCCC.

Lou, Jiehong, Nathan Hultman, Anand Patwardhan, and Yueming Lucy Qiu. 2022. *Integrating sustainability into climate finance by quantifying the co-benefits and market impact of carbon projects*. Harvard Publishing .

Bouri, Amit. 2011. *How Standards Emerge: The Role of Investor Leadership in Realizing the Potential of IRIS*. Report, Global Impact Investing Network.

Riley, Sophie. 2016. *Prioritising the Environment in Sustainable Development: Lessons from Australian Environmental Impact Assessment*. Springer.

Ürge-Vorsatz, Diana, Sergio Tirado Herrero, Navroz K. Dubash, and Franck Lecocq. 2014. *Measuring the Co-Benefits of Climate Change Mitigation*. Annual Review of

Environment and Resources, Budapest: Center for Climate Change and Sustainable Energy Policy.

Rumi, Stefano, and Balashankar Mulloth. 2022. *Challenges to measuring social value creation through social impact assessments: the case of RVA Works*. Journal of Small Business and Enterprise Development, Emerald Publishing Limited.

Schmidt, Lars, and Kristin Gerber. 2016. *A comparison of carbon market standards for REDD+ projects*. Research , Berlin: Germanwatch e.V.

Social Carbon. 2022. *Social Carbon*. Accessed October 20, 2022. https://www.socialcarbon.org.

Verra. 2022. *Verra*. Accessed October 24, 2022. https://verra.org/programs/sd-verified-impact-standard/.

SouthPole. 2022. *Project Development Standards & Labels*. Accessed November 3, 2022. https://www.southpole.com/projects/project-development-standards-labels.

The Offset Guide. 2022. *Climate, Community & Biodiversity Standards*. Accessed November 11, 2022. https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/add-on-standards/climate-community-biodiversity-standards/.

Rogers, Patricia. 2014. *Theory of Change*. Impact Evaluation No. 2, Methodological Briefs.

Matzinger, Stefan. 2018. *https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/infrastructure/pdfs/pathways_low_carbon_economy_brazil.ashx*. Impact Report, Sao Paolo: McKinsey & Company. https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/infrastructure/pdfs/pathways_low_carbon_economy_brazil.ashx.

Trove Reserach; University College London. 2021. *Future Demand, Supply and Prices for Voluntary Carbon Credits – Keeping the Balance*. Analysis Report, London: Trove Reserach.

Jackson, R. B., and C. S. Galik. 2009. "Risks to forest carbon offset projects in a changing climate." *Forest Ecology and Management*. https://jacksonlab.stanford.edu/publications/risks-forest-carbon-offset-projects-changing-climate.

Syed, Ferhan. 2009. *Standardized Work in Toyota Production System*. 18 March. Accessed December 4, 2022. https://totalqualitymanagement.wordpress.com/2009/03/18/standardized-work-in-toyota-production-system/.

Piel, Nina, and Jennifer Knöpfle. 2022. *ClimatePartner*. 28 February. Accessed August 1, 2022. https://www.climatepartner.com/en/climate-action-insights/all-you-need-to-know-about-carbon-offset-projects.

OPIS. 2022. *Opis Carbon Market Report*. Accessed November 22, 2022. https://www.opisnet.com/product/pricing/spot/carbon-market-report/.

Verra Registry. 2022. *Verra Registry Overview*. Accessed November 18, 2022. https://verra.org/registry/overview/.

European Union. 2022. *Sustainable Development Goals (SDGs) – Overview*. Accessed December 7, 2022. https://ec.europa.eu/eurostat/web/sdi.

Global Impact Investing Network. 2019. *IRIS+ and the Five Dimensions of Impact* . Catalogue of Metrics, Impact Man agement Project .

10. Appendices

Appendix I. The values and needs of each stakeholder are different, in Appendix 1, an understanding of stakeholders and their involvement in a forest project are outlined, generating a general understanding of their needs and expectations.

