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Challenges of business models for sustainability in startups

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Abstract

Purpose – This study aims to analyze the challenges startups face in implementing business models for sustainability. In particular, the research question of this study is: How do the challenges faced by startups affect business models for sustainability in the context of an emerging country?

Design/methodology/approach – Startups are increasingly incorporating ways to thrive in a competitive environment with innovative sustainable business models, a key factor for competitive advantage and corporate sustainability. This paper analyses startups' challenges in adopting business models for sustainability through a case study in two startups, using the sustainable value exchange matrix (SVEM) tool through workshops, to carry out the diagnosis of these challenges.

Findings – The barriers and challenges of business models for sustainability in startups were found in different categories, where the main barriers are linked to the institutional category, the organizational and the market and sales culture. Thus, the authors concluded that there is a need to reformulate public policies and to have greater participation of the actors involved.

Research limitations/implications – The main limitation of the research is the number of case studies (only two), which makes it difficult to generalize the results.

Practical implications – The research presents two major contributions. First, through the case studies, it is possible to verify that the barriers and challenges in business models for sustainability have relevance for startups. The second contribution is the adaptation of SVEM in conducting the debate by incorporating the barriers and challenges in value creation and delivery system.

Social implications – This study contributes to the business models for sustainability literature to better understand the challenges startups face in practice and can serve as insights to help overcome them. As this is

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an empirical study, the information gathered can help create metrics and public policies to achieve the United Nations sustainable development goals.

Originality/value – The present research has as originality the analysis of the challenges in startups in implementing business models for sustainability and their relationships with the value proposition, capture and creation, as well as and delivery (adapted to the challenges found in the literature) applying the SVEM tool proposed by Morioka *et al.* (2018).

Keywords Business model innovation, Sustainable development goals, Sustainable entrepreneurship, Circular economy

Paper type Case study

1. Introduction

Entrepreneurs who pursue business sustainability link their commercial success directly to achieving positive effects for the natural environment and humanity, thus creating value for a wide range of stakeholders (Freudenreich, Lüdeke-Freund & Schaltegger, 2020). Business efforts are expected to be combined with other societal actors (governments, civil society, etc.) according to the 17 sustainable development goals – SDGs (Morioka, Bolis, Evans & Carvalho, 2017). Business challenges are issues that repeatedly appear as impediments to successful business models. As such, they must be resolved to enable a paradigmatic shift toward innovation and sustainability (Todeschini, Cortimiglia, Callegaro-de-Menezes & Ghezzi, 2017).

Sustainable systems are challenging because of the wide range of environmental, economic and social factors that must be considered throughout the system's life cycle (Fiksel, 2003). As research delimits business models from the perspective of three elements: value proposition, value creation and delivery system and value capture (Richardson, 2008), companies are initially invited to think about behavior, responsibility and corporate performance; to define their resources to frame the main activities; and finally, to analyze the stakeholders and their economic context (Bocken, Rana & Short, 2015; Svensson & Wagner, 2011).

Research on business models for sustainability demonstrates that the process is iterative, with sustainability objectives gradually integrated into stakeholders' priorities (Baldassarre, Calabretta, Bocken & Jaskiewicz, 2017). The research gap is because it is an emerging topic that needs studies to empirically analyze the barriers associated with business models for sustainability as well as the effectiveness of related strategies (Hueske & Guenther, 2021). Therefore, it is essential to continue studying the relationship between organizational commitment to sustainability and its effective implementation and performance (Silvestre & Fonseca, 2020).

How do the challenges faced by startups affect business models for sustainability in the context of an emerging country? Based on the gaps, this research aims to analyze the challenges startups face in implementing business models for sustainability. The sustainable value exchange matrix (SVEM) tool proposed by Morioka, Bolis and Carvalho (2018) will be used for this aim.

Despite possible semantic differences between the terms "barriers" and "challenges," the present research considers the two terms synonymous, as literature uses both. For example, Bocken and Geradts (2020), Hueske and Guenther (2021), Laukkanen and Patala (2014) and Salim, Stewart, Sahin and Dudley (2019) mention *barriers to sustainable business models*, while Todeschini *et al.* (2017), Geissdoerfer *et al.* (2018) and Morioka *et al.* (2017) use *challenges*.

Section 2 discusses business models for sustainability and the challenges of implementing business models for sustainability in startups based on the exploratory literature. Section 3 discusses the research method (case study), selection of startups and application of the SVEM, proposed by Morioka *et al.* (2018). The SVEM aims to critically analyze the mutual benefits of

the stages of value proposition, value creation and delivery and value capture with the stakeholders. Furthermore, with this tool, we aim to assess the challenges of startups and how they can become more sustainable by making explicit decisions to connect their business model elements to address the barriers to sustainable development. Section 4 presents the results and discussions obtained through the application of SVEM. Finally, Section 5 summarizes the conclusions of our analysis and its relation to other research streams and suggests possible avenues for future research.

