Fecha de recepción: abril 2025
Fecha de aceptación: mayo 2025

Diseño en el contexto de la bioeconomía: una experiencia en la selva amazónica

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Abstract: In 2021, the "Inova Amazônia Pará" initiative invited projects in northern Brazil and provided support, including training and subsidies, to initial-stage bioeconomy companies. This initiative embraced "eco-design" projects, recognizing the design role in the innovative landscape of Amazonia. This study scrutinizes the Cuia Colab project, a design initiative selected as a startup under the aforementioned initiative, employing it as a case study. Our research question is 'How does the Cuia Colab project align with biodesign/bioeconomy intentions? The objective is to provide references for prospective design endeavors in analogous contexts and engage in reflective discourse on potential enhancements to the experience. The literature review addresses Biodesign and Bioeconomy, Human and non-human interactions, and the context of the Brazilian Amazon. Cuia Colab envisioned the creation of innovative objects involving an Amazonian tree and local artisans in its production process. The project successfully crafted prototypes with the support of the initiative and the work of a local team. Departing from traditional industrial practices asserting control over resources, standardization, and scalability, Cuia Colab adopted a collaborative ethos with trees, viewing them as active agents that shape procedures. Despite efforts to uphold forest vitality and foster positive environmental and social impacts, there persists simultaneous pressure to maximize production and substantiate the economic viability of the forests. In conclusion, Cuia Colab exemplifies the imperative for a reevaluation of fundamental design principles and sustainability within the bioeconomic landscape, illustrating the intricate balance between ecological preservation, socio-economic imperatives, and innovative design paradigms. In pursuing a bioeconomy enterprise imbued with ecological design principles, we suggest adopting bio-situated approaches prioritizing biodiversity over scalability. Additionally, it is urgent to demonstrate respect for and a deep understanding of the environment's custodians and local knowledge systems. By prioritizing these considerations, designers can ensure their endeavors contribute to ecological sustainability while fostering harmonious relationships with local communities and ecosystems.

Keywords: biodesign - bioeconomy - ancestral knowledge - amazon forest.a

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Introduction

The In 2021, SEBRAE, the Brazilian Service of Support to Small Entrepreneurs, initiated a call for projects entitled 'Inova Amazônia Pará.' Situated in the northern region of Brazil within the context of the Amazon Forest, the primary objective of this call was to stimulate entrepreneurship and innovation through training for the development of products (commodities and/or services) or pioneering processes (SEBRAE, 2021). The initiative's goal was to facilitate the transformation of inventive concepts into sustainable enterprises, concurrently fortifying small-scale businesses that integrate novel technologies within sectors related to the bioeconomy.

Amidst conventional investment sectors associated with the Amazon Forest, such as Food, Pharmacy, and Cosmetics, the call extended its horizon to encompass diverse projects, including but not limited to Packaging, Construction, Fashion, and Ecodesign (SEBRAE, 2021). The call invited submissions for nascent ideas and projects from individuals or companies across Brazil.

'Inova Amazônia Pará' marked the inaugural initiative in a series, with subsequent calls slated for other districts within the vast Amazon Region. SEBRAE delineates compelling reasons to engage in business within Amazon, emphasizing:

> *"little explored bioeconomy market; greatest biodiversity in the world to generate new products; great potential for generating sustainable innovations; products originating from the most famous forest in the world; and innovation as an instrument for the conservation and preservation of natural resources" (Sebrae, 2024).*

This demand for projects caught the attention of many researchers around Brazil, as even ideas at a very initial stage could be supported. That was the case of Cuia Colab, a design proposal by the researcher Andrea Bandoni at the initial stage of her Ph.D. investigation with the theme "Biodesign + Amazon."

In 2021, the researcher undertook a comprehensive mapping of extant initiatives within the Amazonian context that could interact with Biodesign concepts. This exploratory process encompassed diverse entities, including businesses, museums, communities, and non-governmental organizations (NGOs). Within this mapping, Andrea found the alignment of the Inova Amazônia program's interest with the domain of "ecodesign", and this is when Cuia Colab project (CCp) was created.

CCp centered around a regional item native to Pará: the cuias (figure 1). In succinct terms, cuias represent traditional artisanal objects crafted from an Amazonian tree, predominantly employed as bowls, vases, and containers. The fundamental objective of CCp was to furnish a resilient and fully biodegradable alternative to commonplace domestic items while simultaneously contributing to the fortification of local artisan communities. By integrating innovative design practices into the production process and leveraging the inherent qualities of cuias, Cuia Colab offered an ecologically sound solution while preserving and promoting the cultural significance of these traditional Amazonian artifacts.

