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**The Paradoxes of Sustainability:**  
A systemic analysis of socio-biodiversity entrepreneurial initiatives

**Os Paradoxos da Sustentabilidade: Uma análise sistêmica de iniciativas**  
empreendedoras da sociobiodiversidade

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## ABSTRACT

Kaetsu, P. T. (2023). *The Paradoxes of Sustainability* (Doctoral thesis). School of Economics, Business Administration, Accounting and Actuarial Sciences, University of São Paulo, São Paulo

Sustainability management has interrelated and contradictory elements representing unavoidable tensions and paradoxes. Those elements exist in human, ecological, legal, and economic systems nested in multilevels of stakeholders. In order to cope with the perceived paradoxes, organisations polarise the elements into dualities or address parts of tensions. However, socio-biodiversity entrepreneurial initiatives represent a joint effort of organisations requiring shared management of sustainability paradoxes. Therefore, the governance overlaps governments, civil society, private companies, Indigenous peoples and local communities, and diverse types of formal, informal, and illicit organisations. In this context, this study questions how socio-biodiversity entrepreneurial initiatives cope with sustainability paradoxes. The qualitative data analysis comprises thirty-six interviews in six Amazonian countries and nine socio-biodiversity entrepreneurial initiatives. Sequentially, the study presents the causal structures and interaction of reinforcing and balancing loops to illustrate the tensions forming paradoxes. From a theoretical perspective, the main contribution explains the persistence of paradoxes due to a reductionist and dual focus. The multi-scale and spatial point of view clarifies the interconnected elements of sustainability paradoxes. It sheds light on the contractions of multi-stakeholders' goals and the purpose of escalating solutions in a context where diversity prevents repetition and replication. The practical contributions relate to the use of systems analysis as a powerful tool to identify the underlying paradoxes of sustainability and to have a distinct approach to complex phenomena. Moreover, embracing the Pan-Amazonia provides empirical inputs to initiatives and policies management of paradoxes.

Keywords: Sustainability paradoxes, Socio-biodiversity, Entrepreneurial initiatives, Systems thinking.





## RESUMO

Kaetsu, P. T. (2023). Os Paradoxos da sustentabilidade (Tese de doutorado). Faculdade de Economia, Administração, Contabilidade e Atuária, Universidade de São Paulo, São Paulo.

A gestão da sustentabilidade e de seus elementos inter-relacionados e contraditórios representam tensões e paradoxos que desafiam as iniciativas empreendedoras. Esses elementos fazem parte dos sistemas humanos, ecológicos, legais e econômicos, aninhados em múltiplos níveis de partes interessadas. Usualmente, as organizações gerem os paradoxos percebidos por meio da simplificação em dualidades ou pelo foco em partes das tensões. No entanto, as iniciativas empreendedoras da sociobiodiversidade, por representarem a junção de esforços de diversas organizações, representam um contexto complexo que demanda a gestão compartilhada dos paradoxos da sustentabilidade. A governança dos múltiplos níveis sobrepõe governos, sociedade civil, empresas privadas, povos indígenas e comunidades locais, e diferentes tipos de organizações formais, informais e ilícitas. Este estudo, portanto, questiona como as iniciativas empreendedoras da sociobiodiversidade lidam com os paradoxos da sustentabilidade. A análise de dados qualitativos compreende 36 entrevistas em seis países amazônicos e nove iniciativas empreendedoras de sociobiodiversidade. Sequencialmente, o estudo apresenta as estruturas de realimentação e a interação dos ciclos de reforço e equilíbrio para ilustrar as tensões que formam os paradoxos. Do ponto de vista teórico, a pesquisa contribui para explicar a persistência de paradoxos decorrentes de um enfoque reducionista e dual. Já o olhar espacial e multi-nível ilustra as contradições dos objetivos das múltiplas partes interessadas e o propósito de escalar soluções em um contexto em que a diversidade impede a repetição e a replicação. As contribuições práticas dizem respeito ao uso da análise sistêmica como uma ferramenta poderosa para identificar os paradoxos da sustentabilidade, com o potencial de ajudar o entendimento de fenômenos complexos. Além disso, a abrangência da Pan-Amazônia fornece insumos empíricos para apoiar iniciativas, intervenções e políticas a gerirem as tensões e paradoxos.

Palavras-chave: Paradoxos da sustentabilidade, Sociobiodiversidade, Iniciativas empreendedoras, Pensamento sistêmico.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

CLD	Causal Loops Diagrams
CS	Corporate Sustainability
CSR	Corporate Social Responsibility
GST	General Systems Theory
IFCL	Integrated Forestry, Crops & Livestock
IPLCs	Indigenous Peoples and local communities
NGO	Non-Governmental Organisations
NTFP	Non-Timber Forest Products
PA	Protected Areas
ST	Systems Thinking
SD	Systems Dynamics
TBL	Triple Bottom Line
TK	Traditional Knowledge
WCED	World Commission on Environment and Development



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## 1 INTRODUCTION

Sustainability management requires businesses to deal with multiple stakeholders, inherent conflicting demands and consequential tensions (Gao & Bansal, 2013; Hahn, Figge, Pinkse, & Preuss, 2015; Van der Byl & Slawinski, 2015; Zehendner et al., 2021). When those tensions have opposite and interdependent elements and are persistent over time, they represent the sustainability paradoxes (Carmin & De Marchi, 2023).

Studies on the management of tensions and paradoxes have evolved significantly to answer sustainability challenges. The conceptualisation of sustainability paradoxes joins the conceptual challenges of the traditional theory of paradoxes and sustainable development resulting in a subjective and comprehensive definition. A sustainability paradox embodies contradictory and concurrent elements, which interactions are persistent, complex and multidimensional, affecting long-term sustainable development (Smith, Lewis, Jarzabkowski & Langley, 2017).

In practice, the use of the paradox's lens in empirical investigations on sustainability implies the meaning (Carmin & De Marchi, 2023). When used as an analytical 'detective' tool, it supports identifying the paradoxical tensions through, for example, an iterative process (Jay, 2013). A 'sensemaking' use relates to the concept of paradoxical frame/thinking indicating the understanding or contextualisation of tensions among businesses (Xiao et al. 2019). The 'responsive' use implies paradoxical actions and strategies for the management of tensions such as organisational versus societal climate issues (Slawinski & Bansal, 2015) or place-based challenges (Slawinski et al., 2021).

Existing studies concern the paradoxical tensions and paradoxical actions/strategies at the individual or organisational level lacking investigations on a systems level and the relationships between levels (Carmin & De Marchi, 2023). In higher levels of inter-organisations and macro-environment, the complexity of conflicts and tensions increase, for example, as found in the grand challenges. In empirical studies, there is a general gap in the use of a systems perspective on paradoxes (Hahn & Tampe, 2021). As a broad phenomenon, the study of sustainability paradoxes reaches different levels of analysis, i.e., individual, organisational, inter-organisational and macro-environment, within and across levels (Bansal & Song, 2017; Hitt et al., 2007).

This research focuses on businesses in the Pan-Amazonia and the management of sustainability paradoxes in multilevel through a systems perspective. The entrepreneurial

initiatives in the Pan-Amazonia join a plurality of people, groups, communities, organisations and countries seeking the sustainable development of the area. To support the development of entrepreneurial activities, there is self-organisation in unstructured initiatives. They are arrangements emerging from formal and informal relationships among actors where tensions and synergies co-exist.

The sustainability paradoxes become particularly visible in high biodiversity contexts where traditional people and communities live. The use of socio-biodiversity is essential as native species represent the livelihood, culture, traditional knowledge, and religion of communities (Ministry of Environment [MMA], 2009; Ribeiro & Soares Filho, 2022). This study, therefore, aims to answer the following research question: **How do socio-biodiversity entrepreneurial initiatives cope with sustainability paradoxes?** Managing the paradoxes is crucial to address the multiple-level demands of conservation, and social and economic issues.

This empirical study on socio-biodiversity entrepreneurial initiatives sheds light on the macrolevel and systemic management sustainability paradoxes. The practical contribution of the research relates to the use of systems thinking and causal diagrams. The results show the causal interaction of reinforcing and balancing loops representing virtuous or vicious cycles. The system's causal structures illustrate the connections and feedback of elements, forming tensions and paradoxes. Through the technique of causal mapping, this representation demonstrates the contribution to qualitative studies of sustainability. These results show that, in order to cope with sustainability paradoxes, socio-biodiversity entrepreneurial initiatives focus on isolated tensions or dual parts of paradoxes. The systems analysis proved to be a valuable technique to represent the underlying paradoxes of sustainability.

The theoretical contributions embrace the problematisation of incremental discussion about the dualities and the spatial constraints counterintuitively reinforcing paradoxes. This is an alternative explanation for the persistence process of paradoxes. Additionally, the discussion on contradictions of scaling needs in a diverse context has practical implications for people and organisations working in Amazonia. A methodological contribution is the use of systemic tools to describe paradoxes from identified tensions.

In what follows, the study's theoretical background is discussed focusing on socio-biodiversity entrepreneurial initiatives, the sustainability paradoxes and the systems approach. Then the methods section describes the analytical strategy and explains the stages

of analysis. Sequentially, the results present the findings of each analytical step, followed by the discussions. Finally, the conclusion presents the main theoretical, practical and social contributions, limitations and suggestions for further research.

## 1.1 RESEARCH OBJECTIVES

This research aims to analyse the causal structure of socio-biodiversity entrepreneurial initiatives in coping with sustainability paradoxes in Amazonia.

Specific Objectives:

- I. To identify socio-biodiversity's entrepreneurial initiatives and the sustainability tensions.
- II. To categorise the patterns of sustainability tensions in socio-biodiversity entrepreneurial initiatives.
- III. To map out the systems feedback structure of sustainability paradoxes in system diagrams.

## 1.2 RATIONALE OF THE RESEARCH

Sustainability, systems approach and paradox studies have become relevant in the past few years. General paradox studies presented an average of 10% annual growth from 1998 to 2008 (Smith & Lewis, 2011). A systematic literature review covering the period of 2007 – 2021 pointed out that 81% of paradoxical studies were published between 2017 and 2021 (Carmin & De Marchi, 2023). This increase in studies lying in the intersection of sustainability, systems and paradoxes reached a diversity of business fields.

The intangibility and broadness embedded in the concept of sustainability defy strategic management and its limits of resources and influence. It is an elementary sustainability paradox of organisations. The management of paradoxes, as perceived by managers, may lead to a superficial view of sustainability complexity. When considered a dilemma, it involves weighing pros and cons (Smith & Lewis, 2011), so managers seek to find win-win relations or trade-offs. However, there are latent paradoxes that are not perceived during the decision-making process misleading the planning and interventions.

This investigation addresses the latent and perceived paradoxes. As sustainability studies demand a system view of organisations (Van der Byl & Slawinski, 2015) paradoxes and systemic approaches deal with the complexity and time-space constraints. The

connection of both concepts and theories may shed light on the management challenges of socio-biodiversity entrepreneurial initiatives. Their use may well bring practical impacts such as the clarification of how sustainability takes place in high biodiversity areas and the identification of behavioural patterns among the entrepreneurial initiatives.

### 1.3 RESEARCH SCOPE

The study joined the comprehensiveness of sustainability and the long-time debate of paradoxes in a large area. This choice for a broad study implied several limitations on study deepness. The use of the paradox lens in business studies has the challenge of embracing contradictions at multilevel despite the recommendations of limits and boundaries definition (Poole & Van de Ven, 1989). This research, therefore, analysed the characteristics of entrepreneurial initiatives in different countries. It does not include a comparative analysis of countries' differences.

The research iterative process has its cycles where the researcher tries to solve an ever-changing mystery, so it took us to a diversity of paths. Knowing the theoretical concepts embraces learning, remembering, and forgetting while connecting to real-life data. Systemically, the information inputs and individual processing represent our mental models and it required time to understand the relevant scope and limitations of the research concerning the dynamics of paradoxes. As this research seeks to address the phenomenon of sustainability paradoxes, the analysis of the causality does not embrace the dynamics. Therefore, it is not one research employing system dynamics. Understanding the dynamics requires a specific dynamic hypothesis and data to produce a model and test scenarios that are likely to be found in case studies.

Socio-biodiversity products and services represent the use of native species often entailing traditional extractive activities (Siqueira-Gay et al., 2020). The scope of this research focused on forest products, timber and non-timber. As the Non-timber Forest Products (NTFP) represent an extensive list of nature's material (Belcher & Vantomme, 2003), which potentially include, for example, animal products (such as honey), services (such as carbon sequestration), rocks and stones. This research does not include animal products due to the different complexities of each chain and the need for exclusive studies. Also, the definition of socio-biodiversity products and services does not include mineral extraction.

Studying Amazonia comprises a diverse set of people, countries, ecosystems, products and organisations. Two main reasons motivated the choice of studying all Amazonia countries. First, a macrolevel analysis would encompass a systemic overview of the biome. Secondly, there is a large body of literature covering only one country (Brazil) overlooking the Pan-Amazonia. So, this study endeavours to fill this gap in investigations.

A diversity of interventions for sustainability exists within levels of analysis. Examples are production practices such as agroforestry or integrated systems at the individual level. Despite the immense value of sustainable practices and interventions, the study of system structures focuses on the interaction among variables rather than the specific internal content (Forrester, 1971). Therefore, the scope focuses on the paradoxes resulting from multilevel interactions rather than paradoxes inside levels.





## 2 THEORETICAL BACKGROUND

This section presents two main discussions concerning the merge of theories and concepts on sustainability paradoxes and systems thinking, and the research context of socio-biodiversity entrepreneurial initiatives. Joining the paradoxes and systems thinking is the result of a will to find alternatives to (re)frame corporate sustainability. First, I critically position this research to explain the theoretical merge. Sequentially, a review of previous studies employing the concepts of sustainability paradoxes supports the identification of research gaps. The existing literature presents the use of the paradoxes' lens as a tool to detect tensions or to respond to paradoxical actions/strategies. However, the analysis on a systems level is still missing.

Systems thinking discussion shed light on the contradictory and interrelated elements persisting over time (Smith & Lewis, 2011). The system perspective on paradoxes focuses on three key properties (Schad & Bansal, 2018) of interconnections (Meadows, 2008), hierarchy (Checkland, 2000) and emergence (Sherwood, 2006) through feedback structures and counterintuitive behaviours (Forrester, 1971; Sterman, 2000). The systems approach has a dual role as the theoretical background and the method. Together, paradoxes and systemic approaches inform studies on wicked problems (Rittel & Webber, 1973) and their complexity.

The complex context of socio-biodiversity entrepreneurial initiatives in Amazonia has characteristics of a wicked problem. On a systemic level, the relevance of Amazonia relates to grand challenges such as biodiversity conservation and global warming. Paradoxical tensions brim from the relationships among multilateral and local organisations in addressing worldwide concerns, and issues when supporting entrepreneurial initiatives. Businesses based on socio-biodiversity products and services rely on the existence of Indigenous People and Local Communities in high biodiversity areas (Siqueira-Gay et al., 2020; Ribeiro & Soares Filho, 2022). Therefore, the study is grounded in the controversial discussion of space, place and territory as a complex context where sustainability paradoxes happen.

### 2.1 SUSTAINABILITY PARADOXES AND SYSTEMIC APPROACH

The study of sustainability in the Business Management field has conceptually embraced “environmental integrity, economic prosperity, and social equity” (Bansal, 2005 p.198). The implementation of this concept among organisations, however, is an endeavour.

Often, an apprehensive adoption of sustainability practices focuses on short-term reputational risks, costs and legal requirements instead of long-term opportunities (Hart & Milstein, 2003).

This concept is based on the Triple Bottom Line (TBL), whose framework represented an organisation's adaptation to sustainable development. Originally, sustainable development relied on the systemic view of natural and human resources needs and constraints observing the non-isolation of environmental or social issues (Brundtland et al., 1997). The employment of the framework, however, did not reach the systems level (Bansal & Song, 2017; Elkington, 2018).

Grouping and assembling the concept into a framework facilitated the implementation of sustainability among organisations. Counterintuitively, however, it reinforced the detachment of the economy, society, and environment. As the use of the framework negatively affects the systemic view, in this research, sustainability goes beyond the division of social, environmental, and economic variables employing the spatial context as a common ground. In this subsection, the discussion explains the synergies of sustainability paradoxes and systemic approaches and the need to employ multilevels of stakeholders.

### **2.1.1 Sustainability paradoxes**

“Conflicts are an unavoidable experience for those who deal seriously with sustainability” (Carminé & De Marchi, 2023. p150.). In organisations, tensions represent issues caused by contradictory demands, plural needs, and different interests and goals. Distinct tensions are often interconnected sharing specific elements related to resource constraints, power settings, and time and space limits (Slawinski & Bansal, 2015; Carminé & De Marchi, 2023). However, not all tensions are paradoxical as paradoxes have contradictions, persistence and opposition of elements (Smith & Lewis, 2011).

The philosophical view on paradoxes carries the basic principle of wholeness, where the separation into two parts generates tensions and the recurrence of those tensions indicates the existence of paradoxes (Schad et al., 2016; Schad & Bansal, 2018). However, it is a perceptual duality, i.e., a dual view of reality which is a cognitive or social construction. Individuals place brackets or boundaries around a phenomenon (Lewis, 2000) therefore, they perceive pieces or parts of a paradox. A rooted view potentially becomes highly resistant to change, causing defensive responses (Lewis & Smith, 2014).

This individual view of paradoxes indicates their origin. Actors experience salient or perceived paradoxes (or pieces and parts). Otherwise, latent paradoxes are “[...] embedded in organising processes that persist because of organisational complexity and adaptation” (Smith & Lewis, 2011, p 389). Over time, salient paradoxes may become perceived ones.

Schad and Bansal (2018) remark on the epistemological and ontological differences between paradoxes. Epistemologically, actors perceive the salient tensions resulting in a partial and simplified view of organisations or a phenomenon. However, the latent tensions are in a fundamental and ontological reality where the relationships and interconnections contribute to a complex dynamic.

Many paradox studies have the epistemological analysis of tensions that emerged from empirical situations (Schad & Bansal, 2018). In organisational contexts, failure in identifying latent problems relates to issues in the ontological “real world” for example, the local impacts of climate change (Bansal, Kim & Wood, 2018). In practice, perceived paradoxes gain attention to the detriment of latent ones, generating bias in perceiving the paradoxes. The results are unattended consequences.

Another reflection on the individual level is the perceptual polarisation of paradoxes (Lewis, 2000). The dual sides of a paradox lead actors to send mixed messages to resolve it (Luscher & Lewis, 2008). The consequences are the diffusion of ambiguous messages in other hierarchical levels, causing the persistence, and the emergence of other paradoxes. An example is the multiple institutional logic of hybrid organisations and how it triggers tensions at other organisational levels such as hiring and socializing (Battilana & Dorado, 2010).

The polarisation of elements is a simplified understanding of paradoxes (Cameron & Quinn, 1988) as there are relationships of interdependence among contradictory elements (Schad et al., 2016). In organisational studies, the increasing use of the paradox approach demonstrates the need to understand businesses' fast and changing dynamics (Epstein, Buhovac & Yuthas, 2015) and the challenges of dealing with competing internal demands (Smith & Lewis, 2011) and external needs. At the level of stakeholders, investigations focus on stakeholders' acknowledgement of tensions and trade-offs (Angus-Leppan, Benn, & Young, 2010) and the understanding of tensions to overcome communication barriers (English, 2001).

At the macro level, studies with a territorial and global perspective on the tensions and trade-offs of sustainable development address the ambiguities of competing and

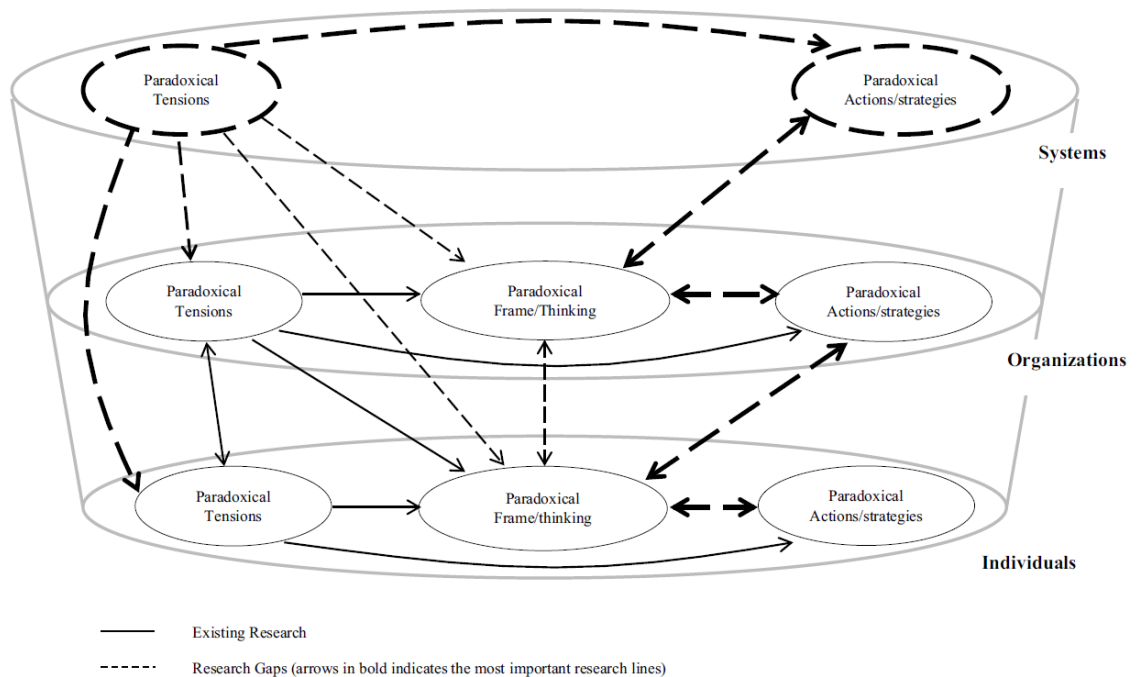
complementary demands (Lindsay, 1993) and the challenges of utility planning policies (McDaniels, 1994). Other paradoxes emerge at macrolevels due to social structures (Poole & Van de Ven, 1989), and plurality and change (Eisenhardt, 2000) triggering the dynamics of paradoxes. The dynamics analysis can employ tools such as feedback cycles and dialectical processes (Schad et al., 2016).