2. Theoretical framework

2.1 Business model for sustainability

Several studies have examined business models from the perspective of their three elements: value proposition, value creation and delivery system and value capture (Richardson, 2008). A brief explanation of each element in the context of sustainability is presented below. The customer value proposition supports a business model's logic, data and other evidence, integrating a viable revenue and cost structure for the company delivering that value (Teece, 2010). The challenge of developing offerings (products and services) that can create value for customers and contribute to global sustainable development is considered high for companies (Selberherr, 2015). Economic viability is a requirement for the business model for sustainability (Boons, Montalvo, Quist & Wagner, 2013; Morioka & de Carvalho, 2016). However, business goals should be aligned with social and environmental values, following the triple bottom line – TBL approach (Elkington, 1997).

The *principle of reflexivity* is interesting to define the value proposition and support organizations. It can be defined as a continuous consideration of environmental, economic and social aspects of corporate sustainability, which should be constantly observed to achieve the goals and analyze the power of all organizational actors (Schneider, 2015). This principle supports organizations, critically analyzes their role in society and reinforces the formation of the value proposition of business models for sustainability (Boons *et al.*, 2013).

The study conducted by Morioka *et al.* (2017) in the analysis of multiple case studies converging to business models for sustainability resulted in the value proposition being composed of two levels: *tangible* and *intangible*. The tangible level is ensured by the products and services offered by the organization, whereas the intangible level of the value proposition represents the business purpose, combining entrepreneurial vision and personal values and beliefs. Therefore, delimiting a value proposition is fundamental in the business model for sustainability because incorporating a sustainability mission in the company's strategy and values directly affects corporate behavior, responsibility and performance (Svensson & Wagner, 2011).

The value creation and delivery system is the second element of business models for sustainability and serves to delimit the organization's main activities: supply chain and logistics, operations, marketing and sales, innovation (design, research and development), human resources, corporate governance and organizational culture (Morioka *et al.*, 2017). Several logics within the literature address how business models for sustainability create and deliver value. Some examples are *corporate social responsibility* (CSR) as a bridge between TBL pillars toward the business model for sustainability (Govindan, Kannan & Shankar, 2014), *business for the sharing economy* (McLoughlin *et al.*, 2009) and *circular economy* (Salim *et al.*, 2019; Tura *et al.*, 2019).

Value capture, the third element of business models for sustainability, refers to aspects of the business model related to the capture of economic, environmental and social value by different stakeholders (Lashitew, van Tulder & Muche, 2020) and tends to consider the financial flow captured by the organization (Richardson, 2008). In general, the ultimate goal

of value appropriation is to maximize shareholder value through decisions related to pricing, customer acquisition, market development and cost management, among others (Lashitew *et al.*, 2020). However, the value captured by stakeholders tends to be often intangible. Thus, business models for sustainability face the challenge of measuring the value captured or destroyed by their existence. Value capture by stakeholders who have not (directly) contributed to value creation is referred to as *value diversion* (Lepak, Smith & Taylor, 2007).

Sustainable business model innovation is a change in how a company operates to create positive impacts or reduce negative consequences for the environment and society. This article aims to explain which paths a company can follow when implementing a sustainable business innovation process aligned with the SDGs (Ferlito & Faraci, 2022). The UN SDGs bring support for implementing business models for sustainability. To deepen the integration of the SDGs into business operations and stakeholder engagement, corporations' need strategy, governance and operation (Devalle *et al.* (2020). Promoting network empowerment due to explicitly highlighting the contribution to the SDGs will require improvements in stakeholder-level governance and, in many cases, will also require changes in the existing institutional logic of actors (Giacomarra, Crescimanno, Sakka & Galati, 2019).

A research stream is focused on proposing tools to help organizations with business model innovation for sustainability, as they need to create a sustainable value proposition (Minatogawa *et al.*, 2022). Studies have proposed practical tools to support sustainable capability integration, such as the business model canvas (Osterwalder & Pigneur, 2010), the three-layer business model canvas (Joyce & Paquin, 2016), the evolutionary processes of sustainable entrepreneurship (Schaltegger, Lüdeke-Freund & Hansen, 2016), the value ideation process (Geissdoerfer, Bocken & Hultink, 2016) and the sustainability-driven service innovation (SOSI) (Calabrese, Forte & Ghiron, 2018).

In the early stages, Bocken *et al.* (2015) proposed the value mapping tool, using structured workshop-based brainstorming sessions to surface both positive and negative value deployed from the organization using a multi-stakeholder perspective (Silvestre, Fonseca & Morioka, 2022). Another particularly suitable tool is the SVEM (Morioka *et al.*, 2018), which seeks to instigate discussions of corporate sustainability innovation based on face-to-face interactions between academics and practitioners with brainstorming/workshop support, in addition to conducting a diagnosis of the organization's value proposition, value creation and delivery system and value capture.

2.2 Challenges of business models for sustainability in startups

The ability to quickly and successfully switch to new business models is an important source of sustainable competitive advantage and a key lever for improving the sustainability performance of organizations (Geissdoerfer *et al.*, 2018). However, the aforementioned author's research found that many business model innovations fail, and despite the importance of the topic, the reasons for failure are relatively unexplored in academic works; in the context of startups, they are yet to be implemented.

Inigo and Albareda (2019) point out that companies can engage in four main organizational changes in innovating for sustainability: seeing new social and environmental regulations as an opportunity; making their value chains sustainable (operations and life cycle assessment); designing sustainable products and services; and developing sustainable business models (finding new ways to deliver and capture value).

