Socio-biodiversity Bioeconomy in the State of Pará

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About the study

This study was developed on the initiative of The Nature Conservancy (TNC) with the support of the Inter-American Development Bank (IDB) and Natura and produced by an interdisciplinary team led by researcher Francisco de Assis Costa, full professor at the Center for Higher Amazon Studies and in the Graduate Program in Economics at Federal University of Pará, lead author of the recently released report of The Science Panel for the Amazon. The document analyzes the current and potential economic importance of the direct use of biodiversity for the economy of the state of Pará and issues recommendations for the implementation of public policies designed development of a bioeconomy based on native forests and socio-biodiversity. The results of the study demonstrate that the value chains of socio-biodiversity products benefit from economic agents from the local to the national sphere and, therefore, are pivotal for the socio-environmental and economic development of the state of Pará and a unique opportunity for a sustainable development model for the Amazon that reconciles forest conservation and income generation by local populations. TNC and the IDB were responsible for the overall coordination and supervision of the study.

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Prologue

Joaquim Levy*

The Amazon rainforest is the largest natural heritage of Brazil, covering almost half of the country's land area. This forest is complex, diverse, rich, lush, but vulnerable to deforestation and global warming. Its preservation is a priority for many Brazilians and friends of Brazil around the world. It is compatible with the livelihood of thousands of people who live off the standing forest, as it has been demonstrated for centuries, and is the path towards the future. There are no better forest guardians than those who know every inch of where they live. These women and men are also guardians of another forest treasure, which is the culture, the traditional knowledge and the way of life that characterize what can be called an Amazonian civilization integrated into the jungle in multiple dimensions.

How to ensure the ways of life that help preserve the forest, through either extractivism or sustainable agroforestry production? The many possible paths include the physical safety of those who work harvesting and processing forest products, as well as providing the means for financing this production with the appropriate technologies. They also involve the creation, expansion and strengthening of domestic and international markets for sustainable products, including those whose consumption is still incipient or non-existent. The objective of this study is to show the economic importance of value chains whose production depends on the preservation of the forest itself and on stimulating innovations, in order to encourage what can be called an ecological bioeconomy, fully sustainable and integrated into the preservation of biological and sociocultural diversity, through environmental protection and maintenance of the standing forest.

This research, which is the result of a partnership between TNC, IDB and Natura and was developed under the technical coordination of Professor Francisco de Assis Costa is very welcome and timely. The conservation of the forest depends on the success of those who live off it in a sustainable way, without prejudice to the importance and urgency of stabilizing the deforestation frontier and finding new modes of livestock production or otherwise anthropized areas.

The detailing of the economic dynamics of key products and their production chains presented in this study is an innovative and important input to formalize policies that stimulate this ecological bioeconomy and ensure its integrity. It could also contribute to the establishment of carbon markets and environmental services at both national and global level. The diagnosis of the difficulties faced to promote the robustness and expansion of ecological bioeconomy in Brazil is presented with great clarity in this study and followed by important recommendations to overcome them. These recommendations are a precious input for those responsible for guiding and implementing public policies in the Amazon and especially in the State of Pará, where the administration has expressed its commitment to forest conservation as an inseparable component of economic and social development policies aimed at enhancing the quality of life for all who live in the Amazon region. They may also serve as a benchmark for commercial or impact investors in the region, as well as for interested donors and public agencies.

It is, therefore, with pleasure and high expectations towards bioeconomy that I congratulate TNC, IDB and Natura for another initiative based on scientific knowledge, which will help improve the living conditions of tens of thousands of people in Pará and contribute to a fair, inclusive, and sustainable economic growth in the region, with positive repercussions for the whole of Brazil and the world.

***Joaquim Levy** is the Director for Economic Strategy and Market Relations at Banco Safra and member of The Nature Conservancy's Latin American Conservation Council. He is also a former Minister of Finance of Brazil and served as President of the National Bank for Economic and Social Development (BNDES) and Vice President for Finance and Administration of the Inter-American Development Bank (IDB).

Summary

Part 2

Executive Summary

The Nature Conservancy has been working in the Amazon for more than 20 years, always with partners that represent different sectors of society, such as those that support this study (IDB and Natura). We know for certain that the best way to conserve this important forest is that in which people and nature thrive together. Unquestionably, this is an idea that has already grown and matured in the minds of many Brazilians. However, we still face the challenge of demonstrating in practice the full potential of this sustainable development model, which entails conserving the standing forest. Therefore, one of TNC's strategies is to focus its efforts on one of the most relevant places for the conservation of the Amazon: the state of Pará. Instead of ranking first in deforestation and greenhouse gas emissions in Brazil, we believe that Pará has another position to fill: at the forefront of the world bioeconomy, bringing not only solutions that preserve the Amazon ecosystem, but also a social uniqueness that only the Brazilian Amazon culture, its peoples and its communities can offer.

This study provides a pioneer analysis of the bioeconomy of an Amazon area in the state of Pará. Using an innovative methodology of systematization of variables such as product, income, and employment across 14 sectors, from the local to the national sphere, the study provides detailed analyses of the current and potential value chains of key products for the development of the state of Pará and the concomitant preservation of its biodiversity. Furthermore, it evaluates the rural productive foundations of this bioeconomy and presents the institutional framework of related policies. Despite the fact that it is based on seven Integration Regions in the state of Pará, its results are proof of the importance of the sustainable production of these products as an essential factor for the development of the entire Amazon region.

The notion of **Bioeconomy** permeates the study. It is, first of all, about describing a **Bioecological Bioeconomy of Pará (EcoSocioBio-PA)**, **hereafter known as Socio-biodiversity Bioeconomy,** in which the conservation of the forest and its biodiversity stand out as the central elements of existence and development. Moreover, it is about bioeconomy as a sustainable development strategy through forest management and cultivation in agroforestry systems of products native to or compatible with the Amazon biome. It is, in summary, about bioeconomy related to the Amazon biome.

The first part of the study presents the dimensions, dynamics and structural composition of EcoSocioBio-PA and analyzes the characteristics of the 30 main value chains and their economic weight in the seven most important integration regions in Pará: Rio Capim, Guamá, Marajó, Tocantins, Baixo Amazonas, Xingu, and Caeté. Together, they account for approximately 88 percent of the production value of EcoSocioBio-PA. The productive foundations – characteristics of the production structures and their land and environmental relations – are then analyzed for four of those integration regions: Marajó, Tocantins, Xingu, and Baixo Amazonas.

The second part presents the institutional identity of EcoSocioBio-PA, makes public policy recommendations and provides scenarios of potential value that could be achieved with the implementation of these recommendations.

EcoSocioBio-PA's Income and Product

In 2019, the production of the 30 products analyzed generated a total income (total value added - VA) of **BRL5.4 billion**, of which 78 percent was distributed in the economy of Pará and more than half of this income, that is 57 percent, remained in the interior of the state (rural and surrounding areas). Of the interior's share, rural production retained 35 percent, industry 13 percent and trade 9 percent . On the other hand, 22 percent of EcoSocioBio-PA's income is appropriated by the domestic economy and the rest of the world, with the trade sector as the main beneficiary with 19 percent. In relation to final demand, about 67 percent of EcoSocioBio-PA's production goes to the extra-local market, that is, markets outside the state of Pará. Therefore, local demand represents only 33 percent of the state's total production.

EcoSocioBio-PA generated around **224,000 jobs in 2019**, 90 percent of them in the state of Pará, mainly in the regions of Tocantins and Marajó. Of this total, 84 percent are in rural production, especially in family-based productive structures, 4 percent in trade and 2 percent in the processing and transformation industry. In this sense, it is demonstrated that investment in this bioeconomy has a high multiplier effect in income and employment generation in rural and urban areas, which have a relevant industrial presence.

Açai berry is the most important product of EcoSocioBio-PA, and the gross output of its rural production has grown at 9.6 percent p.a. since 2006, totaling BRL1.3 billion in 2019. As the result of an average increase of 7 percent p.a. over the same period, the total income generated (VA) of BRL3.7 billion is 2.8 times the original rural production value. The production of açai berry and the processing of açai pulp located in the interior of the state absorbed 87 percent of the VA generated (this is a strongly pro-local chain). The value added absorbed predominantly by retail in the extra-local economy, which is the destination of 54 percent of the product's value, accounted for to 13 percent of the total. This characterizes the açai economy as an important export base of the local economy.

Cocoa is the second most important product of EcoSocioBio-PA, and the gross output of its rural production grew at 13 percent p.a., totaling BRL550 million in 2019. In turn, the total VA generated of BRL1.3 billion is 2.4 times the original rural production value. Middlemen handle 98 percent of the production, which goes entirely to the domestic processing industry outside the state of Pará. Local players that produce and market cocoa beans absorbed 61 percent of the VA generated. In the extra-local economy, to which the entire production was sent, the retail sector absorbed 39 percent of the value added (29.6 percent) and the industrial sector (9.4 percent) in 2019.

Brazil nut, which is the third most important product of EcoSocioBio-PA, grew at 7.7 percent p.a., with the value of its rural production totaling BRL16 million in 2019. The total income generated of BRL140 million is 8.7 times the original rural production value, and 92 percent of this income is absorbed by local players. As the main beneficiary, the industrial processing sector absorbed more than 75 percent of the income generated in 2019. The main destination of the production of Brazil nuts is the extra-local market, which accounts for 93 percent of the demand. The remaining 7 percent is consumed locally.

In addition to the products mentioned, annatto, honey, pupunha and bacuri also showed an annual growth of more than 6 percent and most of their production is consumed in Pará. The income generated, in turn, is distributed to a large extent among the different players of the value chains in the state. In this sense, all these chains are strongly *pro-local economy* and hence their great relevance for income and employment generation in the state.

On the other hand, açai palm, cupuaçu berry and andiroba had a negative rural production growth from 2006 to 2019. Nevertheless, like in the aforementioned value chains, income from these products is distributed mostly within the state itself, among the different players of the value chains. Finally, the study also analyzed promising products such as rubber, cupuaçu almond, copaiba, and buriti which, although produced on a small scale, have growth potential.

In addition to the economic value generated by the sale of its products, EcoSocioBio-PA also includes other real benefits whose value has not yet been assessed, such as environmental services associated with carbon sequestration and carbon stock. The study offers a pioneering analysis that quantifies, for the integration regions studied, the respective carbon balances and stock of different productive structures, in addition to the stocks of different public land modalities. The structures essentially responsible for production are CO_2 sinks in Tocantins (26.7 Mt/year), Marajó (17 Mt/year) and Baixo Amazonas (8.6 Mt/year) in 2017; carbon stocks associated with these structures totaled 93 Mt, 482 Mt and 395 Mt, respectively. Net CO_2 emissions in Xingu totaled 41.6 Mt/year for a stock of 233 Mt. These are consistent bases for a policy on payment for environmental services and to support the GHG emission reduction targets set in the country's NDC (Nationally Determined Contribution).

Policy Recommendations

The recommendations proposed to strengthen EcoSocioBio-PA's value chains seek to create a structured base to overcome existing institutional weaknesses and emancipate the potential of the bioeconomy based on socio-biodiversity principles (forest conservation). They are:

- Rural development through credit, Science Technology and Innovation (ST&I) for additional value and establishment of new markets;
- Creation of a database system, with information, advisory and technical assistance adjusted to the specificities of EcoSocioBio-PA;
- Land policy based on the regularization of territories led by common use;
- Mechanism of payments for environmental services per product-producer of the EcoSocioBio-PA;
- Fiscal policy for redistribution into the local economy of income generated by EcoSocioBio-PA products outside the state;
- Traceability and certification system for environmental services embedded in EcoSocioBio-PA products.

Keeping the forest standing is the main driving force for getting the Amazon region to generate revenue and reduce existing social inequalities. The narrative for the region involves the union between economy and the environment. In this equation, structured and integrated policies to strengthen the bioeconomy are pivotal elements for the sustainable development of the Amazon region, based on the maintenance of social and biological diversity to support the achievement of the Paris Agreement goal and to control global warming.

Concepts of Bioeconomy

The notions organized around the concept of bioeconomy evolve along three routes (Bugge et al, 2016; Villa Nova, 2020). The first, *biotechnology,* emphasizes the importance of research for *innovations in processes* based on biology – biotechnologies that can be appropriated in different sectors of the economy, such as biorefineries, in industry (Scarlat, 2015).

Oriented towards *bioresources,* the second route, in turn, which is central in the European discussion of bioeconomy that has influenced the Ministry of Science, Technology and Innovations of Brazil, emphasizes *the development of products* from biological raw materials and, around them, the formation of new value chains. In this case, special mention should be made of the substitution of industrial inputs from non-renewable sources for those derived from renewable biological resources (Ollikainen 2014; Roos, Stendahl 2015 apud Biancolillo et al. 2020). A classic example in Brazil is sugarcane ethanol (Lorenzi & Andrade, 2019) and in the Amazon the biofuel produced from the palm oil extracted from the fruits of the palm oil tree (Elaeis guineensis) (Nahum et al, 2020).

These two routes entail complementary efforts to overcome the challenges that the global ecological crisis has imposed on industrial dynamic patterns based on mass production and gains of scale, which remain largely dominant. In agriculture, the emphasis is on increasing productivity on renewable bases and enhancing biofuel production (Scar, 2015), without relinquishing the fundamentals of the dominant *mechanical-chemical* or industrialist technological paradigm (Dosi, 1982; Beus and Dunlap, 1990; Hayami and Ruttan, 1971). Driven by such paradigm, the modernization of agriculture has occurred in the form of its industrialization along two paths: one that is represented by a set of technological solutions that improve profitability by enhancing land productivity through the increasingly intensive use of chemistry, and another that meets this economic imperative by improving labor productivity through the increasingly wider and pervasive adoption of mechanics enhanced by the use of internal combustion engines, electricity, electronics, and information technology (Hayami and Ruttan, 1971).

Biological solutions, such as the development of higher yielding varieties in extensive homogeneous plantation are part of the pattern, or a dominant technological paradigm of mechanical-chemical solutions, as they enhance them. Hence their correlation with new levels of mechanical-chemical control of nature: process innovations (the object *of biotechnological bioeconomy)* would be mostly forms of appropriation of nature functions while product innovations (the object of the *bioeconomy of bioresources)* would be forms of their substitution and the presupposed or resulting formation of homogeneous botanical and biological systems dependent on fossil energy sources (Goodman, Sorj, Wilkinson, 1988).

The *third route,* through which the concept of *bioeconomy* is asserted*,* is *bioecological* and focuses on valuing ecological processes that optimize the use of energies and nutrients based on biodiversity, as opposed to monoculture and soil degradation (Bugge et al, 2016). This perspective refers to a rural development paradigm that is also present at the world level, through which alternative forms of production to the industrialist paradigm are developed. Results of solutions guided by agroecological, agro-extractive or agroforestry principles, technological trajectories are presented here (Dosi, op. cit.) from the perspective of harmony with the original nature, management of the diversity of botanical systems and their autonomy in relation to exogenous sources of energy and nutrients (Collicott, 1990; Drengson, 1985).

This study aims to present the core, in Pará, of a Bioecological Bioeconomy of the Amazon, hereinafter called the Socio-biodiversity Bioeconomy (EcoSocioBio-PA). In addition to this introduction, the study is divided into two large parts: the first presents the results of the aggregated EcoSocioBio-PA, the value chains of the 30 products and its productive dynamics and the structural composition in four territories where they are developed, and; the second part of the study, in turn, presents the state of the art of its institutions, offer policy proposals and suggest future scenarios for 10 products value chains.

Part 1
The Socio-biodiversity Bioeconomy of Pará (EcoSocioBio-PA)

1. Introduction

The economy object of this study, fundamentally based on non-timber forest products extractivism, is notoriously lacking in statistical information and, in much of it, a consequent rarefied economic knowledge. Thus, this work follows from the few studies of similar scope carried out before by Idesp - Institute for Economic, Social and Environmental Development of Pará and in partnership with Ipea - Institute for Applied Economic Research, with the same methodology adopted by the Research Group "Agrarian Dynamics and Sustainable Development in the Amazon" (GPDadesaNAEA), of the Center for High Amazonian Studies (NAEA), of the Federal University of Pará.

The economy will be presented at two levels of aggregation. In Chapter 2, the aggregate set of its products will be presented as a virtual economy that will be called the Socio-biodiversity Bioeconomy of Pará (EcoSocioBio-PA). Based on the EcoSocioBio-PA Input-Output Matrix ($IOM_{EcoSocioBio\text{-}PA}$) of 2019, the study presents the Total Value Added (VA), the Product Value (PV) of EcoSocioBio-PA, employment, structure and distribution of PV in supply and the structure of the EcoSocioBio-PA final demand. The analyzed IOMEcoSocioBio-PA was obtained using the Alpha Social Accounts methodology (CSα, see Annex 1, A.1.1).