Figure 1. Traditionally made cuias, from the Amazonian region of Santarém, north of Brazil. Source: Andrea Bandoni, 2024.

Objectives and methodology

Cuia Colab is a representative design project grounded in theoretical research practically applied within a bioeconomy program. In the face of environmental crisis management, bioeconomy emerges as a compelling business approach that captivates contemporary Western societies, including the design community. This paper aims to scrutinize the evolution of Cuia Colab within the context of the "Inova Amazonia Pará" program, employing it as a distinctive case study. The primary objective is to provide valuable references for prospective design projects in analogous contexts and reflections of potential enhancements to the overall experience.

Our research question is 'How does the Cuia Colab project align with biodesign/bioeconomy intentions? Our methodological approach encompassed a thorough literature review on Biodesign, Bioeconomy, and Human/Non-human interactions, establishing the theoretical backdrop for this study. The principal method employed in the subsequent case study analysis involved critical reflection on the experience. Notably, one of the authors, serving as the proposer of Cuia Colab, played an integral role throughout the entire process, offering an insider's perspective and enriching the analysis with firsthand insights. This methodological stance ensures a comprehensive understanding of the project's development, nuances, and implications (Khon, 1997), contributing to the study of biodesign and bioeconomy in a real context.

Literature review

The brazilian amazon context

Brazil occupies a preeminent position among nations boasting the highest levels of biodiversity worldwide. The Amazon Rainforest, a hallmark of Brazil's ecological wealth, is estimated to harbor approximately 40 thousand plant species, 300 mammal species, and 1.3 thousand bird species inhabiting its vast expanse (Instituto de Engenharia, 2021). Furthermore, the Amazon also holds significant ethnic and population diversity, with its territories home to various communities, including riverside and quilombola populations, alongside Brazil's most significant indigenous populace, numbering around 300 thousand individuals (IBGE, 2010).

Despite its ecological significance, the Brazilian Amazon has witnessed a concerning escalation in deforestation rates from 2012 to 2021. Although marginal improvements were observed in 2022 and 2023 (Figure 2), the persistent trend of deforestation has inflicted irreparable losses upon biodiversity. Notably, the primary drivers of this environmental degradation stem from the economic interests of external entities, particularly mineral and timber extraction, monoculture, and cattle ranching endeavors (Instituto Socioambiental, 2020).

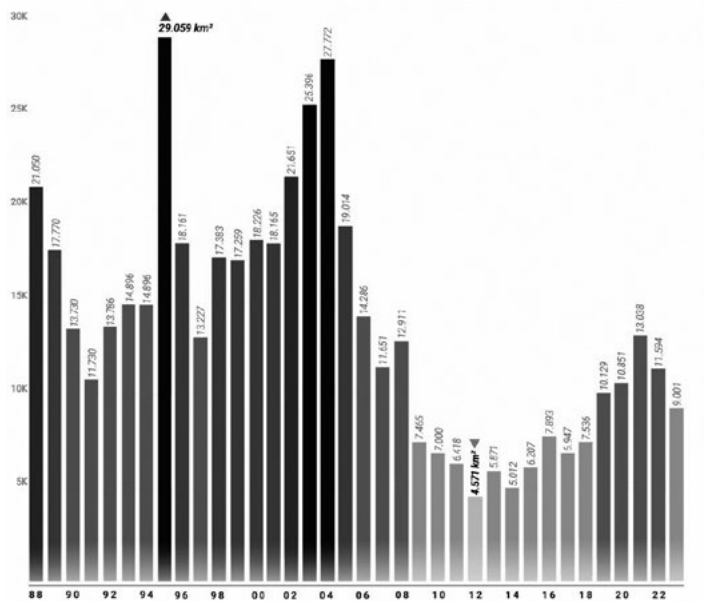

Figure 2. Graph of the history of deforestation in the Brazilian Amazon Forest (1988-2023) in annual km2, Source: Prodes/INPE, @brasilemmapas, 2023.

In response to the pressing challenges facing the Amazon region, diverse stakeholders and researchers, including scientists, have raised alarm regarding the dire consequences of forest degradation combined with the effects of climate change. They have highlighted the potential of Bioeconomy in the Amazon as a way to generate economic value for the region while maintaining the forest, using biotechnology science, and circular economy principles (Silva et al., 2018).

Furthermore, it is widely recognized that local communities' traditional knowledge and practices intricately linked with the Amazon Forest hold invaluable insights that can contribute to new findings. Indigenous peoples worldwide have cultivated unique understandings over generations, rooted in cultural experiences, which guide their interactions with the diverse ecosystems they inhabit. This reservoir of knowledge, often called Traditional Ecological Knowledge (TEK), is increasingly acknowledged in design as a repository of sustainable practices responsive to environmental challenges (Watson, 2019).