There is a threefold problem in sustainable business model innovation: the first is that meetings and workshops on business model innovation occur, but the ideas are not followed up; the second is that even though there are promising sustainable business model concepts,

they are still not implemented; the last is that most implemented business models, especially at their inception, fail over time in the market (Geissdoerfer *et al.*, 2018).

Table 1 was divided into the contexts of the challenges found in the literature that fall into different categories such as institutional, organizational culture, marketing and sales, supply chain, operations and logistics, innovation and research and development. These categories were an adaptation of SVEM, which frames the following categories in the value creation and delivery system: supply chain and logistics, operations, marketing and sales, innovation, research and development, organizational culture and corporate governance (Morioka *et al.*, 2018). These dimensions are interconnected, and business models for sustainability depend on balancing all of them, as a lack of performance in one can harm the others.

The discussion in the literature of barriers is in different segments of companies following business models for sustainability, e.g. the renewable energy sector (Engelken, Römer, Drescher, Welpe & Picot, 2016; Salim *et al.*, 2019), circular economy (Tura *et al.*, 2019; Vermunt, Negro, Verweij, Kuppens & Hekkert, 2019) and fashion industry (Todeschini *et al.*, 2017). Most studies mention barriers in general terms and lack conceptual clarity on how barriers may differ across various business models for sustainability (Vermunt *et al.*, 2019).

External barriers are considered external forces that prevent companies from developing their business model for sustainability. They were also divided into two categories: institutional and market and sales. Category 1 refers to social norms and rules that impact business models for sustainability, such as regulations (considered "hard" institutions) and social values, habits and traditions (considered "soft" institutions) (Crawford & Ostrom, 1995). Lack of strict legislative pressure and economic incentives are seen as the main barriers to the business models for sustainability of technological orientation, whereas, in the social category of market and sales, the main challenge is the lack of consumer or customer acceptance and economic incentives to those of social orientation (Laukkanen & Patala, 2014). In the context of market and sales, Vermunt *et al.* (2019) pointed out challenges related to efficient interaction with stakeholders, which is given by the lack of involvement of stakeholders in decision-making.

Internal barriers are considered to be the pressures within a company that hinder the implementation of its business model. We distinguish three categories of internal barriers:

(1) supply chain, operations and logistics;

(2) organizational; and

(3) innovation, research and development (Hoffman, 1999).

The factors related to organizational culture are linked to the company's internal decision-making; when the company becomes flexible to new changes and empowers employees to be protagonists, it may be innovation-oriented (Morioka *et al.*, 2017).

There are differences in the types of barriers encountered between business models. Research by Vermunt *et al.* (2019) shows that companies with a product-as-a-service model mentioned mainly internal organizational and financial barriers (88 and 63%, respectively), and external market and institutional barriers (63 and 50%, respectively) but did not mention supply chain barriers. Firms with a product life extension model encountered mainly external supply chain and market barriers (70 and 80%, respectively). Most companies with the resource recovery model mentioned supply chain barriers (67%), followed by institutional barriers (56%) and market barriers (50%). Regarding knowledge and technology barriers, 44% mentioned them (Vermunt *et al.*, 2019).

3. Research method

To analyze startups' challenges in implementing sustainability business models, this research will adopt the case study method. This method is appropriate to specify research

Category	Barrier/challenge	Description	References
Institutional	Non-alignment with the TBL	The social and environmental context is usually not aligned with the economic one in companies	Fiksel (2003)
	Lack of consumer acceptance	The lack of acceptance by the consumer or the customer creates the need for their education to expand awareness about sustainability, which is still quite limited	Laukkanen and Patala (2014), Todeschini *et al.* (2017)
	Lack of regulatory incentives	The challenge of the lack of regulatory incentives is associated with the government, which often fails to stimulate business with public policy, adequate regulation and incentives for sustainability. Stronger legislative pressure and supportive economic incentives are needed to achieve a sustainable economy	Laukkanen and Patala (2014)
Organizational culture	Short-termism	Allocating resources to projects with quick returns rather than long-term payoffs and discontinuing slowly maturing initiatives	Bocken and Geradts (2020)
	Lack of strategic importance of sustainability for companies	There is a gap between companies willing to innovate their business model toward sustainability and born-sustainable startups that strive to make their business model replicable and scalable	Todeschini *et al.* (2017)
	Reluctance in the provision of new resources in the institution	Difficulty allocating resources for business model innovation and reconfiguring resources and processes for new business models	Chesbrough (2010), Zott *et al.* (2011)
	Lack of scaling up sustainable startups	This barrier is due to the difficulty in sticking to core sustainability values, linked to factors such as fair trade, commitment to recycling, *upcycling* and the use of sustainable materials	Todeschini *et al.* (2017)
Market and sales	Lack of efficient interaction with stakeholders	Lack of stakeholder involvement in decision-making	Laukkanen and Patala (2014), Vermunt *et al.* (2019)
	Lack of product-market fit	Difficulty in achieving a good product-market fit, dealing with business ideas to be tested with potential customers quickly and cheaply	Blank (2006), Ries (2011)

(*continued*)