Chapters 3 analyzes the value chains of the 30 fundamental products of EcoSocioBio-PA. The components of these are based on the terms of the generation of the IOMs of the products (IOMProduto-EcoSocioBio) that make up the EcoSocioBio-PA (see Annex 2), which result from the composition of the IOMs of the products obtained for the seven – Rio Capim, Guamá, Marajó, Tocantins, Baixo Amazonas, Xingu and Caeté – among the twelve Integration Regions of Pará (IR), territorial references used for management and planning by the state government. On the other hand, some products analyzed have a dual productive modality, namely, collection in native forest – treated in the census as Non-Timber Forest Products (NTFP) – and that of agricultural origin – treated in the census as permanent crop cultivation. Considering that the value chains articulate production (rural and industrial) and commercialization at different scales without distinguishing production modalities, products with these characteristics were aggregated. They are: açaí, cocoa, annatto, pupunha and cupuaçu berry.

Given that the production value considered in the study refer to a part of the territory of Pará, it is worth clarifying the weight of this cut. In the 2017 Agricultural Census, the Pará total production value of the products considered here – ie. the sum of the NTFPs rural production (which includes the products mentioned) and the agricultural production of those with dual mode – summed R$ 1 .6 billion, at current prices. The value of the same variables for the seven IRs considered here, the basis for CSα calculations, totaled, by the same source, R$ 1.4 billion. What we are dealing with here corresponds to 88.5 percent of the total registered in the entire state (Table 1).

Table 1 – 2017 production value of the products analyzed at current prices (BRL1,000.00)

Non-Timber Forest Products	**698,942**	**43.2%**		
Cultivated acai	474,551	29.3%		
Cultivated cocoa	422,347	26.1%		
Cultivated annatto	4,859	0.3%		
Cultivated pupunha	2,150	0.1%		
Cultivated cupuaçu	14,404	0.9%		
Value of analyzed production			1,431,360	88.5%
Value of non-analyzed production			185,892	11.5%
Total	1,617,253	100.0%	1,617,253	100.0%

Source: IBGE, 2017 Agricultural Census.

The MIPs generated by the CSα for this study describe the relationship of the "local economy" (of the state of Pará) with "extra-local" economies, that is, the domestic economy (minus Pará) and the rest of the world, in value chains of different lengths.

The "local economy" of Pará is described by two sets of socio-productive relations:

> i) That which occurs in the "rural and surrounding areas" or in the "interior" of Pará, comprising rural production (extractive and agricultural), rural retail, processing and transformation industry, and wholesale and retail trade that occur in the proximities of the production process; very short value chains are organized at this structural level.
>
> ii) That which is seen in the main "urban centers", or simply in the "center" of the "local economy" of Pará, comprising the processing and transformation industries and retail and wholesale trade, which absorb the local rural production, sometimes in medium-sized local supply chains, sometimes in intermediate relations of long supply chains for the rest of Brazil and the rest of the world.

1.1 Actors, territories, and productive foundations of EcoSocioBio-PA

Chapter 3 will describe the productive foundations of EcoSocioBio-PA, considering the different rural productive structures of its main territories. A description of the agrarian dynamics of the Amazon region from 2005 to 2017, based on its structural diversity was presented by Costa (2021). The study shows six techno-productive trajectories (groups of companies with similar productive characteristics – social and technical relations) in competition (competing for the same input and output markets). Five of them (three commercial and two peasant trajectories) seek efficiency in the specialization and use of mechanical-chemical techniques; one of them (peasant) is based on the diversity of agroforestry systems (SAF: productive systems that comprise forest, agriculture, and livestock, according to definitions compiled by Atangana et al. 2014)[1].

This last trajectory, designated by Costa as "T2 Peasant based on SAFs", comprises the most relevant actors that make up the rural base of EcoSocioBio-PA. It includes peasant groups treated as traditional populations in the Amazon – sometimes

1 The structural definition of the different groups of establishments that converge to make up these different structures in motion was based on a methodology developed by Costa (2009; 2012b; 2021), which applies multifactorial analysis, linear regression and main components (factorial) techniques to production data from Agricultural Censuses, shared by commercial (salary-based) and peasant (family-based) establishments, associating the resulting factors with the types of technological trajectories in Rural Amazon. The trajectories are of the following types: those that result from the convergence of relatively specialized peasant farming systems (type T1, associated with the vector basically explained by the value of temporary crops), or with an emphasis on livestock (type T3, associated with the vector explained by the value of dairy and beef cattle production), partially oriented by shifting cultivation, partially defined by the "mechanical-chemical paradigm" of agricultural production that dominates all commercial trajectories: those oriented towards grains (type T7, associated with the vector explained basically by the value of the production of temporary crops), towards permanent crops and forestry (type T5, associated with the vector explained by permanent crops and forestry) and towards beef cattle (type T4, associated with the basically explained vector). Peasant systems that are organized as SAFs, following an "agroecological" paradigm, are those of type T2, associated with the vector that is basically explained by non-timber extractivism, permanent crops, forestry, and temporary crops. Within this T2 set, cases dominated by non-timber extractivism are defined as SAFs-F and those dominated by by permanent crops as SAF-A (Costa, 2020).

referred to as riverside dwellers or *caboclos*, others simply as rubber tappers or forest peoples, and others yet as family producers who use agroforestry systems. These historical peasants in the region (Costa, 2019; Castro, 2013; Harris, 1998; Nugent, 1993; Nugent, 2010), in addition to the family or household condition of work organization, share the use of techniques that have as reference the Amazon biome.

As family forms of rural production, peasant farming differs radically from commercial farming, as in the former any production-related decision must necessarily factor in the reproductive conditions of the family – that is, how the consumption needs of family members are being met by their work resources and means of production (Chayanov, 1923). Efficiency indicators, in this case, concern a "reproductive efficiency" associated with the average degree of abundance with which one lives and the stability of this condition in a time horizon defined by changes in the family group overt time – e.g. the birth and growth of children and the aging of parents (Costa, 1995; Costa, 2012a; Costa, 2019). This is different from commercial companies, which assess their performance based on "marginal capital efficiency" criteria (Keynes, 1970) defined by the flow of net monetary gain over the lifetime of the assets set in motion (Costa, 2009; Costa, 2012b).

Such differences have implications for the scale of production and for the productive techniques and processes of the corresponding agricultural structures. The diversity of means, processes and products is very often a consistent basis for improving the *reproductive efficiency* of peasant companies; for rural commercial companies, on the contrary, efficiency in achieving their purpose - the net monetary pay-off - almost always depends on the degree of specialization.

Peasant specificities generate different productive systems also in accordance with the endowments of natural resources and the accumulated capacities to deal with them in each location, generally mediated by institutional arrangements that are also territory-specific (Costa and Fernandes, 2016). In the case of the Amazon, special mention should be made of the knowledge about the particular nature of the biome and its remarkably diverse ecosystems. T2 peasants differ from other peasant forms in the region – peasants whose strategies are based on greater agricultural (T1) or livestock (T3) specialization - because *techniques critically based on the Amazon biome have been develop therein.*

The Amazon biome and its fundamental principles of organization and reproduction are considered in the technical solutions of these productive structures either because the resources originating in the biome (forest, water and soil resources) are managed in a kind of "dynamic extractivism", maintaining the seminal diversity and complexity in "agroforestry systems" (hereinafter referred to as F-type Agroforestry Systems: SAFs-F, where F stands the forest as the starting point) under the influence of the needs and control of the families' reproductive capacities; or because the idea is to mimic the qualities of the biome in "agroforestry systems" – which results in a diverse and complex "holistic agriculture" (hereinafter referred to as Type-A Agroforestry Systems: SAFs-A, where A stands for agriculture as the starting point). This is the fundamental technical basis of EcoSocioBio-PA. These variants are the foundation of a *bioecological bioeconomy* in the Amazon – an economy of the standing forest and of the rivers that flow through the region.

1.2 SAFs-F managers and their territories

T2, in the variant that manages the original botanical, land and water resources – land, forests, rivers – is endowed with diverse and complex productive systems that comprise, in the estuary floodplains, gathering extractivism with permanent crop plantations and fishing; a highly peculiar floodplain livestock in the floodplains of the lower and middle Amazonas river; on terra firma, in any of the environments, gathering extractivism is essentially comprised of temporary and permanent crops (Costa and Inhetvin, 2013; Soares and Costa, 2013; Folhes, 2016).

Many of these management systems were bequeathed by indigenous cultures, incorporated into the colonial economy of the Amazon by religious settlements until the mid-eighteenth century and after that by a peasantry formed by nuclear families remaining from the settlements, which sought to establish the Christian ideal of family and the ensuing settlement and defense policy in the Pombaline period, when the miscegenation of Portuguese and Indians was encouraged. This Amazonian caboclo peasantry grew and took roots in the second half of the eighteenth century, alongside the trade structure which, led by "regatões" (mobile merchants), small village merchants and large "aviators" (suppliers, financiers) from Belém, connected the Amazon with the world market of

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"drugs from the backlands" (spices from the Amazon forest like Brazil nut, cloves, guarana roots, cinnamon, etc.).

In the following century, this same peasantry and their associated trade network will be solely responsible for the rapid growth of rubber production until the end of the 1970s (Costa, 2019). The structuring of large-scale commercial rubber plantations founded on immigrant workers from Northeast Brazil allowed for new levels of rubber production, in an inflection that characterized the boom of the rubber economy in the Amazon. The caboclo peasantry also grew during that period, and at the time of the crisis they accounted for some 13,000 family production units in Pará and Amazonas (Costa, 2019). The crisis in the rubber economy led to the collapse of the mercantile rubber plantation of its heyday, transforming rubber tappers into new caboclo peasants. The agricultural censuses of 1960 and 1970 recorded, respectively, 27,000 and 51,000 caboclo peasants engaged in the extraction of multiple forest products, including rubber. And the last agricultural census of 2017 recorded across Northern Brazil the remarkable presence of 112,000 establishments with the characteristics of this SAFs-F route.

1.3 SAFs-A managers and their territories

Following the intense agricultural use that led to the total elimination of the original cover (SAFs-A), the version of the biome-based economy that creates botanical systems similar to the forest has developed in association with the great experiences of agricultural colonization in northeastern Pará – in Bragantina, since the end of the 19th century, led by Northeastern migrants who, during the first half of the following century advanced into Guajarina; in the microregion of Tomé-Açu, led by Japanese immigrants since 1929; and in the Transamazônica highway and Rondônia, which started in the early 1970s with the presence of settlers from all over Brazil, especially from the south and southeast.

The colonization of Bragantina, which began in the late 19th century based on official projects to populate the area with European settlers, gained steam after the rubber economic crisis with the arrival of part of the northeastern migrants driven out of rubber plantations. The population continued to grow in the following decades, directly attracting migrants from the northeast of the country until the 1960s. Between 1960 and 1970, Bragantina began to show signs of saturation, freeing the population to explore new fronts, with an emphasis on that developed in Guajarina (Costa, 2012a, p. 225). Like in Bragantina, the peasant front in Guajarina was based on shifting cultivation, which experienced a profitability crisis that started in the late 1970s, and spanned the 1980s, with slight recovery in the first half of the decade (Costa, 2012b, p. 171-3). In this phase, as a response to the crisis there was a relatively broad trend in Pará towards the introduction of permanent crops, hence diversifying the peasant production systems. This process was particularly intense among northeastern immigrants in Capitão Poço (Costa, 1997; Costa, 2012, p. 166; Costa, 2012, 272) and in Tomé-Açú, with many of the innovations found among the former with contributions from the latter (Shmith et alii, 1996), in a chain of events that resulted in a vivid local innovation system of SAFs organization: by the second half of the 1990s, 300 polyculture combinations using 70 different species had been generated (Yamada, 1999). At that time, researchers described the agricultural establishments of Tomé-Açú as part of an irregular landscape with species of different ages in a variety of intercropping combinations. It should be mentioned that the crop sequences resembled the *natural succession of the biome,* moving from the herbaceous stage to the arboreal stages and allowing the permanent use of agricultural fields (Subler and Uhl 1990; Serrão and Homma, 1993; Subler 1993).

The colonization process of the Transamazônica Highway and Rondônia show itineraries with equivalent outcomes as regards experiments and the creation of SAFs-A. In the first decade of colonization, the main product among peasants in both colonization processes was rice monoculture. Rapid soil depletion by leaching led to a first crisis as a result of decreased productivity (Smith, 1978). Also in the 1970s and early 1980s, the Executive Committee of the Cocoa Farming Plan (CEPLAC) and the Brazilian Agricultural Research Corporation (EMBRAPA) promoted cocoa and coffee monocultures in the Amazon highlands to replace rice, particularly in the Transamazônica and Rondônia. Late in 1980s, the peasants in these areas were hit by a new crisis, this time caused by the sharp drop in the prices of these commodities.

Smith et alii (1996) record, as a way out of the crisis, first the intercropping of cocoa or coffee with other perennials, followed by the development of a wide variety of systems involving cocoa and coffee. Fruit species intercropped with cocoa include acai, biriba and mango, while pineapple and tangerine were intercropped with coffee. In this context, wood trees were the long-term investment of families: mahogany, cedar, freijó (Brazilian walnut), ype and Cuiabá pine were indistinctively intercropped with cocoa and coffee in the Transamazônica and Rondônia.

The 2017 census recorded 106,000 establishments that statistically corresponded to the characteristics of this agroforestry route (SAFs-A), distributed in 136 municipalities in the region, in 52 of which they accounted for more than 50 percent of the local agricultural economy.

1.4 Selected territories

Four planning and management Integration Regions (IR) of the state government of Pará were selected for the detailed analysis of the productive foundations of EcoSocioBio-PA. Three because they have the highest weights in the composition of the value added in EcoSocioBio and, at the same time, are the fundamental territories that represent the aforementioned developments. They are IR-Tocantins, IR-Marajó and IR-Xingu, with 36 percent, 27 percent, and 22 percent of the VA of EcoSocioBio-PA, respectively. The first two, as primary territories of the colonial period and, therefore, of historical peasants, have a massive presence of SAFs-F; the latter, as a prominent stage of recent colonization, is rich in SAFs-A. The fourth territory chosen is IR-Baixo Amazonas which, with 4 percent of GVA would rank fifth in EcoSocioBio-PA, after IR-Guamá (7 percent of GVA). It just happens that IR-Baixo Amazonas, which houses 30 percent of the remaining forests of Pará (the highest proportion among the seven EcoSocioBio IRs studied here), in addition to indigenous land, conservation units and reserves that protect 80 percent of these areas and are the stage of soybean expansion in the Amazon, has become an arena of decisive disputes for the future of EcoSocioBio in the Region. Observing what is happening there seems to be an unavoidable requirement for the purposes of this study.

Each IR will be analyzed based on their aggregate supply and demand patterns. Aggregate demand patterns indicate the extent to which the EcoSocioBio-IR is an “export base” or a “domestic supply base” of the IR economy. These different components of aggregate demand are pivotal to local economies. However, there are differences that need to be highlighted.

The “export base” is the structural foundation of local economies that enables accessing the productive and reproductive resources in which they are lacking (North, 1955; Pred, 1966). Therefore, the dynamics of innovation and related transformations that can lead to development depend on the growth of this export base. On the other hand, this growth entails an increase in local needs derived from both profits and wages associated with the export base, implying new scales of the local economy and the creation of new productive opportunities. This is referred to in the economic literature as growth by formation of dynamic economies of scale through pecuniary, vertical or income externalities and non-pecuniary, horizontal or technological externalities (Scitovsky, 2010; Harris, 2008; Dosi, 1988).

The aggregate supply structure of the local economy, in turn, expresses its internal labor division and complementarity with extra-local economies, allowing to qualify production and place it systemically – its degree of rurality or industrialization, density of services and external dependence.

Once the general features of the EcoSocioBio-IR have been verified, its agricultural foundations will be explained in the context of the IR agrarian system. Agrarian systems are settings, or arrangements, established in rural territories, which concretely distinguish them based of forms of competition and cooperation – via the market or governance structures – among the productive structures found in techno-productive or technological trajectories. Competition and cooperation occur around natural resources, work capacity and institutional mechanisms and organizations related to the rural character prevailing therein. In addition to productive capacities in the strict sense - which are inherent in “production functions” -, the agrarian systems also include institutional arrangements that determine how natural, knowledge and technological culture resources are accessed, used, produced and distributed and of which land relations, rules and mechanisms for accessing innovation systems, such as credit and technical assistance organizations, are expressions (Costa, 2013; Coast, 2012). All these topics will be addressed here, insofar as information is available.

In the analysis of production associated with different technological trajectories, the same databases organized by Costa for his recent study, incorporating the results of the 2017 Agricultural Census (Costa, 2021) were used. For the analysis of the land base, census data from the aforementioned databases were used at the establishment level; at the same time, a sample of the private land base was used, which allowed for obtaining parameters used on different occasions. For land consigned in settlements and reserves, in addition to public land, the study used documentary data from land agencies and image analyses (for image analyses of private and public land, see Annex 1, A.1.3). Regarding technical assistance, producers’ organization and credit, the authors relied on census data and, in the case of the latter, also on data from the Central Bank of Brazil.