Biodesign and bioeconomy

Biodesign is a relatively new discipline officially defined over ten years ago (Camere & Karana, 2018; Collet, 2017; Ertürkan et al., 2022; Karana et al., 2020). According to Myers, Biodesign: "transcends mere imitation, aiming for seamless integration, erasing the boundaries that traditionally separate natural and constructed environments, and forging hybrid typologies" (2018, p. 8). Furthermore, this author states that biodesign practices can replace industrial processes by utilizing biological processes that require less energy and fewer materials. As stated by Antonelli: "Biodesign harnesses living materials, whether they are cultured tissues or plants, and embodies the dream of organic design: watching objects grow and, after the first impulse, letting nature, the best among all engineers and architects, run its course" (2018, p.7)

Ginsberg and Chieza (2018) warn that, despite Biodesign's goal to upend the dominant industrial paradigm, this approach risks failing to realize its transformative potential and instead just replacing standard products, which would maintain and strengthen current markets, systems, and ecological footprints.

Similar to Biodesign, Bioeconomy has become increasingly prominent in contemporary discourse and the implementation of Bioeconomy initiatives within the Amazon Forest is a relatively recent undertaking, as underscored in pertinent studies (Abramovay, 2022; Coslovsky, 2021; Grupo de Bioeconomia da Concertação pela Amazônia, 2021; Instituto de Engenharia, 2021; Silva et al., 2018), leading to different understandings of the term. 'Inova Amazônia Pará' defined Bioeconomy as: "sustainable initiatives based on the use of renewable biological resources that aim to innovate processes and/or products in production chains, generating market opportunities for small businesses" (SEBRAE, 2021).

Markus M. Bugge, Teis Hansen, and Antje Klitkou (2019), in their paper entitled 'What is the Bioeconomy,' distinguished between three Bioeconomy visions. The *Biotechnology* vision strongly focuses on the value of biotechnology research, applications, and commercialization across several economic sectors. The *Bioresource* vision centers on creating new value chains and upgrading and processing biological raw materials. Finally,

the *Bioecology* vision prioritizes ecological processes and sustainability, optimizing energy and nutrient utilization, supporting biodiversity, and preventing soil deterioration and monocultures. This paper aligns closely with this third vision proposed by the authors, emphasizing the primary objective of establishing, developing, and revitalizing economic systems based on the sustainable utilization of renewable biological resources.
Moreover, among Bioeconomy studies, we emphasize the 'Framework for the Bioeconomy in the Amazon' (Grupo de Bioeconomia da Concertação pela Amazônia, 2021). This framework intricately considers the socio-spatial diversities inherent in the Amazon, delineating four distinct 'Amazons': those characterized by urban settings, altered forests, the deforestation arc, and conserved forests. Significantly, the bioeconomy operates within all these contexts, employing varied approaches and production systems. A noteworthy aspect of this framework is introducing the 'Traditional Bioeconomy' concept, which prioritizes preserving biodiversity by considering the local community's culture.

Human and non-human interactions

According to Capra and Luisi's ideas (2016) the term 'systems view,' refers to a living organism in the totality of its mutual interactions. Therefore, nature is no longer viewed as the other. In their model, humanity's mission and the planetary system's purpose coincide:

> "(..) *we can say that the cell – the living being – is a thermodynamically open system: the living being needs nutrients and energy, and these acquisitions are parts of its own life. According to Maturana and Varela (1980, 1998), the organism interacts with the environment in a 'cognitive' way whereby the organism 'creates' its own environment and the environment permits the actualization of the organism.*" (Capra and Luisi, 2016, p.134)

While several interrelationships between humans and non-humans persist, acknowledging rights and agency among non-human entities still needs to be addressed. As Romani et al. (2022, p.2) articulated, "we are currently acting as part of a separated context from the rest of the world, lacking an interconnected pluriverse vision." Since the 1980s, the design domain has been predominantly characterized by a "human-centered and user-centered paradigm," which, as noted by Forlano (2017, p.16), has tended to overlook alternative forms of life as potential agents or participants in design processes.
Design endeavors have historically contributed to and perpetuated this hierarchical anthropocentric outlook by promulgating models of production and consumption that prioritize human-centric perspectives, thereby exacerbating the unsustainable trajectory of ecological changes. Nevertheless, as noticed by Romani et al. (2022), a discernible shift in the role of design research and practice is underway within this milieu: firstly, in facilitating the transition toward novel sustainable paradigms of production and consumption, characterized by a departure from anthropocentric viewpoints to embrace a more inclusive perspective; and secondly, in fostering the collaborative coexistence of human and non-human entities to envision and realize equitable and sustainable futures.