Table 1.
Barriers/challenges of sustainable business models

Category	Barrier/challenge	Description	References
	Impediments arising from the consumer market or from competition between manufacturers	Only a small amount of waste becomes available for recovery, making it difficult for businesses that rely on recycling to make a profit	Salim *et al.* (2019)
Innovation, research and development	Lack of integration with the technological level	Integrating technological innovation, e.g. clean technology, with business model innovation is multi-dimensional	Zott *et al.* (2011)
	Lack of economic incentives	The lack of economic incentives from the government is one of the main technology-oriented barriers to business model innovation for sustainability	Laukkanen and Patala (2014)
Supply chain, operation and logistics	Lack of internal operations in supply chain management	This barrier impacts environmental initiatives for financial performance and the role of environmental management in their product and service value proposition	Wu and Pagell (2011)
	Difficulty in reconciling resources and the actors involved	Lack of partners and low availability of materials, lack of information exchange between supply chain actors, conflicting interests between supply chain actors	Vermunt *et al.* (2019)

Table 1. **Source:** Authors (2021)

questions until reaching their closure, in addition to checking whether validation occurs with the exploratory literature, allowing theory building through the combination of previous publications and the data collected about the organizations (Eisenhardt, 1989). The steps for the core case studies adopted in this study follow the sequence proposed by Eisenhardt (1989) and are described below to ensure replicability and increase research reliability (Yin, 2001).

This research was divided into three stages (Figure 1), according to Yin (2001):

(1) definition and planning;

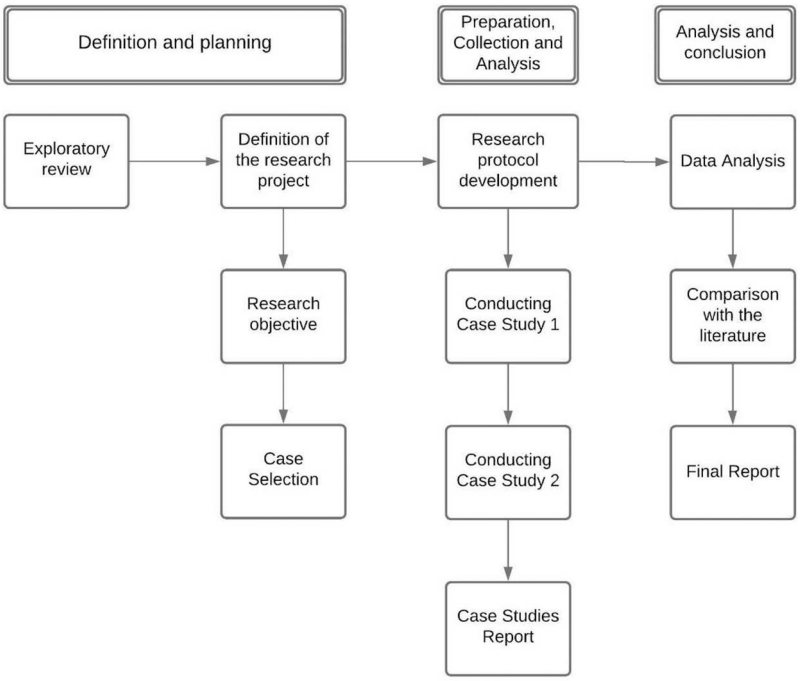
(2) preparation, collection and analysis; and

(3) analysis and conclusion.

The first stage focuses on the part of the exploratory literature review, the research question described earlier in this paper and the elaboration of the case selection criteria. According to Eisenhardt (1989), defining the research question allows the researcher to specify the type of organization to be addressed and the type of data to be collected.

3.1 Case definition and planning

Case selection was conducted with two companies named "Company A" and "Company B." Both companies are located in Brazil, an emerging country that faces institutional gaps and



Sources: Authors (2021), adapted from Yin (2001)

Figure 1.
Research framework

sustainability paradoxes, requiring greater empirical evidence (Jabbour *et al.*, 2020). Company A is focused on solutions related to the environment, also serving as a consultant and in the development of products such as composting. In terms of services, it offers solid waste management plans, water allocation, rainwater harvesting and licensing, among others. Company B is in the phase of consolidating the minimum viable product on the market. Its product is an automated waste collector that automatically separates recyclable waste, without the need for human collection.

The criteria for selecting these companies were:

- to be a startup company;
- to be concerned with environmental and social issues, expressing the need to minimize society's challenges to sustainable development; and
- the workshop participants had to be the company's chief executive officers (CEOs), given their high hierarchical level and the support required to conduct the research, as indicated by Voss, Tsikriktsis and Frohlich (2002).

3.2 Data preparation and collection

The second stage consists of developing the research protocol, conducting Case studies 1 and 2, and finally, the case study report. According to Yin (2001), the protocol is one of the main tactics to enhance the reliability and validity of the case study research as well as the

procedures and general rules that should be followed when using the instrument and instructions for collecting other empirical evidence. A fundamental strength of data collection for a case study is the opportunity to use multiple sources for obtaining evidence, allowing for triangulation. Such methods may include interviews and workshops that can strengthen the validity of the research (Voss *et al.*, 2002).