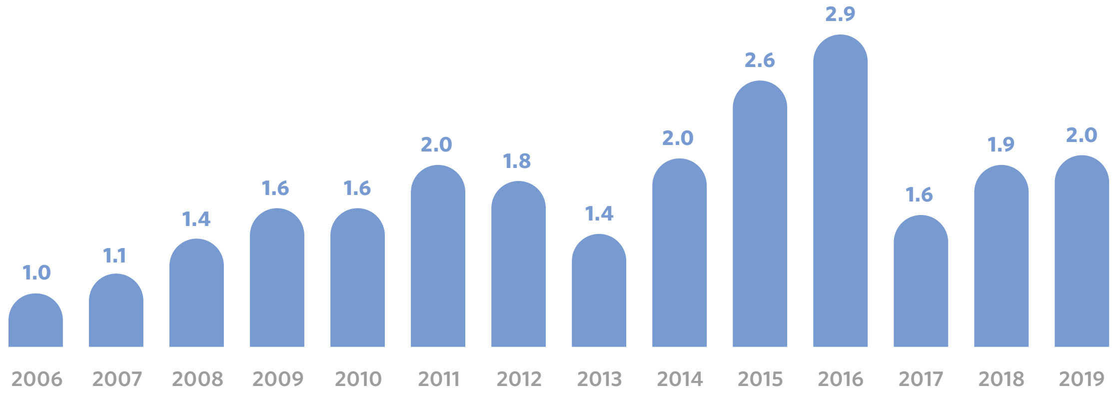
2. The Socio-biodiveristy Bioeconomy of Pará (EcoSocioBio-PA): Dynamics and Dimensions

Thirty products form the agricultural base of the Socio-biodiversity Bioeconomy of Pará (EcoSocioBio-PA), whose Gross Value of Agricultural Production (GVAP) grew at the average rate of 8.2 percent p.a. between 2006 and 2019: from BRL1.0 billion in 2006 to BRL2.0 billion in 2019, with fluctuations (Chart 1-1).

The rural products of EcoSocioBio-PA changed in different ways in the meantime. Four different groups stand out. The “relevant and dynamic” groups were among the most important in terms of production value in 2019 and, at the same time, showcased positive and high growth rates. They are: Açai Berry, Cocoa Beans, Brazil Nut, Honey, Pupunha, Annatto, and Bacuri, which together have grown to 9.2 percent p.a. since 2006, representing in 2019 nothing less than 97.4 percent of the total value added in EcoSocioBio-PA as a whole (see Table 1-1 and Chart 1-2).

The second group comprises the most important products with negative growth rates – this group is referred to as “relevant-decadent” and includes: Cupuaçu Berry, Açai Palm, and Andiroba. The value of the rural production of these products has been falling at -2.6 percent p.a. and their value added represented 2.2 percent of EcoSocioBio-PA in 2019. The products found among the ten with the lowest weight monitored by IBGE, which represent 0.2 percent of EcoSocioBio-PA but show high growth rates, are referred to as “promising”. They are: Rubber, Buriti, Copaiba and Cupuaçu Almond. Taken together, the value of their rural production grows 7.9 percent p.a. A fourth group will include the products for which official information on weight or dynamics is not available.

Chart 1-1 – Change in the Gross Value of Agricultural Production of EcoSocioBio-PA products (EcoSocioBio-PA), 2006 to 2019, in BRL billion, at constant 2019 prices



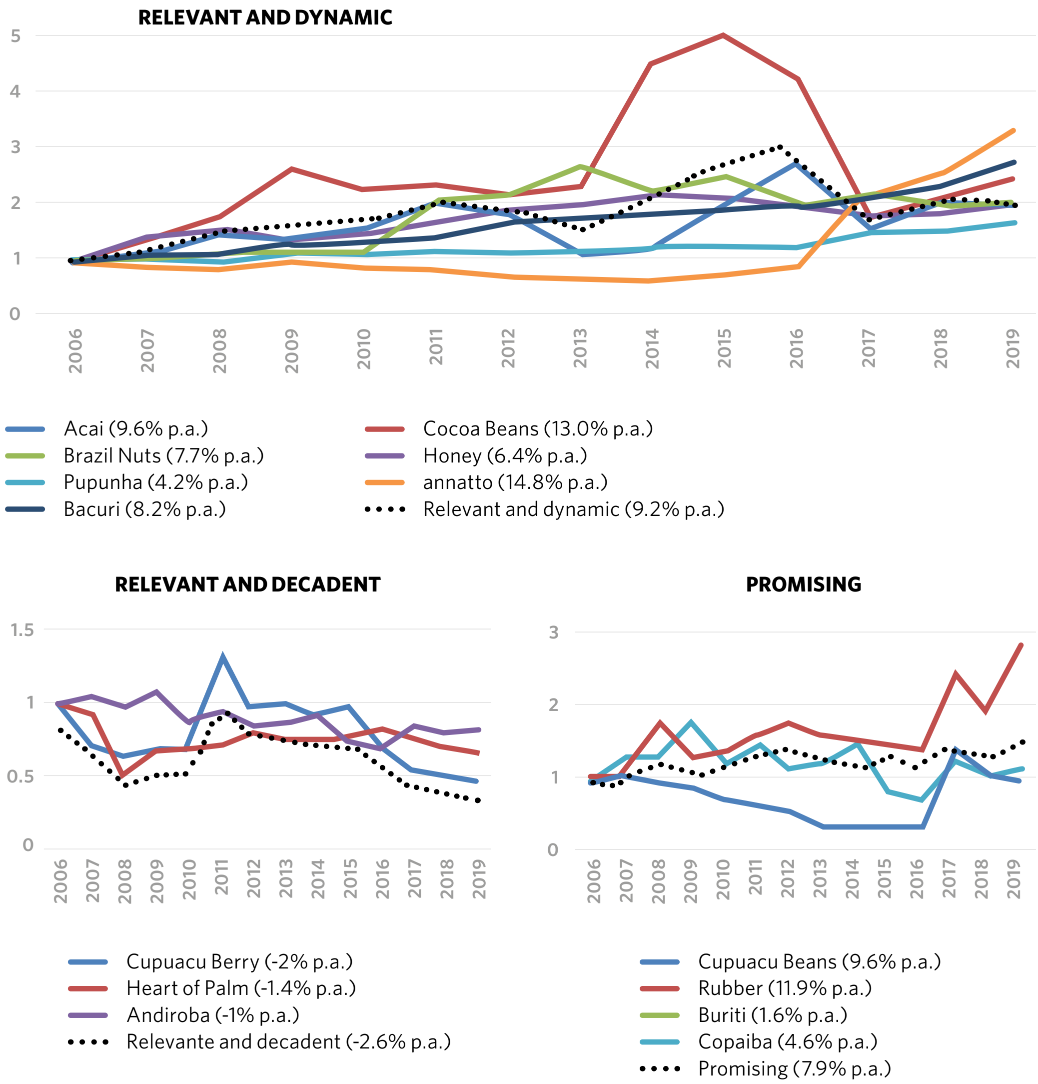
Source: IBGE, 2006 and 2017 Agricultural Census; PAM and PEVS. Methodological note: for the products monitored by IBGE, production and production value data (and, therefore, the implied price) for 2006 and 2017 reported by the respective agricultural censuses were considered. For fluctuations in intercensus periods, annual MAP, LSL and PEVS data for the same variables were considered.

Table 1-1- EcoSocioBio-PA products – Value of Agricultural Production and Value Added in EcoSocioBio-PA value chains in 2019 (2019 price)

EcoSocioBio-PA Products	Gross Value of Agricultural Production in 2019 (BRL)	Value Added in 2019	
		Total (BRL)	Total %
Açai Berry	1,258,178,519.59	3,695,040,876.00	68.386%
Cocoa Beans	549,585,028.47	1,281,649,924.56	23.720%
Brazil Nut	16,007,583.78	247,434,902.50	4.579%
Honey	5,797,671.73	6,894,978.32	0.128%
Pupunha	4,358,533.53	6,537,922.85	0.121%
Annatto	4,072,797.05	15,230,082.29	0.282%
Bacuri	3,255,321.66	11,544,467.38	0.214%
Relevant and dynamic	**1,841,255,455.80**	**5,264,333,153.92**	**97.430%**
Açai Palm	8,369,741.56	89,128,986.51	1.650%
Andiroba	779,812.43	1,342,288.11	0.025%
Cupuaçu Berry	13,233,321.18	25,929,778.64	0.480%
Relevant and decadent	**22,382,875.17**	**116.401.053,26**	**2.154%**
Buriti	2,719,578.16	3,776,512.54	0.070%
Rubber	2,120,100.63	4,897,724.06	0.091%
Cupuaçu Almond	300,691.88	1,190,209.27	0.022%
Copaiba	114,587.51	211,022.02	0.004%
Low scale with positive growth	**5,254,958.17**	**10,075,467.89**	**0.186%**
Murici	1,755,031.54	3,976,433.22	0.074%
Tucuman	1,287,803.27	1,899,994.24	0.035%
Piquia	1,048,574.11	1,471,116.96	0.027%
Handicrafts	793,377.92	981,521.94	0.018%
Tapereba	643,608.35	1,842,415.51	0.034%
Medicinal Plants	175,387.77	405,288.99	0.008%
Cumaru	138,461.54	309,782.39	0.006%
Bacaba	136,496.18	222,705.44	0.004%
Açai-Seed	129,432.00	252,965.80	0.005%
Breu-Branco	59,483.88	119,627.34	0.002%
Murumuru	43,784.73	96,393.87	0.002%
Milks	34,549.35	54,892.16	0.001%
Uxi	22,094.60	60,644.70	0.001%
Brazil Nut Oil	3,800.00	6,689.00	0.000%
Piquia Oil	3,100.00	17,096.00	0.000%
Cocoa Fruit	415.13	664.66	0.000%
No information on scale or growth	**6,275,400.38**	**11,718,232.21**	**0.217%**
Others	**492,943.78**	**662,210.63**	**0.012%**
Total EcoSocioBio -PA	**1,875,661,633.30**	**5,403,190,117.92**	**100%**

Source: Annex A.2.2 Input-Product matrices.

Chart 1-2 Change in the Value of Agricultural Production at constant 2019 prices for different EcoSocioBio-PA product groups, 2006 to 2019 (Index Numbers, 2006=1)



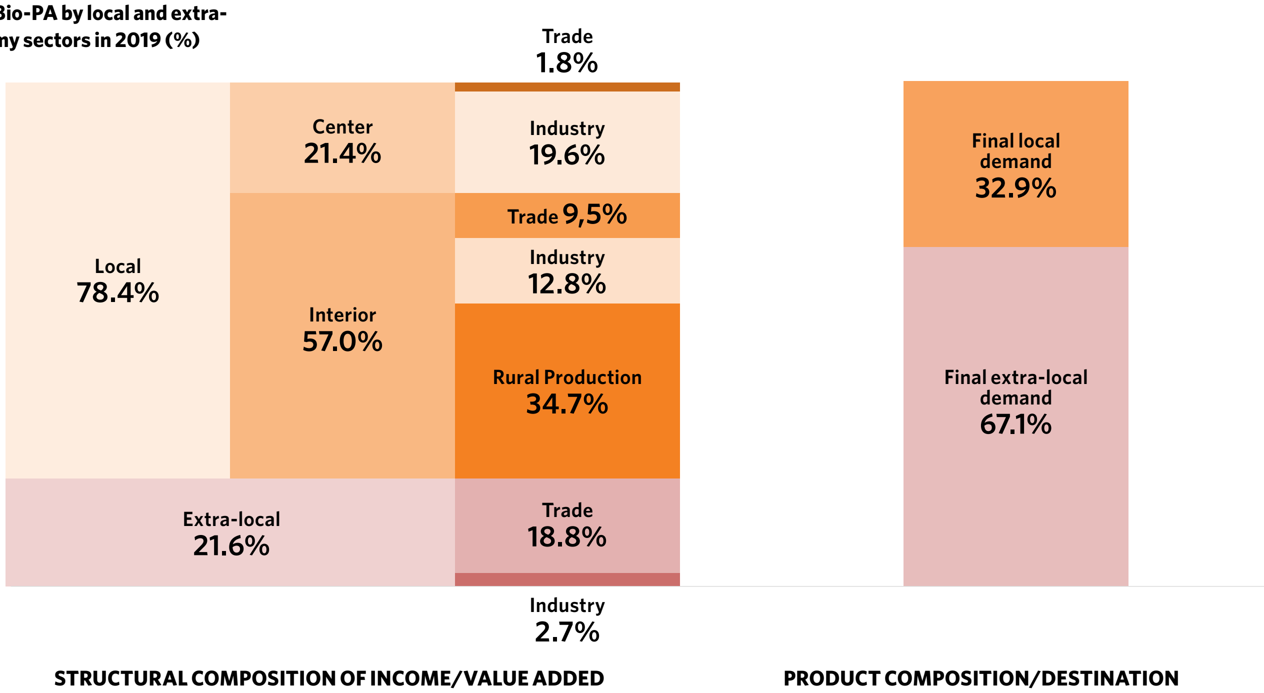
Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

This rural production and the links of the chains that take it, whether fresh or processed, to final consumers in Pará, Brazil and the world, make up EcoSocioBio-PA: an economic aggregate, whose total value added (VA, roughly, the income generated) totaled BRL 5.4 billion in 2019 (Table 1-1). The equivalent to 78.4 percent of the VA generated was distributed in the economy of Pará: 57.0 percent in its interior (rural and surrounding areas) and 21.4 percent in its center (basically the metropolitan area of Belém). Of what fell to the interior, 34.7 percentage points were retained in rural production, 12.8 in industry and 9.5% in trade; of what fell to the center, 19.6 percent was retained in industry and 1.8 percent in trade.

In the domestic economy and in the rest of the world, where the main final demand of EcoSocioBio-PA is found (equivalent to 67.1 percent of the product value (PV)), 2.7 percent went to industry and 18.9 to trade, totaling 21.6 percent of the VA distributed (see Chart 1-3). EcoSocioBio-PA is basically an export base in the state of Pará, predominantly for the domestic market: only 1.1 percent of the PV was exported to the rest of the world. Local demands account for 32.9 percent of the PV.

Employment associated with this production totaled 224,600 workers - 90 percent of them in the interior, as follows: 84

Chart 1-3- Value Added Distribution in EcoSocioBio-PA by local and extra-local economy sectors in 2019 (%)

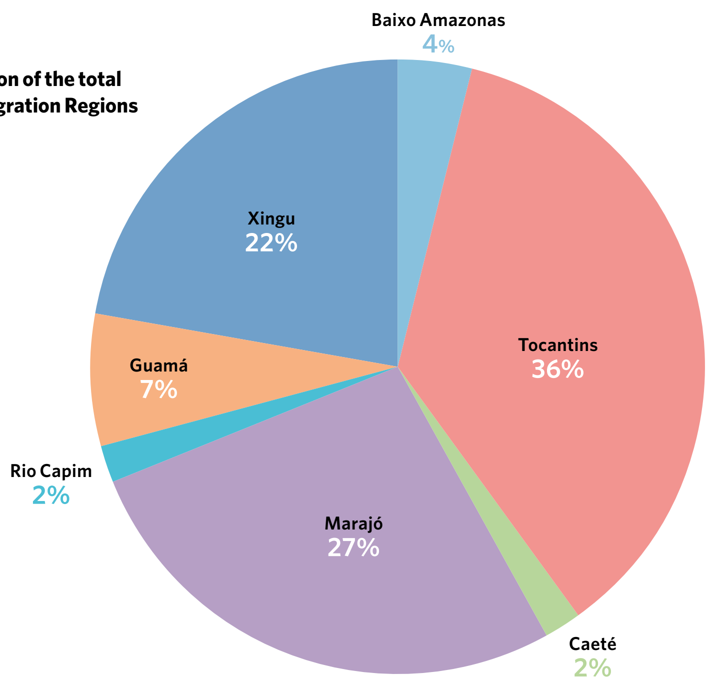


Source: Table A.2.1-1.

percent in agricultural production, 4 percent in trade and 2 percent in the processing and transformation industry. Urban centers concentrate 3 percent of the jobs creates, with 1 percent in trade and 2 percent in industry. The domestic economy, in turn, concentrates 7 percent of the jobs created, with 6 percent in domestic trade and 1 percent in industry (Table A.2.1-1).

Three Integration Regions concentrated 84 percent of the total EcoSocioBio-PA VA in 2019: Tocantins and Marajó, with equivalent shares of around 30 percent, and Xingu with 22 percent, followed by Guamá with 7 percent, Baixo Amazonas with 4 percent, Rio Capim with 2 percent, and Caeté with 2 percent.