Stakeholder/ Interest Group	Dependency on Forest Area	Impact on welfare in economic terms
Group with commercial interest in certain aspects and parts of forest	Interest in the market value of land and resources from forest area; may vary dependent upon area within the forest.	• Resource abundance • Access and Infrastructure • Longevity
Local landowners / forest dwellers with interest in their wellbeing and livelihoods	Dependent on their living environments as a source of sustenance and livelihood; monetary and material dependency on forest area; high interest in sustaining the whole ecosystem for long term reliability.	• Gender equality • Sustainable, culturally appropriate means of living • Food security, food sovereignty • Resource security • Waste management • Water quality • Protection of human rights • Soil health and nutrition • Education and development • Community & cultural events
Environmental Advocacy Groups interested in forest preservation and biodiversity conservation	Holistic and non-consumptive view of forest area, with interest in developing environmental goods and services that can be gained while upholding the highest standard of sustainability; high value on educative and spiritual aspects.	• Biodiversity • Species dominance and variety • Protection of native species • Watershed health • Soil health
Local government interested in the wellbeing of the communities	Encouraging of sustainable development and conservation practices that support and develop the communities around project areas and enable locals to become sustained in health and finances. Underlying advantage to government in having committed members of society. Ability to push local and global agenda in social and environmental advances.	• Education • Economic Development • Sustained livelihoods • Tangible Forest Resources • Enhanced agricultural practices
Local government interested in economic development and payments from private institutions	Persistence of developing economic prosperity from forest resources and mainly immediate opportunities and not necessarily long-term vision. Potential ability to push local and global agenda in social and environmental advances while focussing on agenda of private payments and money flow.	• Tangible Forest Resources • Private earnings over community earnings • longevity of resources • Economic development • Infrastructure • Infrastructure • Public Health
Research institutions interested in preserving and researching	Interest in the preservation and restoration of forest landscapes for research and preservation desires. Fauna and flora research as well as soil, water, community and ecosystem structures, quality and changes.	• Species examination • Climate change impact • Pressures from human activity • Carbon research • Educational purposes • Research Development • Testing and Modelling
Government agencies for environmental policy development, partnerships and enforcement	Interest in the fundamental preservation of ecosystems and forested areas. Development of environmental agenda based on the needs of the landscape and engagement by communities, government and private institutions.	• Monetary transfers • Development of community education and workshops • Alleviate pressures on the ecosystem • Develop ecosystem services schemes • Community support for the preservation • Conservation • Access & Infrastructure

Appendix II. Table of SOCIAL criteria that coincide with Pachama, partner and customer values developed through analysis of previously certified Brazilian CCB projects within the same scope as Pachama.

Social Criteria	Description	Guiding Questions	Indicators	SDG Indicators
Mutual consent and agreement	Application to land owners or indigenous people with land. All the concerning stakeholders must be consulted with enough information to make an informed free decision.	Have all the key stakeholders given their consent? Did they have have equal information ? Were they all free from any kind of coersion? Was there an opportunity for involvement in project planning that was mutually agreed on my stakeholders?	- Compliance verification with the chosen standard for stakeholder consent - community baseline establishment - Feedback and grievance redress procedures	//
Stakeholder Identification and Engagement	- While consent applies only to concerning stakeholders (owners and indigenous rights holders), all relevant stakeholders (either affected by the project or that could affect it) should be properly engaged. - Stakeholders should primarily be analysed by their influence and importance to the project and the land. - This means they need to be informed and that their perspectives also need to be integrated into the design of the project. - Involvement of a strong diagnosis phase at stage 0 of the project before starting the activities so that they can provide inputs into potential negative impacts or how to increase positive impacts.	Are all stakeholders informed about the project's potential and its positive and negative impacts? Are stakeholders aware of the project timeline and its impact on their day-to-day? Have stakeholders been given the opportunity to have an open dialogue discussion? Is there a valid and trustworthy representative for each stakeholder, especially landowners and indigenous groups?	- Development of land tenure agreements and authorisations for indigenous people - Amount of stakeholder meetings and meaningful results generated - KPI's for project developed at stakeholder gatherings	16.3.3 Proportion of the population who have experienced a dispute in the project and who accessed a formal or informal dispute resolution mechanism, by type of mechanism. 17.19.1 Dollar value of all resources made available to strengthen statistical capacity in community area.
Sustainable means of living	Assess changes in means of life created from projects as the difference between means of life after the project and baseline means of life. A project should, therefore create at least the same amount of means of life in the long term than the baseline, either from direct patymenbts of carbon credit sales or through by products of the project (timber, ntfp, fruit, agriculture, ganadería, ecotourism)	Are there any means of life affected by the project? Which means of life are created by the project? How does the project impact the stakeholder's access to development opportunities? How do the stakeholders feel about the implementation of the project in the short and long run?	- Net means of life created (new means of life - previous means of life). - Satisfaction level with means of life (maybe no new means of life are crated buy people benefit from having a more dignified and connected with nature one depending on previous means of life). - Percentage of young people that migrate (perception of future posisibilities within communities) - Increased or decreased value of land - Number of basic necessities owned by community members Total number of community members whose well-being7 was improved as a result of project activities	1.a.2 Proportion of total government spending on essential services (education, health and social protection) 1.b.1 Pro-poor public social spending