In the design realm, examining interactions with non-human entities can benefit from insights drawn from diverse fields. Within the botanical domain, the 'coevolutionary process' concept elucidates the intricate dynamics wherein species mutually influence each other's evolution. This conceptual framework considers many factors, including population increments, offspring numbers, fitness rates, mutation rates, and events and relationships unfolding over evolutionary time (Moreira, 2020). Through such analysis, it becomes apparent that two or more species engage in a continual process of coevolution, wherein reciprocal interactions shape their respective trajectories.

Anthropologist Donna Haraway (2016) introduces the notion of 'companion species' to denote partner species that are intricately linked. Haraway further advances the concept of 'sympoiesis,' which she defines as 'making-with,' underscoring the interdependence between organisms that engenders complex and symbiotic relationships vital for sustaining life.

The Cuia Colab project as a case study

Cuia Colab´s proposal and training

The Cuia Colab project embarked on its journey within the 'Inova Amazônia Pará' program by identifying a pertinent 'problem' and proposing a 'solution': the prevalent challenge of disassembling and recycling household objects, often composed of toxic materials with limited lifespans. The proposal underscored the scarcity of affordable household objects crafted from natural, biodegradable materials and produced through ecological manufacturing processes amidst a market saturated with conventional alternatives. In response, CCp conceived a solution rooted in traditional Amazonian materials and techniques, complemented by circular economy principles and innovative technologies. In the Amazon, indigenous people and riverside communities have long used cuias, the fruit of the Cuieira tree (*Crescentia cujete*), for the most diverse functions, primarily as recipients—the Cuia Colab project aimed to manipulate the shape of cuias and transform them into household objects. We were inspired by the 'way of making cuias,' a recognized Brazil's intangible cultural heritage supported by digital technologies and references from Biodesign and Bioeconomy.

The envisioned production process would be the natural ecosystem itself, with the tree as the 'factory' wherein molds were inserted into the fruits, facilitating the desired shaping of cuias before harvest. These molds, crafted through digital manufacturing techniques such as laser cutting or 3D printing, offered a means of imparting form to the growing cuias. Notably, this growth process unfolds organically and without environmental harm, allowing nature to take its course (figure 3).

Integral to the project's ethos is the inclusion of traditional cuia artisans from local communities. Beyond serving as suppliers and consultants during the growth phase, these artisans could actively participate in the production process, whether applying a black protective resin to cuias or creating decorations on cuia's surfaces, as they traditionally do.

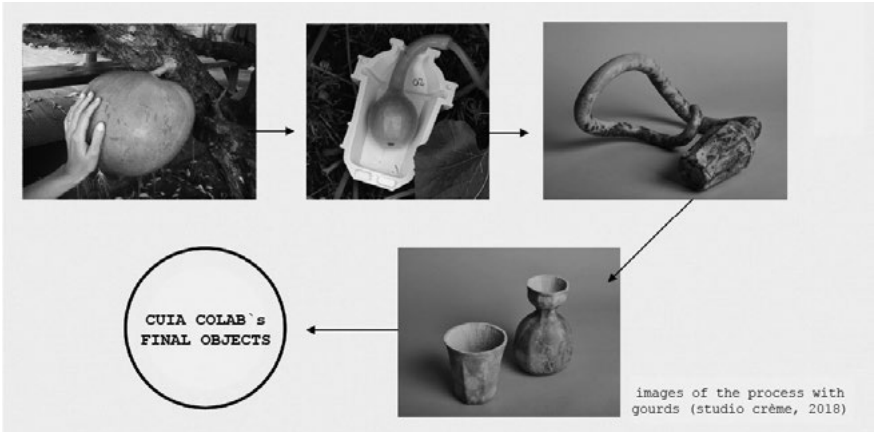

Figure 3: Image from the original proposal of project Cuia Colab, showing the process of making cuia-objects through the example of gourds. Source: Andrea Bandoni, 2021.

The project was named after the collaboration between technology, artisanal communities, and trees facilitated through design (figure 4). At its core, CCp aspired to immerse individuals in a future wherein everyday objects are post-industrial, highly sustainable artifacts crafted from renewable natural resources. These objects would also pay homage to ancestral and local crafting traditions.