Hahn et al. (2010; 2015; 2018) describe the need of identifying and applying other theories to understand tensions and paradoxes nested across distinct levels. In multilevel (individual, organisational, inter-organisational and macro-environment), temporal and spatial scales can support the identification of latent paradoxes. When time and geographical analysis increases, more connections emerge. Schad and Bansal (2018) also argue that emergence indicates the underlying system's structure that helps to interpret multiple tensions.

Several studies have discussed the challenges and strategies for embracing tensions and paradoxes. Smith and Lewis (2011) remark on the required changes to develop acceptance of paradoxical tensions rather than defensiveness. Van der Byl and Slawinski (2015) suggest the use of a paradox lens to develop sustainability investigations to consider the interconnectedness of elements. Gao and Basal (2013) propose the implementation of creative solutions through an integrative approach.

Previous reviews on tensions and trade-offs in sustainability help to clarify the conceptual framing of paradoxes. In a 10 years review, Van der Byl and Slawinski (2010) analyse tension in corporate sustainability differentiating the approaches related to win-win, trade-off, integrative and paradoxes lens. In a critical review, Matos et al. (2020) discuss the unanticipated outcomes, trade-offs and tensions of sustainable operations and supply chain management, which also contributes to understanding the emergence of paradoxes. More recently, Carmine and De Marchi (2023) explain the empirical use of paradoxes construct through a systematic review. Several studies analyse sustainability paradoxes at individual and organisational levels. However, few studies address stakeholders and the macro-environment of systemic levels (Carmine & De Marchi, 2023). Figure 1 presents the research gaps identified.

Figure 1: Adoption of paradox theory in corporate sustainability research



Source: Carmine and De Marchi (2023)

Empirical investigations on corporate sustainability address the three ways to use paradoxes informing their three conceptual meaning (Carmine & De Marchi, 2023). When employing paradoxes as an analytical tool, it assumes ‘detective’ characteristics to explain the nature of paradoxical tensions. One example is the identification of conflictive elements in the social and ecological objectives of the electronics supply chain (Zehendner et al., 2021). The use as a ‘sensemaking’ guide describes the paradoxical cognitive frame of individuals and businesses. As in Sharma and Jaiswal (2018), the paradoxes approach clarifies the different understanding of tensions among managers and organisations. The third use refers to the ‘responsive’, in which academics investigate paradoxical actions/strategies. It happens when considering short and long terms concomitantly, firms are likely to have integrated and multidimensional solutions to tackle tensions with society (Slawinski & Bansal, 2015).

Responses to paradoxes encompass initial defensiveness as a short-term reduction of tensions. According to Jarzabkowski et al. (2013), conflictive defences rely on contradictory positions and are expressed through repression of the tension, or reaction formation through the alignment with one side of a dual tension, or splitting tensions in different places or times. They are evasive responses.

Otherwise, long-term responses acknowledge the inheritance of paradoxes. They relate to confrontation, acceptance, adjustment or transcendence. Differently from the defensive answers, the confrontation acts directly on the management of the paradoxical tension. This response engages the search for a solution. The ‘acceptable’ type of response involves the search for balance. As Poole and Van de Ven (1989) propose to positively work with paradoxes, the acceptance of a paradox uses it in a constructive way embracing the opposing elements. Secondly, considering the spatial separation through the levels of analysis and the clarification of how they interrelate. Another response addresses the temporal separation to understand the influences over time on the paradoxes shift. The fourth alternative is the synthesis to introduce new terms to answer a paradox.

Splitting tensions through a spatial or temporal separation involves solving tensions in different places, moments or shifting turns. Jarzabkowski et al. (2013) describe them as a short-term response. Complementary to the time considerations, Jay (2017) describes the compartmentalisation of tension due to short and long-term different demands. In the long term, strategies to respond to paradoxes evolve to mix answers and the search for active responses.

### **2.1.2 Systems thinking and causality**

Systems thinking embodies an umbrella of distinct types of systems theories and systemic concepts used in academic studies and empirical problems. In common, there is the rationale of elements which (inter)relations form a system, and also the complexity especially present in social systems (Forrester, 1965; Von Bertalanffy, 1977; 2008). Ever since the development of systems works has evolved into theories in studies of fundamental science and also concepts and tools in applied science (Checkland, 2000; Grewatsch, Kennedy & Bansal, 2021). The latter has systems thinking as the perspective to interpret reality and complexity, and a tool to address wicked problems (Meadows, 2008; Sherwood, 2006; Sterman, 2000).

This study uses systems principles, properties and concepts to analyse the sustainability paradoxes. Following this idea, systems are groups of interconnected elements, with natural and/or produced flows, adaptive and dynamically organised a “function” or “purpose” (Checkland & Hayes, 1994; Meadows, 2008). It represents an analytical approach explaining complex phenomena influenced by context and interrelations.

One key property of the system is the *hierarchy*. For Schad and Bansal (2018), hierarchy appears in systems and in nested subsystems which are interconnected and connected to other systems and subsystems. They present specific functions with a unique process dynamic which are understandable through its totality. For Meadows (2008), hierarchies emerge from the self-organizing characteristic of systems, where emerging upper levels serve lower ones towards productivity, stability, or resilience.

The clarification of levels of analysis is a recommended requirement in paradoxes studies. Differentiating parts from the whole, the micro perspective from the macro, individuals from the society, and establishing their interrelation may explain a paradox spread in distinct levels (Poole and Van de Ven, 1989). The distinction among levels of analysis contributes to understanding hierarchies, which is fundamental in system thinking (Checkland, 2000).

The system *interconnections* between elements are the links through processes of influencing each other (Schad & Bansal, 2018). The interconnections relate to the “rules of the game” of how information or physical flows occur in a system. Within sub-systems, relationships are denser and between subsystems, stronger (Meadows, 2008). The interconnections explain how the elements happen to be together and how they work and exchange.

The interconnections producing an effect on a previous part of the system represent a feedback loop. There are negative and positive feedback loops of balance and reinforcement. The first one provides structures of stability and resistance to change. The second indicates an exponential growth or potential collapse of a system (Meadows et al., 1972; Meadows, 2008; Sterman, 2000) found in virtuous or vicious circles.

A problematic shared concept of systems thinking, and paradoxes is the positive reinforcing logic. In the paradoxes lens, the reaction to paradoxical tensions fuels reinforcing virtuous (positive) or vicious (negative) cycles (Lewis, 2000; Smith & Lewis, 2011). The systems approach also has virtuous and vicious cycles, but their representations are always through positive feedback loops (Forrester, 1961; Meadows, 2008). Positive loops are reinforcing leading to exponential health growth (virtuous) or runaway destruction to collapse (vicious) (Meadows, 2008). Positive and negative signs do not indicate good or bad, but are just a self-reinforcing process (Sterman, 2000). A negative feedback loop has a balancing

and stabilising effect (Meadows, 2008). This is a relevant point of attention when studying paradoxes and systems together.

Finally, the *emergence* represents the continuous reconfiguration of elements. Schad and Bansal (2018) present an example of the emergence of climate change due to the industrialisation process and carbon emissions. The elements formed a balanced pattern limiting their status related to each other. However, a dominant process (industrialisation) strengthens the relevance of small changes (carbon emissions) and increases emergence (climate change). When a stable dynamic structure emerges, the systems demonstrate the property of self-organisation (Sherwood, 2006).

The cause does not produce a proportional effect since the nonlinearity of systems and delays make systems oscillate expressing a complex behaviour (Meadow, 2008). In the same example, the growth of industrialisation is not linearly proportional to carbon emissions; there are several variables to be considered such as types of industries and sources of emissions. The delays between cause-effect describe the emergence of climate change and also the difficulty to connect cause-effect due to oscillations in the system.

The properties of interconnections, hierarchy, and emergence describe the dynamics of paradoxes as wicked problems. The interconnected and contradictory elements are tensions that scale to upper levels and paradoxes emerge. Instability increases as the complexity levels increase (Van Marrewijk & Werre, 2003). Over time, the persistence of paradoxes and complex dynamics characterises wicked problems. These problems have confusing information, conflicting values, and undetermined implication for the whole system. “The formulation of a wicked problem is the problem!” (Rittel & Webber, 1973, p. 161).

In systems, actors act on what they perceive about the world, depending on the source of information and biases nested in their mental models, which are usually different from the actual situation (Forrester, 1971). So, the diffusion of mixed messages constitutes a system’s dynamic, and actors try to reduce the communication noise, aware it will not disappear. The noise and misunderstanding move to other levels scaling to paradoxes. In complex and large-scale social wicked problems, tracing the cause-effect of private and public responsibilities may require the effort of re-framing the focus to parts of systems and manageable issues (Reinecke & Ansari, 2016).



Table 1 shows the system's key properties (Schad & Bansal, 2018) and the existing dynamics of complex systems (Meadows, 2008; Sterman, 2000) explaining the wicked problems and their main characteristics, as summarised by Rittel & Webber (1973).

Table 1: Relation of wicked problems and dynamic complexity

<b>Systems properties</b>	<b>Dynamics of complex systems</b>	<b>Wicked Problems</b>
<b>Hierarchy</b> in subsystems nested in systems which are interconnected and connected to other systems. They present specific functions with a unique process dynamic.	<b>Hierarchal</b> systems evolve bottom up where upper layers serve lower ones. Through <b>self-organisation</b> , systems structures emerge, learn, diversify, and complexify towards <b>resilience</b> , stability or productivity.	No definitive formulation of a wicked problem. Several explanations for the discrepancies represent a wicked problem.
<b>Interconnection</b> as many elements influence each other and manifest the interconnections through processes	Tightly coupled due to interconnections and <b>feedback</b> as consequences changing the causes. <b>Counterintuitive</b> as cause and effect are distant in time and space	No stopping rule as every wicked problem is a symptom of another problem. No immediate/ultimate test of a solution.
<b>Emergence</b> in dominant processes and continuous reconfiguration of elements. A reasonably stable pattern limits other elements' positions so the dominant process strengthens the notability of small changes increasing emergence.	<b>Nonlinear</b> due to disproportionate cause-effect. Change in systems occurs at (interacting) time scales and long <b>delays</b> often mean an <b>oscillation</b> . Feedback loops shift the dominance representing <b>complex behaviours</b> which are <b>policy resistance</b> where obvious solutions to problems fail or worsen the situation.	Every solution to a wicked problem is a "one-shot operation" No trial-and-error Every wicked problem is essentially unique.

Source: Adapted from Schad and Bansal (2018); Sterman, 2000 and Rittel & Webber, 1973

Wicked problems are system problems with a dynamic complexity that reveal the multiple tensions across levels of analysis. Common goods management exemplifies a wicked problem as it involves the social dispute of a limited resource, such as socio-biodiversity issues (Ostrom, 2010). Schwaninger (2018) states that addressing multiple-level problem-solving depends on structures working as a whole at each level. They constitute recursive structures that, as whole structures, are capable to deal with complexity to the level it rises.

The intricate interactions of businesses and the environment in high biodiversity areas encompass conservationism and income generation needs. Areas requiring protection due to the value of biodiversity and landscape conservation are mostly present in low-income countries (Myers et al., 2000). Once the local livelihood affects the conservation efforts producing consequences to income generation and subsistence, a reinforcing cycle emerges (Fisher & Christopher, 2007). It can also create either a vicious cycle, when degradation and

biodiversity loss lead to impoverishment increasing the exploitation and pressure on ecological systems, or a virtuous cycle, when conservation provides natural resources alleviating poverty. In addressing this question, entrepreneurial sustainable ventures generally have the objective of income generation and likewise value creation, employment generation and improvement of people's lives (Anand et al. 2021).

In order to cope with paradoxes, people and organisations implement interventions trying to re-establish the balance in a system, pushing it towards the initial state (Forrester, 1971). It represents an effort with good intentions to solve a problem that, however, causes resistance or an unexpected effect (Sterman, 2000). In systems thinking, this scenario represents a counterintuitive behaviour of a system.

## 2.2 SOCIO-BIODIVERSITY ENTREPRENEURIAL INITIATIVES

The use of native species represents the livelihood, culture, traditional knowledge, and religion of communities (MMA, 2009; Ribeiro & Soares Filho, 2022) often entailing the traditional extractive activities (Siqueira-Gay et al., 2020) represent the socio-biodiversity goods and services. Due to the limitation of employment options and the constraints on availability and access to the job markets, the main entrepreneurial opportunities rise in sectors based on natural capital such as agriculture, tourism, and the extraction of natural resources.

Individual entrepreneurial activities take place within organisations of socio-biodiversity products and services. In high biodiversity areas, household livelihood is critical to conservation (Fisher & Christopher, 2007). Productive activities based on biodiversity depend on seed capital, subsidies, and a structure to market maintenance such as platforms, networks, and research knowledge base, among others (Seidl et al., 2010).

To answer to those needs, the biodiversity territories require the involvement of local people and communities, Governmental bodies, environmental institutions, and social assistance NGOs, among others. Those organisations develop coordinated or uncoordinated interventions such as plans, programs, projects, activities, and actions. Therefore, formal, and informal interrelations among those organisations form arrangements supporting the development of entrepreneurial businesses.

Socio-biodiversity entrepreneurial initiatives translate the set of interventions of organisational arrangements into the development of businesses based on goods, services and

benefits from the use of native species. The sound use of local biodiversity generates income reducing the risk of environmental degradation.

The concept of socio-biodiversity entrepreneurial initiatives joins elements of social and environmental domains. It embraces individuals nested in institutions within global organisations and depends on the biodiversity area. The concept, therefore, goes beyond the organisational frame as it closely relates to the place and territory where they are located.

### **2.2.1 Entrepreneurial initiatives and environmental management**

Entrepreneurial initiatives rely on sound management of the ecosystem but have limited influence on decisions. Moreover, there is a shift in the idea of an organisation's environmental management of natural resources to organisational self-management while constantly exchanging with its ecosystem.

As a macrolevel concept, the discussion on environmental management has evolved amongst international organisations. Several agreements and protocols are the base of countries' environmental legal frameworks. As a consequence, environmental conservation has general standards that are relevant to businesses and entrepreneurial initiatives in biodiversity contexts.

The first agreement is the Nagoya Protocol on Access and Benefit Sharing on the use of genetic resources, the traditional knowledge associated with the genetic resources and the benefits arising from their use. The protocol was the result of the Conference of the Parties to the Convention on Biological Diversity at COP 10 on October 29, 2010. The agreement addresses the transfer of technologies, rights over the resources and technologies, the instruments and mechanisms to implement the protocol, and the potential monetary and non-monetary benefits (such as royalties, funding, and joint ventures) (Convention on Biological Diversity [CBD], 2011).

The Nagoya Protocol is particularly relevant for entrepreneurial initiatives as it relates to the innovative potential found in native species and traditional knowledge. There is a general expectation of the development and use of biomaterials in industries such as pharmaceuticals, foods, and cosmetics (Nobre, 2019) and the expansion of the bioeconomy to promote reindustrialisation and create wealth (El-Chichakli et al., 2016). Bioeconomy relies on technological and innovative solutions, which could power the development of

creative industries, attracting productive entrepreneurs (Audretsch & Belitski, 2021). It is a promising, virtuous cycle, of development and limited growth.

On the one hand, there is the convergence of biotechnological knowledge and infrastructure in developed countries and, on the other, the concentration of biodiversity in developing countries. As economies based on agriculture and manufacturing industries do not represent the best context for productive entrepreneurship (Audretsch & Belitski, 2021), socio-biodiversity entrepreneurial initiatives face the vicious cycle of unattractive context for creative sectors that lack successful innovative entrepreneurs, which leads to the perpetuation of an economy based on agricultural and basic industries. Those virtuous and vicious cycles represent a paradox of technological transfer and intellectual property.

A second document is the Guidelines for Protected Area Management (International Union for Conservation of Nature [IUCN], 2013), which concerns the categories and governance of Protected Areas (PA) and, indirectly, the development of economic activities in those areas. IUCN and governments, NGOs, the UN and companies, develop policies, laws and best practices for nature conservation. The guidelines describe six categories of PAs according to the conservation objectives (Figure 2). Category I of Strict Areas, for example, aims to preserve the natural condition. Its management intends to limit and control human visitation, use and impacts. Other categories such as Category V of Protected Landscape or Seascape consider the interactions of humans, nature and the ecological, biological, cultural and scenic values, therefore, related farming, fishery and tourism activities are allowed.

Figure 2: Human activities and entrepreneurial context in protected areas

Protected area management categories				Outside protected areas
Ia) Strict nature reserve	II) National park	VI) Protected areas with sustainable use of natural resources	V) Protected landscape or seascape	Other zoning or categories may apply in a specific/large area with different objectives
Ib) Wilderness area	III) Natural monument or feature	IV) Habitat/species management area		
Human activities and entrepreneurial context				
Research and visit in the case of traditional wilderness-based or sacred sites (limited), restricted educational and recreation activities.	Tourism, recreation, education, research, subsistence resource use for indigenous and local communities.	Sustainable extraction of natural resources, tourism, recreation, education, research	Long-term settled farming or management processes of sustainable agriculture, forestry, fishery, tourism, recreation	Agro-ecological zoning to map land use, forest management for commercial/protection/multiple purposes
← Most natural conditions		Least natural conditions →		

Source: adaptation of IUCN, 2013

Overlapping the management categories, guidelines acknowledge four types of PAs governance: government, shared governance (formal or informal actors in collaboration), private governance (including individual, cooperative, NGO or corporate control and/or ownership) and governance by Indigenous peoples and local communities. Among other responsibilities, they define the conservation objectives, and develop and enforce the management plan - but do not necessarily own the PA's land, water and related resources.

It is possible to combine different governance types with one or more management categories in the same PA. As the management category applies to, at least, 75% of the PA, different parts may have distinct governance and conservation objectives. Moreover, in shared governance schemes, the collaboration of several formal and informal stakeholders may lead to overlapping responsibilities (IUCN, 2013). The variety of combinations in governance types and management categories increases the risk of conflicts and mismanagement requiring more specific management and governance efforts.

The general guidance of IUCN supports institutions, governments and countries. However, different contexts have social and environmental specificities. Ostrom (2010) explains that the general governance of a forest does not define its conditions as there are more relevant elements. Essential considerations to understand the conditions of a PA are the representation of the local context and ecological systems relations, the development and adaptation of rules and the people's view on the equity and legitimacy of the systems. Ostrom reinforces the significance of local communities' autonomy in increasing the effectiveness of environmental interventions.

Environmental management, therefore, embraces the complexity of social-ecological systems. It includes a variety of stakeholders participating and collaborating in decision-making and governance (Virapongse et al., 2016). Multistakeholder perspectives have social equity as a growing concern in conservation studies. The concept of social equity encompasses ethical concerns and social justice related to the distribution of costs and benefits, process and participation, and recognition of identities, histories, values, interests, and knowledge (Friedman et al., 2018).

Environmental management and socio-biodiversity entrepreneurial initiatives often share the same stakeholders, consequently sharing their conflicts of agendas. In general, stakeholders aim to promote nature conservation and income generation through socio-

biodiversity products and services. The differences in how to plan and implement activities lead to disconnected and discontinued interventions.

Other challenges in environmental management impacting entrepreneurial initiatives are the scale specificity or mismatch, the availability of empirical data and the institutional limitations (Virapongse et al., 2016; Goworek et al., 2018). The challenge in the scales relates to stakeholders addressing the same issue despite having a local goal detached from the macrolevel, or incompatible measures or boundaries definitions, such as one organisation using the watershed limits while another uses the political division. This issue also relates to the challenge of the empirical data available to long-term studies, the evaluations and the monitoring of social and environmental information that is relevant to decision markers. Finally, the challenge of institutional limitations concerns outdated or overwhelming laws and regulations that hinder systemic actions.

### **2.2.2 Place and territory of socio-biodiversity**

Socio-biodiversity products and services are available in areas with a high density of biodiversity. After the 80s, studies on the relevance of socio-biodiversity increased, especially on non-timber forest products. Several studies analysing the sustainability of forestry areas following the environmental movement (e.g., Myers, 1988; Godoy, Lubowski & Markandya, 1993) focused on the sustainability of forest products.

The conceptualisation of socio-biodiversity goods and services emerged as a national environmental plan aiming to address people and environmental protection (Organisation for Economic Co-operation and Development [OECD], 2015). Socio-biodiversity goods and services are the final products, raw materials or biodiversity resources constituting productive chains to benefit IPLCs and small-scale farmers (MMA, 2009). The plan also considers the traditional practices and knowledge, and the safeguards to promote wealth to beneficiaries.

They presented several benefits to people's livelihood through insurance and income generation, the ecological process when avoiding the timber harvest, and the value of maintaining forestry (Arnold & Perez, 2001; Shackleton & Pandey, 2014). However, managing forest products has several limitations and consequences due to its complex system (Belcher & Schreckenberg, 2007; Ticktin, 2004). In order to discuss the governance of use, the high-level environmental management and the intricate web comprising social,

ecological, economic, and political concerns and opposing interests, this research employs key aspects of space, place, and territory.

Socio-biodiversity products and services combine biodiversity resources with social culture uses and traditions in a specific place and/or territory. These terms have a variety of definitions and meanings. They are often used interchangeably to represent a portion of space. Therefore, the objective and abstract logics of the space are the common ground informing the discussion of socio-biodiversity entrepreneurial initiatives.

Objectively, the distance, direction and connection underlie the studies of space enabling the development of maps and models, and human activities to represent movements, networks, nodes or hierarchies (Hubbard, Kitchin & Valentine, 2004). The distance from one point to another may represent scales such as miles, kilometres and lightyears, and the directions, for example, towards north or south, express the movement and represent the connection between the locations. It follows a positivist rationale of social relations which own the spaces they occupy on a part of the planet's surface. In a broader sense, space is a dimension within which things, structures and connections exist or are contained (Agnew, 2011).

In abstract terms, the void represents the basis of the scientific idea of space (Cresswell, 2013). The existence of human beings is subject to the surrounding space (Hubbard et al., 2004), which is socially produced and transformed. Therefore, two paradoxical logics coexist in an abstract space. The first one, as logical-mathematical, evokes the emptiness of the space in isolation; and the second one of social space, as a product of social (power) relations transforming the space. Thus, it is not a void space filled by elements (Lefevre, 1991).

