International Journal of Sustainable Development and Planning
Vol. 18, No. 9, September, 2023, pp. 2703-2712
Journal homepage: http://iieta.org/journals/ijsdp

Developing a Sustainable Business Model in the Bioeconomy: A Case Study of an Amazon Rainforest Enterprise

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https://doi.org/10.18280/ijsdp.180909

Received: 3 April 2023
Revised: 31 August 2023
Accepted: 9 September 2023
Available online: 26 September 2023

Keywords:
sustainable business model, bioeconomy, B Corp, case study, sustainable development, business model, Amazon rainforest, SDG

ABSTRACT

The importance of incorporating sustainability into business models is well recognized, particularly in the bioeconomy industry, where enterprises rely on natural resources as role material. This study aims to analyze how a bioeconomy (BE) enterprise operating in the Amazon rainforest has integrated sustainability into its business model. A case study was conducted with Latin America's largest activated carbon enterprise, a B Corp (Benefit Corporation) certified by B Lab and aligned with the Sustainable Development Goals (SDGs). Data were collected from various stakeholders in the babassu coconut (raw material) supply chain. The findings reveal that incorporating sustainability into the business model required long-term actions (approximately 30 years) and was influenced by internal and external inductors. This study contributes to the literature by proposing a sustainable business model framework, detailing the implementation of each business model element. Furthermore, the environmental and social outcomes of the SBM are presented. Managerial implications are provided to guide enterprises in integrating sustainability into their business model.

1. INTRODUCTION

The notion of sustainability is linked to the definition of sustainable development. Sustainable development meets the needs of the present generation without compromising the ability of future generations to meet their own needs [1]. However, the problem of sustainable development is complex and cannot be tackled simply by controlling greenhouse CO_2 emissions [2]. The search for more and more income and resources is depleting forests, drying up lakes and rivers, and poising fruits and vegetables [2]. In the business sphere, enterprises play a relevant role in economic development. In this context, social and environmental aspects as well as their incorporation into business strategies and practices still need to be studied, better defined and implemented [3]. This study considers the role of bioeconomy (BE) enterprises in the face of sustainable development and the need to understand how to insert sustainability into the enterprises' business model. The research question is "How to implement a sustainable business model in a bioeconomy enterprise?". The aim is to analyze how a BE enterprise operating in the Amazon rainforest has incorporated sustainability into its business model.

Despite the role and responsibility of enterprises to sustainability, studies on how enterprises can transform themselves into sustainable ones still need to be explored in the literature [4]. In this sense, an innovation in an enterprise's business model, considering environmental and social factors integrated with the business logic, can improve sustainability performance [5]. Initially, the literature suggested that a business model should be focused on value proposition, value creation and delivery, and value capture to the enterprise [6]. However, social and environmental commitment has entered the agenda. So, enterprises' business models are demanded to indicate how the value is created and delivered while being attractive to the customer and beneficial to the environment and society [7]. Local communities affected by the enterprises' operation should be considered as part of the business model [8]. A sustainable business model (SBM) is a model that creates a competitive advantage through value and, at the same time, contributes to the sustainable development of the enterprise and society [9].

The literature on SBM is recent [10] and this research topic has grown recently. However, knowledge on the subject needs to be improved [11, 12]. In addition, the literature suggests investigating practical examples of how enterprises should consider sustainability in their businesses [9, 10]. Also, the literature needs to explain how an SBM can be operationalized in practice [13]. Therefore, more research is needed in this area [5]. This need is related to managerial knowledge and new theories that can effectively contribute to the sustainable development of the economy and society.

Bioeconomy (BE) has been one economic segment highly pressured to align its purposes and practices with sustainability principles [14]. BE has emerged as a new economic paradigm that competes with traditional fossil-based models [14], being an alternative to forest-based products under the lens of sustainable development. In BE, new products and services are based on biomass or hybrid materials. Advancements in

production and innovation are achieved along the value and supply chains by biotechnology [15]. It is also noteworthy that natural resources-the basis of BE-are not inexhaustible, reinforcing the need to emphasize socio-environmental practices [16].

Forests in developing countries are a relevant part of the physical, material, economic and spiritual life of millions of people living in and around such regions [17]. However, deforestation in the Amazon rainforest land and the demand for beef, soy, timber, oil and minerals have threatened the forest and indigenous people [18]. If properly managed, the forest sector can contribute significantly to regional development by helping to create new markets for advanced forest-based products [19]. Thus, preserving the Amazon rainforest and other biomes and considering local culture and traditions while promoting sustainable development through BE is an opportunity and challenge. In this sense, BE enterprises in the Amazon rainforest, aligning with sustainability principles, are relevant to support diverse biomes while providing revenue to local communities.