In this research, a workshop was conducted with each company. A guiding script drove the workshops using the SVEM (Morioka *et al.*, 2018). Before the application of SVEM, improvements were made to adapt the research instrument, with a researcher expert in business models for sustainability, to refine and make the understanding easier in the reality of challenges found in Table 1. After the initial contact, the workshops with the startups were conducted in July 2021 with a CEO from Company A and two CEOs from Company B, which lasted 1 h and 21 min and 1 h and 9 min, respectively.

The SVEM tool application was developed through structured *brainstorming* in the form of a *workshop*. The application of the tool focuses on the sustainable value exchange of organizations with their stakeholders. The application of SVEM was adapted for this research, comprising the following stages:

- (A) value proposition: delimitation of the business reason for existence;
- (B) value capture: value captured by stakeholders;
- (C) value creation and delivery system (in the case of this article, this stage was adapted and is related to the challenges): practices, capabilities and resources (Figure 2); and
- (D) critical analysis of the matrix.

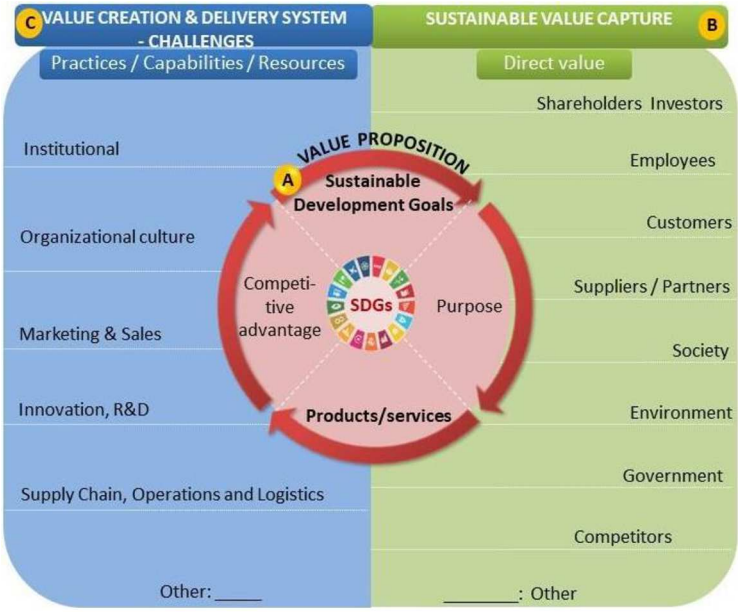


Figure 2.
SVEM

Source: Adapted from Morioka *et al.* (2018)

During the application of SVEM, delineations of relevant contextual factors were considered, from which the more specific sustainability challenges can be derived. Step (A) serves as an input to delineate the business purpose and competitive advantage, which is made tangible by the organization's offerings, e.g. its products and services (Morioka *et al.*, 2018). Step (B) starts with naming the key stakeholders and seeks to identify the key sustainable value captured by each stakeholder. Step (C) names key business processes, i.e., participants are asked to point out the key practices, capabilities and resources required for each process (Morioka *et al.*, 2018). In the case of this paper, Step (C) was adapted by making a relationship between SVEM and the barriers found in the literature in Table 1.

Steps A, B and C seek to promote a description of the main aspects that represent the organization, initiating some reflections during execution. In the end, we expect to provoke more profound reflections by pointing out the contribution of business model innovation guidelines for sustainability (Step D) for an organization that can become more sustainable by making explicit decisions to connect its business model elements as a tool to address the challenges of sustainable development (Morioka *et al.*, 2018).

3.3 Data analysis and report generation

The third stage of the research consists of analysis to produce analytical conclusions involving the description of the cases. After this, a comparison of the challenges with the literature was carried out to analyze whether existing theories match the empirical findings to strengthen them at a higher conceptual level (Voss *et al.*, 2002). As for the recording of workshops, two synthesizing reports were prepared with transcribed information from the interviews with the CEOs, resulting in four pages for each company. Subsequently, both reports were forwarded to the respective interviewees to validate and ensure information accuracy.

Then, the analysis of the transcribed data occurred through content analysis of the workshops. This technique consists of a systematic and objective research method to make replicable and valid inferences from data in their context to build a model, conceptual system or category that describes a broad phenomenon (Elo & Kyngäs, 2008). At this point, it is noteworthy that the results of the empirical study were compared with the literature review findings, thus enabling data triangulation and discussion.

4. Results and discussion

Business models can involve different organizational contexts (Morioka *et al.*, 2017). Therefore, this section is divided into three sub-sections: (4.1) analysis of the value proposition of the case studies; (4.2) analysis of sustainable value capture by stakeholders; and finally, (4.3) discussion of the barriers to value creation and delivery practices affecting business models for sustainability, derived from the theoretical foundation (Section 2.2).

4.1 Value proposition

Company A is an environmental consulting startup whose work mainly focuses on a solid waste management plan, water and sewage treatment and environmental licensing. Company B proposes technology solutions in more sustainable projects and develops services through one of its projects, the "LISA - Lixeira Inteligente Seletiva." It automates the separation of solid residues. In addition to forwarding them to companies that perform recycling, it also supports recyclable materials collectors.