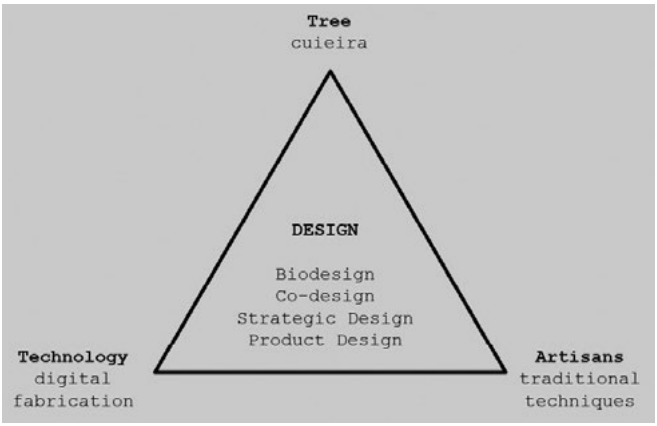

Figure 4: Diagram from the original proposal of project Cuia Colab. Source: Andrea Bandoni, 2021.

It is relevant to highlight that Cuia Colab was conceived and submitted to the call as an embryonic idea without prior business ventures or practical implementation. Despite lacking experience, the project referenced analogous experiments involving molds on gourds, fruits bearing a resemblance to cuias in appearance and resistance. However, it is imperative to underscore that this technique has never been trialed with cuias before, nor has it been integrated with their traditional crafting methods. Thus, while drawing inspiration from existing practices, Cuia Colab embarked on uncharted territory, venturing into innovative terrain at the intersection of traditional craftsmanship and contemporary design methodologies.

The selection process for 'Inova Amazônia Pará' unfolded in three stages. The initial phase involved the 'pre-acceleration' of the 50 chosen projects, entailing a two-month online training program. The second phase comprised the 'acceleration' of the 30 projects, providing intensive six-month training and financial support. The third and final phase encompassed the 10 projects selected for 'internationalization' training. CCp started in October 2021 and extended until September 2022, culminating in a program-organized event featuring a final pitch for the 'accelerated' startups.

During the pre-acceleration phase, from October to December 2021, Cuia Colab started to evolve towards a viable business solution. Facilitated by the expertise of Neoventures, an innovation consultancy firm enlisted by SEBRAE, the training regimen comprised a curriculum delivered through online weekly classes, mentoring sessions, and assigned tasks. Adherence to the program's schedule was mandatory for progression into subsequent phases. It culminated in a 3-minute online pitch, showcasing the potential of Cuia Colab as a business venture and delineating its next steps.

CCp emerged as the sole candidate in the realm of 'eco-design' to advance to the second phase of the 'Inova Amazônia' program, starting in April 2022. However, organizational hitches reduced the program's efficacy, as startups received no financial support until July 2022. Consequently, the initial four months of developmental endeavors were exclusively supported by the entrepreneurs' resources, negatively impacting the program.

The training curriculum had a pronounced business-centric orientation, focusing on customer-centric paradigms. Invited experts graced the sessions, offering lectures across a spectrum of topics encompassing human resources, branding strategies, pricing mechanisms, market analysis, minimum viable product (MVP) development, intellectual property considerations, and sales tactics. A lecture dedicated to Bioeconomy materialized only in September 2022, just prior to the conclusion of the training period. Although the lectures were engaging, they often lacked tailored references applicable to the context of businesses operating within the Amazon Forest.

A notable disparity in the business maturity stages of the 30 selected startups was observed, ranging from nascent concepts to well-established enterprises with a track record spanning several years. This divergence engendered logistical challenges wherein certain training activities proved incongruous or impractical for some participants, culminating in frustration for facilitators and entrepreneurs alike.

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Cuia Colab´S Development

In the case of Cuia Colab, a local team was assembled in Belém do Pará in May 2022, comprising a designated local design manager, a stagiaire, and a freelance designer specializing in mold-making. The team's first challenge was identifying suitable trees for experimentation. Viable trees were discovered within the Federal University of Pará campus, and subsequent authorization enabled the project to experiment with six cuieira trees.

Various tests were conducted with different molds, with promising outcomes (Bandoni et al., 2023 – figure 5). Nonetheless, the iterative nature of the process uncovered the inherent complexities associated with Biodesign endeavors outside laboratory settings. Factors beyond the team's control, such as the presence of insects or rain, emerged as issues capable of impeding or delaying progress. However, amidst the trials and tribulations, the most exciting part was learning that, in a Biodesign experience, the agency of the living entity – in this case, the trees - cannot be ignored and should be included in the process to achieve better results.

Figure 5: One of the tests conducted by Cuia Colab during the startup development. Source: Andrea Bandoni, 2022.