The research method was the case study. The company, called in this study by T, is the largest producer of activated carbon in Latin America and uses babassu coconut as its primary raw material. The case refers to a non-timber forest-based BE acting in the Amazon rainforest.

This study adds to the context that enterprise T is a Benefit Corporation (B Corp) certificated by the B Lab [20]. A B Corp is a for-profit company whose statute explicitly recognizes and intends the impacts of managerial decisions on the well-being of society and the environment, as well as on its stakeholders [21]. In this case, the social mission shapes the business strategy by expanding the scope of 'doing good' as a contribution to society [22]. However, adjustments in business models are required by a B Corp to achieve the social mission while making a profit [22]. The literature points out that the business models of B Corps consider sustainability at their core [23]. Thus, this study assumes that enterprise T, as a B Corp, can be a case of SBM. There are about 4,100 such corporations in the world as of 2021, from 77 countries, operating in 153 industries [20]. These include such companies as Danone, Patagonia and Natura, among others.

This study contributes to the literature by discussing how a BE enterprise has incorporated sustainability into its business model. This study also presents the results to the enterprise, environment and forest-dependent communities. Managerial contributions are suggested to guide practical actions and decision-making processes. The findings could support further research on the subject and SBM implementation in other BE enterprises.

Next, the literature review presents Sustainable Business Model, Bioeconomy and babassu in the Amazon rainforest and B Corps themes. Afterward, the method section details the research approach and each step. The results and discussion section points out the contributions to the literature and implications for practice. Finally, conclusions are presented, mentioning the research limitations and further research avenues.

2. LITERATURE REVIEW

This section presents the literature review on SBM, BE and babassu in the Amazonian Forest and B Corp.

2.1 Sustainable business model

The first studies on business models emerged at the end of the 20th century [5], motivated by the need to describe and analyze new business opportunities [6]. A business model represents how the creation, capture and delivery of value are structured by organizations [6] to leverage new market opportunities and revenue sources.

As for the business model, there are different views on SBM in the academic literature. In general terms, an SBM can be treated as a modification of the conventional definition of a business model [24]. It incorporates concepts, principles and objectives to integrate sustainability into an enterprise value proposition, value creation/delivery and value capture mechanisms. Therefore, SBM considers proactive stakeholder management as well as monetary and non-monetary value for this wide range of stakeholders. The inclusion of sustainability into an enterprise' business model has reflected a paradigm change in global thought, prompting organizations to rethink how they measure organizational performance and improve it by integrating social, environmental and economic issues [25].

An SBM helps describe, analyze, manage and communicate an enterprise's sustainable value proposition to its customers and stakeholders, how it creates and delivers that value and captures economic value while maintaining or regenerating capital [5]. SBMs seek to provide alternatives to social and environmental problems, make it possible to achieve sustainability goals and explore the conscious use of natural resources while contributing to people's well-being [26]. In addition, they can maximize materials and energy efficiency, creating value from waste [27]. The leadership's ability and expertise are essential in carrying out all functions in achieving the goals [28] while consolidating the business model.

Considering the presented context, this study proposes to include the sustainability principles into the Business Model Canvas structure established by Osterwalder et al. [29]. It is noteworthy that the literature presents different typologies [12]. However, the tools available for SBM analysis are still limited [30].

The main blocks for SBM are value proposition, value creation and value capture. The value proposition comprises the value specification, customer segments (to whom), relationships with each segment and channels to deliver the proposed value. In addition to the value proposition to the customer segments, an SBM should contemplate the environment and society as entities that will receive positive returns and value from the enterprise's activities. Value creation includes the main activities, partnerships and resources. Again, in an SBM, the environment and society should be considered participants in the value chain. Value capture considers costs and gains or revenue. In an SBM, all segments and partners should be positively affected by some value [31, 32].

2.2 Bioeconomy and babassu in the Amazon rainforest

Natural resources are not unlimited and should not be considered free. Thus, they need efficient and planned use as well as be managed considering the principles of justice in the environment, economic and social spheres [33, 34] to provide forest resources to fulfill current and future needs. A BE can be understood as a specific social-ecological system that aims to produce, use and recycle biomass to satisfy a given population with food, energy, material and chemical needs. It

considers an assigned geographical territory while replacing partially or entirely non-renewable resources with biomass and ensuring sustainable management of natural resources [35].