Places and territories represent portions of a space (Agnew, 2011) and both carry objectives and subjective aspects sharing different and sometimes competing meanings. Objectively, a 'place' is a physical location with abstract boundaries and mutable meanings. People's places are shared spaces (Massey, 1991). A place embodies the social relationships where people's routine and life happen, conveying the connection, attachments and interrelations of social organisations and their environment (Massey, 1999). The statement 'my place' can refer to a chair, a city, or an informal area sharing the same culture. The sense of place is a space with a subjective meaning to individuals, people, or communities (Mazutis et al. 2021), which significance can be shared within groups or organisations.

The ‘territory’ emerges from the abstract values of a dominant group which translates it into objective political boundaries. The power relations in a portion of space do not imply the establishment of only one territory as different animal species can share different territories (Hubbard et al., 2004), for example, as bees and birds in the same forest.

The existence of rules impacting governance and different actors in the same space may lead to territorial conflicts (Blume et al. 2022). Escobar (2008) discusses political ecology as the ecological distribution of conflicts over the access and control of natural resources and where the privilege of a capitalist creates a conflict in cultural distribution. In human society, the values of a dominant group become an objective political boundary. A bounded territory of people’s economic, political, and cultural identification turn into countries' borders, which are embedded in contraction due to the protective and imprisoning barriers (Anderson & O’Dowd, 2010).

In the legal domain, Moore (2015) underlines the relevance of distinguishing territorial rights from property rights through three connected concepts: the land representing an area on the earth’s surface; the territory as the geographical scope of political actors; and property which generally is associated with the access and control of objects, and the exclusion of others from it.

The debate of place, territory and other space-related concepts show it goes beyond geography and earth sciences and has repercussions in disciplines such as economy, ecology, law, sociology, and political sciences. In the business area, previous studies emphasized the promising path of integrating social and physical ambiguities through the interconnection of places, communities, and planetary limits in the spatial concept of land (Walck, 2004; Slawinski et al., 2021). However, space and time attributes differ according to markets and locations (Bansal & Knox-Hayes, 2013).

In this research, the use of spatial concepts is relevant to understand several paradoxes in Amazonia. Conflicts relate to cultural places, territorial properties, power relations and control, and borders. Complex tensions emerge in socio-biodiversity space.







### 3 METHODOLOGY

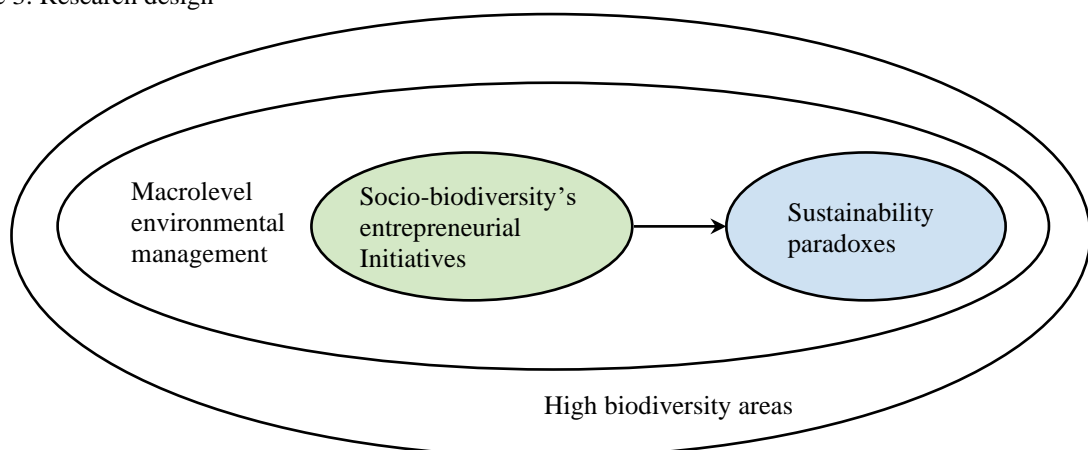
#### 3.1 RESEARCH DESIGN

This is a qualitative interpretive study embracing a broad and complex phenomenon of sustainability paradoxes. The use of a qualitative approach relates to the exploratory need to understand the phenomenon of sustainability paradoxes among the systemic macrolevels. The systems approach has a dual role representing the theoretical background and the method to analyse the paradoxes.

As there are no intrinsic bounds and a definable unit of analysis of case studies, this study represents a basic type of qualitative study, also called generic or interpretive studies (Sharan & Tisdell, 2015). The boundaries of the research, therefore, relate to the geophysical context where the phenomenon takes place, i.e., Amazonia as a high biodiversity area.

The inquiry focuses on Socio-biodiversity Entrepreneurial Initiatives. Those initiatives contemplate different private, public, and civil society organisations and their intervention through plans, programs, projects, activities, and actions, towards environmental management and sustainable development in high biodiversity areas (Figure 3). Through the actors involved in the initiatives, the research seeks to understand the sustainability paradoxes.

Figure 3: Research design



In high biodiversity areas, entrepreneurial initiatives are dependent on their natural environment, but have limited managerial influence. Environmental management involves different levels of governments, small and large-scale businesses, NGOs and several bilateral

organisations. In this study, therefore, the focus is the organisational self-management while interacting with other organisations and the environment, instead of the organisation's environmental management of natural resources. The embeddedness of entrepreneurial initiatives in high biodiversity areas causes and results in paradoxes. In practice, this switch from inside the organisation to the outside environment delineates the need for multiple-level analysis.

The systems approach presents several logics to analyse the world. The context of the study explains the choice to follow the systems thinking through the multilevel analysis (Hitt et al., 2007) and Causal Loops Diagrams (Sterman, 2000). As entrepreneurial initiatives incorporate organisations with unstructured and unstable interactions, it was not possible to apply the complex-adaptive systems (Holland, 2005). Alternatively, the analysis of business ecosystem would require a focal offer of a product or service (Kapoor, 2018) and the modularity of technological characteristics (Jacobides, Cennamo & Gawer, 2018), which do not correspond to the Amazonian context of socio-biodiversity.

In sustainability studies, the individual, organisational, inter-organisational and macroenvironment levels of analysis, contribute to the operationalisation of the investigation. The systemic approach employs the hierarchies of the system that apply to the levels of analysis (Hitt et al., 2007). According to Schad & Bansal (2018), the multilevel approach of individual, organisational, stakeholders (inter-organisational) and macroenvironment may indicate variations in the temporal and spatial scales of paradoxical processes.

Different actors involved in entrepreneurial initiatives face multiple-level paradoxes. The inquiry of entrepreneurial initiatives aimed to understand those actors' experiences and views on paradoxes, i.e., the parts and interrelations of perceived paradoxes explaining the hidden ones.

## 3.2 METHODS AND TOOLS

This study entails an emergent and changing phenomenon in a particular context requiring an exploratory and inductive approach (Birkinshaw, Brannen and Tung, 2011). The use of a systematic inductive method (Gioia, 2021) responds to those needs adding rigour to the process of exploring the phenomenon of sustainability paradoxes and inducing insights from the respondents' qualitative data. Likewise, in the systemic approach, each observer has a mental model representing a way to perceive the reality (Forrester, 1992).

This study sequentially employed different qualitative methods and data sources. Primary data from interviewees of entrepreneurial initiatives represented the knowledge, assumptions, understandings and meaning of their experience in Amazonia, which informed the inductive process of data structure (Gioia, Corley & Hamilton, 2012; Gioia, 2021) and causal mapping (Eker & Zimmermann, 2016; Sterman, 2000). Following Gioia (2021), the collection of respondents' interpretation of reality employed open coding in the first-order data, also called informant-centred. Afterwards, an axial coding of first-order information produces the second-order analysis or researcher-centred. The second-order categories in this research have the background of sustainability paradoxes and systemic approach concepts. Both first and second-order data and findings demonstrate the path of theorisation, connecting the ground of field experiences with the insights, concepts, and theories.

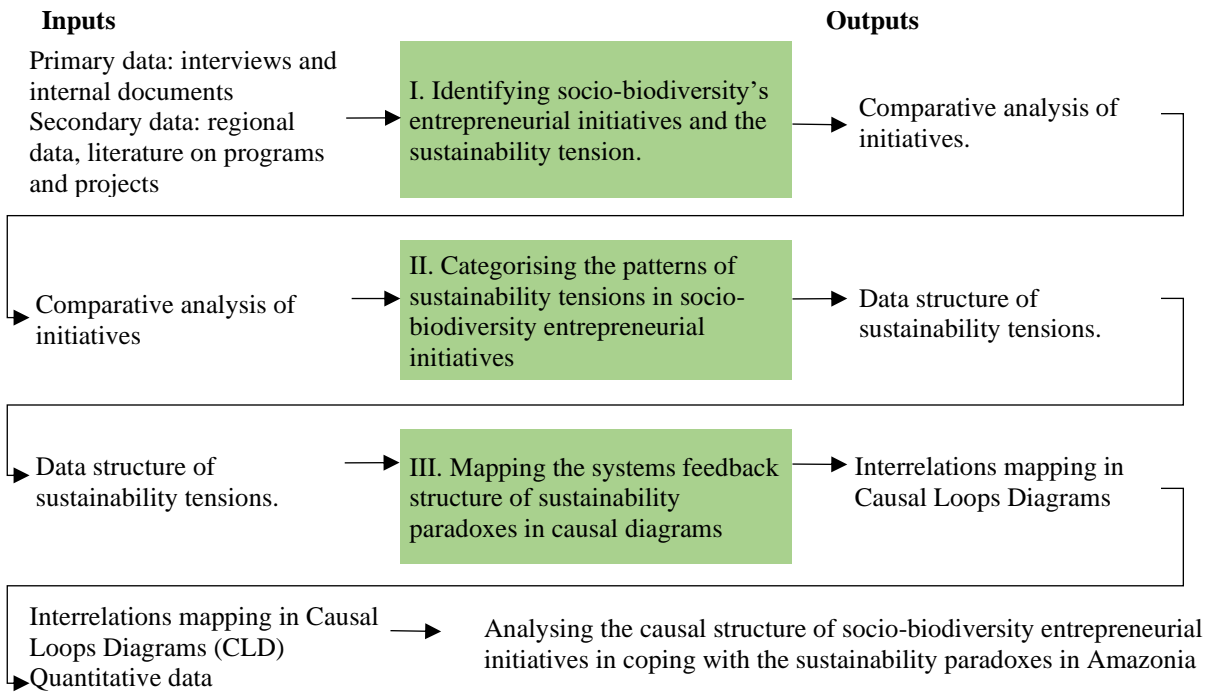
The concept of paradox represents the “contradictory yet interrelated elements that exist simultaneously and persist over time” (Smith & Lewis, 2011, p. 382). Therefore, the coding process of paradoxical tensions is considered the core characteristics of contradiction, interdependence and persistence (Carmine & De Marchi, 2023). Firstly, contradictory elements are logical alone, but illogical when analysed simultaneously. Second, interdependent elements have two opposing interpretations, which are connected. Third, paradoxical tensions persist over time.

Amazonia's relevance to world biodiversity, climate change and related global challenges put the forest under the spotlight. Therefore, there is an extensive and relevant body of grey literature issued by multilateral organisations, governments, environmental NGOs, think tanks, consulting companies, development organisations and research institutes, among others. This literature includes maps, reports, evaluation statements, publications, technical notes, working papers, news articles and other documents from expert sources. The use of this grey literature helped to obtain contextual information and potential knowledge not presented in academic papers (Adams, Smart and Huff, 2017).

Figure 4 presents the research steps embracing the flow of data and analysis, the inputs and outputs related to each specific aim to reach the research objective. The data inputs fed the first Specific Objective to generate outputs of first order (informant-centred) data and a comparative analysis of the initiatives. Then, the analysis of those outputs contributed to the second-order data, which constituted the data structure of sustainability paradoxes and the framework of entrepreneurial initiatives, respectively. The interrelations of sustainability

paradoxes and the levels of analysis support the identification of underlying issues through the systemic approach. Complementary, modelling one category of paradoxes helps to validate the qualitative inputs and to learn about the dynamic complexity.

Figure 4: Research steps sequence



### 3.3 RESEARCH CONTEXT

Amazonia is a clear case of a wicked problem embedded in sustainability paradoxes. It comprises hot-spots areas where a high number of endemic species and biodiversity are under threat (Myers, 1988). Living in the area, there are more than 350 ethnic groups, small and large-scale farmers, historical and new migrants and immigrants (Nobre, et al. 2021). At the macrolevel, nine countries share parts of Amazonia with different structures of social and environmental governance. The management of Amazonia, therefore, overlaps government hierarchies, environmental management institutions, civil society groups and a range of local and international organisations willing to support the area. Consequently, different interests and organisational objectives collide.

This study on sustainability paradoxes in Amazonia explores the interrelations of multilevel of stakeholders. On a macrolevel, there are Governments of nine countries ruling different environmental, agrarian, social and economic policies through diverse

governmental departments and governance structures. In addition, a myriad of multilateral and bilateral organisms supports other institutions working in the area. Those stakeholders interact with local organisations reaching a limited number of communities and individual forest people. The inter-organisational relationships are dynamic and non-linear as organisations bear to support specific groups on their agenda or the most accessible locations.

The arrangement of different organisations and their interventions in the development of businesses define entrepreneurial initiatives. Those stakeholders have synergic and conflicting demands while participating in the initiatives. In common, they share the territory where the sustainability paradoxes emerge.

### 3.3.1 The Pan-Amazonia

“The Amazonia is the largest tropical forest in the world [...] On just two forested acres, there is a greater variety of trees than in all of North America. Just one of these trees can host as many ant species as there are in the entire United Kingdom. Today, this ecosystem of over 7 million square kilometres is threatened by deforestation, fires, mining, oil and gas development, large dams for hydroelectric generation, and illegal invasions. A forested area the size of Luxemburg was lost in the month of July 2019 alone...” – Science Panel for the Amazon (Nobre et al., 2021)

The administrative and political boundaries of Pan-Amazonia cover eight countries, including Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela, and the overseas department of French Guiana where Amazonia occupies their territories (Albert et al. 2022). The choice of studying several countries has the motivation to cover other countries as the majority of studies focus on Brazil. This study analysed 166 other studies resulting from the search for Amazon\* and forest\* or biom\* and the respective translations to Spanish and Portuguese. The search was limited to the business, management and accounting area of the Scopus database. The major part covers Brazil (51%), reasoning with the higher proportion of Amazonia's total area (Table 2). Investigations include themes such as the effects of deforestation on the decrease in NTFP production (Brandão et al., 2021), the limits of territorial occupation by cattle ranching (Strassburg et al. 2014), and the correlation between a political speech dismissing the financial support to Amazonia Fund and fire outbreaks (Caetano, 2021). As for overall market opportunities, studies focus on the value of biodiversity (Ribeiro & Soares Filho, 2022) as an economic alternative for Amazonia.

Several studies address Western Amazonia, which includes parts of Bolivia, Colombia, Ecuador, Peru and Brazil and it is a hot-spot area where the high biodiversity has been rapidly depleted (Myers, 1988) and there is a negative change in forest cover (Food and Agriculture Organization [FAO], 2020). Investigations into the area focus on the decision-making to answer to the conservation needs (Josse et al., 2013) to address the externalities caused by oil and gas activities (Finer et al., 2008) and expansion of oil palm (Furumo & Aide, 2017).

Table 2: Countries and Amazonia

	Amazonia area (km <sup>2</sup> )*	Proportion of Amazonia region (%)*	Proportion of country total area (%)*	Amazonia population	Proportion of country total population
Bolivia	714,834	8.4%	66.0%	8,276,645	71.1%
Brazil	5,238,589	61.8%	61.0%	29,062,423	13.8%
Colombia	506,181	6.0%	44.0%	1,460,833	3.0%
Ecuador	132,292	1.6%	53.0%	956,699	5.5%
Guyana	211,157	2.5%	100.0%	751,223	100.0%
French Guiana	84,226	1.0%	100.0%	237,549	100.0%
Peru	966,190	11.4%	74.0%	4,076,404	13.0%
Suriname	146,523	1.7%	100.0%	534,500	100.0%
Venezuela	470,219	5.6%	60.0%	2,064,243	6.9%
<b>Amazonia</b>	<b>8,470,211</b>	<b>100%</b>	<b>n.a.</b>	<b>47,420,519</b>	<b>n.a.</b>

Sources: Amazonian Network of Georeferenced Socio-environmental Information (RAISG), 2020

The social, economic, and ecological context of Amazonia has the challenge to balance income generation and biodiversity conservation. It is not possible to conceive the Amazonian development without considering their spread, diverse and low-density population. The diversity has historical roots including the original people, but also the African people, the national migrants due to developmental policies, and the contemporary people linked to large-scale companies, among others. Their way of life is also diverse including in farms, labour camps, traditional territories, communities in protected areas, forests, and mainly in the larger cities.

The diversity in the area overlaps with different structures of governance and distinct organisations' objectives. The map in Figure 5 illustrates the territorial mosaic of overlapping governance in Amazonia. The authority over protected areas varies according to countries' policies and political hierarchies such as municipalities, states or provinces, and federal governments. Some protected areas intersect Indigenous territories, therefore, involving other management institutions. For example, in Brazil, the National Foundation of the Indian (FUNAI) and the Brazilian Institute of Environment and Renewable Natural Resources



(IBAMA) decide on Indigenous territory in protected areas without the involvement of Indigenous representation or authority.

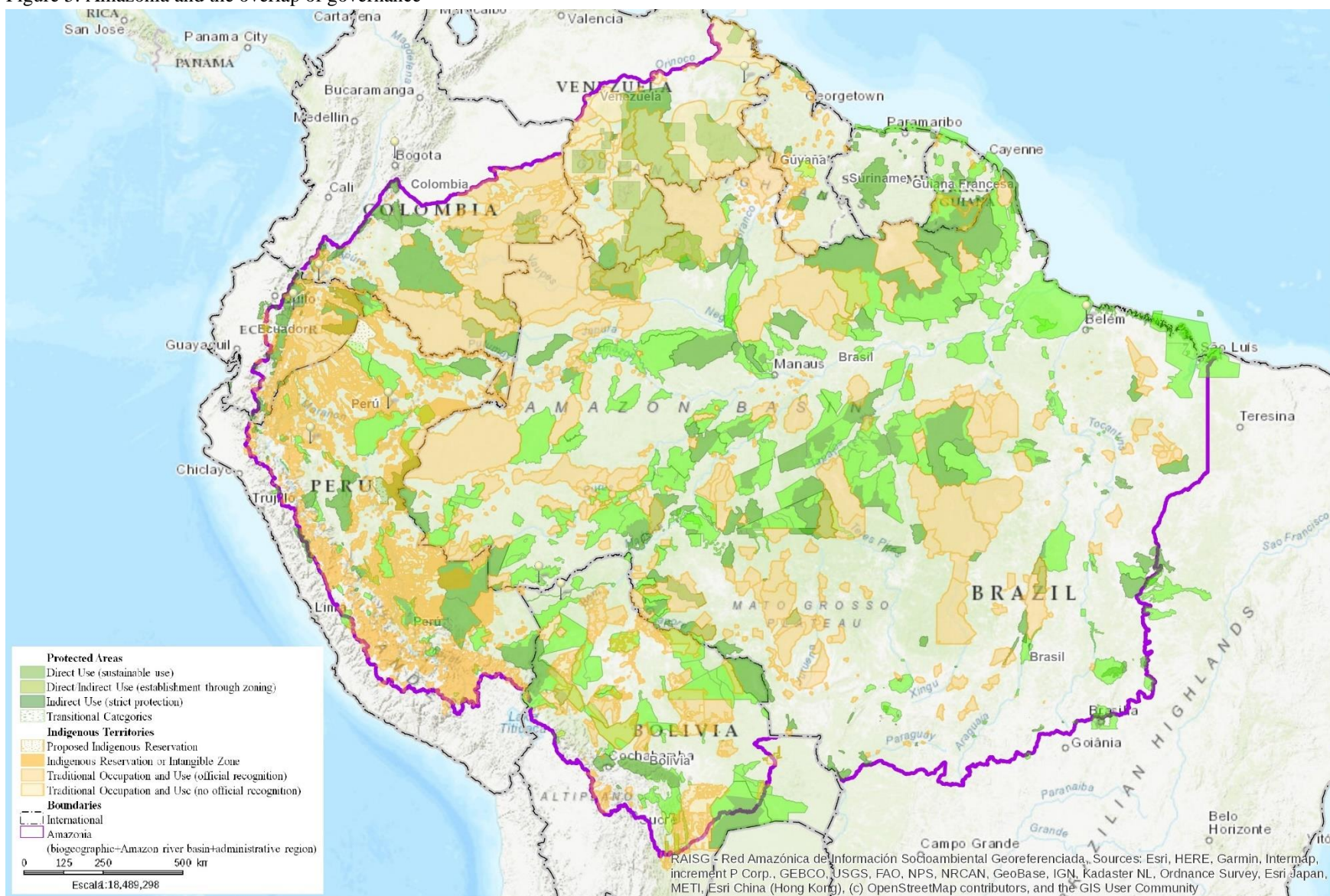
Few studies in the business area focus on socio-biodiversity products or services. Albeit the value superfoods or natural ingredients for cosmetic and pharmaceutical industries, they have a small international market share. Important products are Amazonian nut (*Bertholletia excelsa*) and açai berries (*Euterpe oleracea*), mainly produced in Bolivia and Brazil.

Until 1980, Brazil was the largest exporter of Amazonian nuts when Bolivia overtook the lead (Coslovsky, 2014). After a process of unshelling and the laboratory checking on the limits of aflatoxins, the nuts can be commercialised. Although they have low added value, Amazonian nuts are the most exported socio-biodiversity product from Amazonia.

In the Northern region of Brazil, the high consumption made Acai berries a staple food. The processing may involve the pulping and freezing or lyophilisation of the berries. Other products are *moriche/aguaje* (*Mauritia flexuosa*) found especially in Peru (Horn et al., 2018) and *babassu* palm fruit (*Orbignya phalerata*) and *pupunha* (*Bactris gasipaes*) for palm heart and oil. In Ecuador and Peru, coffee and banana are commodity products with extensive production. In Venezuela, the foci were handcraft and tourism.