Chart 1-4- Territorial distribution of the total VA of EcoSocioBio-PA - by Integration Regions



Source: Table 2-1

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3. EcoSocioBio-PA Value Chains

3.1 Dynamic products among the most relevant

3.1.1 Açai Berry

Since 2006, the gross value of the rural production of açai berry, which is the most important product of EcoSocioBio-PA, has grown at 9.6 percent p.a., reaching BRL1.3 billion in 2019. As a result of an average increase of 7 percent p.a. over the same period, production in that year totaled 720,000 tons, which were distributed through the chains shown in Figure 2.1.1-1. In this structure, the following characteristics stand out:

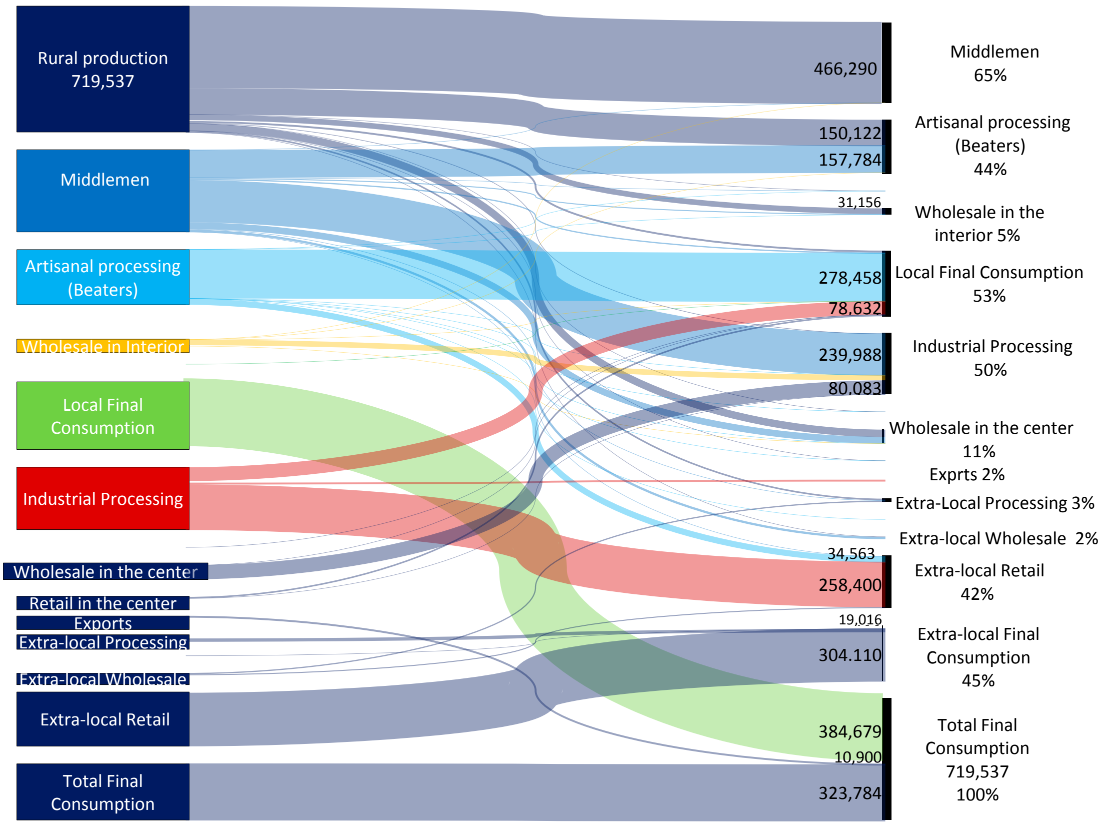
1. Rural producers have two main points of entry into the chains: middlemen and wholesalers in the interior (65 percent and 5 percent of the production respectively) and açai beaters (artisanal pulp processing, 22 percent); the others are small shares of direct sales to consumers for wholesale in the center.

2. Middlemen with 51 percent and wholesalers with 100 percent of the purchases supply the pulp production industry which, in turn, supplies extra-local markets.

3. With what is purchased directly from producers and with a share of what is mediated by middlemen (approximately half of one) the "açai beaters" supply the local end markets that consume açai pulp daily as an important item in the local diet.

4. The chains covering the local market have a greater weight (53 percent of the total produced) than the longer domestic (45 percent) and international (2 percent) supply chains.

Figure 2.1.1-1- Product flows underlying açai pulp value chains (t)



Source: IGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processed in the Netz System.

Value is formed and distributed around these product material flows and expressed in the input-output matrix (IOM) generated by the CSα as the Value Added (VA) of the sectors, which in turn is equal to the Gross Value of Production (sales value) minus the value of the sector's Intermediate Production (cost of inputs) (see Açai Berry IOM in Table A.2.2-1). In essence, the VA is formed in the productive processes and realized in the sale of the resulting final products for the respective market prices and is distributed among the different chain participants according to the conditions in which the transactions are carried out between them.

From the perspective of the Global Commodity Chain (GCC) approach program, these conditions are often ultimately established by power relations stemming from asymmetries in the availability of pecuniary or real resources, regardless of the latter being tangible or intangible. Such asymmetries would characterize the chains as producer-driven or buyer-driven, that is, the leadership and ability to retain value from the arrangements that are formed in the most developed centers, if marked by the leadership of the last resort producer or distributor, respectively (Gereffi, 1994; Gereffi, Korzeniewicz, 1994).

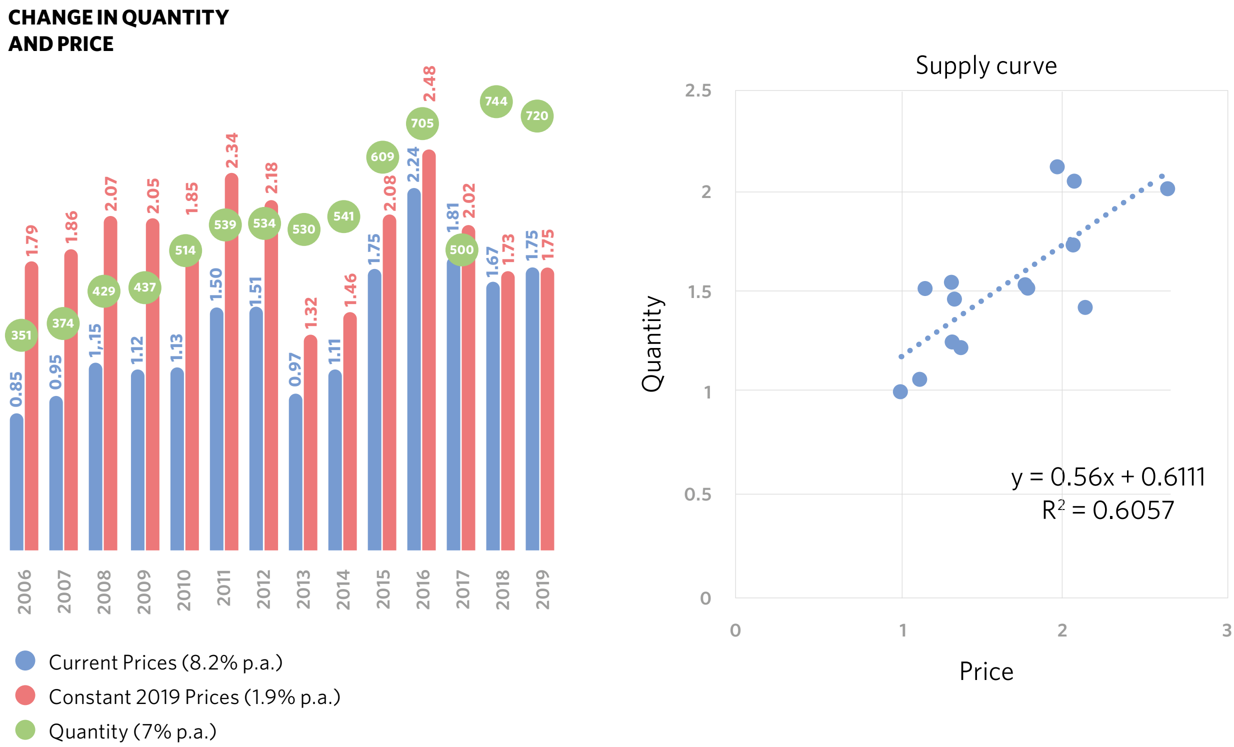
These are important concepts, which will be covered here. However, aspects neglected by GCC approaches that are crucial in EcoSocioBio-PA chains will be addressed. First, proper emphasis will be placed on local (short) branches of (long) global chains and to strictly local (short and sometimes very short) chains; second, the different moments of local production will be highlighted in a polarity of their own (the rural interior and local regional commercial and industrial centers) and the polarity between local (as a productive arrangement, a producer) and extra-local (as a productive arrangement, a buyer) at the national or global level. Thus, accepting the criticism of the GCC will avoid attributing to the arrangements of the central regions the a priori condition of dominant (Bair, 2008; Bair, Kiplinsky, 2000; Topik, Marichal and Frank, 2006; Talbot, 2011; Conti, Giaccaria, 2001; Costa, Brito, Amaral, Cavalcanti, 2016).

In turn, the polar decompositions of the chains raised above allow for binary evaluations that explain in each case the different conditions of i) of domination and subordination (hierarchy); ii) (market) parity; or iii) (relational) cooperation that prevail in the interactions. This perspective has been laying the foundation for a new moment of the research into Global Value Chains (GVC, see Gereffi, Humphrey, Sturgeon, 2005), based on a dialogue with the New Institutional Economy (Williamson, 1975 and 1983) and with economic sociology (Granovetter, 1985) around the meaning of the specificity of the products and their level of codification when determining transaction costs. In this regard, it is important to consider that EcoSocioBio-PA products are, by definition and to a greater or lesser degree, *biome-specific.* As such, obtaining them entails having uncoded tacit knowledge in different amounts and complexities, giving rise to a variety of arrangements and governance structures with related implications regarding the generation and distribution of value.

The initial polarity to be addressed in EcoSocioBio product chains is established between rural production and the other sectors and is expressed in what hereinafter will be referred to as rural production *supply regime.* This *supply regime* is described by two indicators: the relationship between current prices paid to the producer and the quantity produced, which informs us about the short-term supply regime – influenced by the willingness of producers at each moment in their structural positions – and the average variation in the actual price (current prices discounted for inflation) paid to the producer between 2006 and 2019. This variation, when positive, indicates that supply has grown over time at a lower rate than (total) social needs for the product, and the opposite when negative – constant prices would indicate a continued equilibrium.

The supply of açai berry is characterized by a moderately inelastic short-term response, since the 1 percent variation in the (current) price results in a 0.56 percent increase in the quantity produced; this is consistent with the fact that the actual price paid to the producer has grown at 1.9 percent p.a. and points to an accumulation of unsatisfied demand (Chart 2.1.1-1).

Chart 2.1.1-1. -Açai berry supply regime: a) change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values; b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.



Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The prices paid to producers in açai berry chains are established in the two different interactions mentioned above, which are part of the two different productive arrangements that make up the acai economy: with middlemen connected to the processing industry that supplies the extra-local pulp markets and with the *açai beaters,* who supply the local markets with fresh pulp.

Rural açai producers are a large group of family establishments: in IR-Tocantins, for example - which with 43 percent of EcoSocioBio-PA's total production value of açai berry is its main producer -, they total more than 40,000; in IR-Marajó, the second largest producer with 39 percent of the production value, they exceed 25,000. Furthermore, there is a low level of coordination and cooperativism among them (see 3.1.5). Influenced by this scenario, their ability to determine the price is, in principle, low. However, prices also depend on the characteristics of the buying sectors, including their ability to impose their interests on the rural producer (sector). This capacity is higher or lower depending on the number and autonomy of agents: too many autonomous agents (without hierarchical coordination) leads to a competitive situation that limits the power of the group (the sector) as a buyer; the opposite increases this power. The analysis of the data on EcoSocioBio-PA's CSα using a graph and network methodology (see Annex 1, A.1.2) allows to observe the internal structural conditions of the sectors, with the respective number of agents and hierarchies between them.

The number of *açai beaters* is high: for example, the survey identified 198 of such workers in IR-Tocantins and 146 in IR-Marajó – 52 percent and 50 percent, respectively, of the total commercial and industrial agents operating in the two IRs. In addition, in all cases açai beaters, like rural producers, move around without coordination, in short chains. So the two groups are in market-like conditions, without notable hierarchies. The images of the georeferenced graphs, which represent these agents in Cametá, Mocajuba, and Igarapé-Miri in IR-Tocantins, and Gurupá, Portel, Megaço and Breves in IR-Marajó, and the statistics derived therefrom, demonstrate the endogenous density of interactions and the relative balance in the scales of their participants and in the flows passing through them.

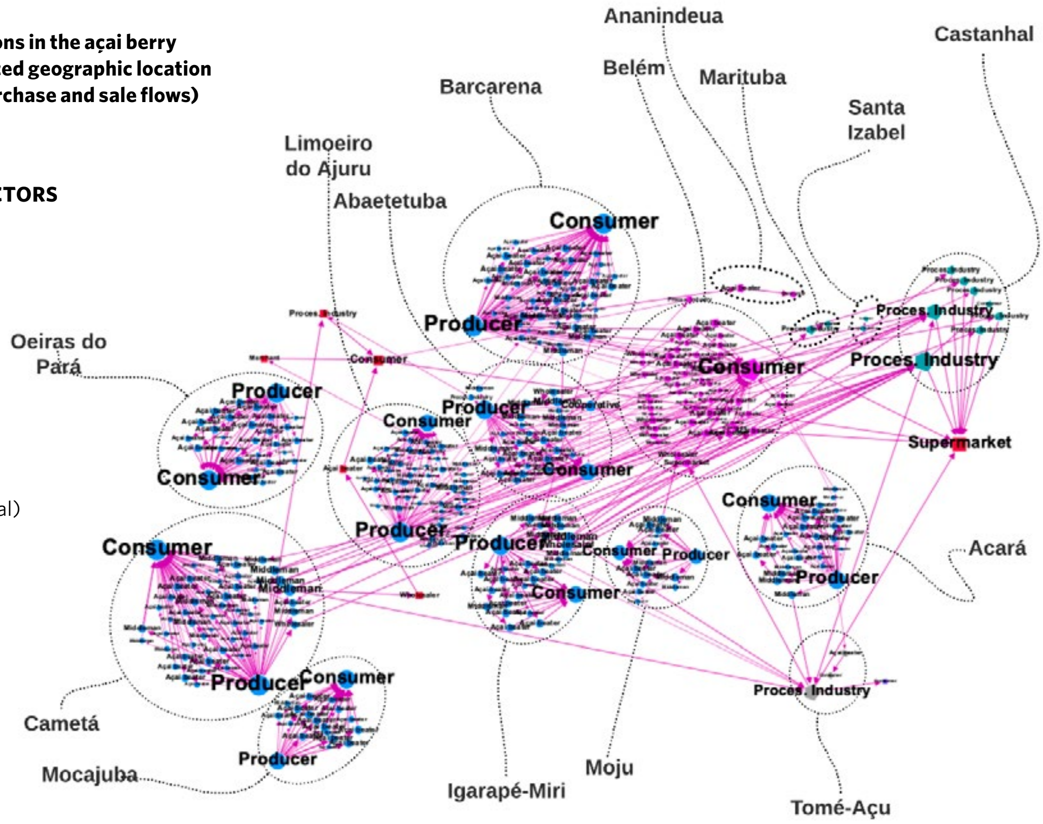
On the other hand, middlemen and wholesalers in the interior make up a relatively small group of agents (88 in IR-Tocantins and 96 in IR-Marajó) which, in turn, are coordinated by some of them operating as bridging agents for the production accessed by other smaller middlemen: 16 in IR-Tocantins - Igarapé-Miri, Cametá, Abaetetuba and Acará and 13 in IR-Marajó - Anajás, Breves, Curralinho, Gurupá, Portel, and Limoeiro do Ajuru (Figure 2.1.1-2 and 2.1.1-3; Annex 1,Table A.1.2-1).

For rural producers, the relations with these different structures imply different prices: the prices paid to them by açai beaters are 57 percent higher than those paid by middlemen and wholesalers - BRL2.2 and BRL1.4/Kg, respectively (Chart 2.2.1-2).

On the other hand, the highlighted group of large middlemen in the RIs maintain exclusive relations with at least one of the eight largest industrial pulp processing companies, among the 50 detected by the survey. Four of these companies are located in Castanhal, one in Tomé-Açu and three in the metropolitan area of Belém (Figure 2.3.1-3 and Table 2.3.1-2).

The weight of these *authorities* in the system ensures the local processing industry a central role, whether in its relations with the rural sector - which underscores, with the mediation of middlemen and wholesalers, the polarity between the interior and the urban centers of the local economy - or in the extra-local economy which, through direct relations with domestic retail, defines the polarity between local and extra-local. This condition guarantees them a differentiated position in the formation of the final product price, with the highest gross markup among all sectors: 177 percent (Chart 2.1.1-2).