Notably, in the BE, many stakeholders are involved in supplying the growing demand for bio-based raw materials for industrial applications [36]. The focal company assumes a relevant role since it usually has more decision-making power, which is the same in non-timber forest-based businesses [33]. So, different engagement levels from forest owners, local communities and indigenous people are demanded. Under the lens of an SBM, the focal company is responsible for avoiding exploiting such stakeholders and assuming social sustainability issues as their mission, which is vital to sustainable development.

This study is focused on non-timber forest-based products. These products are increasingly used to produce textiles, bioplastics and chemicals where demand tends most often to be significant in scale [37]. Additionally, forest-dependent communities living in marginalized rural areas [38] need such products to survive. These communities, including the indigenous, believe they belong to the forest and resist accepting the idea of the forest as a resource [18]. Thus, BE businesses should consider this meaning involving stakeholders such as forest-dependent and indigenous communities. This is linked to the success of the sustainable development of any territory [39]. The level of development of the material, technical and production spheres, human capital, availability and sufficiency of the resource base, natural and climatic conditions, the effectiveness of regional management and the population's quality of life should also be considered [39].

Brazil's Amazon forest biome occupies 49% of the country's land area and is the home of 12% of the country's population [40]. Deforestation in Amazonia and conflicts among cattle, farmers, squatters, miners, indigenous groups and public authorities remain in the public eye as hot topics [40]. Meanwhile, the sustainable use of forest resources and developing a forest-based economy have been presented as forms to protect such biomes and ecosystems [41].

The babassu palm (Attalea speciosa) is widely distributed in the Amazon biome, on a shared border with the Cerrado biome. Babassu palm has a straight, single, cylindrical stem of 10-30m in height. Each fruit bunch contains 200-600 elliptical to oblong fruits (Figure 1). Babassu palm trees are among the target species for extracting non-timber forest products [42].

Figure 1. Babassu palm

Oil palm plantations have been produced in the part of the Amazon, in the same region where babassu is abundant [43]. Forest-dependent communities have faced the environmental and social risks imposed by oil palm expansion and other agricultures such as eucalyptus, soya beans and sugar cane [44].

Among forest-dependent communities, there are coconut breakers. It is estimated that more than 300,000 women live off the babassu coconut: the Babassu Coconut Breakers. The tradition of coconut breaking has been passed from generation to generation, from mothers to their daughters, as a female and collective activity. Breaking the coconut is done manually with an ax and a club; the oil is then extracted. Charcoal is made from the mesocarp. Baskets, fans and mats are made from leaves [45]. Although some coconut breakers' have advocated for laws to protect babassu palm and guarantee access to collect the coconuts, only some Brazilian states have protected babassu by law. Farmers and companies often ignore the laws and prohibit access to the field [45].

2.3 B Corp (Benefit Corporation)

As the Introduction presents, the studied enterprise is a B Corp (or Benefit Corporation). B Lab certifies the corporations as B Corp if it proves its alignment with social, economic and environmental issues through their business activities [21]. B Lab uses the B Impact Assessment (BIA) to evaluate the social and environmental impacts of enterprise and the recertification process occurs every three years [20].

BIA criteria, since 2020, have been integrated into UN Global Compact and aligned with the sustainable development goals (SDGs). The tool is designed to induce B Corp certified enterprises and those pursuing certification to achieve the SDGs [20]. A company must achieve 80 out of 200 points in the BIA criteria and meet other transparency and accountability. Also, B Corps must publish their impact report and amend their legal governing documents to formally balance profit and purpose [21].

The intrinsic value of the environment, systemic change based on the beneficial relationships with external stakeholders, long-term vision and enterprise's mission including social and environmental purposes are present in the B Corps' business models [23]. Such characteristics guide the B Corps to build an SBM.

B Corps worldwide has increased significantly in the last few years. Most B Corps are small, but large enterprises, including multinationals and their subsidiaries, have adhered to the B movement [21]. Some multinational B Corps, with at least $1.0 billion in annual revenue, are B Movement Builders (e.g., Bonduelle, Gerdau, Magalu, Danone, Natura). They recognize the leadership of certified B Corps and are committed to the principles of the B Corp movement, as well as the company-level and collective actions that bring these principles to life [46]. The presence of such enterprises endorsing B Lab actions provides reliability to the B Lab purposes. The amount of B Corps has significantly increased in the last few years. By November 2020, 3,345 were B Corps; by August 2023, more than 6,400 B Corps were in more than 80 countries [47].