During the acceleration phase, an indispensable step for CCp involved the immersive visit to the community of artisans (Figure 6). Situated in a peripheral region of Santarém, accessible solely by boat, these artisans offered invaluable insights into traditional cuia crafting practices. Besides closely watching the artisans' traditional technique, the researcher noted that the ancestral knowledge of the observed women encompasses a broader range of practices that present valuable insights to contemporary sustainable designers. Key among these insights was the symbiotic relationship between women and trees, underscored by practices utilizing biodegradable tools, meticulously assessing

the maturity of cuieira fruits, and even leveraging urine as a chemical resource. The resulting aesthetics of cuias varied based on the process, as their form depends on ecological considerations. Due to their organic nature, cuias confront the standardization typical of industrial artifacts, imbuing each piece with a unique identity reflective of its environmental origin.

Figure 6: Artisan Silvane Maduro harvests a cuia in her backyard. Source: Andrea Bandoni, 2022.

The visit also brought to light an upsetting reality: the gradual decline of the artisan community. This trend threatens the erosion of traditional knowledge and poses practical challenges as the existing artisans already have enough work and are not interested in molding cuias. Consequently, the intergenerational transmission of craft knowledge, traditionally passed from mother to daughter, faces an uncertain future.

The Cuia Colab project analysis and discussion

Four primary issues emerge upon scrutinizing the initial proposal and subsequent development of the Cuia Colab project:

• Firstly, the realization that cuieira trees cannot produce objects at the rapid pace or uniformity characteristic of conventional 'factories.' The design must undergo significant adjustments to accommodate nature's imperfections and temporal rhythms. This underscores the importance of fostering meaningful connections and exchanges between humans and non-humans (trees), which has the potential to extend these positive impacts to the entire ecosystem.

• Secondly, achieving scalability would entail establishing plantations. However, such endeavors encounter complex challenges in the Amazon region, where diverse species necessitate cohabitation. The establishment of monocultures, while expedient for mass production, invariably undermines the ethos of a bioeconomy that prioritizes biodiversity conservation.

• Third, Cuia Colab's assumption that artisans would readily engage in the project proved overly optimistic. Despite their profound ancestral knowledge of cuieira trees, artisans showed limited interest in embracing novel techniques. The encounter with artisans prompted Cuia Colab to reconsider prevailing production and consumption systems while also catalyzing reflections regarding ethical engagement with these custodians of invaluable knowledge.

• The fourth issue pertains to the logistical challenges inherent within the Amazonian terrain. Vast distances exacerbate production and environmental costs, posing formidable obstacles to scalability. Regrettably, viable solutions to address these logistical obstacles remain scarce.

While helpful, the business training offered by the 'Inova Amazônia' program fell short of adequately addressing these critical issues. Cuia Colab project flourished in the program as prospective clients expressed enthusiasm for the proposed ideas and products, even though it was struggling with ecological concerns. It underscores the imperative for program organizers to delve deeper into the nuances of bioeconomy within the specific context of the Amazon Forest. Training content and activities should be calibrated with the developmental trajectories of participating startups to foster a conducive learning environment. Moreover, transitioning towards a planet-centric rather than user-centered approach would be imperative for a bioeconomy program.

Situated biodesign and bioeconomy practices

It is becoming increasingly essential to comprehend the new implications that the designer professional figure may provide for environmental sustainability issues and ideas connected to local development in the current worldwide context of social problems and climate change. Today's design area entails evaluating distinctive territories' characteristics and the numerous interdependencies of elements related to social dynamics, cultures, climate, ecological, and anthropological concerns. Projects should thoroughly examine a context's specifics before moving on to more widespread issues and finding connections. This approach flips the dynamic from macro to micro, emphasizing tangible and authentic eco-social issues, in line with a small-scale concept of sustainability that examines the connection with territory.
A place's climate, geographic position, and resources should be linked to Biodesign and Bioeconomy. They establish the evolutionary attributes of a particular identity, shaped by expertise, rituals, ideologies, and cultural influences. They also point to local materials

and traditional and contemporary practices. The distinctive qualities of a location, a region, a city, or a small community are defined by these intricate dynamics, which are predicated on the reciprocal interactions of environment and culture. Through inventive and traditional techniques passed down through the years, local identity is manifested in tangible objects.

Abramovay (2022) mentions that improving the quality and chances of insertion in dynamic bioeconomy markets requires solutions adapted to different locations. They are neither ready-made and established techniques nor homogeneous: they will vary depending on the territories where they are implemented and the knowledge of those who manipulate them.

Finally, Weiss and Besoain (2022, p.10) mention that a bioregionalist perspective in the context of design "contributes to the recognition of opportunities for new local economies and material autonomy for each territory." They name this approach 'situated biodesign.'

BIODIVERSITY BEFORE SCALABILITY

Biodesign and Bioeconomy can play a crucial role as eco-social mediators. As the Cuia Colab project exemplifies, any endeavor to scale production in the Amazonian context must navigate the intricate balance between economic viability and ecological integrity, mindful of the overarching imperative to preserve biodiversity.