Figure 2.1.1-2. Actors and their relations in the açai berry chains in IR-Tocantins by georeferenced geographic location (scale representation of weighted purchase and sale flows)



PRODUCTION AND MARKETING ACTORS

Location

- Tocantins
- Guajará
- Guamá
- Rio Capim
- Nacional
- Internacional

Actor's sector

- Rural and surrounding areas (local)
- Urban Centers (State)
- Domestic/International

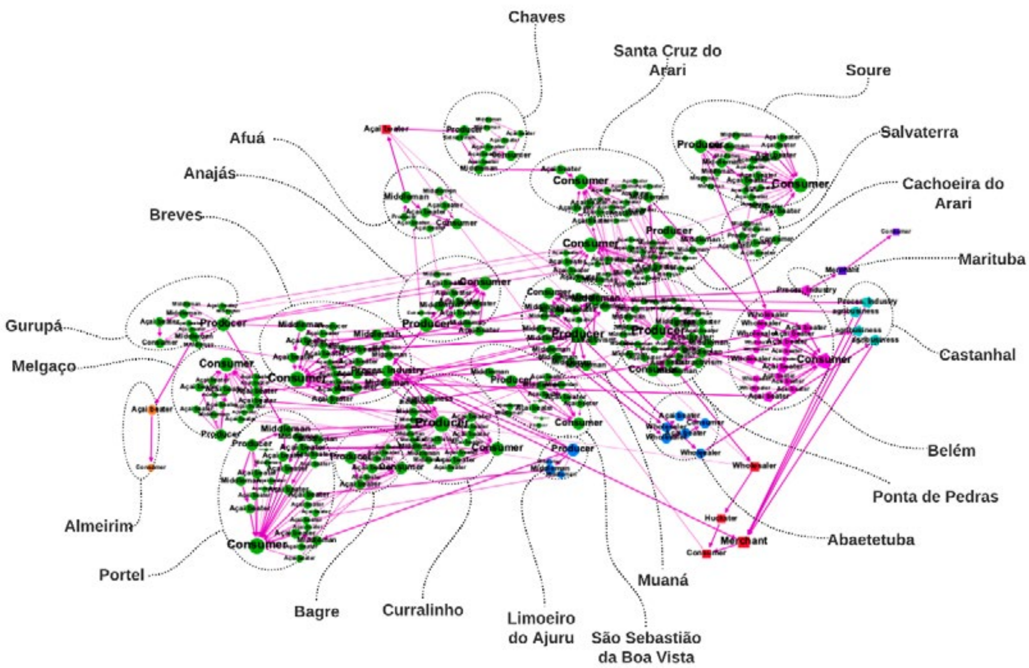
NTFP FLOW

Product analyzed

Açaí

Source: IDESP-DADESA/NAEA-IPEA field survey; CSα Netz system. Processing by the authors.

Figure 2.1.1-3 Actors and their relations in açai berry chains in IR-Marajó by georeferenced geographical location (scale representation of weighted purchase and sale flows)



PRODUCTION AND MARKETING ACTORS

Location

- Marajó
- Guajará
- Guamá
- Baixo Amazonas
- Tocantins
- Domestic
- International

Actor's sector

- Rural and surrounding areas (local)
- Urban Centers (State)
- Domestic/International

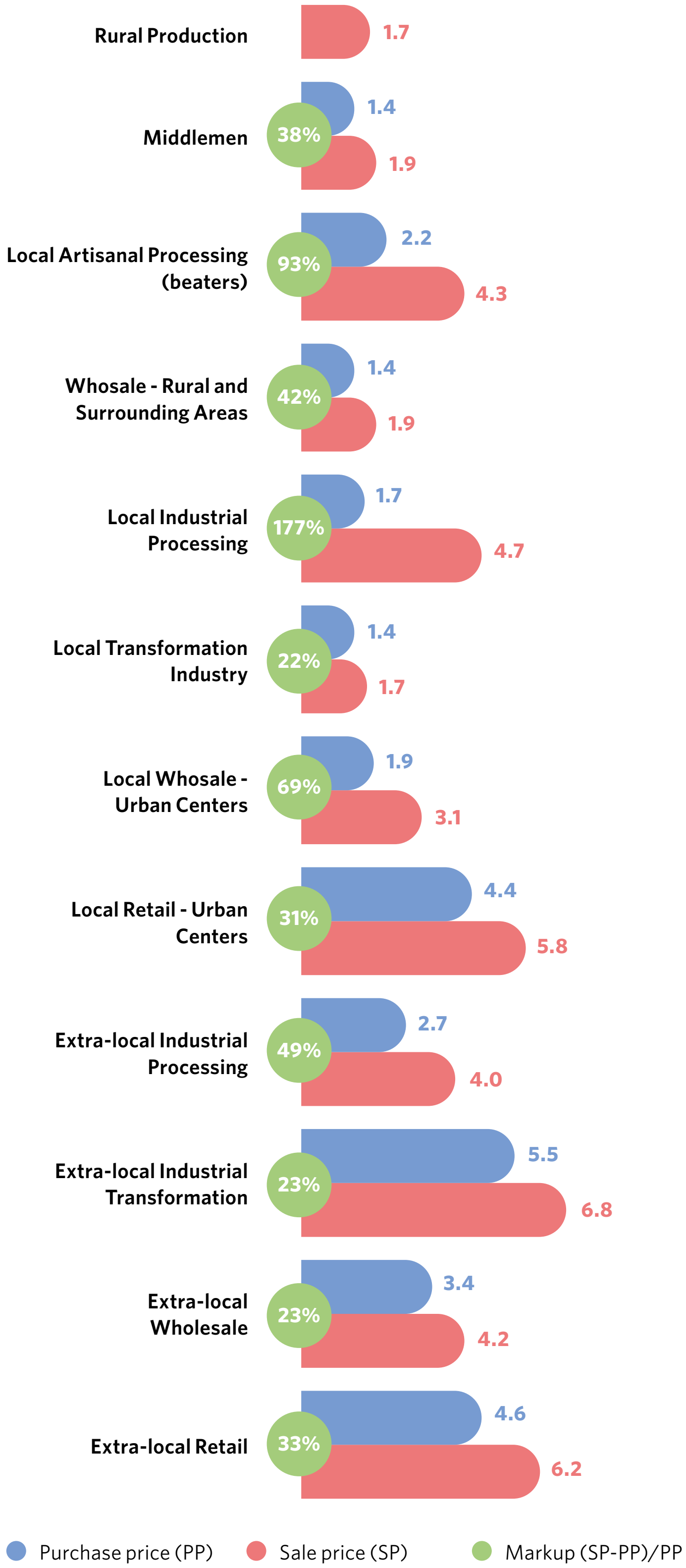
NTFP FLOW

Product analyzed

Açaí

Source: IDESP-DADESA/NAEA-IPEA field survey; CSα Netz system. Processing by the authors.

Chart 2.1.1-2-Price formation and markup along the açai pulp value chain (BR 1,000.00/t and % of purchase price)



Source: IVBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

The conditions described establish the mode of distribution of the total VA (the chain income) generated in 2019 along açai chains and their constitutive arrangements. The highlights are:

- The total VA generated of BRL3.7 billion is 2.8 times the original value of the rural production of BRL1.3 billion (Table A.2.2-1).

- The arrangements that produce açai berry and pulp in the *local economy of Pará,* accounted for 87.1 percent of the VA generated: these are, therefore, *pro-local chains* (first column in Chart 2.1.1-3).

- The interior accounted for 57.5 percent of the share of the local economy of Pará – these are, therefore, *pro-interior* chains (second column in Chart 2.1.1-3);

- In the interior, rural production accounted for 34.3 percent, artisanal production (açai beaters) for 15.6 percent, and for trade 7.6 percent. Considering this high share of the VA and the already mentioned supply regime, in which the price paid to the producer has increased, these are *pro-rural production* chains (third column in Chart 2.1.1-3);

- Of the 29.6 percent that fell to the largest urban centers, the processing industry accounted for 27.3 percent and retail trade for 2.3 percent. These are, therefore, local *pro-industry* chains (third column in Chart 2.1.1-3);

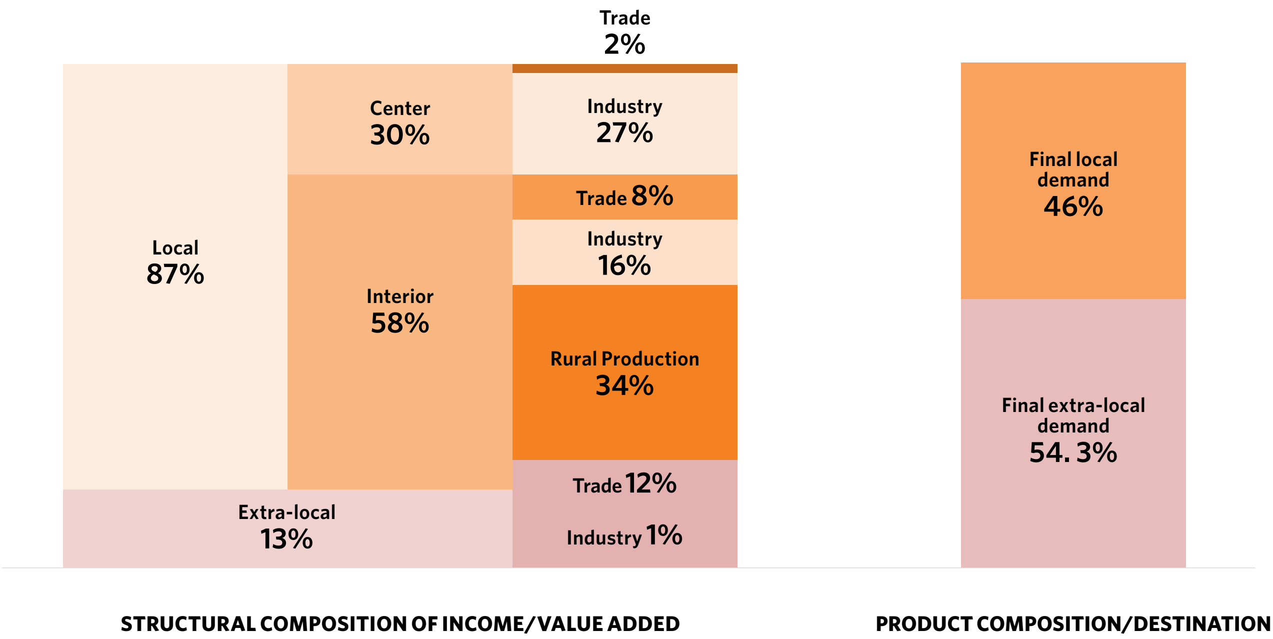
- The extra-local economy, which is responsible for 53.9 percent of the product's value, accounted for a value added of 12.9 percent, mostly in retail trade. This characterizes the açai economy as an important *export base* of the local economy (first and fourth column in Chart 2.1.1-3);

- The value of *exports to the rest of the world* did not exceed 0.8 percent of the total VA (Table A.2.2-1).

- Employment associated with the chains totaled 175,900 workers: 86 percent in rural production, 2 percent in primary intermediation (middlemen), 3 percent in artisanal processing (beaters), 3 percent in industrial processing, and 5 percent in extra-local economies (Table A.2.2-1, last line).

- Two RIs accounted for 82 percent of the VA of açai in EcoSocioBio-PA in 2019: Baixo Tocantins and Marajó, with 43 percent and 39 percent, respectively, followed by IR Guamá with 10 percent, Rio Capim with 3 percent, and Caeté with 2 percent.

Chart 2.1.1-3 Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Açai-Berry Chain



Fonte: Anexo 2, A.2.2, Tabela A.2.2.-1.

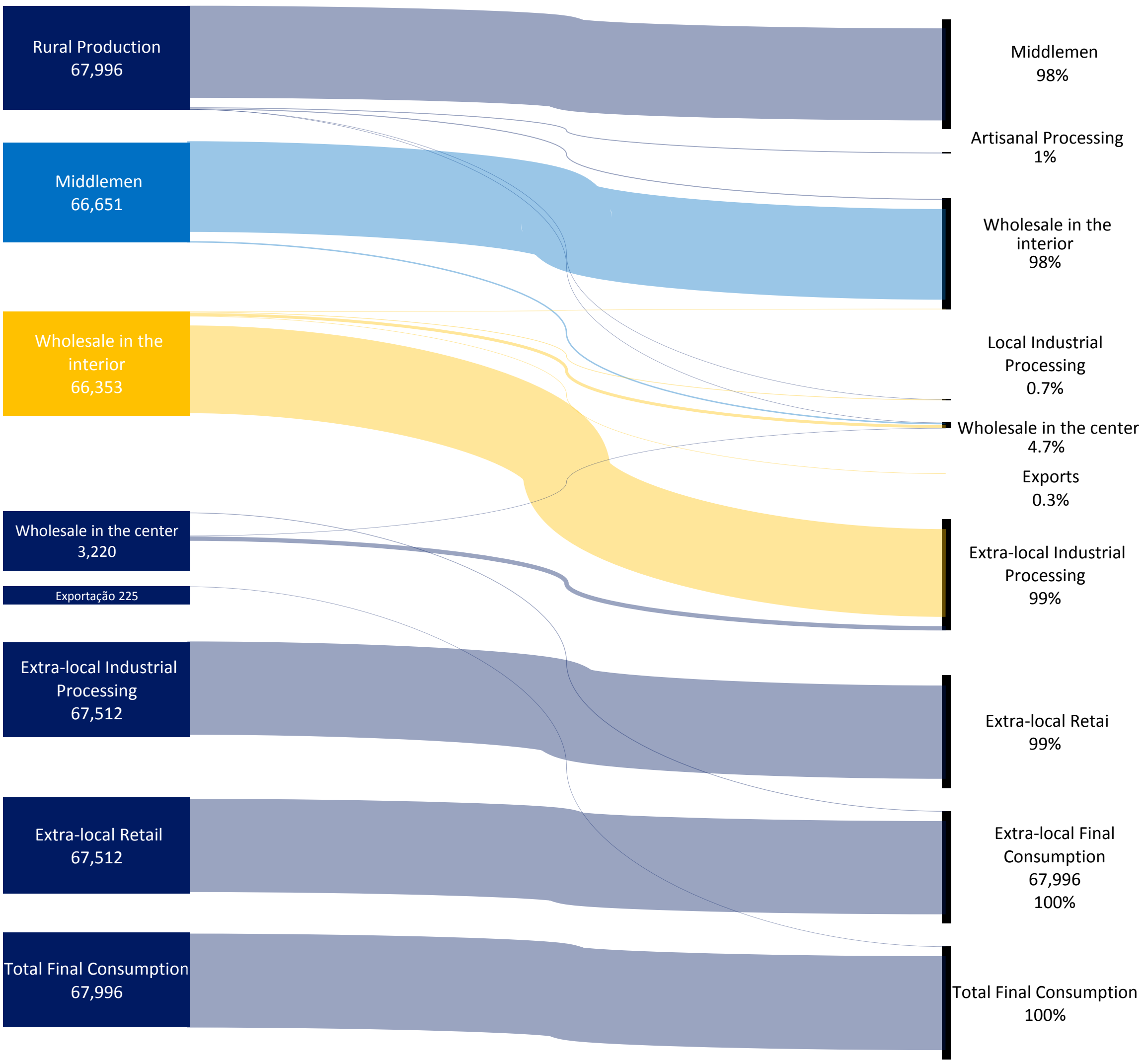
3.1.2 Cocoa Beans

Since 2006, the gross value of the rural production of cocoa, which is the second most important product of EcoSocioBio-PA, has grown at 13 percent p.a., reaching BRL550 million in 2019. As a result of an average increase of 8.5 percent p.a. over the same period, production in that year totaled 68,000 tons, which were distributed through the chains shown in Figure 2.1.2-1. In this structure, the following characteristics stand out:

1. Agricultural producers have virtually a single point of entry into the chains: middlemen in the interior, who handle 98 percent of the quantity produced (Figure 5.3.1-1).

2. Middlemen supply the wholesalers who, in turn, supply the extra-local transformation industry, which is predominantly domestic (99.7 percent) and international (0.3 percent).

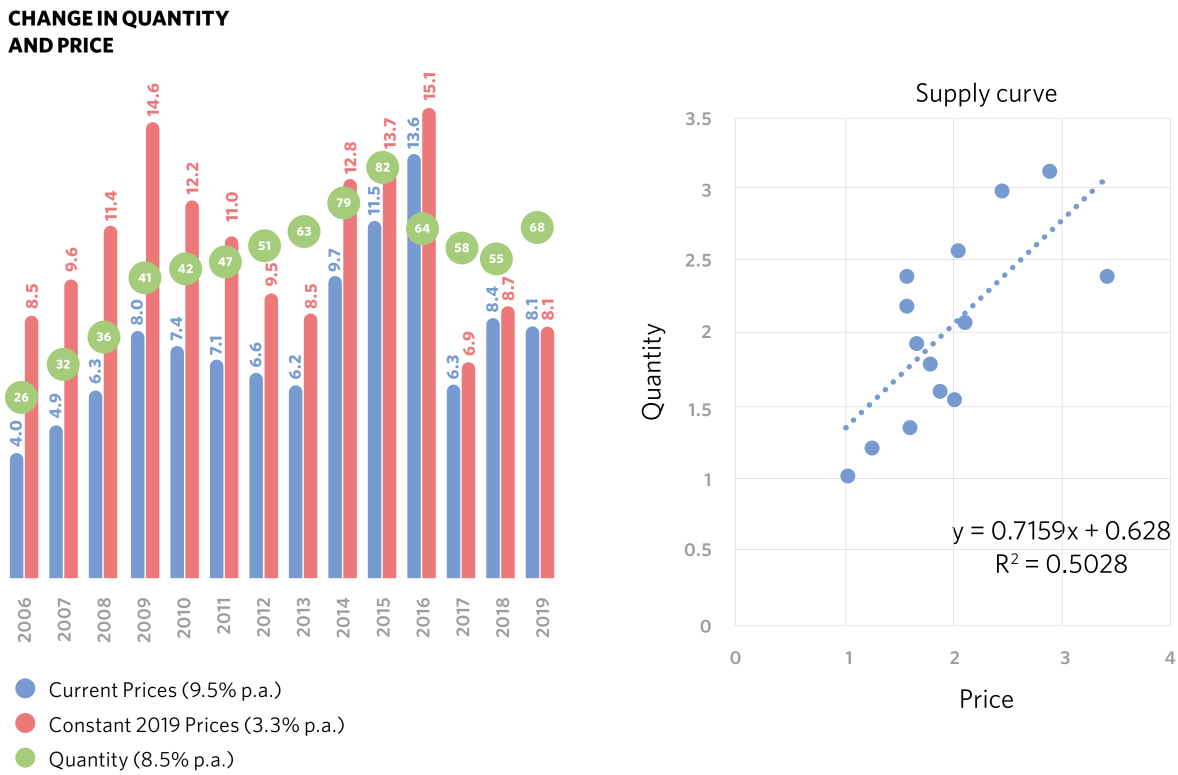
Figure 2.1.2-1-Product flows underlying cocoa beans value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

The *supply regime* of the rural production of cocoa is characterized by a weakly inelastic production response, since the 1 percent variation in the (current) price results in a 0.7159 percent growth in the quantity produced, and by a 3.3 percent p.a. increase in the actual price paid to the producer, pointing to an accumulation of unsatisfied demand (Chart 3.1.1-1).