Figure 5: Amazonia and the overlap of governance



The entrepreneurial initiatives represent the inter-organisational arrangement of several stakeholders. They contribute to the businesses based on socio-biodiversity products/services aiming to develop the area. Table 3 characterises the entrepreneurial initiatives of this study.

Table 3: Characteristics of entrepreneurial initiative

<b>Initiative</b>	<b>Country</b>	<b>Socio-biodiversity products/services</b>	<b>Main organisation</b>	<b>Inter-organisational stakeholders' involvement</b>
1 Collective commercialisation	Bolivia	Unprocessed or minimally processed Amazonian nuts	Association	Small farmers and collectors, International and local NGOs, Certification bodies, Importers
2 Protected area shared governance and certification	Bolivia	Unprocessed or minimally processed Amazonian nuts and açai berries	Natural reserve	Small farmers and collectors, National and local government, International and Local NGOs, Importers
3 Value chain development	Brazil	Minimally processed and processed traditional food products	Manufacturer	Suppliers (Small farmers and collectors), Local NGOs, Exporters and Importers
4 Forest care and surveillance	Colombia	Services of geomapping and forest surveillance	Foundation	Subcontractors (Indigenous groups), International and local NGOs, Buyers
5 Resilience of ancestral knowledge	Ecuador	Minimally processed beverages	Social enterprise	Indigenous groups, Suppliers (Indigenous farmers and collectors), International and local NGOs, Buyers
6 Traditional community engagement	Peru	Minimally processed fruits	Social enterprise	Indigenous groups, Suppliers (Indigenous farmers and collectors), International and local NGOs, Buyers
7 Socio-technical development	Peru	Minimally processed oils	Association	Indigenous groups, Suppliers (Indigenous farmers and collectors), International and local NGOs, Buyers, Exporters
8 Developing and sharing experiences	Venezuela	Touristic services	Foundation	Indigenous groups, International and local NGOs, Local and international buyers
9 Intermediation of networks	Venezuela	Handcraft products	Foundation	Indigenous groups, International and local NGOs, Local buyers

A challenge in the area is accessing reliable statistics on socio-biodiversity products and services. To find data and studies, we often used the term NTFP. Even though, the NTFPs definition varies from country to country (Shackleton and Pandey, 2014) as products have

different economic relevance. Most academic studies reflect the Brazilian context, so grey literature contributes to filling the data gap. A great recent study produced by more than 200 scientists is the Science Panel for the Amazon (Nobre et al., 2021).

### **3.3.2 Assumptions on Amazonia**

The process of research analysis first started with a researcher's statement of previous beliefs about Amazonia's life and dynamics as an exercise to refrain from judgment. Some relevant beliefs have changed during the development of the research. As a learning process, these assumptions aimed to reflect on the qualitative work:

- Forestry activities extracting timber are worse than other economical alternatives: the use of native timber represented the initial development of Amazonia and is still a great source of income. However, logging companies have a strong influence on the territory and informal power relations on governance. Until today, respondents mentioned that people struggle against these established organisations' rules.
- Agribusiness companies migrating to Amazonia are responsible for the expansion of cattle production and deforestation: the initial process to produce cattle is to harvest the forest or the practice of slash-and-burn. However, it often starts with small farmers or family householders arriving in the area and implanting agriculture and subsistence activities. They are not able to legalise their territorial rights, which often prevents the development and maintenance of their businesses. An alternative is selling their share to other companies with the structure to legalise property ownership.
- Most projects in socio-biodiversity products and services of this research engage and/or focus on women as the primary beneficiaries. Respondents informed they are the holder of traditional knowledge and practice. The literature supports that women are the best custodian of the forest (Nightingale, 2006). Respondent 34E declared “women found spaces for empowerment because they are the ones who pulp the product... they are more careful with the cleanliness, with the processing”. However, successful initiatives in this research have men as leaders heading the interventions and representing the beneficiaries.

### 3.4 DATA COLLECTION

The data collection started in March 2021 and continued until September 2022. The primary data collection consisted of semi-structured online interviews, informal interviews and internal documents from the respondents' organisations and the secondary data comprised the grey literature. Therefore, the use of different data sources for a within-method triangulation aimed to cross-check the internal consistency or reliability (Jick, 1979). The data also provided information to establish the existence and reasons for causal relationships. Table 4 describes the techniques of data collection and the respondents' type and description.

Table 4: Primary data sources and techniques

<b>Technique</b>	<b>Stakeholders</b>	<b>Description</b>	<b>Qty.</b>
Semi-structured interviews	Specialists	Experts working in the Amazonian area for at least 10 years. E.g.: auditors, NGO personnel, Government officers, and academics.	25
Semi-structured interviews	Leaders and Entrepreneurs	Professionals developing Amazonian business organisations. E.g.: founders, presidents, directors, and managers.	11
Review of internal documents and informal interviews	General	Other stakeholders provide additional documentation. E.g., Interviewees' co-workers providing plans, reports and general information about context and businesses.	17
<b>TOTAL</b>			<b>53</b>

The first round of interviews employed a purposeful sampling to identify key respondents (specialists) in Amazonia to help connect to information-rich initiatives (Suri, 2011). These interviewees were specialists working in Amazonia for more than 10 years. The interview protocol comprised 12 questions in the three languages (Spanish, Portuguese, and English) used in the interviews. In general, the one-hour interviews covered distinct aspects of Amazonia with specific questions for each level of analysis. Exceptions happened during four interviews due to one case of internet breakdown, one longer group interview, an interviewee delay causing a shorter interview and one case of extensive answers requiring more time.

The main question themes related to the socio-biodiversity production and commercialisation at the individual, organisational, inter-organisational and macroenvironment levels of analysis and the interactions amongst actors and organisations (Appendix A). The protocol was tested with two preliminary interviews with a Portuguese

and a Spanish native speaker aiming to check the questions sense-making and potential changes.

The first round of interviews summed up 14 participants. All specialists had more than ten years of working experience in Amazonia of Bolivia (3), Ecuador (3), Peru (4), Colombia (1) and Brazil (3). Native speakers of the respective language transcribed the recorded audios of interviews. This interviews and the preliminary data analysis contributed to questioning adjustments and participant sampling in the following round.

The second round of 22 interviews focused on actors involved in the socio-biodiversity entrepreneurial initiatives in Amazonia. Initially, we contacted international and national organisations having long-term projects and/or branches in the area and interviewed their staff working in the field in Amazonia. They provided information, and contact details and/or mediated the connection with the people and organisations in the forest. Through snowball sampling, the recommendation of organisations led to interviews with other actors involved in the entrepreneurial initiatives.

The contact with organisations and their representatives presented specific challenges. Internet, mobile and phones are not part of the routine of most groups in Amazonia Forest due to cultural or infrastructure motives such as contact details not being available or updated, connectivity during limited hours per week, non-necessity of external contact and other reasons. Other challenges during the interviews were the time difference, leading to interviews in early or late hours; meetings split into different days due to connection breakouts; and two cases in Venezuela of unrecorded meetings to protect the respondents and not included in the codification process. Therefore, snowball sampling was essential to access respondents through the contact information that is provided by other respondents (Noy, 2008).

The entrepreneurial initiatives embraced different institutions, directly or indirectly supporting the development and/or implementation of a socio-biodiversity product or service. There is a main organisation leading the initiative that is the beneficiary or it is bounded with the beneficiaries. Details on the type of organisations, their role in the entrepreneurial initiative, interviewees' titles and countries described in Table 5.

Table 5: Type of organisations and interviewees

Type of organisation	Role in the entrepreneurial initiatives	Interviewee title	Countries	Qty
Associations or Cooperatives	Main organisation in an entrepreneurial initiative	Entrepreneur	Bolivia, Ecuador, Peru	3
Certification bodies	Third-party audit services to organisations, enterprises, and individuals in organic, fair trade or forestry certifications	Auditor	Bolivia (2), Ecuador, Peru	4
	Main organisation in an entrepreneurial initiative	Director	Bolivia	1
Governments	Support through funding, technical assistance and multi-organisations projects and programs	Manager	Ecuador	1
		Analyst	Ecuador	1
		Director	Peru	1
		Analyst	Brazil, Ecuador, Peru	3
International NGOs	Support through funding, technical assistance and multi-organisations projects and programs	Director	Peru, Venezuela	2
		Manager	Bolivia (2), Colombia	3
Regional NGOs	Support through funding, technical assistance and representation of collectors and producers, multi-organisation projects and programs.	Manager	Bolivia (2), Peru	3
	Support through low-interest rates financing and technical assistance	Director	Brazil	1
Local NGOs	Main organisation in an entrepreneurial initiative	Director	Venezuela	1
		Manager	Venezuela	1
Multilateral Organisations	Support through funding, technical assistance and multi-organisations projects and programs	Manager	Germany	1
Research institutes and universities	Support through technical assistance in socio-biodiversity products, multi-organisations projects and programs to develop research.	Researcher	Brazil (3), Peru	4
		Director	Colombia	1
Small-medium enterprise	Main organisation in an entrepreneurial initiative	Entrepreneur	Venezuela	1
Social enterprise	Main organisation in an entrepreneurial initiative	Entrepreneur	Brazil, Colombia, Ecuador, Peru	4
			TOTAL	36

In total, 78 people were contacted resulting in the final sample of 36 respondents from Bolivia (8), Brazil (6), Colombia (3), Ecuador (6), Peru (8), Venezuela (4), and Germany (1). Other 42 participants provided informal interviews and internal documents with valuable information on the initiatives.

The triangulation process relied on initiatives combining different data sources. The overlap of more than one interview and documentation referring to the same initiative



resulted in the final selection of entrepreneurial initiatives. The study identified nine initiatives nominated by more than one informant. The description relied on the interviews, internal documentation and official websites and social media, when available.

In this research, the secondary data included the grey literature of significant to moderate retrievability and credibility to reduce the heterogeneity of data (Adams et al., 2017). The literature related to Amazonia provided information on the overall context, projects and developmental programs specific to the area and an overview of socio-biodiversity products and services.

### 3.5 DATA ANALYSIS

#### 3.5.1 Interviews analysis and coding

The interview analysis combined techniques of coding and systemic analysis (Miles et al., 2020; Saldaña, 2016; Kim & Andersen, 2012) in three stages. The first and second stages comprised the coding of respondents' transcriptions to generate the data structure (Gioia et al., 2012; Gioia, 2021). The third stage embraced the identification of relationship patterns and representation in causal loop diagrams of the system's structure (Repenning & Sterman, 2002; Eker & Zimmermann, 2016). Table 6 summarises the analytical process.

Table 6: Summary of the coding process

	<b>Description</b>	<b>Method / Tool</b>	<b>Input</b>	<b>Output</b>
Stage 1	Identifying concepts and theoretical codes	Open coding	Primary data from interviews	1 <sup>st</sup> order data on sustainability tensions
Stage 2	Categorising and aggregating data into variables	Axial coding	1st-order data on sustainability tensions	Data structure of sustainability tensions
Stage 3	Identifying causal relationships in causal diagrams	Relationship and casual mapping	Data structure of sustainability tensions	Causal relationships and mapping of sustainability paradoxes

In the first stage, open (or initial) coding was employed to decompose the data, analyse the parts and axial coding to reorganise according to similar or different properties (Corbin & Strauss, 2008; Saldaña, 2016). The open coding generated an extensive list of 69 first-order codes consistent with the respondents' descriptions. Afterwards, through axial coding, similar codes were merged, repetitions removed, the descriptions improved and the most recurrent ones were selected so the conceptualisation emerged from the data. This stage represented the second-order analysis which resulted in 24 low-level conceptual groups and

6 categories of higher-level concepts. In both stages, the use of computer-assisted qualitative data analysis software (NVivo R1.7) helps to systematise the coding and recoding processes.

The second-order categories in this research have the background of sustainability tensions and systemic approaches. According to Corbin and Strauss (2008), the codes' properties are the features defining and describing concepts. These properties have dimensions indicating variations in concepts' specificity and range. The main dimensions analysed in this research are the sustainability levels of analysis of individual, organisational, inter-organisational and macroenvironment (Bansal and Song, 2017). According to Schad and Bansal (2018), the multiple-level approach may indicate variations in the scale of paradoxical processes considering the temporal and spatial extent.

### **3.5.2 Causal analysis**

In the third stage, the identification of dominant codes and reassembling of data into categories also indicated the main variables of the causal relations (Saldaña, 2016; Kim & Andersen, 2012; Eker & Zimmermann, 2016). Then, those variables were employed to map the feedback structure of systems (Eker & Zimmermann, 2016; Sterman, 2000). The ties of variables in the data explain the causal connections among codes, emergent feedback processes and the closed chain of causal links, i.e., runaway loops of reinforcing feedback or stabilising loops of balancing feedback (Meadows, 2008). The representation of relationships, feedback, and other interconnected elements in causal diagrams constitutes the conceptualisation phase (Repenning & Sterman, 2002). Causal Loops Diagrams (CLDs) are a tool to represent the feedback structure of a system capturing people's mental models (Sterman, 2000). This representation shows the causal links among variables with arrows from a cause to an effect explaining the cyclic connections, if applicable.

In this research, the development of CLD employed the software Vensim PLE version 8.2.1. Finally, the reiterative process of combining and/or splitting variables required a consistent data recheck in the causal mapping. It resulted in maps of the system structures and variable behaviours (Eker & Zimmermann, 2016) of sustainability paradoxes.

## **3.6 RESEARCH PROCESS**

This section aims to clarify the logic and the process of the research summarising the main information. The general objective of the study is to analyse the causal dynamics of

socio-biodiversity entrepreneurial initiatives in addressing the sustainability paradoxes. The logical matrix (Table 7) demonstrates the three specific objectives which contribute to the achievement of the main objective, their hypothesis, data collection and analysis description and the product expected from this analysis.

Table 7: Research logical matrix

Research Theoretical Model	Research Main Objective	Specific Objectives	Theoretical Background	Research Propositions	Data Collection and Analysis	Analysis Product
Socio-biodiversity entrepreneurial initiatives interrelation with sustainability tensions	To analyse the causal structure of socio-biodiversity entrepreneurial initiatives in coping with sustainability paradoxes in Amazonia	I. To identify socio-biodiversity's entrepreneurial initiatives and the sustainability tensions.	Sustainability paradoxes: Bansal, 2005; Bansal & Song, 2017; Hahn et al., 2010; 2015; 2018; Smith & Lewis, 2011; Schad & Bansal, 2018; Quinn & Cameron, 1988	P1: socio-biodiversity entrepreneurial initiatives shape and are shaped by sustainability tensions	Data: semi-structure and informal interviews, documental research	1st-order data on sustainability tensions;
↓			Socio-biodiversity entrepreneurial initiatives: MMA, 2009; Ribeiro & Soares Filho, 2022; Siqueira-Gay et al., 2020		Analysis: open coding in Nvivo software	Comparative analysis of initiatives.
Patterns of sustainability tensions in socio-biodiversity entrepreneurial initiatives		II. To categorise the patterns of sustainability tensions in socio-biodiversity entrepreneurial initiatives.	Systemic approach: Checkland, 2000; Meadows, 2008; Sterman, 2000; Sherwood, 2006; Forrester, 1971; 1992; 1993; 1994	P2: patterns of sustainability tensions change in different levels of analysis	Data: 1st-order data on sustainability tensions	Data structure of sustainability tensions.
↓		Levels analysis: Bansal & Song, 2017; Hitt et al., 2007; Haffar & Searcy, 2017	Analysis: axial coding in Nvivo software		Framework of entrepreneurial initiatives	
Causal dynamics of sustainability paradoxes in socio-biodiversity entrepreneurial initiatives		III. To map out the systems feedback structure of sustainability paradoxes in system diagrams.	Causal dynamics: Meadows, 2008; Peter Senge, 1990; Sterman, 2000; 2001.	P3: causal dynamics explain how to cope with sustainability paradoxes	Collection: Archival research Analysis: causal mapping in Vensim software	Interrelations mapping in Causal Loops Diagrams

## 4 RESULTS

This section presents the results addressing the research objectives. The sub-section 4.1 answers specific objective I by identifying and describing nine socio-biodiversity entrepreneurial initiatives and their sustainability tension. Item 4.2 presents the categorisation of patterns in the sustainability tensions related to the socio-biodiversity entrepreneurial initiatives to fulfil objective specific II. In sub-section 4.3, causal diagrams illustrate the systems feedback structure and explain the sustainability paradoxes as stated in specific objective III.

### 4.1 ENTREPRENEURIAL INITIATIVES

The entrepreneurial initiatives are composed of a main organisation heading the idea, and other stakeholders supporting the initiatives. The partnerships were essential in implanting the vision of one or more people to constitute the main organisation. Their support focused on the development of activities, financing and/or addressing tensions and challenges.

This section describes the entrepreneurial initiatives presenting the tensions they face and how they cope with them. Entrepreneurial initiatives 4.1.8 and 4.1.9 are Venezuelan organisations. In order to safeguard the organisations and their work, the description of initiatives, tensions and responses have an overview of the countries' challenges and general issues in the industry. There is no inclusion of historical data such as the foundation and main changes, or the name of Indigenous communities and their location.

#### 4.1.1 Collective commercialisation & joint benefits

This initiative has a small association as the main organisation aiming to increase income generation and maintain the exports of Amazonian nuts to international fair trade and organic markets. Since the beginning of the group in 2017, 26 registered families have joined. In the past, individual members used to be part of a large cooperative of Porvenir, which had operations in other Departments such as La Paz. However, the cooperative went bankrupt due to administrative issues. A few families living in a closer area decided to create another association to re-establish joint sales and benefit from the stable prices of Amazonian nuts.

After obtaining the Fairtrade certification, the group rebuilt the commercial relationships and the exports of nuts and developed activities to improve livelihood and subsistence.

#### *Relevant tensions*

The certification process was a challenge as the organisation needed an organised group of collectors willing to follow external rules and deliver their productions to the negotiation. Association and producers need to accomplish socio-environmental criteria which can cause cultural tensions, but also potentially support environmental maintenance and social value.

The organisation additionally has a dependence on a third party as they rely on a nuts processing party company as a services provider. The processing of external products in the company's plants depends on the processing and idleness of their production, which has an irregular schedule due to the harvest and season. This prevents the association from scheduling the orders' delivery and fulfilling the negotiated orders on time.

#### *Responses to tensions*

The smallholders' cooperation guaranteed the products' volumes enabling the exports. The product had certification offering a minimum price to promote more stable revenue to members and families, and an incentive to maintain the group together. Joint commercialisation contributed to the negotiation and establishment of commercial partnerships.

The organisation receives the support of several national and international organisations, including their European importers-buyers. The support comes as technical assistance to post-harvest and financial support from Latin American organisations. They also have assistance in the development of negotiation and market skills.

### **4.1.2 Protected area shared governance and certification**

This initiative refers to a long-term plan to promote the income generation of producers living inside a PA defined as a natural reserve. The creation of the PA in 1973 guarded this part of Amazonia Forest located in the Pando department of Bolivia. According to an internal document, the plan has multiple level aims of promoting the sustainable use of wild resources through integrated management, guaranteeing long-term productivity, improving the living conditions of the local population, and contributing to the development of the department.

The management aimed to address the issue of income generation and natural resource conservation.

In 2010, 1,691 people lived inside the reserve, of which 306 families lived in communities and 68 in *barracas*, or private facilities. In the *barracas*, workers do the processing of natural resources and live in local accommodations with their families. The families culturally identify as collectors, as a result of the migration of *campesinos* from different and mixed backgrounds, including Indigenous and local people.

The initiative successfully promoted the income generation of the area using socio-biodiversity products. The general income of families is higher than the local average, which creates some tensions in neighbouring communities located outside the reserve. It is part of the certification process which offers better commercial conditions for those in compliance, but also excludes the non-conformant from its benefits.

#### *Relevant tensions*

Families have few production alternatives due to the legal restrictions of the environmental laws of a conservation area. It is not possible to develop farming activities to support the households' subsistence.

The organisation has several challenges related to the administration of the area due to government changes and an inconstant public budget. The government nominates the director of the reserve, which changes every five years due to the elections or more, depending on political concerns. Every change demands the adjustment of the civil actors involved in the joint initiative to the discretionary regulations of the new director. This requires constant effort from participants and brings instability to the partnership.

#### *Responses to tensions*

It is a joint initiative of the government, which is the legal administrator of the area; an environmental NGO offering long-term, consistent and capable technical support at the production and management levels; the private *barracas* and communities, which represent the direct beneficiaries of the initiative. It started focusing on the management of Amazonian nuts and, since 2014, the plan has included the production of lyophilized *açai* berries as a source of income during the nuts off-season.

The initiative differentiation relates to the process of changing the structure that manages the certifications. Usually, only established organisations such as companies,

associations, or cooperatives receive certifications. However, the initiative customized the socio-environmental governance inside the PA creating rules and procedures to guarantee the compliance of communities within the reserve. They all must fulfil the requirement and have the benefits of better commercial conditions. This enabled the PA as a certified entity. The creation of an association answered to certification requirements and, currently, the reserve owns several certificates: Organic, Fairtrade and National title of Amazonian Origin.

#### **4.1.3 Value chain development**

The initiative has a Brazilian enterprise as the main organisation. Two entrepreneurs founded this enterprise aiming to process and commercialise typical products from the Para area. The state has a beautiful, traditional, and regional cuisine, which is still inaccessible in other parts of the country. The organisation presents the socio-biodiversity as, for example, cassava flour, *açai*, *tucupi*, and *tapioca* are part of local culture and daily routine. The development of commercial products uses local and natural ingredients and low-processing methods. The final portfolio includes *tapioca* granola; *açai*, *cupuacu* or *cumarú* jams, *tucupi* sauces and snacks.

The venture has commercial partners upstream to provide the raw material and, in some cases, the initially processed ingredients to their industry from the forest. Downstream, the partners involve e-commerce and sales to locations of consumer concentration in Brazil. The business follows the principles of working with ingredients from Amazonia conserving the forest, producing natural products and promoting fair and responsible trade with suppliers and their communities.