The debate on the company's value proposition started with the contribution of startups to the SDGs of the United Nations Organization, the company's purpose, its main products and services and its competitive advantage. The companies' value proposition corresponding to

each category is summarized in Table 2. The 17 2030 United Nations Goals can be considered a call to action for society actors, including organizations (Morioka *et al.*, 2017).

Therefore, it is possible to see that startups have common points concerning the SDGs, considering that they contribute to sustainable cities and communities (11), responsible consumption and production (12) and action against global climate change (13). Therefore, startups' relationship with the SDGs can be based on their value proposition; for example, the products and services offered by the company are able to contribute to one of the SDGs, even if it is on a small scale.

Below, we list examples mentioned by companies regarding their contribution to the SDGs. Company A: "(SDG 6 - drinking water and sanitation), we carry out projects for systems to capture and use rainwater." Company B: "(SDG 11 - sustainable cities and communities), as we contribute to the reduction of waste sent to landfills and this also impacts on (SDG 13 - action against global climate change), as it reduces the emission of greenhouse gases."

The results show that the value proposition is composed of the company's purpose, encompassing the value that is delivered to customers with social and environmental responsibility, in addition to the economic one. For Company A, evidence of this is: "To deliver services and projects to our clients and partners with social and environmental responsibility on an ongoing basis." For Company B, this value delivered to customers is given by its product's contribution to the circular economy, as evidenced in the following line: "Encourage our customers, by purchasing our product, to send waste that would previously go to landfills, to recyclable material cooperatives." The tangible level of this delivered value is evidenced by products and services such as rainwater harvesting and home composting (A) and advertising in app advertisements and integration with other apps (B).

	Value proposition	
Categories	Company A	Company B
SDGs	Safe drinking water and sanitation (6), sustainable cities and communities (11), responsible consumption and production (12) and action against global climate change (13)	Sustainable cities and communities (11), responsible consumption and production (12), action against global climate change (13), life in water (14) and terrestrial life (15)
Purpose of the company	To contribute to the environmental responsibility of its clients	To contribute to the circular economy, stimulating the consumption part and forwarding waste to cooperatives; return of recyclable materials
Main products and services offered	Waste management plan, civil construction and health network; mandatory environmental licenses (e.g. clients can get a loan from the bank); use of rainwater; home composting	The LISA "Intelligent Selective Waste Bin" with rental service or sale; advertising in applications with ads for each client; integration with other platforms (e.g. National Information System on Solid Waste Management – SINIR)
Competitive advantage	On-time delivery, cost–benefit to client; technical expertise in waste management; continuous monitoring in practice	Few companies offer this service in the Brazilian market

Table 2.
Value proposition of startups

Source: Authors (2021)

Data collection showed personal narratives and insights to build the company's value proposition regarding economic, environmental and social values. Both organizations focus on the social, environmental and economic pillars. A sustainable business opportunity can derive from an environmental problem, adding social and economical solutions (Morioka *et al.*, 2017). One of the common roles of both companies is to make environmental information available to society, government and customers. Evidence of this are the sentences: "Environmental responsibility, in addition to social issues. Deliver socio-environmental responsibility to our customers and partners continuously. [. . .] Try to show that customers can generate economic value to their companies through environmental licensing. The licensing can be positive so that these regularized customers can get loans with banks" (Company A). "In addition to our product, we intend to build a platform to serve our clients with various resources. One of them would be to integrate our platform with the National Solid Waste Information System (SINIR), and the companies that would have the data of this waste stored in the cloud would directly communicate with SINIR since they need to account for this waste."

As expected, the competitive advantages pointed out by the case studies depend on the sector in which they operate. The competitive advantages mentioned include an innovative approach to problem-solving and knowledge in the environmental area, as well as meeting deadlines: "Competitive advantage with deadlines, we are able to ensure delivery within the deadlines" (Company A). "We see our project as a very broad field, we were able to identify few companies in Brazil with our product and there is little exploration. Waste generation is high and we can't recycle even 4% of it. Our product would help in this regard, but everything that is new needs to prove its worth" (Company B).

4.2 Value capture

Several stakeholders capture the value created by the case studies' business models for sustainability: shareholders/investors, customers, employees, suppliers/stakeholders, society, environment, government, competitors, universities, organizations with similar interests and indirect stakeholders. In addition, the startups studied present indirect stakeholders represented by a person or group.

In terms of the financial value captured by the companies studied, income generation is a point in common for both. Clients of startup A capture value from their customers through regularization, licensing and environmental awareness. Those of Company B can benefit by obtaining greater control of their waste and through scoring apps "place your waste and score," in addition to waste management and green marketing itself (Table 3).

Mechanisms to be used by companies to ensure the value captured by society were mentioned, such as environmental education through lectures (Company A) and by reward systems for the user in exchange for benefits (Company B). For the environment, points such as improvements are highlighted through reports and in the very performance of Company A: "We were able to make groups of people gardening, giving lectures on how to compost at home, applying environmental awareness daily. And the encouragement of selective collection and assistance in the logistics of forwarding the collection of solid waste"; Company B: "Environmental education, through the application and gamification, which is precisely a reward system, obtaining discounts on energy bills, in supermarkets."