It is possible to observe some B Corps in Brazil operating in the Amazon rainforest (e.g., Manioca Comércio de Alimentos and Tobasa Industrial) or focused on biotechnology, reforestation in subtropical areas and forestry management (e.g., Solubio, The Green Branch and Amata

among others) [47]. These companies are examples of successful B Corps in areas related directly or indirectly to BE sector. They are committed to empowering ecosystems, considering the forests as a means, not an end or raw material.

The presented context of B Lab certification process and its application to BE sector supported the decision to perform the study on a B Corp operating in the Amazon rainforest.

2.4 Proposed framework for SBM in BE enterprise

A proposed framework is presented based on the literature review on SBM and BE (Figure 2). This framework makes up for the lack of a structured business model for BE enterprises aligned with sustainable principles. Therefore, it also includes the environment and society in the value proposition, value creation and value capture. The purpose of the business model is extended beyond company profits and customer focus.

It adds two more areas in value proposition and value capture: environmental and social. Social propositions and its respective results are related to the quality of life, social integration, well-planned workable neighborhoods, job creation, inclusion and justice [48]. Social practices are related to social innovation that considers new ideas or working methods that meet social needs more effectively than existing approaches [49, 50]. Value to the environment is aligned with the central focus of BE enterprise [36], depending on non-timber raw materials and their abundance and preservation. Value creation considers preserving the babassu forests due to diverse threats such as oil palm and soya entrance and forest fires to grow cattle. These are permanent challenges in the Amazon rainforest. Also, it considers the local community, such as pickers and breakers, as critical partners. BE enterprises implementing an SBM that considers particular environmental conditions and forest-dependent communities are essential to sustainable development.

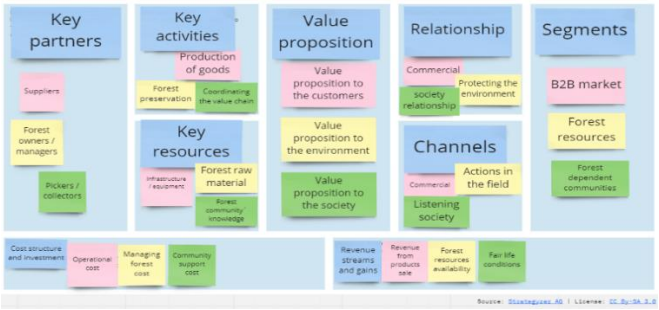

Figure 2. Proposed framework for SBM in BE enterprise

3. METHOD

This study is qualitative, applied and exploratory. It aims to unveil empirical insights to support a deep understanding of a phenomenon such as the development of SBM in the BE enterprise.

The research method was the case study to allow an in-depth analysis of the phenomenon [51]. Single or multiple case studies focus on the dynamics of multiple levels of analysis [51] and can be used for different aims, such as theory testing, generating theories and providing descriptions and explanations, as is the case of this study [52]. Case studies typically combine multiple data collection methods, including interviews, observations and questionnaires and the evidence collected may be qualitative or quantitative. Thus, we follow the approach recommended by Eisenhardt and Graebner [52]. Also, this study recognizes the limitations of the case study method.

On the one hand, it provides a deep understanding of a phenomenon in specific conditions. Insights into how processes or conditions occur and their consequences can be helpful to be applied or analyzed in other cases. On the other hand, the generalization of the findings is limited to similar cases with the same characteristics [52].

An inductive approach is used because it is appropriate to study phenomena such as SBM in BE where theories were developed in other contexts (such as studies of traditional enterprises and investors) and can be revisited [52]. This study relies on qualitative data collection from ethnographic observation followed by semi-structured interviews and direct observation. Ethnographic observation is appropriate for inserting the researcher into organizational life and observing the diverse elements that build its structure and management [53]. Semi-structured interviews allow interviewers to gain new insights and a deeper understanding of the phenomenon under study and the relationships between the emerging themes since they allow the flexibility to explore the topic and delve further into it [54].

The steps of the work method are presented below.

The development of this study took place in four steps. The first was the development of a theoretical framework (shown in Figure 2-section 2.4) to organize academic knowledge around the topic and guide data collection and subsequent analysis.