It is a successful business whose initiative involved several organisations supporting entrepreneurship. The seed capital came from three main funding organisations after a prize in a forum on impact investing and sustainable business in Amazonia. Currently, they have other impact investing organisations on their advisory board, which support the initiative on strategic planning.

##### *Relevant tensions*

The challenges the organisations face concern both downstream and upstream supply chains. Upstream, finding the quality and quantity of products in the same supplier was an issue so the organisation faced instability in the sourcing of raw materials. It prevented them from establishing commercial relationships and contracts. Downstream, the challenge was to



develop a commercial product not accepted in the local market due to processing and enter into the consumer market in areas outside Amazonia, mainly in the Southeast region which is the largest consumer market in Brazil.

The current challenge relates to the market potential of their socio-biodiversity products. The development of new products and finding market opportunities requires research and development and, consequently, investments. The aim to reach exports and international markets requires great R&D efforts because, even though ingredients have been long consumed in regional markets, their characteristics such as nutritional information and benefits are still unknown.

#### *Responses to tensions*

Following their main challenges, the business model is based on the development of the supply chain (upstream) and new products and markets (downstream). Upstream, the organisation has an agricultural professional who is responsible for supply chain procurement. This professional identifies and diagnoses the suppliers, checking their potential and will to adapt to the market requests. Interviewee 35P stated, “we selected ingredients with market potential, with which suppliers could offer a good product and were willing to work on self-development... because they were not professionalised in all sense, no structure, no source, no legal formalisation...”

Downstream, the venture initially answered the request of special gourmet markets and renowned chefs to provide their ingredients to major capital in the country. Those key clients helped to display the products and aroused curiosity among potential customers. Therefore, the products accessed national retail markets.

Additionally, the development of partnerships with research institutes addresses the benefits of socio-biodiversity products. Activities of research and development would provide information about the products and services, especially related to nutritional information and unknown benefits of socio-biodiversity products.

#### **4.1.4 Forest care and surveillance**

This Colombian initiative started in 2015, joining the technical skills of geoprocessing and the protection of Amazonia. An entrepreneur and his mother, an expert in Geographic Information Systems (GIS), launched a foundation offering the “adopt a tree” concept to individuals and people motivated to support forest conservation. The social mission of the

organisation focuses on Amazonia conservation and fighting the climate crises. Over time, the interest in reforestation services and carbon sequestration increased especially among corporative customers, who are their current commercial partners. In 2022, the organisation had twenty-five employees and 240.000 planted trees.

The foundation works in collaboration with 22 Indigenous communities to provide the services. In the field, Amazonian people are responsible for planting and following-up the trees over the years. Every six months, they upload images in a system linked to the GPS location and the code of each customer. Additionally, the foundation has partners such as NGOs financing the initiative and entrepreneurial accelerators. The organisation also received awards and grants from national and international entrepreneurial organisations.

#### *Relevant tensions*

The first challenge was the development and adaptation of a system to manage the data such as pictures and location, then the process automation and standardisation as the operation grew. The main challenge, however, concerns the cultural interference, availability and use of technologies. The capture and transmission of pictures and location require training for the Indigenous partners and regular access to areas connected to a transmission system. According to the foundation director “many people say: of course, any attempt to speak with Indigenous communities is already a matter of transnationalism! You are imposing a Western culture or not, we have another tool that, if well used, there is the well-being of people”.

#### *Response to tensions*

The choice of communities has some pre-requirement as their partners are Indigenous groups already contacted that wear Western clothes and have used computers, televisions or electricity. Moreover, they consider the characteristics of each Indigenous group as these traits vary according to their history and previous interaction with other people and technologies in general. There is no standard procedure to interact with the communities. Regularly, through a collective process, the communities decide how they want to work in their territory. The foundation proposes planting one thousand trees so the group can decide who wants to plant those trees, what species, which planting designs and their reasoning for it. There is an introduction to the concept of standardisation as a requirement of the project.

The foundation is aware of this interference and believes it is a modern language that could benefit their governance and the development of other activities.

#### **4.1.5 Resilience of ancestral knowledge**

This enterprise in Ecuador was founded by an Indigenous entrepreneur using the seed capital coming from her father. The initiative has a long history, as the ancestor beverage made from the leaves of Guayusa (*Ilex guayusa*) was part of a ritual among the Kichua's group, as the first drink consumed in the early morning to provide strength and energy for the day. The entrepreneur's grandmother was an inspirational force for her and, although the predominant machismo, the elder knowledge brought awareness to women's strength and labour power. Following the tradition, she was taught to prepare and use the beverage. The interviewee shared how the idea was born during the COVID pandemic: "My dad had the idea of preserving, strengthening our nationalities, our language, our knowledge because he says that many people come and take our ideas and we stay with them and do nothing. Why don't we, who have the nationality, make a drink with what is ours? That comes from our ancestors, from my grandparents, from your grandparents said my dad".

To start a business, the entrepreneur succeeded in joining the ancestral traditional knowledge and the lessons of a two-year training in natural resources technology in the United States. The initiative maintains its roots in its traditional territory as the father is a small landholder of a *wayusa* crop providing part of the raw material. The factory also receives *wayusa* leaves from other people from the neighbouring community, sharing the beverage revenue.

##### *Relevant tensions*

Initially, the venture faced challenges concerning the beverage recipe, the legal institution, and the transportation. The product preservation using natural ingredients and the taste preferences of different customers required a partnership with local universities to develop the formula of the beverage. Additionally, the formalisation process had barriers in the legal assistance, which charged and deceived the entrepreneurs in the complexity of organisational establishment. Alongside the enterprise's legal institutionalisation, the organisation had the packing and distribution challenge concerning the bottles' size and logistics. The final and current major issues concerned the commercialisation in retail chains

and the disadvantage conditions such as the need for promotion at the point of purchase and the 30-day payment conditions.

*Response to tensions*

The entrepreneurs rely on a motorcycle logistics, which allows small-scale commercialisation. The main regular sales are in stalls and farmers' markets. Due to the commercial bottom neck, the venture began a social media mobilisation to find like-minded groups in the area willing to sell products/services. The initiative grew and they formed a network of products from multiple nationalities of Indigenous people. Together with local government support, the network's initiative coordinates a regular street market to enable customers' access and improve sales of communities.

**4.1.6 Traditional community engagement**

The initiative has emerged from the necessity of preserving the products the group extract from the forest. The Awajún participant, native of Peru, was motivated by the local biodiversity and the economic needs of women and youth. Over the years, he and his father saw the changes of times and how they also changed the community. The agriculture of non-native products arrived requiring large areas to produce coffee, bananas, and other crops and bringing revenue to producers. However, the establishment of farms also comes with the loss of biodiversity, which was their earliest guarantee of living. This shows the Awajun community's interactions with external people were quite recent, so they maintain the heritage of their ancestors.

Inspired by other initiatives exporting socio-biodiversity products in the area, the entrepreneur searched for information about the commercial process. He learnt about the need for a stable supply concerning the quantity and quality of products and realized the challenges along the way. In 2014, after joining two private partners, the venture was founded. The new company received support from several international organisations as part of a local program for the development of IPLC ventures. Additionally, this initiative engages approximately 100 families from the Awajun community to work in the collection, processing, logistics and sales of the product.

*Relevant tensions*

The initial concern in the organisations was the lack of opportunities for income generation, especially among women and youth. There are few employment opportunities and no availability of formal education in the area.

After the initial idea of working with the socio-biodiversity in the area, the initiative started producing fruit pulps for distribution in the gourmet markets of Lima. This process enabled the commercialisation of the community's main products: *ungurahui* (*Oenocarpus bataua*) and *aguaje* (*Mauritia flexuosa*). However, the artisanal process was not efficient and required the implantation of a processing and freezing structure. Although fruits could reach longer distances and Amazonian commercial markets, other challenges started. The freezing process demanded appliances and constant provision of electricity, which were non-existent in the community. Once the infrastructure was placed, the equipment required maintenance and regular use. So, the frozen products were a source of income for the community for two years until the pandemic outbreak, when the demand for the products dropped impacting pulp production and sales.

#### *Response to tensions*

The organisation joined the local fruitful trees and the woman's knowledge of their use to meet the need of bringing economic stability to the community. The venture received support to install the freezing equipment and a diesel-powered electric generator. Now the current infrastructure has 50m<sup>2</sup> and a capacity to process 80kg of pulp per day. The venture's participants agree to share 5% of each sale with the group aiming to construct community infrastructures. Until 2020, approximately 20 people were working in the operation.

#### **4.1.7 Socio-technical development**

The main institution of this initiative is a native community association of approximately 40 families of Kukama ethnics, located in Peru. The community has a traditional history of multi-purpose employment of *aguaje* (*Mauritia flexuosa*) fruits. There was a well-established tradition of harvesting the fruit through the felling of palm trees. However, the community is inside an environmental reserve and the availability of palm trees was getting scarce, requiring hours of walking to reach an *aguaje* tree. The low productivity and the motivation to preserve the resources lead the group to a period of changes.

This process changed in 1999, when members of one family envisioned a tool to enable tree climbing. So, they created the 'Super Uno' which, after one year of tests and

improvements, became the ‘Super Dos’ tool. This easily operated equipment allowed a quicker extraction of fruits keeping the standing forest, which over time increased the oil productivity. Currently, the tool has a patent registration, and it is sold in other countries.

#### *Relevant tensions*

In the beginning, the new process of climbing the palm trees created resistance in the community, which reacted by isolating and excluding the members of the family. While the family were working on the improvements of the equipment and presenting it to external people, they developed a network in the area.

Previously, the sales of *aguaje* fresh fruits in local markets happened on occasion, as the group relied on transportation availability. The main clients were ice cream manufacturers with small-scale orders.

#### *Response to tensions*

It took 5 years of persistence and negotiation to implement the novelty for climbing trees, as it required a cultural change in the community. After receiving the demand to produce *aguaje* oil, the family worked for more than one year in the development of the oil extraction process to provide a half-litre sample. Six months later, they received the first order of one hundred litres, which was 60% fulfilled in one harvest. The second order was 300 litres with an exponential increase in the following orders.

It was possible to increase the quantity of oil each year due to the maintenance of trees. According to the interviewees, each community has a limited area to collect fruits, so individuals and groups can provide the raw material. The current production is 100 litres/day, reaching a production of two metric tons per month. The group exports to the United States, France, Canada, and the United Kingdom, where the product is mainly used in the cosmetics industry.

### **4.1.8 Developing and sharing experiences**

This initiative from Venezuela has an NGO as the main organisation. It was born to financially support communities and develop micro-finance projects. Over time, the presence of entrepreneurs in the tourism industry supported the redirection to offer touristic experiences and ecotourism in several parts of the country, including Amazonia Forest. The

organisation connects traditional communities and travellers and external visitors through activities such as youth and general volunteering, travel advice, and music and culture rescue.

#### *Relevant tensions*

In general, the Venezuelan current political context, international sanctions and economic instability bring severe consequences for people and create challenging situations for entrepreneurial initiatives. The most relevant issues to entrepreneurial operations are high inflation and shortage of basic goods. They affect the prices of non-subsidised fuel turning field interventions unfeasible. This initiative involves tourism operations which are highly dependent on transportation and fuel.

A local challenge is the controversial situations related to tourist activities in IPLC. Communities in distinct areas have cultural differences in the decision-making process and management of community operations. The NGO, therefore, has partial access to critical information with potential negative impacts, such as waste management.

#### *Response to tensions*

Over time, the organisation expanded their mission and shift to wider awareness and development programs in those areas. Their interventions are specific for each case and can embrace training in areas such as waste management, income generation or traditional cultural activities.

During the pandemic, the organisation also developed an online experience offering the visitor customized activities. Complementary, the organisation has a commercial platform for handcrafts from native and Indigenous communities. Moreover, the initiative has several partners, embracing influential individual supporters, multi-lateral organisations, and private companies.

#### **4.1.9 Intermediation of networks**

This initiative joins NGOs, and public and private organisations to plan and implement sustainable development programs. The main organisation is a Foundation working in the Amazonia area for more than 20 years, which is responsible for the development of joint actions to improve the livelihood of traditional communities. Their motivation was the development of environmental actions in oil production areas.

The foundation developed partnerships with the Indigenous communities, who are the main beneficiaries. The entrepreneurial activities involve the commercialisation of handcraft and traditional products produced by women groups of Indigenous communities. The foundation supports the connection between the communities and their customers. The Indigenous organisations focused on the production of handcraft based on natural fibres and the foundation supports the production processes, commercialisation and cultural diffusion. Recently, the foundation is developing a project to support the improvement of livelihoods by enhancing agricultural production, local crops and fishing as the main source of food.

#### *Relevant tensions*

Venezuelan current political context and the prices of non-subsidised fuel also affect the operations of this initiative. There are scarce logistics alternatives to transport handicraft products from communities to the buyer. Despite the possibility to maintain the operations, communities often struggle to find transportation solutions.

The most important tension is the commercial relationships relying on the pre-financing of production, i.e., it is necessary to have the buyer paying in advance to guarantee the liability of production and trustworthiness to the community.

#### *Response to tensions*

The Foundation's involvement as an intermediary provides credibility to the commercial flow and stability in the commercial partnership. They follow three main approaches for commercialisation: the involvement of Indigenous women in fairs and markets around the country, the creation of an online store offering the products and the bridge with corporative procurement to supply special artisanal packing or promotional products. This later strategy brought the best results as it enabled the creation of new products for specific needs, bringing regularity to the product's demand.

Over time, the foundation received financial support from different private and public organisations, which included an oil company, the humanitarian fund of Venezuela and bilateral organisations from the European Union.



#### 4.1.10 Comparative analysis of initiatives

The entrepreneurial initiatives have differences and similarities related to their dynamics, support, and overall result. Their practices in responding to tensions vary according to the products and services available, and stakeholders' involvement as all studied initiatives received external support. The motivations for each entrepreneurial initiative reflect the shared objectives of all involved stakeholders to promote socio-biodiversity products and services.

The respondents offered an overview of entrepreneurial organisations in Amazonia and the analysis showed they share aspects describing the willingness to receive support and investments from external stakeholders. According to the interviewees' experience in the field, six aspects are relevant for Amazonian entrepreneurial organisations:

- a) Social configuration: the presence of a group or collective social structure oriented to work and develop actions together. This aspect provides the potential of having production volumes and negotiation capacity.
- b) Organisational establishment: organisations having a physical place, territorial rights, and legal business requirements are market-friendly and more likely to receive local and external support and access to financial alternatives.
- c) Product or service: products fulfilling market requirements, available to commercialisation with standard quality and quantity.
- d) Stable market: experience in commercialisation, long-term businesses and market partnerships.
- e) Profits or return to members: organisations with a positive net income.
- f) Governance: organisations with a governance structure following socio-environmental market practices and the capacity to navigate in multi-governance environments.

These aspects work as the basis for a comparative analysis (Table 8) concerning entrepreneurial initiatives. It offers an overview of the status of organisations and the context of tensions and paradoxes.

Table 8: Comparative analysis

	<b>Initiative</b>	<b>Objective or motivation</b>	<b>Social configuration</b>	<b>Organisational establishment</b>	<b>Product or service</b>	<b>Stable market</b>	<b>Profits or return</b>	<b>Governance</b>
1	Collective commercialisation	Organisational strength of a group of families	Association formed by families	Yes. Collective commercial experience	Yes. Raw materials.	Yes	Yes	Yes
2	Protected area shared governance and certification	Income stabilisation of small farmers in conservation areas	Households, communities, and private companies	Yes. Group of organisations	Yes. Raw materials.	Yes	Yes	Yes
3	Value chain development	Market and products development	Local-based entrepreneurs	Yes. Venture's experience and business training	Yes. Consumer-ready products.	Yes	Yes	Yes
4	Forest care and surveillance	Intermediation of forest conservation	Entrepreneurs	Yes. Technology experience and business training	Yes. Services.	Yes	Yes	Yes
5	Resilience of ancestral knowledge	Raw products adaptation	Local-based entrepreneurs	Yes. Technology training	Yes. Consumer-ready products.	No	Yes	Yes
6	Traditional community engagement	Raw products adaptation	Local-based entrepreneurs	Yes. Living in community	Yes. Industrial ingredients.	No	Yes	Yes
7	Socio-technical development	Process improvement	Local-based entrepreneurs	Yes. Living in community	Yes. Industrial ingredients.	Yes	Yes	Yes
8	Developing and sharing experiences	Community-based services	Foundation supporting communities	Yes. NGO.	Yes. Services.	No	Yes	Yes
9	Intermediation of networks	Community-based services	Foundation supporting communities	Yes. NGO.	Yes. Services.	No	Yes	Yes

## 4.2 SUSTAINABILITY TENSIONS

This subsection describes and consolidates the tensions collected from the entrepreneurial initiatives. It also presents quotes from interviews to illustrate those patterns. As patterns of sustainability tensions and categories emerged from this consolidation, it answered Specific Objective 2.

Biodiversity and environmental conservation in Amazonia represent a major global concern. The strict protection of areas intends to maintain the ecological characteristics of

primary forests and prevent the extinction of species and their potential benefits to humankind. Interview 23E paraphrased a European researcher "... there is an enormous potential, not even with our help... we can develop it. So, we ask that you please keep it so that everyone can benefit in the future, for the good of the planet...". There are gaps between the development of the potential benefits and the current situation, so the strict PAs are under pressure.

The general criticism of the strict protection in environmental management concerns the restriction of traditional human activities. These activities support the regeneration of the forest. Interviewees remark on the interdependence of people and forests, and their role in conserving the environment. The income generation in Amazonia represents one of the main concerns of governments and development organisations as it has a direct link with environmental conservation. According to respondents, there are very distinct relationships between people and the environment depending on economic activity and people's background.

Interviewees described the different "Amazonias" in addition to the countries' differences. Developmental policies encouraged the occupation of Amazonia, an area with plenty of resources, but uninhabited by producers and agriculture activity, mining, oil and gas extraction, and extractivist forest-based activities (such as rubber and timber). The occupation shaped the current Amazonia people, their practices and income sources. There are the native Indigenous people, their descendants (the historical peasants) (SPA, 2021) and farmers, developing different economic activities over the year.

Respondents mentioned the role of guardians belonging to people with cultural and historical connections with the forest, who protect the environment while using the necessary resources from socio-biodiversity products. Their main income activity is the extractivism of vegetal and animal products. They often have extensive farming practices to cultivate socio-biodiversity products close to their communities and/or the production of other products such as subsistence production and small-scale sales for household supplies.

The small farmers and producers' organisations in Amazonia have diverse backgrounds. In addition to the Indigenous people, there are *mestizos* (i.e., mixed of Indigenous and European people), *quilombolas* (descendants of Afro-Brazilians), migrants and people from local communities. Respondents often emphasise the background when mentioning their field practices and mindsets, in special, the migrants (from the South of

Brazil, the Andean area of Ecuador, the mountain range in Peru and the lowlands in Bolivia) bringing to Amazonia the practices of intensive production and monoculture.

Respondents agreed about the Indigenous culture in overseeing the Amazonian territory, and how that culture influenced the migrants living from extractivism inside the forest. They reproduce the extractivist traditions. Additionally, interviewees highlighted the cultural differences among different Indigenous communities and, consequently, their diverse interactions with forest outsiders. Although there were reports of participation in informal and/or illegal activities inside the forest, most interviews described the original people's involvement in forest-based activities and their traditional culture.

The cosmovision and the strong tradition of conservation in IPLCs were regularly highlighted by interviewees. Participants from Indigenous communities explained their history, ancestral practices, and contemporary changes. Going to school to learn about numbers they did not need, seeing the modifications caused by agriculture, understanding that money is useful and realizing the loss of nature had made people poorer. Participant 028P said, “For example, my father when he was young, 17 or 16 years old, he didn't know the money. So, we lived from hunting and fishing, picking fruit in the forest, right? I think it's healthier (laughs) consuming natural, organic and chemical-free foods. And that's the world we've been living in”.

The respondents from Indigenous communities were involved in entrepreneurial initiatives and they shared their concern about the community's welfare and the motivation to preserve and present their culture. Their economic activities were based on socio-biodiversity products or services, being developed by women, and engaging the youth. Interviewees affirmed they have knowledge about products and techniques. Participant 26P said “what we want [...] from the beginning is to be this company that is Indigenous Quechua and comes from this nationality [...] it is our habit [...] and we are here presenting our product, what we do and live daily. We are not inventing; it is not something new for us.”

The conservation and traditional culture have won the respect and the interest of international and local supporting organisations, which (self) criticise past and present interventions. There is a long list of governments, multilateral bodies, NGOs, socio-enterprises and private companies offering assistance in Amazonia with different cooperation degrees. Some development organisations have been financing projects to prevent the production of drugs even though without significant success, as they require “cultural

changes". Several interventions concern the support and development of local businesses primarily linked to socio-biodiversity products or services such as Amazonian nuts, açai, handicraft and tourism. Financial resources to promote income generation were the most cited type of help. However, short and medium-term investments are declared to be unsustainable as they often fail over time.

Entrepreneurial initiatives are constituted by supporting institutions, local organisations and communities, and beneficiaries working together to promote economic alternatives. Common practices mentioned during interviews include (1) creating an association or cooperative; (2) increasing the volumes, improving the quality, or developing products; (3) providing processing or other business infrastructure; and (4) establishing management and organisational skills. However, each practice has different challenges.

Respondents from supporting organisations declared that members spread in a large area with mobility restrictions are not regular in meetings and social gatherings. In general, the existence of groups and communities of people does not imply that individuals are willing to join a formal association or cooperative. It is convenient to sell products to intermediaries who reach them, exchange forest products with staple food and pay at sight.

Other entrepreneurial constraints relate to the challenge of increasing goods' volumes, improving quality or developing products suitable to the markets. In the context of low population density and few collectors of different and mostly perishable forest products, it is tricky to gather relevant volumes before losing quality in the warm and humid climate. The development of product resistance depends on the packaging, use of chemicals, refrigeration or processing technologies, requiring infrastructure.