Strengthening the bioeconomy at the Amazonian biodiversity involves a triple challenge, as Abramovay (2022) described. The first consists of locating the material and immaterial means that allow for improving the quality of products, the opportunities for local processing, and the agility in obtaining information regarding prices and commercialization. The second challenge is to understand the possible conflicts that arise from introducing typically economic rationality in an environment whose social reproduction is not guided by it. The third challenge is the environmental problems that can be generated by poor ecological management by changing an already established balance.

About the logistic and infrastructural solutions needed in the context of CCp, the work of Ana Cristina Barros (n.d.) is exemplary in clearly showing the possibility of conciliation between two dimensions: the infrastructure focused on commodities and that oriented both to the economy of biodiversity and to improving the living conditions of those who live in the Amazon.

Since the arrival of Europeans, the occupation of the Amazon region has treated the forest as an obstacle to be overcome by economic growth needs (Salles, 2021). Solutions such as Biodesign, which aims to mitigate the effects of the climate crisis, can overcome that view by paving the way for a model based on nature preservation. The interaction between entrepreneurs and populations that live and use forest resources might open the way to more promising markets for these products and their protagonists.

Social regeneration before economic growth

> "*If bioeconomy is premised on respect for the material culture of the people responsible for its development, then understanding the way these people deal*

> *with space and time and their local hierarchies, among other issues, will have a strong influence on the productive organization and cannot be treated as a detail.*" (Abramovay, 2022, p.57)

Indigenous and local communities' territories and knowledge, women-led efforts to conserve and restore traditional practices, and community-based projects with small-scale sustainable production are all motivating instances of how local economies can be built upon the values of human rights and care for the environment. These initiatives can improve the well-being of humans and non-humans involved. The bio-cultural methods of indigenous people and local communities, who, as mentioned, have succeeded in creating lives in harmony with the surrounding environment, should be acknowledged.

> "*An alternative worldview would acknowledge the bio-cultural methods of indigenous peoples and local communities, who have long succeeded in creating sustainable livelihoods, a "buen vivir" in harmony with the environments they live in, rather than advocating a socially indifferent green economy.*" (Hall, 2012, p. 3).

Conclusions

Our research question was 'How does the Cuia Colab project align with biodesign/ bioeconomy intentions? With this in mind, the literature review delved into fundamental concepts underpinning the case study: the unique context of the Brazilian Amazon forest and its Cuia's artisan communities, the Biodesign and Bioeconomy conceptual framework, and the theoretical analyses of human and non-human interactions. It paved the way for critical reflection and analyses of the subsequent CCp case study.

In presenting this review, the paper elucidated its ideological standpoint: an ecological perspective emphasizing the fostering of biodiversity relationships and the reverence for traditional knowledge and non-human entities, as the CCp adopted a collaborative ethos with trees, viewing them as active agents that modified the initial design procedures. It also fostered a positive environmental and social impact, moving away from a traditional industrial practice that mainly assert control over resources and prioritizing standardization to corroborate with the forest's economic viability.

In conclusion, the Cuia Colab project exemplifies the imperative for reevaluating fundamental design principles and sustainability within the bioeconomic landscape. It can be seen as an example that illustrates the intricate balance between ecological preservation, socio-economic imperatives, and innovative design paradigms. In pursuing a bioeconomy enterprise imbued with ecological design principles, we suggest adopting bio-situated approaches prioritizing biodiversity over scalability. Additionally, it is imperative to demonstrate respect for and a deep understanding of the environment's custodians and local knowledge systems. By prioritizing these considerations, designers can ensure their endeavors contribute to ecological sustainability while fostering harmonious relationships with local communities and ecosystems.

Acknowledgements

The project that gave rise to these results received the support of a fellowship from "la Caixa" Foundation (ID 100010434). The fellowship code is LCF/BQ/DR22/11950001. It is also funded by FCT - Fundação para a Ciência e a Tecnologia, I.P., under the Strategic Projects with reference UIDB/04042/2020.