Chart 2.1.2-1- Cocoa beans supply regime: a) change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values; b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.



Source: Chart 3.1.2-2. Prepared by the authors.

The prices paid to producers are established in interactions with middlemen and wholesalers, who together capture cocoa production and make it available to the domestic processing industry. In IR-Xingu, which is responsible for 98 percent of the gross value of agricultural production (GVAP) of this traditional Amazon product in EcoSocioBio-PA, there are 38 middlemen and wholesalers, with three of them acting as coordinators in Medicilância; in IR-Tocantins, 28 middlemen are spread throughout the region, with a greater presence in Baião and Cametá. The production they capture is oriented towards five wholesalers in the IR itself, with the most important among them located in Mocajuba and the others in Cametá (Figure 2.1.2-2 and 2.1.2-3 and Table A.1.2-1).

The entire production is transferred to the domestic processing industry, which has units in the states of Bahia and São Paulo. The hierarchical structure of the chain can be evaluated in price formation: in the local structure, wholesalers have a 40 percent markup, while that of their suppliers (middlemen) and buyers in the extra-local processing industry does not exceed 1 percent and 16 percent, respectively. In the extra-local structure, the markup percentages are 15 for the processing industry and 43 for retail trade (Chart 2.1.2-2).

Figure 2.1.2-2 Actors and their relations in cocoa-almond chains in IR-Xingu by georeferenced geographical location (scale representation of weighted purchase and sale flows)

PRODUCTION AND MARKETING ACTORS

Location

- Xingu
- Guajará
- Guamá
- Domestic

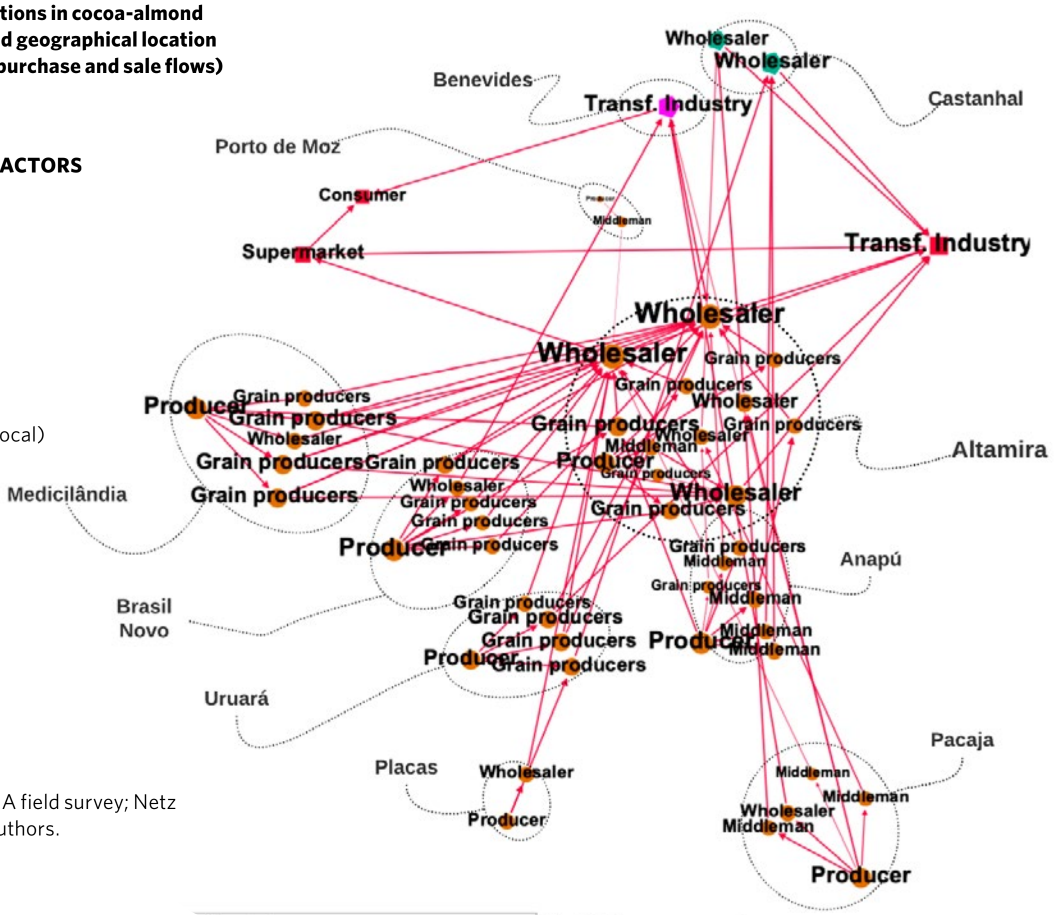
Actor's sector

- Rural and surrounding areas (local)
- Urban Centers (State)
- Domestic/International

NTFP FLOW

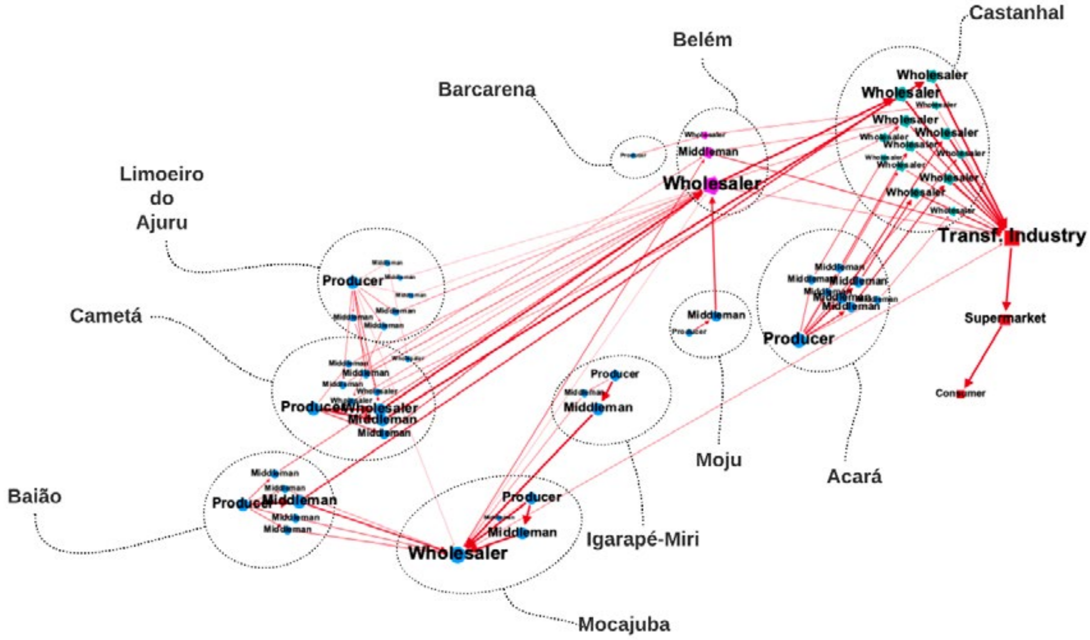
Product analyzed

Cocoa beans



Source: IDESP-DADESA/NAEA-IPEA field survey; Netz system for CSα. Processing by the authors.

Figure 2.1.2-3 Actors and their relations in cocoa-almond chains in IR-Tocantins by georeferenced geographic location (scale representation of weighted purchase and sale flows)



PRODUCTION AND MARKETING ACTORS

Location

- Tocantins
- Guajará
- Guamá
- Domestic

Actor's sector

- Rural and surrounding areas (local)
- Urban Centers (State)
- Domestic/International

NTFP FLOW

Product analyzed

Cocoa beans

Source: IDESP-DADESA/NAEA-IPEA field survey; Netz system for CSα. Processing by the authors.

The conditions described establish the mode of distribution of the total VA (income) generated in 2019 along cocoa chains and their constitutive arrangements. The following stands out:

- The total VA generated of BRL1.3 billion is 2.4 times the original value of the rural production of BRL550 million (Table A.2.2-2).

- The arrangements that produce cocoa beans in the *economy of Pará* accounted for 61 percent of the VA generated: these are, therefore, *pro-local* chains (first column in Chart 2.1.2-3);

- The interior accounted for 60.3 percent of the local economy share – these are, therefore, *pro-interior* chains (second column in Chart 2.1.2-3);

- In the interior, rural production accounted for 43 percent and middlemen for 17.1 percent. Considering this high VA share of and the already mentioned supply regime, in which the price paid to the producer has increased, these are *pro-rural production* chains (third column in Chart 2.1.2-3);

- The industrial processing sectors are incipient (0.1 and 0.2 percent in the center and in the interior of the local economy (third column in Chart 2.1.2-3);

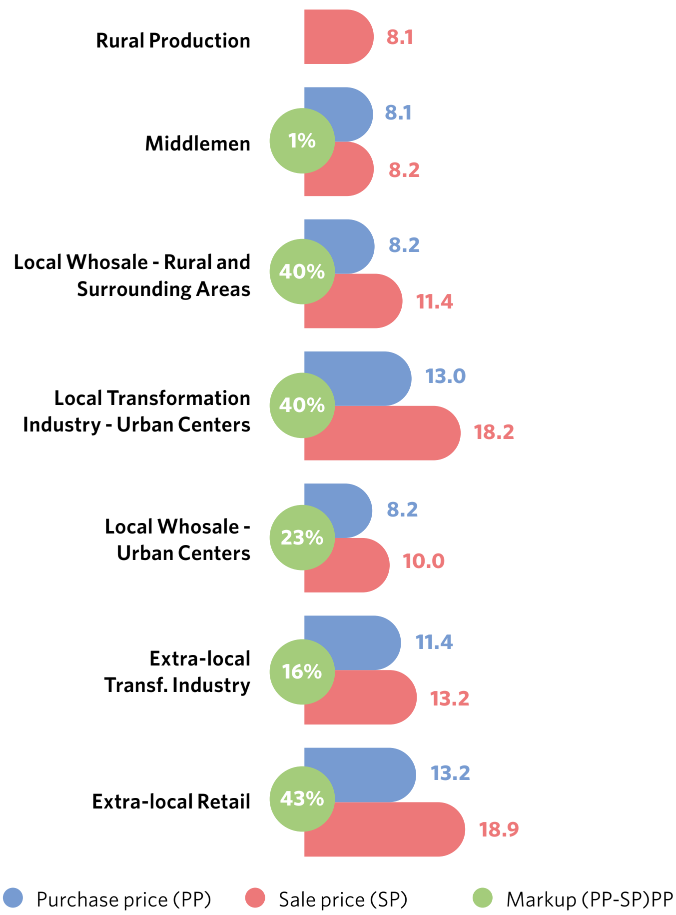
- The extra-local economy, which is responsible for 100 percent of the product value, accounted for 39 percent of the value added in retail trade (29.6 percent) and industry (9.4 percent). This characterizes cocoa as an *export base* of the local economy (first and fourth column in Chart 2.1.2-3).

- The value of exports to the rest of the world did not exceed 0.4 percent of the total VA (Table A.2.2-2).

- Employment associated with the chains totaled 38,700 workers: 64 percent in rural production and 14 percent in trade (Table A.2.2-2).

- IR Xingu accounted for 98 percent of the VA of cocoa in EcoSocioBio-PA in 2019. However, with the exception of IR Caeté, all of them produced cocoa: IR Tocantins, which ranked second, accounted for 1.5 percent of the VA and Rio Capim for 0.7 percent, followed by Marajó and Baixo Amazonas with small shares.

Chart 2.1.2-2-Price formation and markup along the cocoa-almond value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, field rsurvey and processing in the Netz System.

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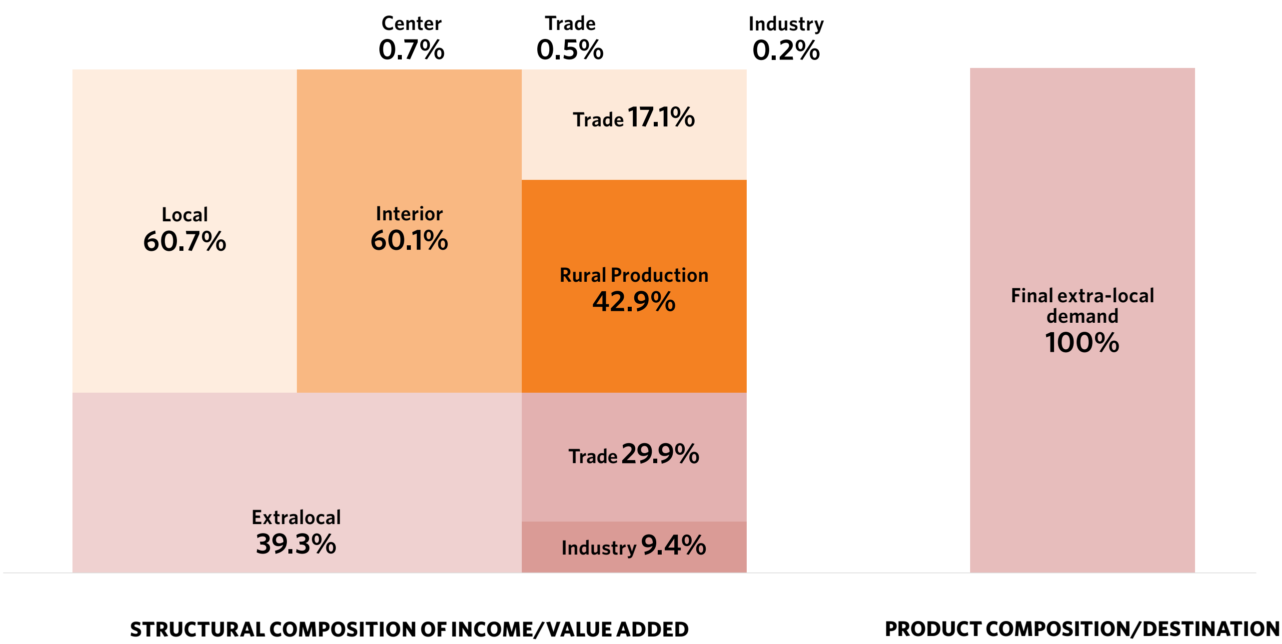
Chart 2.1.2-3 Added Value/Income Distribution and Product Destination in EcoSocioBio-PA's Cocoa Beans Chain



Source: Annex 2, A.2.2, Table A.2.2.-2.