Product processing in Amazonia often refers to minimum processing. Unshelling Amazonian nuts, pulping and chilling/freezing açai berries or other fruits and extracting oils are the common processing described by interviewees. Moreover, commercialisation requires phytosanitary licenses, transportation and access to communication means. It is a reduced infrastructure, which is inviable without electricity, roads, and people to operationalise it. It is usual to hire third parties for processing, relying on their agenda and conditions. Respondents reported issues from the dependence on third parties, i.e., logistics and processing companies, middlemen, brokers, and exporters, representing a long chain of intermediaries to fill the gaps between the forest people and the market.

Management and organisational skills represent a higher-level issue linked to previous challenges. Therefore, participants from supporting organisations mentioned how the forest organisations struggle to negotiate products, fulfil contracts, to deal with accounting, finances and planning, in general. They do not have access to credit, (pre)financing for working capital, seed capital or impact investment. Organisations require long-term supporting projects and programs.

It is an endeavour to connect people and communities in remote areas with the financial aid coming from supporting organisations. According to participant 27E "... there is incoordination of time, expectations and responsiveness between government and NGOs... and between the organisations that are on the forest floor and big companies, startups, companies that want to connect with the forest floor". Institutional mechanisms facilitate the financial flow to established organisations which are not representative of the forest floor people.

Interviewees mentioned the generalized lack of access: to education, health, communication, technical assistance, and resources. Participant E22, the leader of a group of 417 Kichwa Indigenous women in the rural community in Amazonia was trying to access support for their project. The group extracts and commercialises products from the water of a bamboo plant to be used as cosmetics. The members have occasional sales as there is no established market for the product and they are still striving to generate a regular income. She said "... it's not like everything is for free, so to buy something to eat, sometimes you don't have it (money). And we do what is possible [...] I am also an artisan and I offer handicraft courses myself, so I teach them handcrafting and then they can sell it. When they do, sometimes they say: - I sold 10 dollars, we can buy a chicken [...]"

Agricultural products such as coffee, banana and cocoa are widespread in some parts of Amazonia in Peru and Ecuador. Those productions, which happen intensively or in sustainable production systems, are less controversial than other agriculture activities such as grazing, cattle and soy production. Ranching and the revenue, however, increase the attractiveness of the activity leading to producers' conversion.

Interviewees repeatedly mentioned the economic attractiveness of coca production and mining compared to other economic activities. Although coca is a traditional crop in some Amazonian countries, informal production has been expanding in Peru and, less, in Bolivia. International Development Agencies, such as USAid, had invested in crop conversion to

cocoa or coffee. However, it is not economically and culturally appealing. Traditional communities do not identify with the production of those commodities. Interview 12E declares “...different organisations have entered, have motivated, have influenced to make small changes in the culture and plant cocoa, for example, and plant coffee, even though they do not see it as their crop”.

Other illegal and criminal activities in Amazonia mentioned in interviews are informal mining, illegal timber extraction and smuggling. Mining, with a concession or informal, is another controversial economic activity. Although legal mining creates jobs, interviewees consider this activity a threat to traditional activities. Large and small-scale gold mining, especially informal extractions, have externalities on the contamination of bodies of water with mercury. The extraction of hydrocarbons also has negative impacts on the ecosystem. Politically, respondents mentioned the corruption involved in mining and hydrocarbon concessions and the lack of public consultation among surrounding communities.

Illegal logging is the most mentioned illicit activity in all researched countries. Timber extraction is a controversial economic activity, as respondents recognise its economic relevance and tradition, as the activity is also carried out by native communities. At the end of the 90s, organisations of environmental protection supported projects to implement forestry certifications, which is still a significant sustainable niche market. Interviewees stress the need of balancing the negative impact on the environment through technical assistance and capacity building. However, several interviewees criticise logging companies due to their political power, illegal timber extraction and other criminal activities. Respondents declare that most of the logging is illegal and is happening inside Indigenous territories, cross-borders, and in PAs.

Cross-border smuggling is described by participants as a common practice in several Amazonian countries. In some areas, people access products and services in neighbouring countries with lower prices, better conditions or convenient mobility infrastructure. However, large-scale smuggling involves the commercialisation of a range of forest products such as Amazonian nuts, açai berries and timber, and the traffic of products from illegal economic activities.

Informality and illegality in the Amazonian context relate to other crimes representing a pervasive challenge. According to participant 18E “... we all know that drug trafficking likewise illegal mining generates other social vices: human trafficking, women trafficking, it

is obviously a problem”. Respondents recurrently reinforced the need for monitoring to prevent illegal activities often connecting with the government's failure to enforce the environmental protection laws.

Participants repeatedly manifested their concerns with territorial issues. In the Pan-Amazonia, illegal and informal activities such as mining, logging, drug production and land trafficking often happen in Indigenous territories and PAs. IPLCs struggle to protect their territory and are forced to move or follow informal rules as there is no government enforcement. Disputes and conflicts are part of entrepreneurial initiatives' challenges and, often, routine. Individuals and organisations have no legal or formal rights over their production land; therefore, they are unable to access assistance and financing and represent a reputational risk for entrepreneurial initiatives. Territories' rights are a major issue in Amazonia.

The research analysis through open and axial coding of tensions resulted in the main concepts related to paradoxes. Table 9 clarifies each concept emerging from data presenting illustrative quotes.

Table 9: Illustrative quotes

Interviewee type	Illustrative quotes	Concepts
Research institution director (23E)	[...] the effect of climate regulation, in terms of the water cycle, and nutrient cycle, as well as the opposite effect, greenhouse effect, and Cooling of Amazonia, is very important at a global level...	Global concerns
Government manager (09E)	[...] in North Amazonia, there is environmental contamination by the oil industry [...] the water that has accumulated there for millions of years. This water is poured into the rivers, to the streams of Amazonia water.	Negative socio-environmental impact
Government researcher (15E)	[...] you limit the extractive reserves and restrict the agriculture in glades [...] the greatest Amazonia nuts regeneration is in the glades. But when you do that, you break a natural cycle of renewal of the nuts.	Protection, maintenance & regeneration
Auditor (08E)	[...] the production from the native communities is so small that sometimes it doesn't justify travel days in the river and it is challenging to move this product to a port.	Business scaling
Certification auditor (01E)	[...] the trader charges the price he wants [...] the organisation must pay or decide not to work with them, but there are few other options.	Infrastructure & intermediation dependence
NGO coordinator (05E)	They have to understand many accounting, tax, tributaries, and laws issues. That training, information is what they do not have clear in their early years... and every 3 years there can be a change [...] There is no continuity in the managerial part...	Management & business competencies
Government researcher (15E)	[...] you are going to make a contract, and then the company sets a lot of contractual conditions. Those who work in the informal market look at all contractual conditions and get terrified [...]	Market dynamics & commercialisation
NGO analyst (20E)	[...] the extraction of any product requires an investment [...] any forestry or work is categorized as high risk, and... financial entities do not grant the financing that many producers require to be able to start the harvesting process.	Working capital & credit access

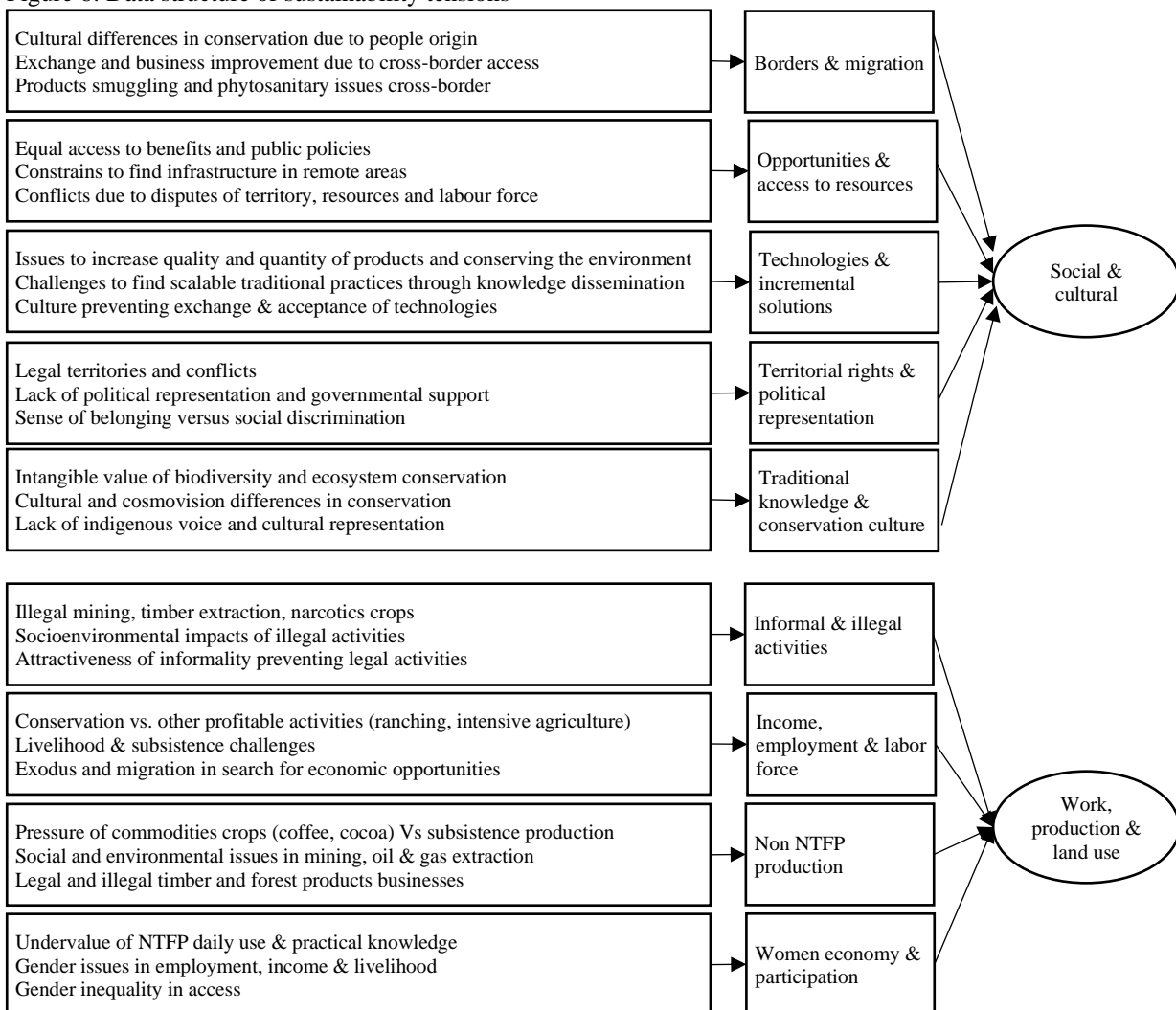


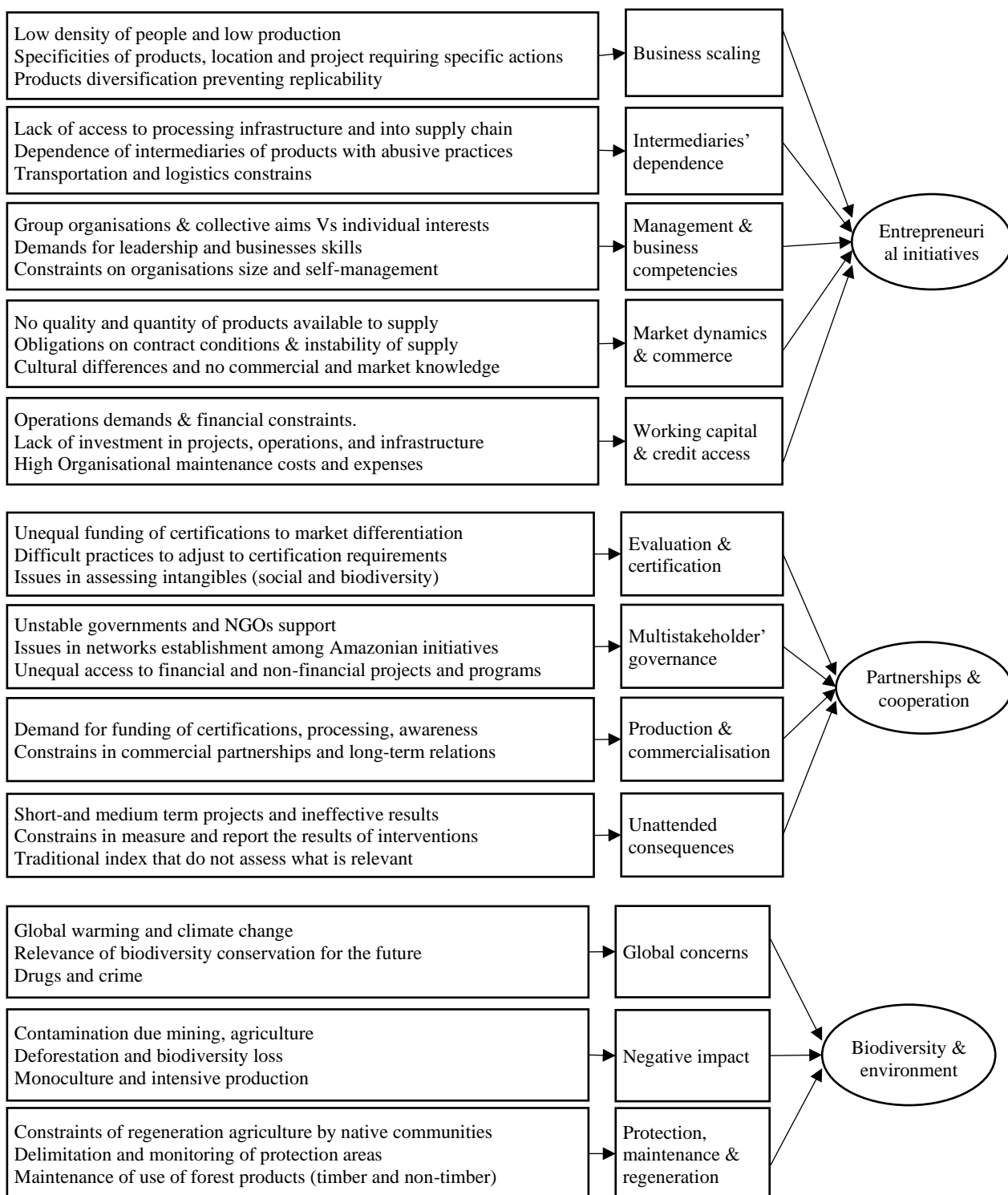
NGO manager (16E)	It was very difficult for the communities to certify, even now, it is very difficult to certify because certification is expensive. Only companies or NGOs can help to pay for the certification.	Evaluation & certification
NGO director (028E)	[...] the way they operated these resources was always the same, it was a donation for a social organisation to execute a project for a determined time, expecting a set of delimited results.	Multi-organisations governance
Entrepreneur (035P)	[...] to have the product we need to make the effort for them, so we are changing the supplier profile, we are searching for associations, established structures to make a little less effort because our difficulty level is too big making it difficult to grow.	Organisations establishment
NGO manager (017E)	[...] they used to go to a national fair... and all selling the same product with no difference... and didn't realise they were competing and there was a problem because some were lowering the price and others were not.	Production & commercialisation
Certification auditor (11E)	On many occasions, we've seen these programs reaching that stage of delivering the equipment or the product, and then they leave [...] the organisation doesn't know what to do with that equipment, and it becomes obsolete. So, there is no follow-up.	Unattended consequences
Government coordinator (04E)	[...] in the Forestry Sector, because these are timber and non-timber forest products, there is a lack of funding for these producers to become competitive. There is a lot of financing for the rice farmer, corn, fruits...	Government priorities
Certification auditor (11E)	The Ministry of Environment tries to provide more support for environmental sustainability[...]organic production, fair trade and all these topics[...] The Ministry of Development comes with another theme: we must produce more; we must put chemicals [...] there is a shock where the producer is between the sword and the wall[...]	Policies & government interventions
Certification auditor (08E)	But it also changes from Government to Government. Sometimes some programs are cancelled upon the entry of a new government, or new programs start, or program budgets are reduced [...]	Policy discontinuity & changes of governors
NGO coordinator (05E)	[...] there is this problem of the migrant who goes to the forest to take advantage of everything and turn the land into agriculture. And does not work for the conservation, the forest, or biodiversity.	Borders & migration
Government researcher (15E)	The internet is fundamental because it relates to education, information access and liberty to access the market. But you have internet coverage where 10% of the population with access rights.	Opportunities & access to resources
Entrepreneur (035P)	[...] we know we will eventually bother the Amazonian with our innovative product, but we try to do it with the maximum respect and limits [...]	Technologies & incremental solutions
Academic researcher (06E)	Including the theme of fighting for the territory, for defending mother nature which implies the fight against the mining invasion, of extractive industries.	Territorial rights & political representation
Government researcher (13E)	Those people who live there, inside the forest, are more concerned with reforestation, seeing a clear area and planting a seedling, in trying to keep the process moving more properly.	Traditional knowledge & conservation culture
NGO coordinator (07E)	[...] to sustain a coffee or cocoa production model, if we compare it with another model of coca leaf, it is much more profitable, the process is much faster. And the peasant sees it is easier...	Illegal activities
Certification auditor (01E)	[...] associates or partners of these organisations of collectors, many of them had other jobs as collectors in the plantation farmers of people who had much more capital	Income, employment & labour force share
Government manager (09E)	There are cases of farmers who left the farm because [...] the company when you start working, there are shifts: 15 days working and 15 days off, but they still pay you the full month.	Non NTFP production
Entrepreneur (28P)	... the women are fundamental, not only because of the work but also the knowledge: to choose the best fruit and cook to make it mature. [...] Here education is a bit complicated to study because you have to leave your home, your town [...] So, the majority of women do not study.	Women economy & participation

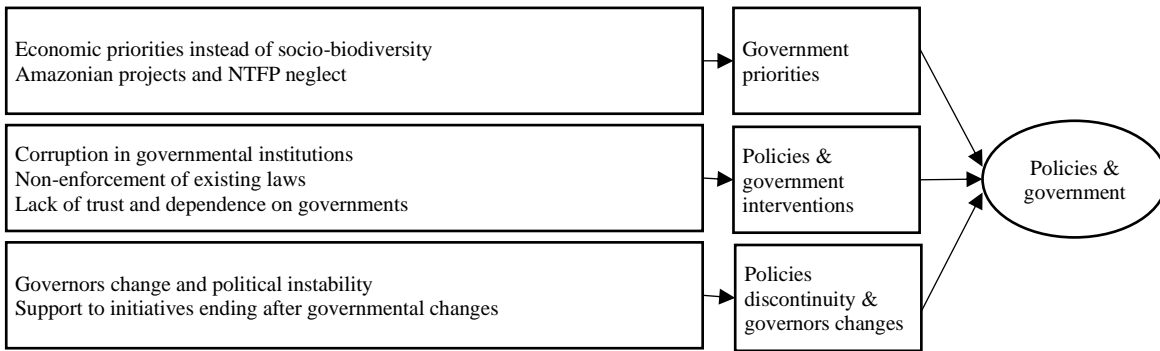
### 4.2.1 Data structure of sustainability tensions

In the examination of the socio-biodiversity entrepreneurial initiatives, sustainability tensions emerged as part of the routine organisations and stakeholders. Their narrative contributed to the identification of tensions and understanding the connections. Figure 6 presents the six high-level categories representing the main tensions in the area. These categories supported the construction of causal structures in section 4.3.

Figure 6: Data structure of sustainability tensions







### 4.3 FEEDBACK STRUCTURE AND CAUSAL MAPPING

Respondents' narratives provided a vivid description of causal relationships among tensions which enable the analysis of the interconnection of elements. Following the literature, the sustainability paradoxes are “contradictory yet interrelated elements that exist simultaneously and persist over time” (Smith & Lewis, 2011, p. 382) which feedback structures are “... a setting where existing conditions lead to decisions that cause changes in the surrounding conditions, which influence later decisions.” (Forrester, 1993, p. 202). The representation of those structures results in causal maps.

The chain of causal links enables understanding the elements forming paradoxical situations. This causal mapping followed the systems dynamics logic where the arrows have a plus or minus sign to indicate the polarity of the connection of two variables. A plus sign implies that an increase (or decrease) in a variable X leads to an increase (or decrease) in Y; and a minus sign, that an increase (or decrease) in X leads to a decrease (or increase) in Y (Repenning and Sterman, 2002).

Table 10 illustrates examples of causal relations and polarities of this research. In the illustration, in a (+) relationship polarity, if Management & business competencies increase, Partnerships & cooperation will be higher than before (or, if Management & business competencies decrease, Partnerships & cooperation will be lower than before). In (-) relationship polarity, if the Policy discontinuity & changes of governors increase, Territorial rights & political representation decrease. The relationships emerge from the coding process and the construction of the data structure. The complete list is available in Appendix B.

Table 10: Illustration of relationship coding

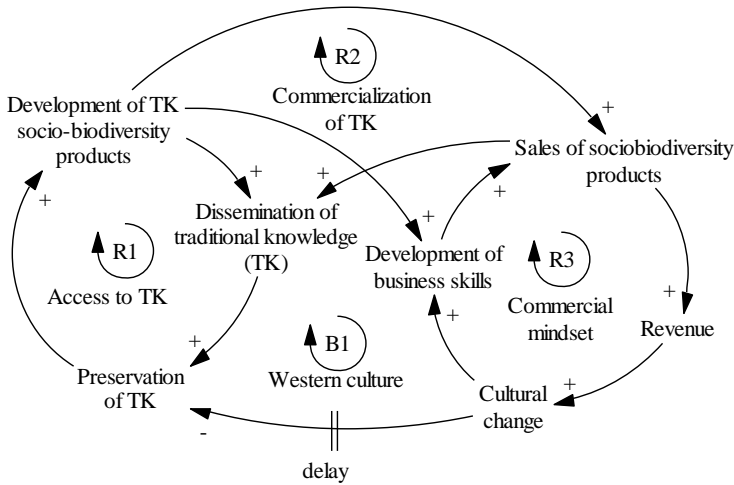
<b>From Name</b>	<b>Polarity</b>	<b>To Name</b>
\Entrepreneurial initiatives challenges\ Management & business competencies	→ +	\Entrepreneurial initiatives challenges\ Partnerships & cooperation
\Policies and Government\ Policy discontinuity & changes of governors	→ -	\Indigenous people and local communities\ Territorial rights & political representation

In this research, interviews lead to six paradoxes joining the most mentioned tensions. Each paradox has a causal map with the least number of variables in the attempt to reach an effective size and complexity to communicate how they generate the dynamics (Stermann, 2000). There is no exhaustive number of tensions in a paradox as increasing the boundaries of a causal map would uncover other paradoxes. Likewise, there is no limited number of paradoxes as the results illustrate the main tensions at the distinct levels.