The second step consisted of defining the unit of analysis. It started from the initial interest in a B Corp from BE sector due to the typical characteristics of these companies concerning the alignment of the business with the purposes of Sustainable Development. The researcher's access to the Legal Amazon region, specifically the borders of Tocantins and Pará states, was also considered. In this region, it was observed that company T is a pioneer as B Corp, certified since 2017. According to the literature review, being certified by B Lab suggests a deep alignment with a sustainable business model. Also, since its foundation, the company is focused on non-timber bioproducts. Thus, company T was contacted and agreed to support the conduct of this study.

The enterprise T produces babassu coconut-activated carbon and bioproducts for industrial use. It is the largest activated carbon producer in Latin America. The babassu is collected in an area of 200,000ha around the plant. The direct workforce comprises approximately 200 employees. Around 1,500 coconut breakers' families, pickers and indigenous communities have been collecting babassu to supply the enterprise. From 25 to 30 microentrepreneurs organize these breakers and pickers, receive from them the babassu for delivery to the company and manage the respective payment.

In the third step, ethnographic observation was performed to understand the relationship among enterprise T, community and suppliers. Between July/2019 and March/2020, one researcher visited two times the enterprise and six times the babassu coconut fields. Nonformal conversations were made with the quality manager, some employees, coconut breakers and pickers, indigenous people and politicians. Also, collecting and providing coconuts processes to the enterprise was observed. Such conversations and direct observations were written or photographed.

In the fourth step, the supply chain of enterprise T was

studied. The field observation allowed us to organize groups of respondents according to their role in the supply chain. One group was formed by respondents from the company: the CEO, B System Supervisor, Environmental Supervisor, Production Manager and Sales Supervisor. Another group with stakeholders from the coconut supply chain: coconut breakers, coconut pickers, microentrepreneurs, indigenous chief and indigenous people. The third group was formed by people who influence or impact indirectly in the supply chain: farm owners and the representative of coconut breaker movement. For each group of respondents, a protocol was structured containing semi-structured questions. The questions looked for aspects related to the SBM elements (Figure 2, section 2.4), considering the role of each respondent. To the group of respondents from the enterprise, the focus was on how the SBM has been developed. The other groups were asked about the impacts of business model changes on the way of life, the coconut access, collection and delivery to the enterprise, the payment for this service, the babassu forest preservation and the breaker´s culture. The interviews were performed in person, in the place where the respondents used to work. Such conditions allowed the researchers to proceed with direct observation of the processes. Some respondents were interviewed more than once to obtain more details or complements. Table 1 presents the characteristics of the respondents. The interviews took between 30 minutes and 2 hours and were performed between March/2020 and March/2021. The COVID-19 pandemic delayed the initial schedule. Some of them were recorded and others written. The anonymity of the respondents was preserved and confidentiality was guaranteed by a term presented to the respondents. Access to the company's internal documents and reports regarding performance indicators, internal procedures and certificates was also confirmed. The company showed its equipment and respective patents, B Lab report, and procedures related to the organization of the coconut field and collection, among others.

Data from interviews, direct observations and documents were transcribed in the fifth step. Subsequently, they were tabulated and organized according to the constituent elements of the SBM (Figure 2, section 2.4), considering each respondent group. The answers and notes from direct observation were summarized for each group to compare the group´s positioning. Based on the constituent elements and the group´s positioning, this thematic analysis was organized using Excel®. The reliability of the results came from the triangulation of the data and the perspective of different respondents. These results generated the final discussions as well as academic and managerial contributions.

It is worth mentioning that the single case study does not allow generalizations about the further applications of the findings in other contexts. However, this in-depth analysis brought insights into how SBM could be developed in BE enterprise and inspired other studies and enterprises in similar issues.

Table 1. Interviewed characteristics

Interviewed	Respondents	Interviews	Formal Education	Years in the Function
CEO	1	4	Doctor of Engineering	30
B System Supervisor	1	4	Mechanical Engineer	6
Environmental Supervisor	1	2	MSc. Environmental Engineering	4
Production Manager	1	2	Production Engineer	No informed
Sales Supervisor	1	1	Graduated	3
Coconut breaker	15	30	Most of them were illiterate; one with high school	More than 30; third generation
Coconut picker	10	20	Most of them were illiterate; one with high school	More than 30; third generation
Microentrepreneur	5	10	Primary school and high school	More than 30
Farm owner	5	5	Graduated and high school	---
Indigenous people	4	4	Basic and high school	---
Indigenous chief	1	1	Graduated	---
Representative of the Coconut breaker movement	5	6	Most of them were illiterate; one graduated	More than 10

4. RESULTS AND DISCUSSION

Enterprise T's supply chain comprises coconut breakers, pickers and indigenous people who supply babassu coconut. Next, the drivers of change in the enterprise´s business model are presented.