3.1.3 Brazil nuts

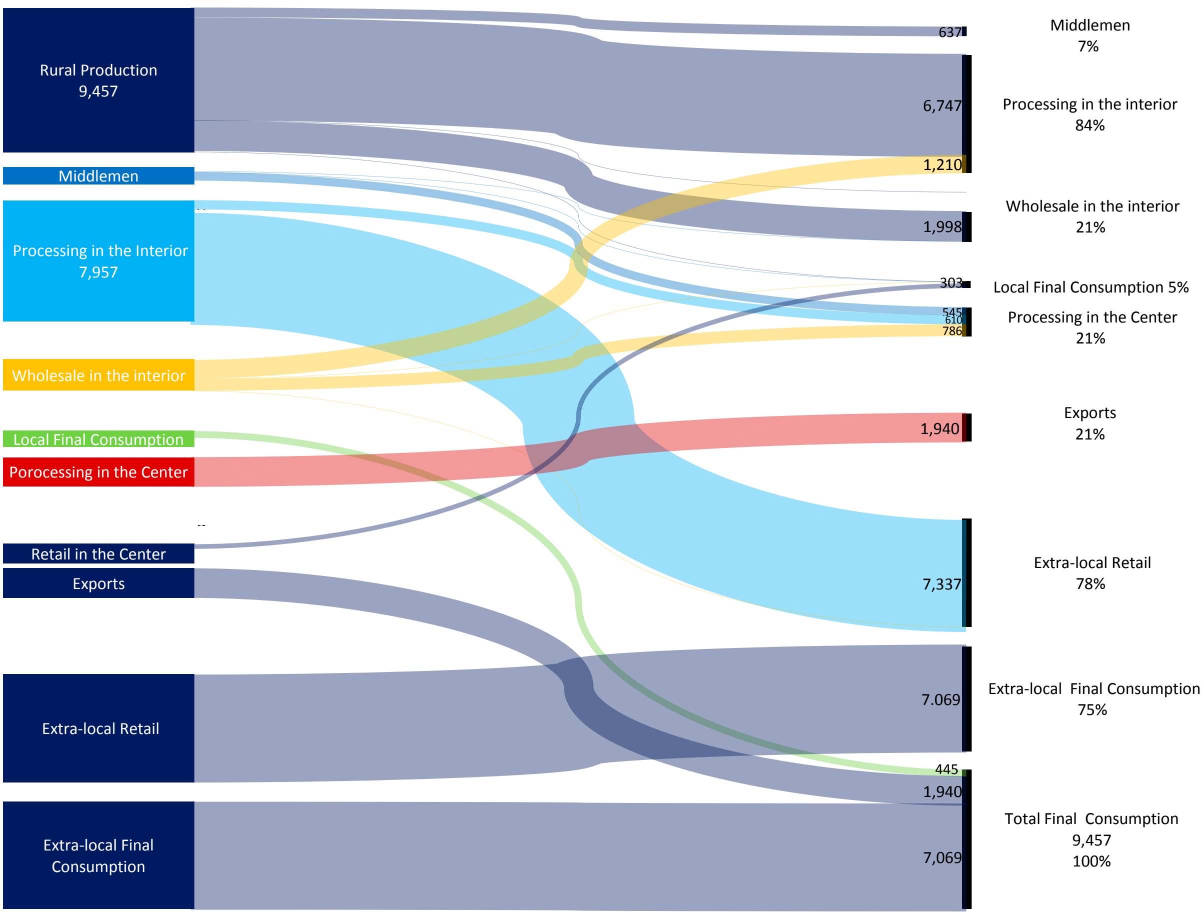
Since 2006, the gross value of the rural production of Brazil nuts, which is the third most important product of EcoSocio-Bio-PA, has grown at 7.7 percent p.a., reaching BRL16 million in 2019. As a result of an average increase of 7.1 percent p.a. over the same period, production in that year totaled 9,500 tons, which were distributed through the chains shown in Figure 2.1.3-1. In this structure, the following characteristics stand out:

- Agricultural producers have three points of entry into the chain: the processing industry in the interior (84 percent of production), wholesalers (21 percent) and middlemen (7 percent) in the interior. These agents supply the industrial processing sector in the center (metropolitan area of Belém) of the local economy and the domestic extra-local retail sector (78 percent) (Figure 2.1.3-1)

- The industrial processing sector in the center exports to the rest of the world the equivalent of 21 percent of total production.

The *supply regime* of the rural production of Brazil nuts is characterized by a moderately inelastic production response, since 1 percent variation in the (current) price results in a 0.657 percent increase in the quantity produced, and by a 1.3 percent p.a. increase in the actual price paid to the producer, pointing to an accumulation of an unsatisfied demand (Chart 2.1.3-1).

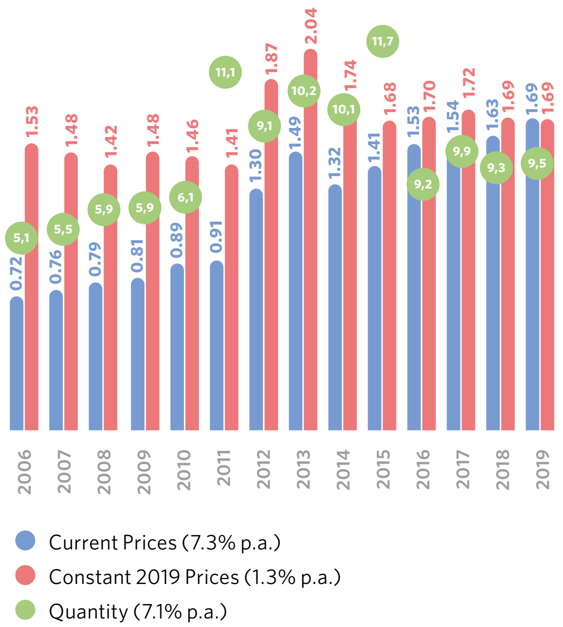
Figure 2.1.3-1 Product flows underlying Brazil Nuts value chains (t) 2019

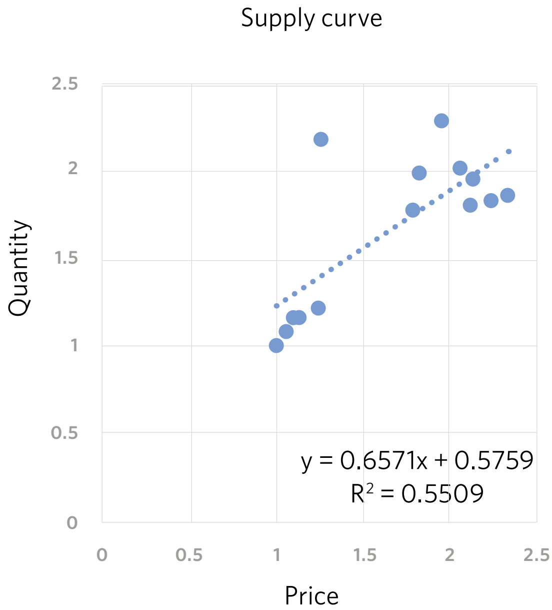


Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.1.3-1- Cocoa beans supply regime: a) change in quantity (1,000 t) and price (BRL1,000.00/t, current and constant 2019 values); b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006=1

CHANGE IN QUANTITY AND PRICE





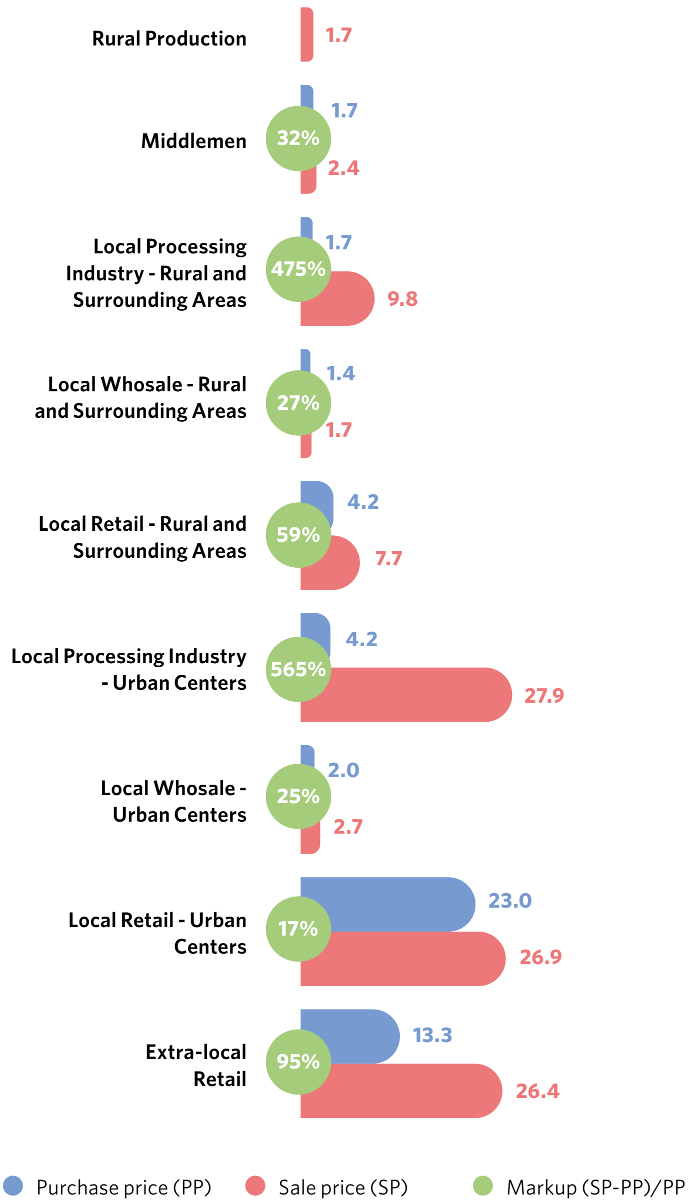
Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The prices paid to producers in Brazil nuts chains are defined in the relations with the processing industry and with wholesale in the interior, the latter being a warehouse of the former.

In IR-Baixo Amazonas, which is the main producer of Brazil nuts in EcoSocioBio-PA, with 74 percent of the VA, the processing industry is formed by three companies, of which the most important is located in Oriximiná and the other two in Óbidos. By trading directly with producers, they challenge the intermediation of middlemen (3 agents) and wholesalers (8 agents). However, mainly for the largest nut processing plants, wholesalers are strategic suppliers of the production that they are unable to access directly, either for logistical reasons or because of the producers' organization. A clear hierarchy is therefore established, with these companies in the top position (Figure 2.1.3-2 and Table A.1.2-1). In IR-Tocantins, which holds 18 percent of the VA and is the second most important producer in EcoSocioBio-PA, one middleman in Baião and four wholesalers in Cametá, Mocajuba and Baião, together with two processing plants in Cametá, channel the production of IR-Tocantins to the industrial processing sector in Belém, which is formed by three companies (Figure 2.1.3-3 and Table A.1.2-1).

These structures ensure the industrial processing industry, whether in the interior (IRs), or in the center of Pará's economy, privileged positions that allow them markups of 475 percent and 565 percent, respectively. The markups of its suppliers (polarity internal to the local economy) are only 32 percent for middlemen and 27 percent for wholesalers; however, in the case of its buyers (external polarity), extra-local retail markups are as high as 98 percent (Chart 2.1.3-2).

Chart 2.1.3-2-Price formation and markup along the Brazil nuts value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

The conditions described establish the mode of distribution of the total VA generated in 2019 along Brazil nuts chains and their constitutive arrangements. The following stands out:

- The total VA generated of BRL140.2 million reais is 8.7 times the original value of the rural production of BRL16 million (Table A.2.2-3).
- The arrangements that produce Brazil nuts in the economy of Pará accounted for 92.3 percent of the VA generated: these are, therefore *pro-local* chains (first column in Chart 2.1.3-3);
- The interior accounted for 60.3 percent of the local economy share – these are, therefore, *pro-interior* chains (second column in Chart 2.1.3-3);
- In the interior, rural production accounted for a mere 11.4 percent – these are, therefore, chains that do not seem to favor *rural production* (third column in Chart 2.1.3-3);

Figure 2.1.3-2 Actors and their relations in Brazil Nuts Chains in IR-Baixo Amazonas by georeferenced geographic location (scale representation of weighted purchase and sale flows)

PRODUCTION AND MARKETING ACTORS

Location

- Xingu
- Guajará
- Domestic
- International

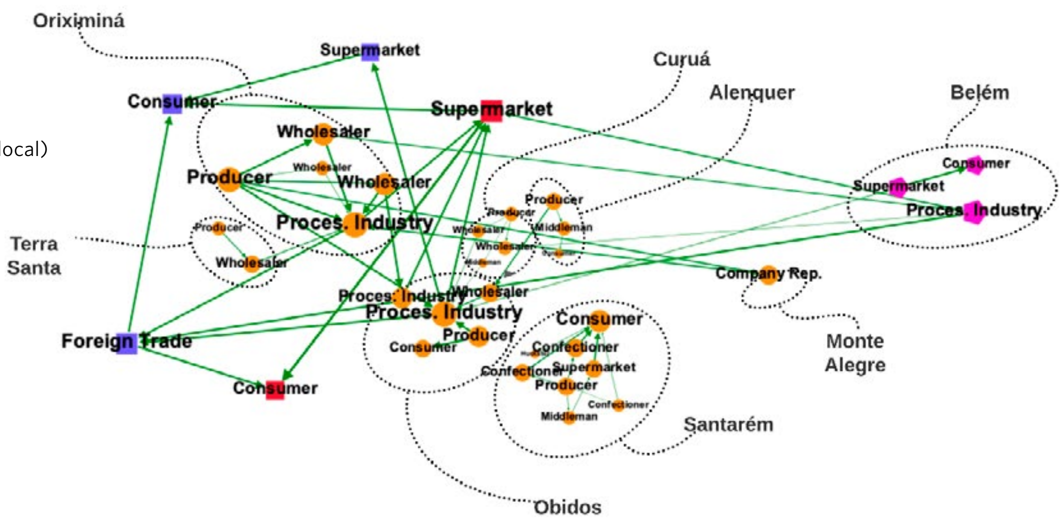
Actor's sector

- ○ Rural and surrounding areas (local)
- ⬡ Urban Centers (State)
- ☐ Domestic/International

NTFP FLOW

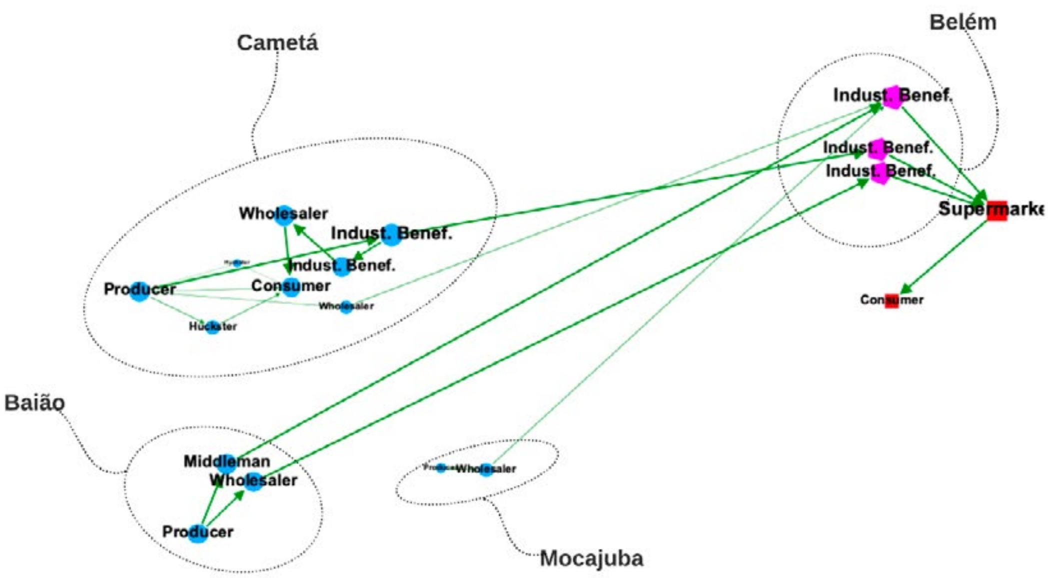
Product analyzed

→ Brazil Nut



Source: IDESP-DADESA/NAEA-IPEA field survey; Netz System for CSα. Processing by the authors.

Figure 2.1.3-3 Actors and their relations in Brail Nuts Chains in IR-Tocantins by georeferenced geographic location (scale representation of weighted purchase and sale flows)



PRODUCTION AND MARKETING ACTORS

Location

- Tocantins
- Guajará
- Domestic

Actor's sector

- ○ Rural and surrounding areas (local)
- ⬡ Urban Centers (State)
- ☐ Domestic/International

NTFP FLOW

Product analyzed

→ Brazil Nut

Source: IDESP-DADESA/NAEA-IPEA field survey; Netz System for CSα. Processing by the authors.