#### **4.3.1 The paradox of commercialisation of traditional knowledge (TK)**

The TK preservation and cultural change embrace connected virtuous cycles (Figure 7). There is the preservation of TK increasing the development of TK socio-biodiversity products to disseminate the TK that is the reinforcing loop of access to TK (R1). Consequently, it enhances the development of business skills boosting sales of socio-biodiversity products that strengthen the dissemination of TK in another positive loop of commercialisation of TK (R2). However, the sales of socio-biodiversity products raise revenue and increase the cultural change towards a commercial mindset (R3). After a delay, these changes lower the preservation of TK, reducing the development of TK socio-biodiversity products and creating a balancing loop (B1) of Western culture.

Figure 7 Paradox of commercialisation of traditional knowledge



**Illustrative quotes:**

“... It is a product loaded of meaning, for being an ancestral, Brazilian product of Indigenous origin but it was not adapted for the market...” - 035P

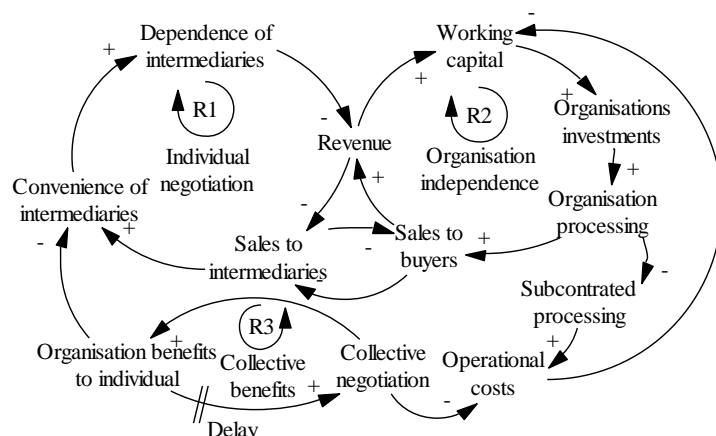
“At this moment we see that money is useful. But we realise what we’ve lost, right? We lost the woods, trees... medicinal plants and animals also run away. And if you are not prepared to invest the money you did, you’ll end up poorer.” - 028P

Respondents from entrepreneurial initiatives working with IPLCs and supporting organisations brought declared their concern in preserving the TK and cultural heritage. In their own and external projects and programs, interference is inevitable. One initiative coped with this paradox after the Indigenous group requested and chose the representatives in the decision-making process.

**4.3.2 The paradox of organisational disengagement**

A recurrent challenge at the organisational level is the paradox of organisational development (Figure 8). This paradox joins three reinforcing loops linked to processing and sales. In R1, individual negotiation of socio-biodiversity and sales to intermediaries is convenient to extractivists (as intermediaries manage the logistics and often swap products for staple food). However, this increases the dependence on intermediaries and reduces the revenue of the extractivists, requiring more sales. The loops R2 describe the organisations' businesses' capacities and collective negotiation which enable the reduction of operational costs and increase the working capital available for investments in processing and direct sales to buyers. It raises the revenue and the capital to reach organisations' independence. Loop R3 shows that collective negotiation increases the benefits to individuals and reduces the convenience of intermediaries.

Figure 8 Paradox of organisational disengagement

**Illustrative quotes:**

“The guy produces, stays at home and delivers to the intermediary who gives him salt, sugar, oil and let’s do it that it is easier, you know?” - 019E

“... they don’t have the investment that a company can have to do the transport and this maybe make the warehouse not have a lot of volumes...” - 05E

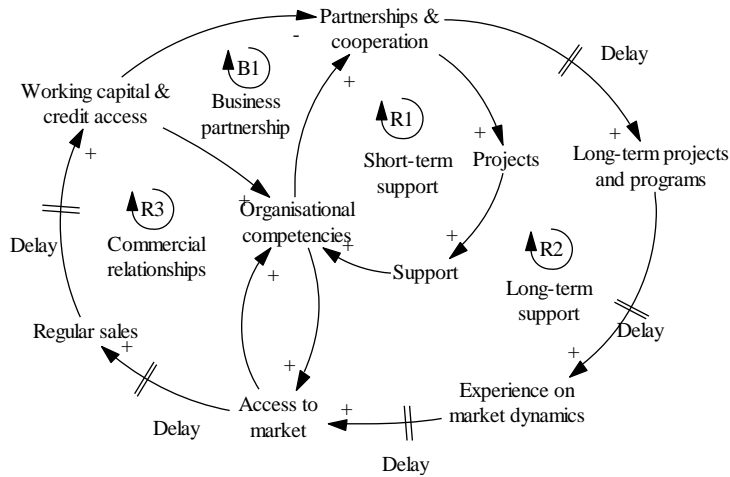
“... they buy products at a very low price and take to regional markets and sell them double or triple priced...” - 018E

Most supporting institutions deal with the paradox of organisational development as their assistance and resources usually focus on established groups such as cooperatives and associations. The benefits for individual extractivist to start and maintain the cooperation should be greater than the convenience of intermediaries.

#### 4.3.3 The paradox of results delay in partnerships

This paradox represents the supporting interventions of external organisations and international cooperation (Figure 9). Loops R1 and R2 represent the short-term and the long-term projects, respectively. The long-term projects and programs have delays representing the time for organisations to increase the experience on market dynamics which, after a delay, will increase the organisations’ regular access to markets and the organisational competencies. The reinforcing loop of commercial relationships R3 has the regular sales increasing the working capital and the access to credit which decreases the necessity of partnerships and cooperation. This loop B1 represents the balancing loop where the business partnerships bring independence to organisations.

Figure 9: Paradox of results delay in partnerships



**Illustrative quotes:**

“Everybody wants to work with a community that is already organized... it is the easiest thing in the world to put a resource, a project, but until the organisation gets there, most time it doesn't work”. - 019E

“...through our own client, we have a friendship with the business manager through Fairtrade, we have managed to get them to support us with a small amount of funding to strengthen two associations we work with in the European market.” - 10E

This paradox also comprises the supporting institutions being able to assist established organisations due to the resources pipeline. Organisations receiving more support can form other partnerships and consequently have more support.

**4.3.4 The paradox of environmental management flaws**

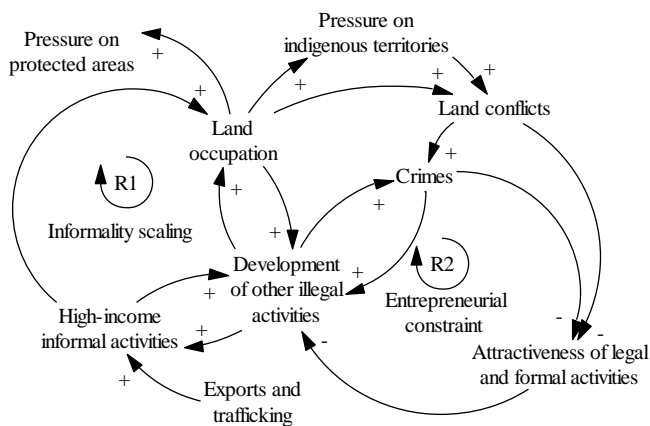
The paradox of environmental management expresses the macrolevel policies which prevent entrepreneurial initiatives of socio-biodiversity at the local level. Figure 10 presents R1 as a reinforcing loop of forest management, linking forest maintenance and regeneration to extractive agriculture, where human intervention involves subsistence agriculture, use and farming of native trees. The development of extractive agriculture increases forest maintenance and regeneration, consequently raising extractive agriculture. In the R2 loop, agricultural land use refers to the farming process after the slash-and-burn that allows monoculture farming to commodities production. There is a reinforcing logic in the increase in agricultural land use, consequently raising the monoculture and soil degradation. When soil degradation increases, forest maintenance and regeneration decrease causing the need for agriculture frontier expansion to new areas of agricultural land use. Loop R1 shows a virtuous cycle and R2, a vicious one. Both loops are recurrent in Amazonia.

In Amazonia, countries define the PAs as a conservation intervention. In B1, this governmental intervention in agriculture restrictions reduces agricultural land use, decreasing monoculture farming and soil degradation, increasing forest maintenance and regeneration that reduces the need for agriculture restrictions. However, when agricultural land use increases, the chain effect of the growth of monoculture and soil degradation, reduction in





Figure 11: Informal and illicit economy

**Illustrative quotes:**

“...it is one more business that takes place within Amazonia. There is the drug business, there is logging, mining[...] the problems generated by migrations, which have to do with prostitution and white slavery, especially women are the most affected - 021E

“... highways attract immigration, and immigration attracts land traffic and land traffic attracts trafficking mafias.” - 018EPE

This paradox affects the entrepreneurial initiatives as respondents said high-income informal activities dispute land use and workforce increasing the living cost in the area. Moreover, it goes beyond the entrepreneurial concerns as it has harmful implications for IPLCs safeguarding and security. Several interviewees reported cases of informal, illegal and criminal activities such as informal mining and logging, smuggling, invasions, trafficking, and murders.

#### 4.3.6 The paradox of scaling the diversity

This paradox was the result of the interview analysis and required the spatial literature to fill gaps in causal connections. Therefore, there is no representation of a causal loop diagram as there are gaps concerning the variables and causal links. The paradox is based on several respondents declaring the urgent need for scalable solutions in Amazonia while stating it is tricky to find scalability in socio-biodiversity products and services. For example, açai production has been questioned due to the implementation of monoculture systems in particular areas affecting biodiversity. Another example is the project of *caoutchouc* production through a small-scale vulcanisation process to add value to the product. It is not scalable as focus areas of rubber trees have a low-density population with few people willing to extract *caoutchouc*.

Scalable businesses imply the repetition or replication enabling the project’s expansion with minimum or no changes. Contrarily, diversity requires changes (Goworek et al., 2018). Socio-biodiversity as the background of projects in Amazonia limits the scalability due to contradictory elements in the idea of scalable diversity.

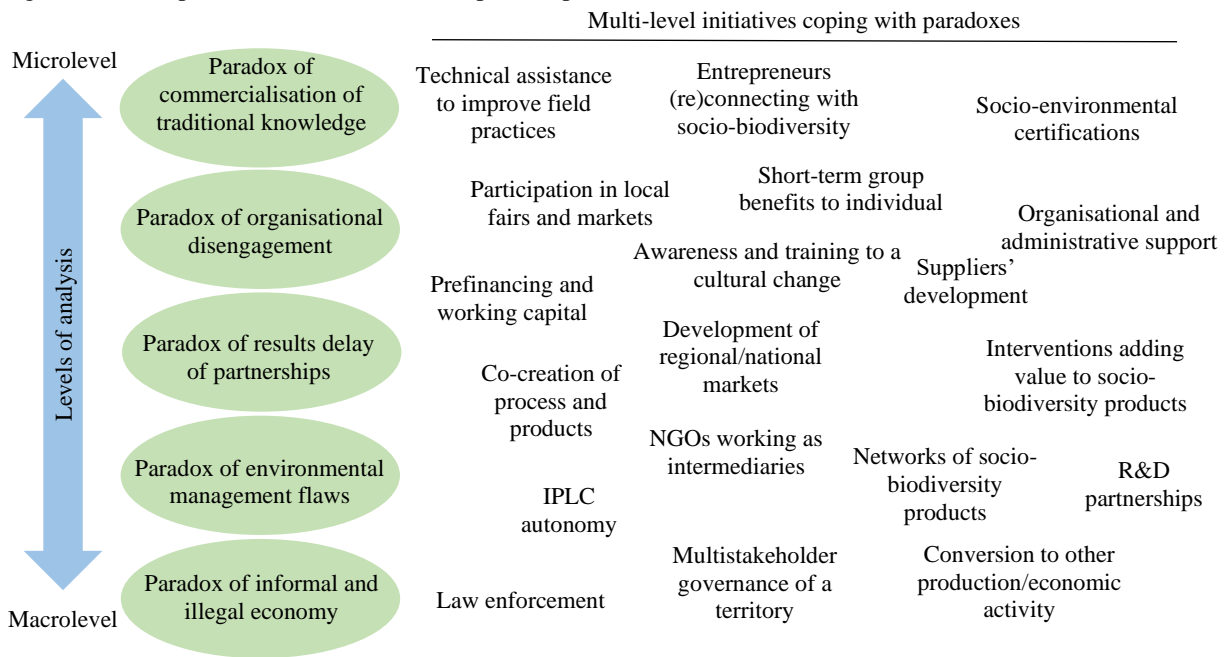
#### 4.4 INITIATIVES COPING WITH SUSTAINABILITY PARADOXES

This section presents the results concerning entrepreneurial initiatives coping with paradoxes. Those initiatives join multiple-level organisations and activities related to socio-biodiversity products and services. The paradox's dualities fit in one level of analysis; however, other elements of tensions escalate to other levels. Likewise, the interventions to cope with the tensions involve levels connecting with higher hierarchies.

The paradox of the 'commercialisation of traditional knowledge', for example, has the dual rationale of the preservation of traditional knowledge and the cultural change due to the commercialisation of socio-biodiversity products. Elements within this paradox were found in the initiatives 'value chain development' (4.1.3), 'resilience of ancestral knowledge' (4.1.5) and 'forest care and surveillance' (4.1.4). Those initiatives faced elements that emerged as tensions on the development of socio-biodiversity products (4.1.3), the commercialisation of socio-biodiversity products (4.1.5) and the cultural changes (4.1.5). Respectively, the initiatives coped with the paradox through the development of a national market, the establishment of a network of original people and a street market, and the shared governance concerning product decision-making.

The causal mapping of the 'commercialisation of traditional knowledge' paradox showed the interconnections of elements and the plurality of tensions. The polarisation of preservation of TK and cultural change is therefore apparent as latent tensions are less obvious when understanding and analysing a paradox. Likewise, the paradox of 'organisational disengagement' represents the duality of individual versus collective interests and also the plurality involving intermediaries, subcontractors, buyers, fair commercial conditions, and issues in logistics infrastructures. Other causal mappings presented in section 4.3 have the same logic as respondents presented separated parts of a paradox. Figure 12 presents the main interventions of the paradoxes and initiatives of socio-biodiversity products and services found in this research.

Figure 12: Multiple-level interventions to cope with paradoxes



In Amazonia, multiple-level initiatives cope with plural and interconnected elements, escalating tensions and sustainability paradoxes of socio-biodiversity products and services. The escalation of tensions through levels of analysis encompasses additional stakeholders and coping interventions and, as a consequence, the spatial escalation of solutions. The paradox of ‘results delay in partnerships’, for example, has the dual logic of short versus long-term support. The delay in the results traps the supporting organisations in a short-term reinforcing cycle, in which the organisations do not reach the business competencies to access other forms of commercial partnerships. The escalation of the solutions requires long-term and multi-organisations programs to align the short-term support and aid in multiple organisational competencies and access to the market. In Amazonia, developing commercial relationships involves a spatial expansion to other areas due to the fragmented consumer market.

## 5 DISCUSSION

### 5.1 SUSTAINABILITY PARADOXES AND SYSTEMS

The synergies of paradoxes' lens and systems approach shed light on alternatives to understanding complexity and wicked problems. Paradoxes studies present dualities and polarities (Smith & Lewis, 2011; Schad et al., 2016) that can be managed through acceptance, clarification of levels of analysis and temporal separation (Poole & Van de Ven, 1989; Smith, 2000). So, the pluralism within those dualities and complexity become salient (Eisenhardt, 2000; Quinn & Cameron, 1988). Systems thinking has the interconnections of elements in (sub) systems of flows comprising causal feedback relationships and emergent dynamic structures. In this research, system thinking has intrinsic pluralist characteristics as paradoxes can only be explained through plural elements.

At the individual level, inputs from different respondents and sources offered an understanding of tensions and their relationships describing dualities. For example, the informal and illicit economy has a reinforcing loop of illegal activities preventing the development of a positive loop of the formal economy. The interconnections of those dual tensions explain pieces of a paradox. When analysing the other elements, the exports or international trafficking increase the force of the loop due to the generation of higher income. Although the clarification of a paradox's dualities simplifies its understanding, the interconnected elements describe the complexity at a higher level.

At the individual level, the perceived tensions explain parts of paradoxes. Organisations, however, frequently fail to notice and act on latent tensions (Bansal et al., 2017) as they are hidden within relationships in multilevel. In the Amazonian context, socio-biodiversity entrepreneurial initiatives are formed by a group of stakeholders as the result of an inter-organisational convergence. In wicked problems, one level of analysis explains parts of paradoxes often dismissing elements that escalate to other levels. The systems thinking explanation has different mental models delivering distinct information. Mixed messages are part of the flow of a system. As a consequence, the development of interventions to solve tensions based on mixed messages involves other levels of disconnected actions.

In this study, the interconnectivity and interdependence relate to the exchanges between the forest and the communities. The maintenance of the forest is essential to people and vice-versa. Although human interventions can produce negative consequences for the

forest, they also potentially provide positive solutions such as genetic improvement, and domestication of native species. This represents a paradox of development and environmental preservation.

At the macrolevel, the scope of environmental management, its degrees of conservation and human interference require multi-organisations governance to address the ecological specificities and social diversities of each territory. In this study, governance and property generate tensions when having different responsible institutions and contrasting or even conflicting organisations' objectives. Respondents from Brazil, Bolivia, Ecuador and Peru described the tensions among supporting organisations, governments, private companies and buyers. Macrolevel flows do not reach the lower levels of the system.

Systemically, the emergence of a hierarchical upper level serves lower ones towards productivity, stability or resilience (Meadows, 2008). The emergence property of a system indicates the constant reconfiguration of elements. Hierarchies of systems constantly emerge in socio-biodiversity entrepreneurial initiatives as a dominant process. For example, monoculture, mining or illicit production emerge as scalable economic activities pressuring the socio-biodiversity economy.

## 5.2 SOCIO-BIODIVERSITY INITIATIVES

The nine entrepreneurial initiatives in Amazonia shed light on the organisational development that is relevant to market access. The main aspects differentiating entrepreneurial initiatives are social configuration, organisational establishment, product or service ready to market, stable market relationship, profits or returns, and governance. These characteristics relate to the main bottlenecks for Amazonia's entrepreneurial initiatives. It is important to remark on the large range of other initiatives in Amazonia that do not answer to any of the mentioned aspects.

The studied initiatives had recognition and were recommended by stakeholders. Even though, they deal with numerous challenges. They face issues related to, for example, the exodus eroding the social configuration, market product dependent on inefficient processes, single customer relationships, and unstable governance, among others.

All economic activities embedded in Amazonia deal with several elements of socio-biodiversity. Even initiatives such as grazing, cattle production and monoculture agriculture have an uncontested impact on countries' wealth and the Amazonian ecosystem. Interviewees

recognise the socioeconomic relevance of non-socio-biodiversity products and services to the necessary economic diversification. The literature, however, cautions against the expansion of the agriculture frontier as in the Brazilian case, there are enough agricultural lands to fill future needs (Strassburg et al., 2014).

In Amazonia, there are virtuous cycles of socio-biodiversity products and services contributing to conservation, regeneration and people's income. There are also vicious cycles of degradation and impoverishment (Fisher & Christopher, 2007). Interviewees declare that activities such as coca production, gold and copper mining, and ranching mainly supply the export market. The attractiveness of high-income products increases the force of vicious cycles as they captivate workers of other businesses, raising salaries and prices, reducing the appeal of formal activities and preventing conservation due to the production of environmental externalities.

Organisations addressing illicit production through the conversion to cocoa or coffee faced a paradox as the solution was not economically and culturally appealing. There were different perceptions of local tensions and how to address them. This is described in the literature as perceptual polarities that lead people to send mixed messages to resolve a paradox and the diffusion of those messages to other hierarchical levels. The perception of formal versus informal duality had the monoculture of cocoa and coffee as a scalable solution. Other elements such as culture and economic pressure cause the persistence of this paradox.

The entrepreneurial initiatives of this study have particular characteristics that make them unique. It means there is no obvious scalable solution. Scalable options deal with commodities, grazing and cattle ranching. Socio-biodiversity entrepreneurial initiatives are handmade patchwork. They face a variety of persistent paradoxes in which formal associations and cooperatives require continuous engagement from the participants and long-term support from stakeholders. Usually, they constitute small-scale businesses in low-density areas, small communities, limited production capacity and restricted infrastructure and transportation. Several organisations search to scale up solutions so common practices have less success in specific issues such as cultural preservation and socio-biodiversity traditional knowledge.

Entrepreneurial initiatives embrace multiple mosaics as they have permeable boundaries of people and organisations' roles and interrelations. In Pan-Amazonia, the

overlap of history, people, cultures, livelihood, and biodiversity enables the socio-biodiversity entrepreneurial initiatives and illustrates the territorial issues. The virtuous cycles of socio-biodiversity products and services begin at an individual level. People's exchanges with the environment generate entrepreneurial initiatives. It is a micro-level requiring specific interventions from macrolevel policies.

### 5.3 SPACE, PLACE AND TERRITORY

In this research, the entrepreneurial initiative of Protection Area certification in Bolivia succeeded in having multi-organisations governance adapted to a Reserve of Wildlife. The model of territorial shared governance brought economic security to communities inside the PA, offering the necessary business support, processing infrastructure and transportation management. The economic results bring stability to the model; however, political interferences and constant changes of managers represent a constant threat bringing uncertainty to stakeholders.

There are distinct power relations established in Amazonia overlapping the political definition of territories of IPLCs, the limits of PAs and legal land ownership. Especially in areas where marginalized groups emerge as alternative political power, there is a major impact on territorial rights and governance. Corruption, competition, and confrontation are likely to happen when coexistence and cooperation fail (Blume et al., 2022). Additionally, land informality and trafficking increase uncertainty and the risk to entrepreneurial initiatives and their value chain.