4.1 Drivers of change in the business model

The alignment of enterprise T's business model towards an SBM started about 30 years ago. The founders considered social commitment and environmental concerns since the beginning of operations. The CEO and the production manager mentioned internal and external inducers to the company. The first and second drivers are related to marketing opportunities and technological innovation.

Until 30 years ago, the company produced babassu oil as its main product. The almond from which the oil is extracted represents 6% of the coconut mass. At the time, the extraction practice adopted considered throwing all the rest of the fruit in the forest or burning it at the collection site. The kernels were offered to the company by coconut breakers, who were paid per kilogram delivered. The founding partner identified technological and marketing opportunities to use all parts of the babassu. It started to produce activated carbon from the previously discarded external part of the fruit. So, activated carbon became the company's flagship product. The main customers for this product are large companies that produce activated-carbon-based water filters. Babassu coconut oil and other by-products, serving cosmetic and food companies remain in the portfolio.

About 15 years ago, technological innovations leveraged the productivity of the plant. The company developed several types of equipment, along with patents for some technologies.

Circular economy principles have been considered and closing looping has been on the agenda.

The third inductor, external to the enterprise, has been the entry of palm oil into the market. Oil palm has higher productivity than babassu while providing higher remuneration to actors in the production chain. Thus, it was, and still is, necessary to preserve the babassu forest and reorganize the production chain. Land conflicts have diminished, although they are still observed where babassu grows. Some farmers (landowners) sometimes do not allow coconut breakers and collectors to enter the farmers. In addition, burning practices have been constant.

These inductors, for 30 years, have been molding the enterprise's business model. To the CEO, the culture for sustainability is a heritage from the founding partner and permeates the enterprise. Working with babassu demands long-term planning due to the babassu cycle, the need to evolve many partners and a broad piece of forest. All these alignments allowed enterprise T to be certified by B Lab as a B Corp in 2017. To the B System Supervisor, the certification results from solid sustainable practices aligned with long-term strategies and partnerships. The B certification contributes to the permanent and systematic analysis of the processes and their results, leveraging improvements in all areas.

The change in business focus from selling oil to activated carbon increased the company's demand for babassu. Babassu management practices were introduced. The babassu production chain was also reorganized with coconut breakers, farmers, public structures such as city halls and the state and indigenous peoples. It was a movement built and adjusted over a few years. The babassu coconut breakers and the indigenous people have indicated that, nowadays, all coconut harvested by them can be sold to enterprise T if they so wish. The company guarantees the purchase of everything that is harvested.

Conflicts with farmers and access to farms to harvest babassu have decreased due to the guarantee of babassu management by the company and the initiatives of groups of coconut breakers that seek to preserve the local culture and tradition. Among these initiatives, a few Brazilian states have enacted "Free Babassu" laws that guarantee access to forest-dependent communities to private babassu areas.

Micro-entrepreneurs work in segmented areas to organize the babassu receiving system and the respective payments. They receive the babassu and pay the breakers, pickers and indigenous people while keeping the connection with the company.

Coconut breakers and pickers indicated that the remuneration paid by the company per kilogram of babassu delivered allows them a dignified life and their families, which was not the case in the past.

"Before, I would add 'half a world' of babassu coconut, take out only the nut and set the rest on fire. Now, with the 'NEW MODEL', company T takes advantage of all the babassu!" (Coconut breaker 1).

"There is no efficiency in the inspection. The environmental agents who must check only walk in the area. The interest in supplying the babassu coconut to the company is not for an obligation, but rather for convenience of the village." (Indigenous 1).

"Even though we have no obligation, loyalty, or direct link with the company, we prefer to transfer all production to company T due to the treatment received and the amount paid. It is a sure return!" (Picker 3).

The results of each element proposed in the theoretical framework referring to the proposition, creation/delivery and capture of value (Figure 2, section 2.4) are presented next.

4.2 The value proposition

As for the value proposition, the business model considers: (i) issues related to market segments that present technological solutions and product innovations; (ii) environmental aspects focused on the preservation of babassu fields; and (iii) social commitment, articulating fair and dignified remuneration with local communities, preserving the local culture. Including local communities as an entity encompassing the value proposition extrapolates the traditional view of business models in which only market segments' needs and wishes are considered. This finding reinforces that SBM is not an isolated construction performed exclusively by the enterprise, contributing to Abed et al. [48] and Bocken et al. [26], approach in which the power of entities is balanced when considering the value proposition.