Economic Development	- To generate sustainable economic opportunities and to implement local social projects for communities living in and around the project area. - Create frameworks on the project area level based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions - Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	How is the project designed to enable the communities to benefit from economic opportunities? What are the project risks to local landowners due to high dependency on the land? What kind of access is needed for greater economic growth? Do project developer ideas coincide with community ideas?	- Number of land ownership titles granted, that allow for ecosystem payments and monetary subsidies by the government - Improved agriculture techniques - Improved access to infrastructure and governmental subsidies - Number of people hired as eco-tourism guides	8.2.1 Annual growth rate of real GDP per employed person in the community 8.3.1 Proportion of informal employment in total employment, by sector and sex in the community 8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP 8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities 8.5.2 Unemployment rate, by sex, age and persons with disabilities 8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training
Community engagement	To implement local social projects for communities living in and around the project area. While simultaneously empowering and promoting the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	Are communities engaged in decision-making processes? Do they have access and availability to cultural and community project planning opportunities? How is the community activated in the project implementation process (set up/ monitoring)?	- Proportion of commmunity engaging and actively pursuing togetherness in the project - Number of employment opportunities for local c communities - Number of educational opportunities	//
Food security	Changes in food security/sovereignty with project implementation. - Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Will the project be implemented on previously cultivated land? Will economic remuneration be enough to guarantee the implementation of alternative sources for food of farmers? Does the project people's access to forest resources such as bushmeat? Does the compensation offer at least the same provision ecosystem services than the ones restricted by projet implementatiojn?	- Nutritional value of families' weekly food supply and percentage which is produced locally. -Food produced from landscapes. If we are sacrificing food production, are the benefits generated by carbon credits enough to compensate for this loss? On the contrary, some ARR (or ALM in case we ventured into them) projects could produce more food than their baseline scenarios by integrating edible species.	2.1.1 Prevalence of undernourishment 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES) 2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium- or long- term conservation facilities 2.5.2 Proportion of local breeds classified as being at risk of extinction 6.5.1 Degree of integrated water resources management
Gender Equality	Based on genders gaps identified by project, monitor how the project is contributing to reducing these gaps. For example, by creating means of life specific for women or by having workshops focused specifically for women. And guaranteeing that activities do not further enlarge these gaps by monitoring participation in activities such as workshops.	What are the gender gaps present at the moment of the project start? Does the project cause any of them to enlarge? Is the project helping reduce these gaps? How?	-Percentage of newly created means of life for men, women and other genders. - Number of assistants to engagement workshops and community project roles - Number of women with access to economic opportunities in comparison to men - Number of women whose well-being was improved as a result of project activities	4.5.1 Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated 4.6.1 Proportion of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex