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Resumen: En 2021, la iniciativa «Inova Amazônia Pará» invitó a presentar proyectos en el norte de Brasil y prestó apoyo, incluida formación y subvenciones, a empresas de bioeconomía en fase inicial. Esta iniciativa acogió proyectos de 'ecodiseño', reconociendo el papel del diseño en el paisaje innovador de la Amazonia. Este estudio examina el proyecto Cuia Colab, una iniciativa de diseño seleccionada como *start-up* en el marco de la mencionada iniciativa, utilizándolo como estudio de caso. Nuestra pregunta de investigación es ¿Cómo se alinea el proyecto Cuia Colab con las intenciones de biodiseño/bioeconomía? El objetivo es propor-

cionar referencias para futuros esfuerzos de diseño en contextos similares y entablar un discurso reflexivo sobre posibles mejoras de la experiencia. Una revisión bibliográfica examina el biodiseño y la bioeconomía, las interacciones humanas y no humanas y el contexto de la Amazonia brasileña. Cuia Colab imagina la creación de objetos innovadores envueltos en un árbol amazónico y artesanías localizadas en su proceso de producción. El proyecto ha logrado producir prototipos con el apoyo de la iniciativa y el trabajo de un equipo local. Alejándose de las prácticas industriales tradicionales que afirman el control sobre los recursos, la estandarización y la escalabilidad. Cuia Colab ha adoptado un espíritu de colaboración con los árboles, considerándolos agentes activos que dan forma a los procedimientos. A pesar de los esfuerzos por mantener la vitalidad de los bosques y fomentar impactos ambientales y sociales positivos, persiste una presión simultánea para maximizar la producción y sustentar la viabilidad económica de los bosques. En conclusión, Cuia Colab ejemplifica el imperativo de una reevaluación de los principios fundamentales de diseño y la sostenibilidad dentro del paisaje bioeconómico, ilustrando el intrincado equilibrio entre la preservación ecológica, los imperativos socioeconómicos y los paradigmas de diseño innovadores. Al perseguir una empresa de bioeconomía imbuida de principios de diseño ecológico, sugerimos adoptar enfoques biosituados que prioricen la biodiversidad sobre la escalabilidad. Además, es urgente demostrar respeto y una comprensión profunda de los custodios del medio ambiente y los sistemas de conocimiento local. Al priorizar estas consideraciones, los diseñadores pueden garantizar que sus esfuerzos contribuyan a la sostenibilidad ecológica al tiempo que fomentan relaciones armoniosas con las comunidades y los ecosistemas locales.

Palabras clave: biodiseño - bioeconomía - conocimiento ancestral - selva amazónic

Resumo: Em 2021, a iniciativa "Inova Amazônia Pará" convidou projetos no Norte do Brasil e forneceu apoio, incluindo treinamento e subsídios, a empresas de bioeconomia em estágio inicial. Esta iniciativa abraçou projetos de "ecodesign", reconhecendo o papel do design no cenário inovador da Amazônia. Este estudo examina o projeto Cuia Colab, iniciativa de design selecionada como startup no âmbito da referida iniciativa, empregando-o como estudo de caso. Nossa questão de pesquisa é 'Como o projeto Cuia Colab se alinha com as intenções de biodesign/bioeconomia? O objetivo é fornecer referências para esforços de design prospectivos em contextos análogos e envolver-se num discurso reflexivo sobre potenciais melhorias para a experiência. A revisão de literatura aborda Biodesign e Bioeconomia, Interações humanas e não humanas e o contexto da Amazônia brasileira. A Cuia Colab imaginou a criação de objetos inovadores envolvendo uma árvore amazônica e artesãos locais em seu processo produtivo. O projeto elaborou protótipos com sucesso com o apoio da iniciativa e do trabalho de uma equipe local. Afastando-se das práticas industriais tradicionais que afirmam controle sobre recursos, padronização e escalabilidade, a Cuia Colab adotou um espírito colaborativo com as árvores, vendo-as como agentes ativos que moldam procedimentos.
Apesar dos esforços para manter a vitalidade das florestas e promover impactos ambientais e sociais positivos, persiste uma pressão simultânea para maximizar a produção e fundamentar a viabilidade económica das florestas. Em conclusão, Cuia Colab exemplifica o imperativo de uma reavaliação dos princípios fundamentais do design e

da sustentabilidade dentro da paisagem bioeconómica, ilustrando o intricado equilíbrio entre a preservação ecológica, os imperativos socioeconómicos e os paradigmas de design inovadores. Ao prosseguir um empreendimento de bioeconomia imbuído de princípios de design ecológico, sugerimos a adopção de abordagens bio-situadas que priorizem a biodiversidade em detrimento da escalabilidade. Além disso, é urgente demonstrar respeito e uma compreensão profunda dos guardiões do ambiente e dos sistemas de conhecimento locais. Ao priorizar estas considerações, os designers podem garantir que os seus esforços contribuem para a sustentabilidade ecológica, ao mesmo tempo que promovem relações harmoniosas com as comunidades e ecossistemas locais.

Palavras-chave: biodesign - bioeconomia - saberes ancestrais - floresta amazônica.

[Las traducciones de los abstracts fueron supervisadas por el autor de cada artículo.]