4.3 The value creation

Concerning value creation, the key activities are centered on activated carbon production and commercialization, the organization of the babassu supply structure, the development of technologies and improvement of circular economy practices. The primary resources are babassu and technologies developed by the enterprise. The key partnerships are the coconut breakers and pickers who supply most of the babassu to the enterprise T.

Regarding value delivery, the enterprise acts in a B2B context. Its customers are large enterprises that produce water filters and hygiene products. According to the respondents, the customers do not perceive value from B Corp certification or sustainable practices adopted by the enterprise.

4.4 The value capture

The capture of value considers the economic value for the company, but also the value for the environment and society. Operating costs were reduced due to babassu uses and technological improvements, including power generation. Logistics costs were reduced because of the reorganization of the babassu chain. In addition, the sale of activated carbon as the main product promoted a significant increase in revenue.

The capture of value for the environment focuses on adequately managing babassu, establishing access to farms for collection, minimizing fires in the pastures, the full use of babassu without irregular disposal or burning of residues and use of a closed cycle for the generation of energy and heat. As a result, the preservation of the babassu area stands out.

The capture of value for society results from joint actions between the company and local leaders (breakers, pickers, indigenous people, farmers and politicians). Fair remuneration for the collection of babassu and free access to collection areas improved people's dignity and quality of life while contributing to the preservation of the tradition of the breakers. Social innovation permeated the business model's reconfiguration while generating a win-win situation for society and business, corroborating with Adeb et al. [48].

4.5 The role of B Corp certification

The B Corp certification to enterprise T resulted from long-term planning and actions. All changes in the business model started before the B Lab actions and propositions. First, the development of SBM was performed; after, the B Corp certification was achieved.

Analyzing each criterion of BIA to evaluate the enterprise´s performance indicated the weak aspects that need to be improved and the issues that the enterprise has had a good performance. To enterprise T, the recertification process is essential to visualize opportunities to refine its SBM and monitor the results of its strategies and practices in each stakeholder group. It indicates that BIA could be an excellent tool to guide changes and improvement in the business model, supported by a solid commitment to sustainable development issues. However, BIA and the certification process are tools to support the SBM development, not the reason an enterprise changes its business model and values.

It should be noted that certification alone did not increase new business for the company. The company declares that in the B2B environment in which it operates with its main product, there is no demand for this certification or even recognition of this importance. As for the supply chain stakeholders, the impacts on the way of operating were significant and are reflected in the quality of life. In the case studied, it denotes that the market did not impose the search for B Corp certification but is instead the result of long-term changes.

4.6 Contributions to the literature

This study contributes to the literature by presenting how a BE enterprise has implemented changes in its business model toward a sustainability approach. It contributes to shedding light on a subject still little explored [4] and little known [12].

The alignment of the company's vision and mission with sustainability has supported the change in the business model [22]. This study contributes to the literature [11] by revealing how the reorganization of a business model for sustainability depends on cultural and technological transformation. It illustrates long-term adjustment in the enterprise T operations and supply chain organization, indicating the need to mature the business model construction. As an external inducer, the market opportunity (or threat) was the accelerator of the business model change process. Technological innovation has advanced in parallel with social innovation practices.

This study corroborates the B Corp literature by presenting a case in which the B certification presents itself as a means of monitoring the alignment of the company's actions with the SDGs and the elements of the BIA [21]. Furthermore, being a B Corp is being part of a network of dissemination of practices aligned with sustainable development.

Different from the literature [9], this study indicates that the enterprise T market and customers do not demand certification as B Corp. Enterprise T operates in B2B context. The certification alone did not contribute to expanding business once the main customers only evaluated if suppliers met legal requirements. However, this situation could change due to investor pressure from enterprise T customers.

This study also indicates that technological innovations and the babassu supply chain reorganization in partnership with local communities have leveraged productivity. Circular economy practices have been relevant to achieving such performance.

The proposed framework (Figure 2, section 2.4) was appropriated to support the field investigation. So, this study contributes to the literature on SBM applied to BE by the proposition of the framework.

4.7 Managerial contributions

The main implications for practitioners, such as managers of BE enterprises of non-timber forest products, consider issues related to business model and strategy, technologies, natural resources, forest-dependent communities, supply chain organization, legal issues, among others.