Considering distances and scales is crucial for socio-biodiversity entrepreneurial initiatives in Pan-Amazonia. Studies rely on spatial information and maps to have a large-scale overview of Amazonia (Finer, 2008; Brandão et al., 2021; Furumo & Aide, 2017; (Strassburg et al. 2014). Spatial tools also support the monitoring of biodiversity (FAO, 2020) and alternatives for local analysis such as participatory mapping.

Objectively, moving a small-scale production from a low-density village to a larger yet small town means great distances and several transport modes. Transportation networks relate to logistic costs and risks for entrepreneurial initiatives. In abstract terms, networks of organisations supporting the initiatives are essential to connect forest people with outside opportunities. They fill a gap in large spaces of disconnection (Goworek et al., 2018) as there are no significant consumer markets in the forest.



The discussion of sustainability in socio-biodiversity entrepreneurial initiatives connects the dynamics of space and related concepts of territory and place. The place as the lens people use to see the world has what exists in Amazonia (ontology) and the way of knowing reality (epistemology). The objective place is the main resource for organisations and distances are the physical constraints. The abstract place has a historically mixed culture attached to the biodiversity.

Mobility infrastructure, transportation under humid and hot weather conditions, countries' limits, and environmental management laws represent the interconnections and flows of the systems. The characteristics of the place control the pace of flows in Amazonia. So, the pace is distinct from the outsiders' expectations where timely quantity and quality are the buyers' minimum requirements.



## 6 CONCLUSION

This research embraced the systemic perspective (Brundtland et al., 1987; Bansal & Song, 2017) to address the sustainability paradoxes in multilevel. Specifically, the study intended to answer how socio-biodiversity entrepreneurial initiatives cope with sustainability paradoxes. The responses to paradoxes rely on the natural splitting of tensions due to the atypical spatial context. The physical distances and natural environment isolation of people and organisations reduce the force of tensions and disturb the understanding of sustainability paradoxes.

Despite the existence of numerous paradoxes in the area, in general, organisations cope with different parts of tensions. A multi-scale spatial perspective explains the sustainability paradoxes as the spatial constraints have four implications:

### 6.1 DUALITY AND SYSTEMIC PERSISTENCE OF PARADOXES

The challenge of coping with paradoxes lies in the human nature of understanding dualities, polarisations, and parts of tensions (Smith & Lewis, 2011; Schad et al., 2016). They provide an easier explanation which strengthens the idea of bias hiding essential elements (Schad & Bansal, 2018). For example, easier explanations make organisations believe in a Western entrepreneurial model where entrepreneurs have an inner initiative and action, the environment is a silent supplier, and the buyer shapes the commercial rules. In reality, this idea of entrepreneurs does not fit the Amazonian context; the environment represents the social and the biodiversity driving the quantity and quality of commercialisation.

Biased consideration of elements is the foundation of paradoxes' persistence as it leads to (biased) interventions and then, solutions failures. In Amazonia, interventions to implement new scalable crops and short-term training to develop business capabilities and market mindset are often misunderstood or criticised. So, communities do not engage in the interventions and become resistant.

Most paradoxes presented in the findings were partially known. Patterns are found in other contexts or are historically recurrent in Amazonia. Examples are cultural change due to capital and market mentality or short-term interventions in which discontinuity does not contribute to the independence of organisations. Differently, the paradox of scaling the diversity was not obvious as the structure of causal relationships required the use of existing literature (Grewatsch et al., 2021). The construction of the causal maps supporting the

connection of tension requires further consultation with stakeholders to understand other elements of the paradox and higher-level connections.

As solutions to wicked problems fail (Rittel & Webber, 1973), new patterns emerge and change the system structure. Entrepreneurial initiatives in Amazonia face sustainability paradoxes translated into wicked problems. The complex behaviours of wicked problems are policy-resistant, and obvious solutions to problems may fail or worsen the situation (Sternan, 2000). The duality leads to constant reshaping of wicked problems explaining the persistence of paradoxes.

## 6.2 MULTI-LEVELS OF GOVERNANCE IN COPING WITH PARADOXES

There is a dynamic connection (Checkland, 2000) explaining the system's hierarchy (Meadows, 2008). Systems are nested within and across the levels of analysis and the scales of a territory. Individual, organisational, inter-organisational and macro-environment represent one form of hierarchy. Alternatively, spatial scales in Amazonia represent a valuable form of understanding the hierarchies.

The studied socio-biodiversity entrepreneurial initiatives join people of the 'forest floor' and multiple-level organisations coping with sustainability tensions. Individuals are spread over Amazonia sharing the cultural and physical connection with the place. Governments mainly focus on the political division of the local, regional, national or international territories as boundaries of their influence. Intermediaries and buyers promote a physical connection of spaces as they are involved in the logistics of products from the forest to the outside. Differently, supporting organisations are an abstract spatial link between people in the forest and larger communities, towns and countries. It is an essential role in the connection of micro and macro scales.

According to Ostrom (2010), the type of governance is not the most relevant influence on forest conditions. More relevant is the governance fit with local ecology, the development and adaptation of rules over time, and the people's view of systems' legitimacy and equity. In Amazonia, the conflicts escalate when considering that management is top-down following political governance.

Government priorities and territorial dynamics are unpredictable as there is a general instability of policies due to shifts in political agendas and governor changes after elections. Moreover, the lack of government enforcement concerns the common illegal practice of

territorial trafficking, protected and Indigenous areas invasions, and overall deforestation. And the priority of tangible economic and scalable solutions leaves a negligible place for the specificities of socio-biodiversity. Top-down policies do not embrace the Amazonian mosaic.

### 6.3 PLURALITY AND MULTI-SCALE PERSPECTIVE ON SOCIO-BIODIVERSITY

Amazonia has the remarking diversity representing its richness, likewise regarding its essential problems. Challenges emerge from the diversity in the mosaic of conservation needs and economic activities (Virapongse et al., 2016). To cope with wicked problems, exploring tensions and dualities creatively benefit the finding of pluralism (Eisenhardt, 2000). Most entrepreneurial activities are relevant to Amazonia. It is essential to consider historical economic cycles, developmental incentives and unintended consequences of Amazonia 1.0, 2.0 and 3.0. Currently, there are scientists involved in the project Amazonia 4.0, which focuses on the implantation of an Amazonian bioeconomy. The technological and innovative solutions of bioeconomy boosting the development of creative industries would be a scenario for creative entrepreneurs and entrepreneurial initiatives.

Systemically, the diversity of new resources, products and services is a competitive differentiation, which requires protection to balance contexts of monopolizing structures (Meadows, 2008). An example of monopolizing structures in Amazonia is businesses having the power to deprive access to land or biodiversity resources through territorial pressure or financial competition. Protection comes through policies and market structures.

Top-bottom decisions in Amazonia do not answer to the socio-biodiversity specificities. In natural systems, macrolevel systems emerge to serve the subsystem's function or purpose (Meadows, 2008). Governance with the Amazonian people is vital. The systemic view of common-pool resources management resonates towards polycentric and multistakeholder governance (Ostrom, 2010; Virapongse et al., 2016). In a socio-biodiverse context, scaling networks is more feasible than implementing scalable solutions (Goworek, 2018). Enhancing the existing networks of Amazonia goes beyond the territory and its physical constraints representing structures of virtual places and potential multiple-level networks.

## 6.4 RESEARCH CONTRIBUTIONS

The contributions of this research relate to the incremental theoretical discussion of paradoxes persistence. The duality limits the paradox's understanding. Additionally, spatial separation is a response strategy to paradoxes. However, the natural environment and the spatial constraints in Amazonia work as conflict buffers reducing the exposure to paradoxical tensions. Duality and spatial constraints prevent entrepreneurial initiatives from identifying and confronting the paradoxes. It is a counterintuitive logic and an alternative explanation of organisational paradoxes' persistence.

As a methodological contribution, the systems analysis represents a valuable technique for describing the underlying paradoxes of sustainability. In systems studies, mental models are actors' beliefs about how a system works and they are often inaccurate (Forrester, 1961; Sterman, 2000; Meadows, 2008; Sherwood, 2007). They are valuable "examples" or pictures of parts of a system, though. Therefore, paradoxes become salient as the interconnections of tensions become clear. Theoretically, paradoxes and systems thinking together provide an excellent match to analyse the complexity of wicked problems.

A practical contribution refers to the theoretical discussion on scaling and diversity. Scaling solutions demand replication and repetition of products, processes, and infrastructure, reducing costs. However, it contradicts the fundamental differences of the diversity definition. The changes required by solutions in socio-biodiversity products, processes and infrastructure are specific, thus, not scalable. Instead, it is feasible to scale networks, platforms and linkages.

## 6.5 FUTURE RESEARCH AND LIMITATIONS

In management studies, the study of tensions and paradoxes is an evolving field. Several studies helped to consolidate the perspective of paradoxes (Lewis & Smith, 2014). A review of paradoxes studies (Schad et al., 2016) remarked three essential themes to further investigations: individual approaches, relationships, and dynamics. These themes connect paradoxes and systems concepts and clarify how tensions emerge and different levels cope with them.

System dynamicists strongly recommend the quantitative analysis following the qualitative one. This research presents a qualitative analysis through the construction of the system's structure. This structure would support the definition of a dynamic hypothesis to a

systems dynamics model and simulation. The model, therefore, is a suggestion for future research. This model is relevant to address the dynamics of a systems analysis.

The diversity of objectives and motivations among organisations forming the initiatives in Amazonia is relevant to understanding the development of entrepreneurial interventions. Therefore, studies on entrepreneurial ecosystems, networks, and cross-sector collaborations in Amazonia would provide insights into the values and missions of organisations shaping local entrepreneurship. Additionally, the focus on entrepreneurs would clarify how they receive and internalise the external inputs from supporting organisations, nature or other time-space influences (Bansal & Knox-Hayes, 2013).

It was a long challenge the search for the definition of the cases until understanding that, due to the lack of unity, it was not a case study. As the responsibilities and interactions of people, organisations, and governments overlap in places and territories, they represent multiple mosaics explaining the difficulty of finding the unit of analysis. Future research embracing entrepreneurial initiatives could focus on R&D institutions as the unity of analysis and how they connect business and the environment. Those institutions represent relevant stakeholders in the development of the area.

Many other unanswered questions inform investigations involving entrepreneurial initiatives in socio-biodiversity. In this context of social-ecological systems, to what extent do non-material stakeholders shape and are shaped by entrepreneurship? Focusing on the practical contributions, a question is: what are the replicable processes or structures addressing the scalability of entrepreneurial initiatives?

Amazonia is a long-time theme of study in many disciplines. Therefore, there is a huge body of literature and several specialists in the subject. Previous studies formed a strong base for the research. However, data collection happened during the pandemic when observations and visits in loco were not possible. This caused another limitation which is the collaborative constructions of the causal structure.





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## GLOSSARY

**Causal diagrams:** “tools for diagramming the feedback structure of system... showing the causal links among variables with arrows from a cause to an effect. (Sterman, 2000, p. 102)

**Environmental management:** the management of complex environmental systems where governance has the participation and collaboration of diverse stakeholders in environmental decision-making (Virapongse et al., 2016)

**Causal structures:** the representation of circular processes (or feedbacks) as “... a setting where existing conditions lead to decisions that cause changes in the surrounding conditions, which influence later decisions.” (Forrester, 1993, p. 8).

**Levels of analysis of corporate sustainability:** individual, organisation, stakeholder, and macro-environment levels “meaning to the focal construct of corporate sustainability but also provides more accurate operationalisation for robust empirical research” (Bansal & Song, 2017, p. 110)

**Socio-biodiversity entrepreneurial initiatives:** the interventions of private, public and civil society organisations such as plans, programs, projects, activities and actions to the development of businesses based on goods, services and benefits from the use of native species representing the livelihood, culture, traditional knowledge, and religion of communities (MMA, 2009; Ribeiro & Soares Filho, 2022).

**Sustainability paradoxes:** “contradictory yet interrelated elements that exist simultaneously and persist over time” (Smith & Lewis, 2011, p. 382) and affect the development that meets present and future needs (Brundtland et al., 1997). Sustainable development embraces the connections of those contradictory elements, beyond the triple bottom line “... shifting and reforming foci of tension over time that could be complex and multidimensional.” (Smith et al., 2017, p. 6)

**Systemic approach:** it represents the varied theories and concepts of system movement where “the common factor that they all make use of the concept system” (Checkland & Haynes, 1994, p. 191).

**Systems:** “[...] a group of elements or parts coherently organised and interconnected in a pattern or structure that produces a characteristic set of behaviours (Meadows, 2008, p. 188), often classified as their “function” or “purpose”. “The systems are an adaptive whole... that may adapt and survive in a changing environment” (Checkland & Haynes, 1994, p. 189).



## APPENDIX A

### INTERVIEW PROTOCOL

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		Organisation: Interviewee: Topics covered: Documents received: Comments and follow-ups post-interview:
<hr/>		
Initial presentation	0	How long have you been...
Experience	0.1	...in this position and role _____?
Experience	0.2	...in this institution _____?
Experience	0.3	...involved in sustainability?
Experience	0.4	At (name of the organisation), what are your main responsibilities?
<hr/>		
Organisational	1	What are the main products here in the region?
Organisational	1.1	What is your involvement with socio-biodiversity products or services?
Organisational	1.2	Which organisations do you work with?
Organisational	2	In your opinion, what are the main factors that facilitate or hinder the existence of (name the socio-biodiversity) organisations?
Organisational	2.1	Has this situation (facilitating or hindering factors mentioned) existed for a long time?
Organisational	2.2	How did it change over time?
<hr/>		
Inter-organisational	3	Can you describe the relationship between your institution and the (name the socio-biodiversity) organisations?
Inter-organisational	4	Are you in contact with other institutions that work with (name the socio-biodiversity) organisations?
Inter-organisational	4.1	What are the main institutions (inside and outside the supply chain)?
Inter-organisational	4.2	Any foreign institution?
Inter-organisational	5	Can you describe the relationships between (name of main institutions) and (name of the socio-biodiversity) organisations?
Inter-organisational	5.1	Has this relationship changed over time?
<hr/>		
Macro-environment	6	Are there special policies and subsidies for (name the socio-biodiversity) production?
Macro-environment	6.1	What are the most used ones?
Macro-environment	7	Does the organisation of (name the socio-biodiversity) producers receive support from other institutions?
Macro-environment	7.1	How did the support change over time?
Macro-environment	8	Do the organisation have to comply with the requirements of other organisations?
Macro-environment	8.1	Any national or international organisation?

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## APPENDIX B

### INTERVIEWEES LIST

Org. ref.	Interviewees / Key Informants	Research group	Type of organisations	Description	Country	Time
001EBO	Regional Manager	Specialists	Regional NGO	Support through funding, technical assistance and representation of collectors and producers	Bolivia	0:50:45
002EBO	Socio-environmental Auditor	Specialists	Certification body	Third-party audit services to organisations, enterprises, and individuals in organic, fairtrade or forestry certifications	Bolivia	0:56:51
003EEC	Socio-environmental Auditor	Specialists	Certification body	Third-party audit services to organisations, enterprises, and individuals in organic, fairtrade or forestry certifications	Ecuador	1:07:18
004EPE	Director Government	Specialists	Government	Support through funding, technical assistance and multi-stakeholder projects and programs	Peru	0:44:57
005EPE	Manager NGO	Specialists	Regional NGO	Support through funding, technical assistance and representation of collectors and producers	Peru	1:04:39
006EPE	Professor and Researcher	Specialists	University	Research in entrepreneurial organisations	Peru	1:07:20
007ECO	Coordinator NGO	Specialists	International NGO	Support through funding, technical assistance and representation of collectors and producers	Colombia	0:57:40
008EPE	Socio-environmental Auditor	Specialists	Certification body	Third-party audit services to organisations, enterprises, and individuals in organic, fairtrade or forestry certifications	Peru	0:55:18
009EEC	Coordinator Government	Specialists	Government	Support through funding, technical assistance and multi-stakeholder projects and programs	Ecuador	1:02:41
010PBO	Community leader	Leaders and Entrepreneurs	Association or Cooperative	Main organisation in an entrepreneurial initiative	Bolivia	0:50:45
011EBO	Socio-environmental Auditor	Specialists	Certification body	Third-party audit services to organisations, enterprises, and individuals in organic, fairtrade or forestry certifications	Bolivia	0:45:02
012EEC	Coordinator Government	Specialists	Government	Support through funding, technical assistance and multi-stakeholder projects and programs	Ecuador	0:28:29
013EBR	Researcher	Specialists	Research institute	Support through technical assistance in socio-biodiversity products, multi-stakeholder research projects and programs	Brazil	1:12:28
014EBR	Researcher	Specialists	Research institute	Support through technical assistance in socio-biodiversity products, multi-stakeholder research projects and programs	Brazil	0:55:58
015EBR	Researcher	Specialists	Research institute	Support through technical assistance in socio-biodiversity products, multi-stakeholder research projects and programs	Brazil	1:38:44
016EBO	Coordinador NGO	Leaders and Entrepreneurs	International NGO	Support through funding, technical assistance and multi-stakeholder projects and programs	Bolivia	1:42:19
017EBO	Coordinador NGO	Specialists	International NGO	Support through funding, technical assistance and multi-stakeholder projects and programs	Bolivia	0:50:00

018EPE	Director NGO	Specialists	International NGO	Support through funding, technical assistance and multi-stakeholder projects and programs	Peru	0:53:27
019EBR	Field Employee NGO	Specialists	International NGO	Support through funding, technical assistance and multi-stakeholder projects and programs	Brazil	0:56:47
020EPE	Field Employee NGO	Specialists	International NGO	Support through funding, technical assistance and multi-stakeholder projects and programs	Peru	0:52:55
021EVE	Director NGO	Specialists	International NGO	Support through networking and multi-stakeholder projects and programs	Venezuela	0:44:20
022PEC	Community leader	Leaders and Entrepreneurs	Association or Cooperative	Main organisation in an entrepreneurial initiative	Ecuador	0:37:32
023ECO	Director Researcher	Specialists	Research institute	Support through technical assistance in socio-biodiversity products, multi-stakeholder research projects and programs	Colombia	1:05:08
024EBR	Coordinator NGO	Specialists	Multilateral Organisation	Support through funding, technical assistance and multi-stakeholder projects and programs	Other	0:49:23
025PCO	Entrepreneur	Leaders and Entrepreneurs	Social enterprise	Main organisation in an entrepreneurial initiative	Colombia	0:46:08
026PEC	Entrepreneur	Leaders and Entrepreneurs	Social enterprise	Main organisation in an entrepreneurial initiative	Ecuador	0:46:02
027EBR	Director NGO	Specialists	Local NGO	Support through low-interest rates financing and technical assistance	Brazil	0:53:23
028PPE	Entrepreneur	Leaders and Entrepreneurs	Social enterprise	Main organisation in an entrepreneurial initiative	Peru	0:54:40
029PPE	Entrepreneur	Leaders and Entrepreneurs	Association or Cooperative	Main organisation in an entrepreneurial initiative	Peru	1:01:50
030PVE	Entrepreneur	Leaders and Entrepreneurs	Small-medium enterprise	Main organisation in an entrepreneurial initiative	Venezuela	0:45:00
031PVE	Director NGO	Specialists	Local NGO	Main organisation in an entrepreneurial initiative	Venezuela	0:55:00
032EEC	Field Employee NGO	Specialists	International NGO	Support through funding, technical assistance and multi-stakeholder projects and programs	Ecuador	0:48:35
033PVE	Manager NGO	Specialists	Local NGO	Main organisation in an entrepreneurial initiative	Venezuela	0:58:00
034EBO	Coordinator NGO	Specialists	Regional NGO	Support through technical assistance in conservation and socio-biodiversity products, multi-stakeholder projects and programs	Bolivia	0:53:15
035PBR	Entrepreneur	Leaders and Entrepreneurs	Social enterprise	Main organisation in an entrepreneurial initiative	Brazil	1:18:59
036PBO	Director Government	Leaders and Entrepreneurs	Government	Main organisation in an entrepreneurial initiative	Bolivia	0:45:32



## APPENDIX C

### CAUSAL CODING LIST

From Name	Type	To Name
Biodiversity & environment\Protection, maintenance & regeneration	Double Causality + ↔ +	Work, production & land use\NTFP culture and practices
Entrepreneurial initiatives\Management & business competencies	Causality + → +	Partnership & Cooperation\Evaluation & certification
Entrepreneurial initiatives\Management & business competencies	Causality + → +	Aggregate categories\Partnerships & cooperation
Entrepreneurial initiatives\Market dynamics & commercialisation	Causality + → +	Social & cultural\Technologies & incremental solutions
Partnership & Cooperation\Evaluation & certification	Causality + → +	Work, production & land use\Income, employment & labour force share
Policies and government\Government priorities	Double Causality + ↔ +	Aggregate categories\Work, production & land use\Non NTFP production
Policies and government\Policies & government interventions	Causality + → -	Biodiversity & environment\Protection, maintenance & regeneration
Social & cultural\Borders & Migration	Causality + → +	Biodiversity & environment\Protection, maintenance & regeneration
Social & cultural\Borders & Migration	Causality + → +	Work, production & land use\Illegal activities
Social & cultural\Opportunities & access to resources	Causality + → +	Entrepreneurial initiatives\Management & business competencies
Social & cultural\Technologies & incremental solutions	Causality + → +	Entrepreneurial initiatives\Market dynamics & commercialisation
Social & cultural\Traditional knowledge & conservation culture	Causality + → +	Biodiversity & environment\Protection, maintenance & regeneration
Social & cultural\Traditional knowledge & conservation culture	Causality + → -	Entrepreneurial initiatives\Management & business competencies
Social & cultural\Traditional knowledge & conservation culture	Causality + → +	Work, production & land use\NTFP culture and practices
Work, production & land use\NTFP culture and practices	Causality + → +	Entrepreneurial initiatives\Market dynamics & commercialisation
Aggregate categories\Partnerships & cooperation	Causality + → -	Social & cultural\Traditional knowledge & conservation culture
Aggregate categories\Partnerships & cooperation	Causality + → +	Entrepreneurial initiatives\Management & business competencies
Aggregate categories\Partnerships & cooperation	Causality + → +	Entrepreneurial initiatives\Market dynamics & commercialisation
Aggregate categories\Work, production & land use\Non NTFP production	Causality + → -	Biodiversity & environment\Protection, maintenance & regeneration