Traditional cultural significance and respect	The integration of community and stakeholder traditions and cultural significant practices and events should be integrated into the project. This will enhance the acceptance and development of the project along with the guidelines that are prior imposed. This also includes agricultural, building and resource usage practices as well as education and development opportunities that coincide with cultural practices.	How are cultural aspects integrated into the project planning and implementation? What cultural events are significant for the communities and stakeholders?	-Proportion of total spending on essential services (education, culture and social protection) - Identification of areas that are critical for the traditional cultural identity of communities.	//
Building Materials	Communities require access to building materials. While forest projects seek to eliminate deforestation – which might negatively impact the communities' access to building materials – the communities use relatively little timber to repair their houses. The communities need to be allowed to continue extracting timber to repair their houses and over time, the Project must promote replanting hardwood species that can be specifically used by the communities for housing.	How dependent are local communities on the forest resources in terms of materials for building? How can sustainable building materials be best harvested to meet the demand and not implicate the project?	- Amount of hardwood extracted for building use - Proportion of maintained forest to resource usage - Proportion of outside sourcing of materials	12.1.1 Number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production 12.2.1 Material footprint, material footprint per capita, and material footprint per GDP 12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
Protection of flora species for medicinal purposes	Primary survival resources need to be preserved and protected, including plants that are used for medicinal, cultural and healing purposes. As an extension, access to healthcare is a factor that ties into preserving medicinal plants.	How dependent are the communities on producing their own medicines from the flora resources? Are the local communities given access to alternatives? How is tradition upheld in healthcare?	- Availability of healthcare practitioners - Abundance of medicinal plants - Number of community members engaging in herbal medicine production	3.8.1 Coverage of essential health services 3.8.2 Proportion of population with large household expenditures on health as a share of total household expenditure or income
General Health	The generation of sustainability and wellbeing in communities is highly dependent upon the general health and access to healthcare services. Improving conditions needs to be a major goal of non-carbon impact generation, in order for the community to persevere with the project.	How healthy is the population? Are there general underlying health issues? How do the community members access healthcare?	- Number of women for whom health services were improved as a result of project activities, measured against the without-project scenario - Total number of people for whom health services were improved as a result of project activities, measured against the without-project scenario	3.b.1 Proportion of the target population covered by all vaccines included in their national programme 3.b.3 Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis 3.c.1 Health worker density and distributio
Access to clean water and sanitation	To develop adequate and equitable access to cleaning water and to sanitation is a basic human right. Being able to generate hygienic conditions through sanitation infrastructure and avoid potential infections and illnesses through unclean water conditions.	How consistent is the availability to clean water? Have proper sanitation and hygiene methods been established? What is lacking for stakeholders and local communities?	- Number of toilets installed - Number of people/ children who were taught proper hygiene techniques - Number of water pumps and wells installed for community usage - Number of women who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario - Total number of people who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	6.1.1 Proportion of population using safely managed drinking water services 6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water 6.3.2 Proportion of bodies of water with good ambient water quality 6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Safety (workers and project affiliates)	Generate a comprehensive assessment of the situations and particular occupations that could pose risks to forest project worker safety. The Project Proponents will need to inform workers of risks, explain how to minimise risks, and the Project Proponents will use best work practices.	What are the risks of working on the project in the specific environment? What are safety measures that need to be developed? Are the conditions adequate for working?	- Total number of venomous or dangerous animals in the project area - Availability of guides and recognition points for identification of location	8.8.1 Fatal and non-fatal occupational injuries per 100,000 workers, by sex and migrant status 8.8.2 Level of national compliance with labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status
Education & Development	Education is the basis of means of implementation for sustainable human development and therefore the longevity and success of forest projects, due to the number of positive benefits it brings across the development goals. Improvements in education clearly aid in poverty reduction, sustainable practices and economic growth.	How many children go to school? How long do they attend? What are the reasons that they do not attend? How many women receive equal education opportunities?	- Total number of people for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario - Number of women and girls for whom access to, or quality of, education was improved as a result of project activities	4.1.2 Completion rate (primary education, lower secondary education, upper secondary education) 4.3.1 Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex 4.6.1. Proportion of the population in a given age group achieving at least a fixed level of proficiency in functional, literacy and numeracy skills

Appendix III. Table of ENVIRONMENTAL criteria that coincide with Pachama, partner and customer values developed through analysis of previously certified Brazilian CCB projects within the same scope as Pachama.