This study alerts BE's managers to the temporal issue of aligning a sustainability-oriented business model. Changing the value proposition, how value is created and delivered and the capture of value considering the enterprise and other stakeholders as a forest-dependent community demand a deep understanding of the enterprise´s role in achieving an SBM.

Furthermore, there is a need to rethink the market and customer segments. The findings of this study pointed out that the entrance of other products into the market, such as palm oil, leveraged marketing repositioning and new product development. However, the importance of technology to support the development of new products and processes under the lens of the circular economy and the integration with the value chain must be considered. This study evidences that technology development, aligned with circular economic principles, is essential to guarantee a leader marketing position and better forest resource uses.

Managers of a BE enterprise are suggested to monitor economic, social and environmental performance permanently. Partnerships with communities and leaders where natural resources come from to define ethical practices for everyone (with care not to overwhelm the company's economic power and subjugate communities) should be considered. Supporting preservation and recovery, if applicable, and adequate management of forest resources are required for BE. The organization of raw material resources must involve all supplier stakeholders in such a structure.

Finally, partnership with public entities is suggested so that public policies favor BE leveraging the alignment to sustainable development. In this study, supporting initiatives such as a law allowing coconut breakers and pickers to enter the farms to collect coconut was essential to forest-dependent culture preservation and guaranteeing raw material to the enterprise.

5. CONCLUSIONS

This study analyzes how a BE enterprise from the Amazon rainforest has incorporated sustainability into its business model. The findings are related to identifying the main external and internal drivers that leverage changes in the enterprise´s business model and how the temporal issue is relevant in maturing processes and relationships. Also, the study points out how each SBM element has been structured. The role of B Corp certification for the studied enterprise, in a B2B context, is discussed. The analysis of the findings towards a proposed framework for SBM brings us academic contributions and managerial implications.

This study contributes to the literature on SBM by presenting the challenges and impacts associated with the

strategies and practices performed by a BE enterprise in Amazon rainforest. Also, it sheds light on how the business ecosystem and its relationships were restructured to include the environment and local communities as participants in the value proposition, value creation and value capture. A framework for BE enterprises focused on non-timber forest products is proposed, contributing to the literature on BE and SBM.

The results are relevant to the field because they show that BE and sustainable development can walk side by side. Listening to different actors in the babassu chain provides reliability to the results from this study. Win-win situations are observed due to innovation practices in the SBM. However, long-term planning and practices are demanded to reorganize a business model and improve them according to the lens of sustainability. This study indicated that partnership with forest-dependent communities is essential to keep or to improve the social results from BE. This pillar demands ethics and should be in the enterprise's mission and vision. Sustainable regional development is evidenced by the speech of coconut breakers and indigenous people, corroborating with Voronov et al. [55]. Economic gains to the enterprise have been pointed out due to technological innovation that allows the use of all babassu coconut instead of only the almond. Based on sustainable forest management and partnership with the farmers, forest-dependent communities and indigenous people, Babassu forest preservation has increased significantly.

Some limitations are present in this study. Just one single case was studied. This case has particular characteristics: the enterprise is situated in the Amazonian Forest and it is B Corp. Such aspects do not allow generalizing the findings and results to other BE enterprises focused on developing SBM. However, customer pressure for certification, legal issues, stakeholders' limitations or demands, and resource scarcity could leverage the implementation of SBM and culminate in B Corp certification. Even so, the results pointed out how aligning the business model to sustainable development was possible and may inspire other BEs to do that.

As future avenues, this study suggests: (i) other case studies could be applied to other BEs to complement the understanding of implementing SBM in different contexts; (ii) to analyze of how B Corp´ business models have been structured and if they are strongly aligned with SDGs; (iii) to investigate the role of government policies and regulations in leveraging the development of SBM; (iv) to understand the impact of different types of partnerships between business and forest-dependent communities on sustainability outcomes; and (v) to investigate the contribution of circular economy principles and practices to the development of SBM.

ACKNOWLEDGMENT

This work is supported by the Research Foundation of the State of Grande do Sul (FAPERGS-Brazil) (Grant number 21/2551-0002168-3) and National Council for Scientific and Technological Development (CNPq-Brazil) (Grant number 312395/2022-1).

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NOMENCLATURE

BE	Bioeconomy
SBM	Sustainable Business Model
B Corp	Benefit corporation
SDG	Sustainable development goals
BIA	B Impact Assessment