In the case of the value captured by the government, there is the aid in environmental licensing (Company A), which minimizes the environmental impacts through the conditions established in the licenses. There is also urban cleaning for municipalities (Company B), by allocating part of waste to collectors of recyclable materials, in addition to generating information on waste to the municipality on platforms such as SINIR (National Information System on Solid Waste Management) and optimizing the collection of recyclable materials

Categories	Value capture Company A	Company B
Shareholders	Income generation; satisfaction in applying knowledge from university studies	Income generation; applying what was learned at university; adding value to society
Collaborators	They do not have employees, only the partners work in the company	The "Centelha Programme,*" as a public resource, lowers taxes
Customers	Environmental regularization; environmental awareness	Waste management within the company; green advertising/marketing
Partners	Referral to services, collaboration network	Plates made of recyclable material, from raw material. Reuse through recycling
Society	Environmental awareness, community lectures (composting)	Environmental education through the app; reward system: exchange for benefits, energy discounts
Environment	Environmental improvements resulting from the company's reports and performance	Selective collection; assistance in the logistics of solid waste collection; appropriate destination of waste
Government	Assisting clients' on environmental licensing, providing data on environmental licensing	Urban cleaning; information related to waste collection; optimize collection by waste pickers directly from households
Competitors	Sharing knowledge, strengthening the network	Sharing knowledge and one's work; strengthening the network; visualization

Table 3.
Value capture of startups

Note: *The program aims to stimulate the creation of innovative enterprises and to disseminate the entrepreneurial culture in Brazil
Source: Authors (2021)

collectors. This is a measure that also generates social value by increasing customer satisfaction for using more sustainable products. As mentioned by both companies, sharing knowledge is necessary to strengthen the network and thereby enable companies to obtain a better market view.

4.3 Value creation and delivery system – challenges and barriers

Several aspects were pointed out during data collection to affect the business model. This topic addresses a vision based on the challenges and barriers found in the literature. Companies indicated that the presence of competitors increases market awareness and the understanding of the solution proposed by the business models for sustainability. Consequently, it can increase market demands to demonstrate product quality when remanufacturing, promoting education and culture on remanufacturing and circular economy (Table 4).

The proper functioning of regulatory structures in business models for sustainability has great relevance (Laukkanen & Patala, 2014). The startups reported different views regarding the institutional scope. Company A perceives the government as absent and legislation as hindered by changing laws or by customers hiring only because it is a legal requirement to obtain reports or environmental permits. Company B mentions that the institutional category is not a barrier for them, as they receive incentives from the "Centelha" program (deriving from the public policy), which facilitates taxation mechanisms. For

Categories	Value creation and delivery system – challenges/barriers Company A	Company B
Institutional	Lack of incentives from the government in general (e.g. lack of tax incentives and from bodies such as CREA*); risk of changes in the legislation regarding environmental licensing; lack of environmental awareness in society; high competitiveness (including of professionals from other specialties)	Not found
Organizational culture	Short term for the company's survival, focusing on only one medium-term investment (Google Ads); lack of ethics amongst competitors	Short-term thinking to develop a minimum viable product
Market and sales	Costs related to investment with social media	Costs of offering the product for free; initial financial cost; difficulty in attracting customers
Innovation, research and development	Difficulty in maintaining continuous training and reconciling it with academic research to develop new solutions	Difficulty in prioritizing time for activities
Supply chain, operations and logistics	Public bodies with monitoring system failure (lack of technology updating)	Products discarded may not be the materials that recyclable material collectors can recycle; concern about what should work

Note: *CREA – Regional Council of Engineering and Agronomy
Source: Authors (2021)

Table 4.
Value creation and delivery system related to the challenges of startups

example, "Centelha" includes the company in the *Simples Nacional*, a simplified taxation system so that companies pay fewer taxes, favoring its services.

Different forms of businesses, e.g. social businesses, cooperatives and collectives, are not well supported by regulators (Laukkanen & Patala, 2014). This occurs with Company A, in terms of the lack of technologies provided by environmental agencies in the transaction of the licensing processes. Another barrier related to the lack of regulatory incentives for Company A is the risk of change in legislation on environmental licensing, which can be evidenced in the statement, "There is a new project to make licensing basically optional. To keep our business active, it is necessary that there is an obligation for the entrepreneur to have engineering projects in the licensing part."

The absence of government incentives, in general, is emblematically revealed in the following statement of the interviewee from Company B: "I don't see tax incentives, I don't see project incentives. I don't see incentives from other agencies, for instance, the Regional Engineering and Agronomy Council (CREA), at least not for the environmental area." In fact, in the Brazilian scenario, double taxation of recyclables is an example of the lack of institutional incentives that should not be ignored. Reductions in taxes on the marketing of recycled materials and products made with them are absent; however, they could be an effective incentive for manufacturers to use more recycled materials, encouraging the entire production chain (Haro-de-Rosario, Gálvez-Rodríguez, Sáez-Martín & Caba-Pérez, 2017).

As for organizational culture, the barrier arises for companies to delimit their proposition for the next generation. In general, this question was interpreted as relating to their financial affairs, in the short term, which suggests the difficulty in staying true to the core values of sustainability,

consistent with sustainable strategic objectives (Todeschini *et al.*, 2017; Zott, Amit & Massa, 2011). The challenge of this category for Company A is related to short-term investments, as the startup is focused on growing as fast as possible. The only medium-term investment is made in internet platforms, such as Google Ads, which is still incipient.