Environmental Criteria	Description	Guiding Questions	Indicators	SDG Indicators	S
Watershed Health	- Development of safety and protection of watershed health, while ensuring the conservation, restoration and use of water resources. - Achieve the environmentally sound management of wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to water and soil in order to minimize their adverse impacts on human health and the environment	What are the main activities and dependencies with the watershed in project area? How healthy is the watershed prior to project? What is the assumed impact on watershed health? How can risks be mitigated and opportunities created?	- Water potability - Development of risks factors over time for dependency on water - Improvement of water dependability - Level of quality of water over time and with different levels of project impact throughout	6.3.2 Proportion of bodies of water with good ambient water quality 6.6.1 Change in the extent of water-related ecosystems over time	
Species Dominance	The dominance of various species plays a large role in the biome. With an unbalance of natural species relationships, through invasive species and forest activity, less dominant species take a backseat and face various risks. Establishing a balance in the occurrence and interdependence of species is vital for ecosystem structure and survival.	What are the more dominant species? Which species are at risk? How will species dominance be best monitored while being minimally invasive toward the environment?	- Before and after values of traceable species - Abundance of species measured through rainforest noise monitoring - Combinations of species observed -Transitions between different biomes and forest areas - fauna monitoring performed in dry and/or rainy season	2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium- or long- term conservation facilities 2.5.2 Proportion of local breeds classified as being at risk of extinction 15.5.1 Red List Index (for area)	
Biodiversity	-Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally - Integrate ecosystem and biodiversity values into local project planning, development processes, and integration strategy	Are any negative outcomes on biodiversity expected with the project? What are methods for the maintenance of species richness? Which organisations will be effective to partner with for monitoring? How can environmental education tie in with monitoring and livelihood development?	- Number of globally Critically Endangered or Endangered species benefiting from reduced threats as a result of project activities, measured against the without-project scenario - Change in the number of hectares significantly better managed by the project for biodiversity conservation, measured against the without-project scenario	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that is covered by protected areas, by ecosystem type 15.4.1 Coverage by protected areas of important sites for forest biodiversity 15.4.2 Mountain Green Cover Index	
Protection of Native/ Endemic Species	The preservation of endemic species is vital for the ecosystem to fully thrive. With forest activity and habitat loss and restoration, species migrate to untouched areas of the forest, therefore leaving the original habitat at risk.	What native species have already been driven away? Do endemic species play a vital role in ecosystem health? What risks does the project pose? What opportunities?	- Measurement of movement of native species (remote sensing) - Number of invasive species and their dominance in the ecosystem (number) - The number of individuals of a particular species that are present on the area directly or indirectly controlled by the project	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species	
Protected Areas	Protected areas offer a vital and undeniable solution to habitat and biodiversity loss. If effectively managed and fairly governed, such areas can safeguard nature and its processes and preserve cultural resources, protect human health and well-being, provide sustainable livelihoods and in the long run, support sustainable development for	What are the threats to protected areas in the project vicinity? Logging? Poaching? How close to human activities come to the protected areas? How much of the project area can constitute as protected?	- Area of protected land in project vicinity - Number of hectares of private land under protection in area - How much habitat is regenerated through forest restoration and proper management techniques?	15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked 15.b.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments 15.c.1 Proportion of traded wildlife that was poached or illicitly trafficked	

Threatened Species	Development of a mitigation plan to mitigate risk to threatened species, either extinction or vulnerability to changes in habitat and human interference. This will need to be pre-planned with inventory of species and constantly monitored to mitigate slight changes due to impact, so that risks can be mitigated swiftly. Animals and Plants are not always durable to changes and may be increasingly vulnerable and intolerant due to the already long-lasting effects of deforestation and climate change.	How are the species classified? Does the greater area outside of the project area see the same threats to species? What are the most vital species to focus on, in order to not disrupt the ecosystem?	- Elaboration of monitoring reports focusing on habitat area. - Full fauna and flora inventory throughout project cycles	2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium- or long- term conservation facilities 2.5.2 Proportion of local breeds classified as being at risk of extinction
Community composition	Community composition is influenced by many direct factors, including abiotic factors, species interactions, level of disturbance (natural or human) and risk of disrupting events. Some species, such as foundation species and keystone species, play particularly important roles in determining their communities' composition and need to be monitored closely so as to not induce a disturbance in the project area and surroundings.	What are the key species on the composition? How stable of the key species? What impact could be a risk to the stability?	- Soil composition and variety throughout project grounds - Imagery of the biological concepts of present species - Number of classes of species traits and diversity	//

Appendix IV. Average Prices for REDD+ and CCB credits from 2017 to 2022.

[OPIS] Monthly Average Retail Sales Prices

		Jun-22	Jul-22	Aug-22	Sep-22
All vintages	REDD+/CCB	$13.64	$13.68	$10.86	$12.28
	Reforestation	$14.71	$14.68	$12.98	$13.92
2017	REDD+/CCB	$11.64	$12.05	$8.74	$11.59
2017	Reforestation	$12.77	$13.05	$10.74	$13.11
2018	REDD+/CCB	$14.71	$13.39	$10.82	$11.91
2018	Reforestation	$15.84	$14.39	$12.82	$13.44
2019	REDD+/CCB	$14.76	$14.36	$12.20	$12.41
2019	Reforestation	$15.89	$15.36	$14.20	$13.94
2020	REDD+/CCB	$14.86	$15.08	$12.45	$12.91
2020	Reforestation	$15.99	$16.08	$14.45	$14.44
2021	REDD+/CCB	$14.96	$15.33	$12.70	$13.41
2021	Reforestation	$16.09	$16.33	$14.70	$14.99
2022	REDD+/CCB	$15.16	$15.83	$13.20	$13.91
2022	Reforestation	$16.33	$16.83	$16.18	$16.42

Source: OPIS. 2022. *Opis Carbon Market Report*. Accessed November 22, 2022.

https://www.opisnet.com/product/pricing/spot/carbon-market-report/.