Another point raised was the lack of ethics amongst competitors, which hinders relations with the municipality's city hall, indicating that the focus on value creation and on value capture encompasses activities beyond the company's own borders (Zott *et al.*, 2011). Therefore, Company B is concerned with recyclable material because this requires a partnership effort with local recyclable material cooperatives. However, to get to this collaborative relationship, it is first necessary to map these cooperatives and their constraints, which limits the startup's scalability and growth to other regions, suggesting a typical challenge, converging with previous studies (Todeschini *et al.*, 2017; Zott *et al.*, 2011).

Regarding the market and sales, the investment with social media is a challenge for Companies A and B, it is related to attracting customers. Consumers or customers appreciate cheaper prices than sustainability aspects, a "disposable" culture is created, where it is more profitable to produce or buy cheap and short-lived products (Laukkanen & Patala, 2014). For Company B, evidence of the difficulty in attracting customers is highlighted in the speech: "capture investments from other agents, get more people in society to know the company and help in the dissemination of the product."

In the category of *innovation, research and development*, continuous training and academic research for developing new solutions in Companies A and B, fundamental for companies' growth, are also challenging in the sense of continuously maintaining innovations: "We use software, but then we went after other tools for more visual work. One of our members is in his doctorate, and developing research is of great value, but it requires a lot of his time" (Company A). "What we are working on today would already be an innovation, and every innovation involves research. The challenge is to reconcile, in terms of time, the Master's degree activities with the company's activities" (Company B). Thus, one notices that both startups have difficulty prioritizing and reconciling time, because at least one company's CEO has other academic activities. What is divergent from what we found in literature, i.e. problems in lack of knowledge and technology (Vermunt *et al.*, 2019).

Finally, in as much as the supply chain is concerned, challenges are related to public agencies with failures in the monitoring system due to the lack of technology updates (A) and for (B) the products that are being discarded might not be the materials that the waste pickers recycle, and there is a concern as to the functioning of the process. Another point for Company B would be possible problems with suppliers of the boards to manufacture their product: "The services that we consume from other suppliers, are well available in the market, but a possible problem could be with the raw material of the boards in the manufacturing of our product." Supply chain dependencies were found to be problematic also in Vermunt *et al.* (2019) research, mainly caused by the limited number of suppliers of circular materials. As the circular economy is still in its infancy, few suppliers are already producing biodegradable or recyclable materials (Vermunt *et al.*, 2019).

5. Conclusion

This study explores the existing research gap concerning the emerging theme and the need for empirical studies insofar as it empirically analyzes the barriers found in the literature associated with business models for sustainability and the relationship between organizational commitment, reflected in the value creation and delivery system, to sustainability and its practical implementation.

This research found that the barriers and challenges of business models for sustainability in startups are found in different categories. The existing theoretical

frameworks of business models for sustainability were highlighted through the challenges focused on the following categories: institutional and organizational culture, market and sales, innovation, research and development, supply chain, operations and logistics. As the case study method, the SVEM tool (Morioka *et al.*, 2018) was applied to analyze the value propositions, value capture and the value creation and delivery system related to the categories of the challenges found in the literature.

The barriers linked to the institutional category have a greater impact on Company A, whereas the market and sales category prevails in Company B. This leads to the conclusion that there is a need to reformulate public policies and to have a greater participation of the actors involved. Similarly to what was found in Hueske and Guenther's research (2021), the barriers related to market and sales are linked to investments and financial return. In other words, the difficulty in making the business model economically viable.

Challenges related to innovation and technology for the product life extension model were reported, for example, by Matsumoto *et al.* (2016). In our sample, technological barriers were prominent in continuing education, especially regarding the search for the development of new solutions and continuous improvement in entrepreneurial performance. This can be explained by the fact that at least one of the CEO's of each company is also pursuing a Master's/PhD degree in parallel to the entrepreneurial activity.

The challenges found in both startups regarding organizational culture are related to short-termed and are also found in the research of Bocken and Geradts (2020). While corporations seek to realize immediate profits to satisfy shareholders who demand quick returns, it is said that short-term investment beliefs dominate investment decisions. Meeting this assertion, the sustainable business model involves a broader understanding of value and stakeholders, as it "captures economic value by maintaining or regenerating natural, social and economic capital beyond its organizational boundaries" (Schaltegger *et al.*, 2016, p. 6).

Our research presents two major contributions. First, through the case studies, it is possible to state that barriers and challenges in business models for sustainability have great relevance for startups and collaborate with empirical data to understand the obstacles to business development toward sustainability. This information can help us create metrics and national public policies to achieve the SDGs. The second contribution is the adaptation of SVEM by holding the debate incorporating the barriers and challenges in the value creation and delivery system.

The main limitations of this research are the number of case studies, which was limited to only two, making it difficult to generalize the results. Furthermore, future research should observe whether the conclusions of this research can be replicated in companies from different sectors. It is also suggested that further research should include a more significant number of case studies of startups to compare with the results of this research and others that deal with barriers and challenges in the literature. Another suggestion for future research is to apply other tools found in the literature on business models for sustainability, after diagnosing the challenges.

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