- The industrial processing sectors are the big winners of the chain: with 46 percent in the interior and 32.8 percent in urban centers, these are *pro-industry* chains (third column in Chart 2.1.3-3);

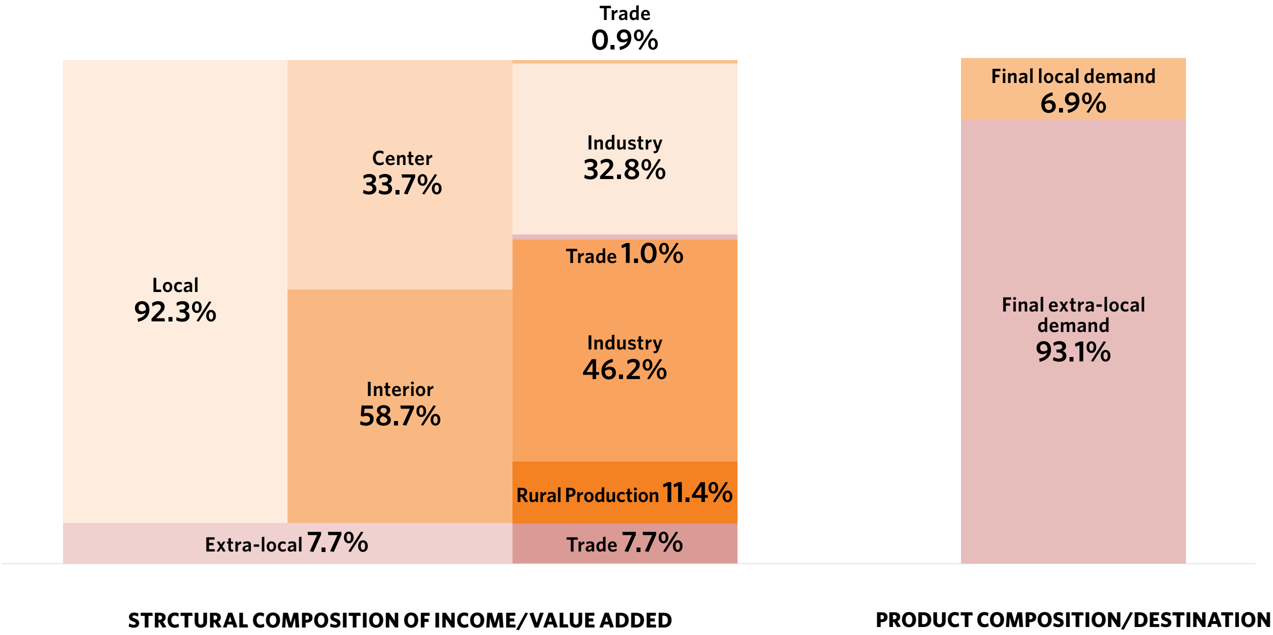
- The extra-local economy, which was responsible for 93.1 percent of the product's value, accounted for 7.7 percent of the VA in retail trade. This characterizes Brazil nuts as an important *export base* of the local economy (first and fourth column in Chart 2.1.3-3)

- The value of exports to the rest of the world did not exceed 12.9 percent of the total VA (Table A.2.2-3).

- Employment associated with the chains totaled 3,700 workers: 65 percent in the interior, 58 percent in rural production and 7 percent in the industrial sector; and another 5 percent in the industrial sector of local urban centers. In extra-local economies, 29 percent were in trade (Table A.2.2-3).

- IR-Baixo Amazonas concentrated 74 percent of the VA, IR-Tocantins 18 percent, IR-Marajó and IR-Xingu 3 percent each, and IR-Guamá 1 percent.

Chart 2.1.3-3 Value Added/Income Distribution in EcoSocioBio-PA's Brazil Nuts chains by local and extra-local economy sectors and Product destination



Source: Annex 2, A.2.2, Table A.2.2.-3.

3.1.4 Annatto

Since 2006, the gross value of the rural production of annatto has grown at 14.8 percent p.a., reaching BRL4.1 million in 2019. As a result of an average increase of 8.5 percent p.a. over the same period, production that year totaled 591 tons, which were distributed through the chains shown in Figure 2.1.4-1. In this structure, the following characteristics stand out:

- Producers have three points of entry into the short annatto chain: middlemen (31 percent), the processing industry (34 percent) and the industrial processing industry (28 percent) in the interior of the local economy.

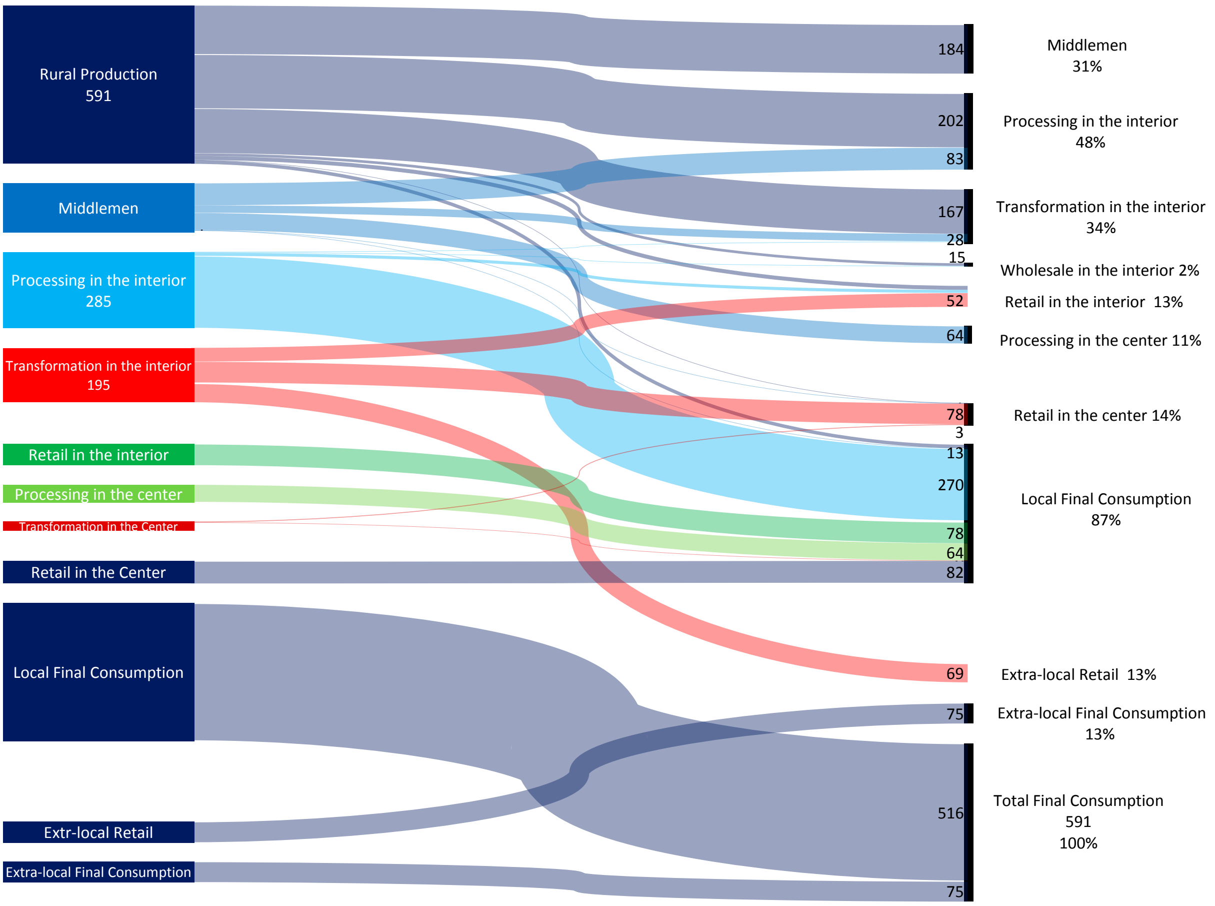
- With approximately 2/3 of what they buy, middlemen supply the industry of the interior and with the other 1/3 the industry in the center of the local economy;

- Final production is earmarked for the local market at a proportion of 87 percent.

- The transformation industry in the interior supplies the extra-local domestic market with an amount equivalent to 13 percent of total production (Figure 3.1.4).

The *supply regime* of the rural production of annatto is characterized both by a strongly inelastic production response, since the (current) price variation of 1 percent results in a 0.2999 percentage points increase in the quantity produced, and by a 5.2 percent p.a. increase in the actual price paid to the producer, thus indicating an accumulation of an unsatisfied demand (Chart 2.1.4-1).

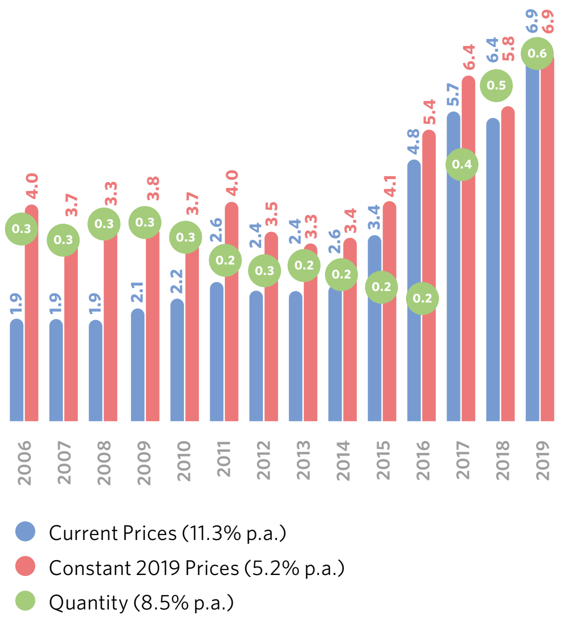
Figure 2.1.4-1-Product flows underlying annatto value chains (t)

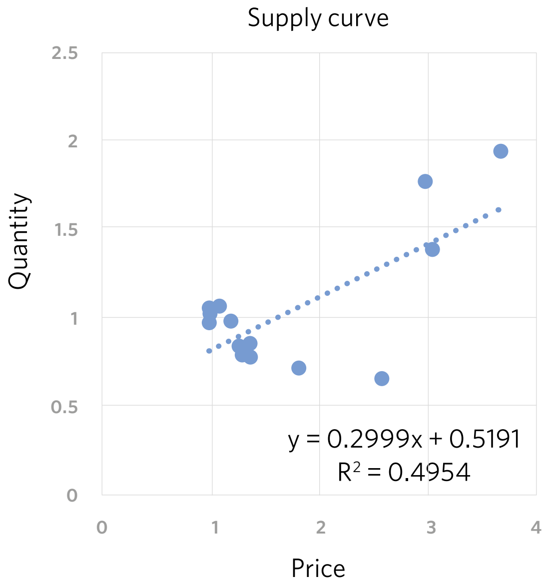


Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.1.4-1- Annatto supply chain regime: a) change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values); b) supply curve: Quantity Index as a linear function of the Current Product Price Index (2006 = 1), with the linear coefficient defined as zero

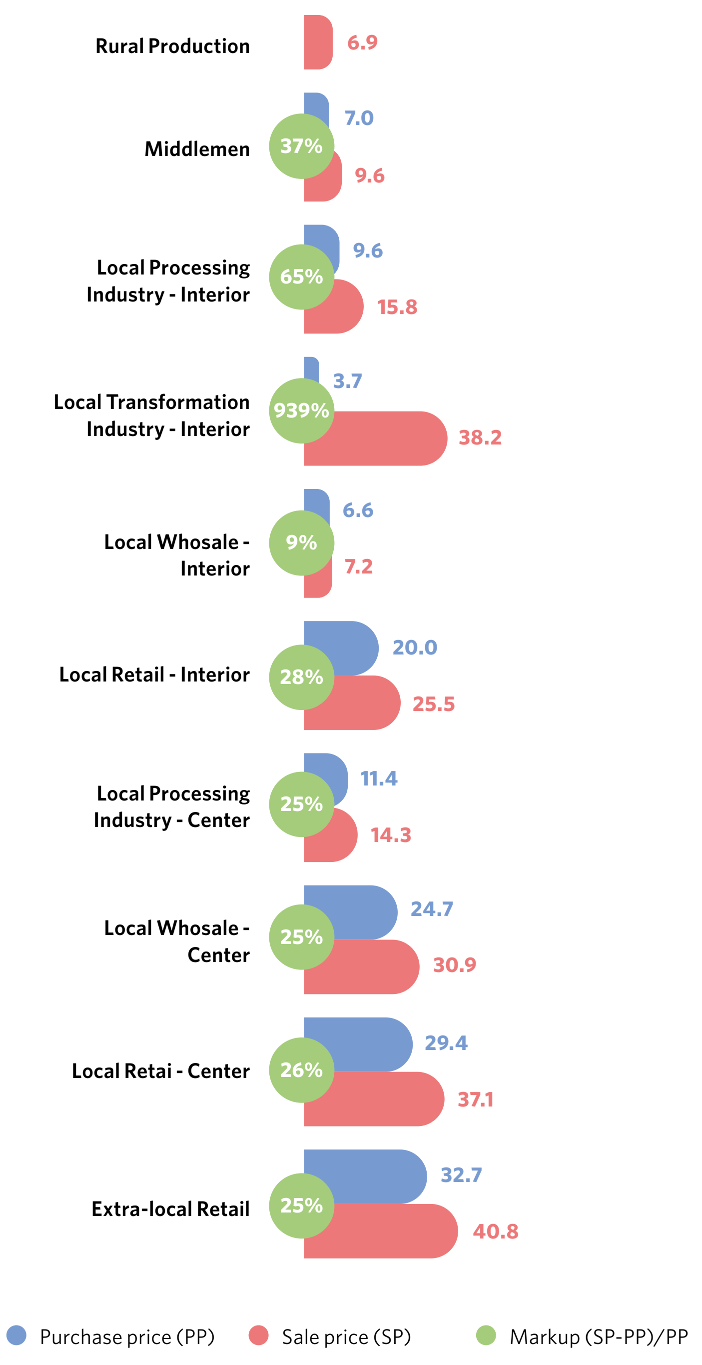
CHANGE IN QUANTITY AND PRICE





Source: IBGE, Agricultural Census 2006 and 2017; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

Chart 2.1.4-2-Price formation and markup along the annatto value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

The highest markups were found in the transformation industry in the interior (93 percent) and in the processing industry (65 percent); the markup of their suppliers upstream varies between 9 percent and 37 percent, and that of their byers downstream of the network between 25 and 28 percent (Chart 2.1.4-2).

The conditions described establish the mode of distribution of the total VA generated in 2019 along annatto chains and their constitutive arrangements. The following stands out:

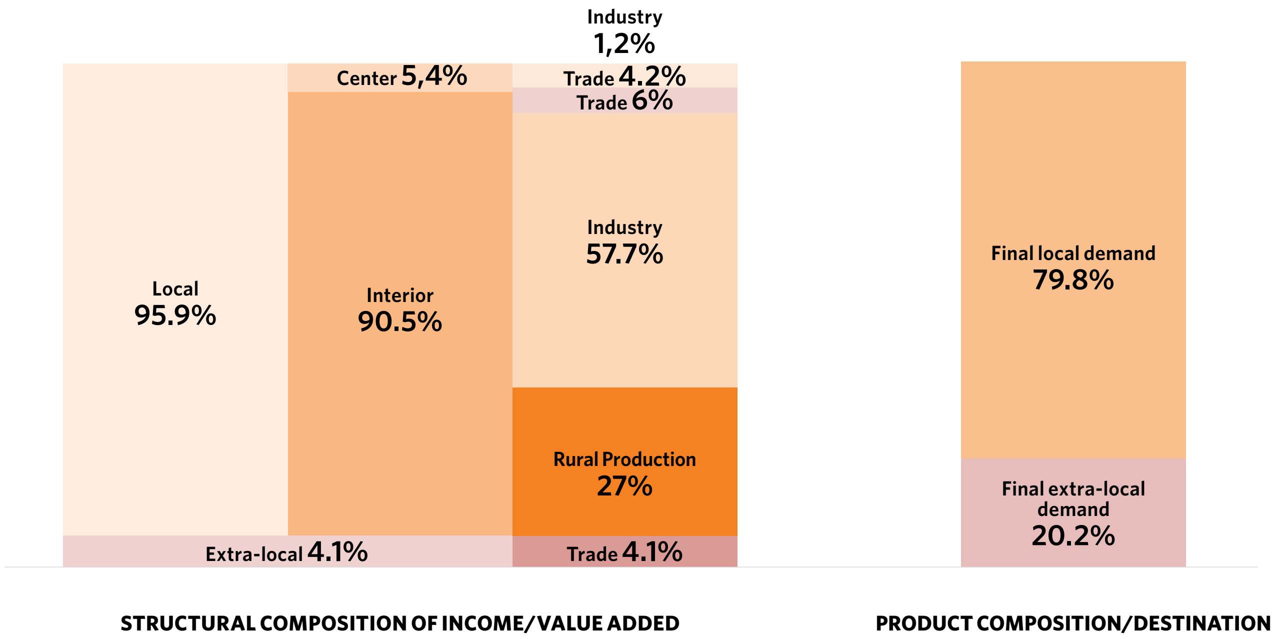
- The total VA generated of BRL15.2 million is 3.7 times the original value of the rural production of BRL4.1 million; this can be considered a primary chain multiplier (Table A.2.2-4).
- The arrangements that produce annatto in the *local economy* accounted for 90.5 percent of the VA generated: these are, therefore, *pro-local* chains (first column in Chart 2.1.4-3)
- The interior accounted for 90.5 percent of the local economy share – these are, therefore, *pro-interior* chains (second column in Chart 2.1.4-3);
- In the interior, rural production accounted for 27 percent, industry for 58 percent and trade for 6 percent – these are, therefore, *pro-industry* chains (third column in Chart 2.1.4-3);
- Of the 6 percent that fell to the largest local urban centers, the processing industry and trade accounted for 1.2 and 6 percent, respectively (third column in Chart 2.1.4-3);
- As much as 80 percent of the product was consumed in the local economy. Therefore, 20 percent of the product value was earmarked for the extra-local economy, where retail trade accounted for 4 percent of the value added. This

characterizes the annatto economy as predominantly oriented to the domestic needs of the local economy, with a share also as its export *base* (first and fourth column in Chart 2.1.4-3);

- Employment associated with the chains totaled 321 workers, with 86 percent in the local economy: 73 percent in rural production, 12 percent in industry and 1 percent in trade. (Table A.2.2-4, last row).

- IR-Guamá and IR-Xingu, with 50 percent and 49 percent, respectively, accounted for 99 percent of the VA of acai in EcoSocioBio-PA in 2019. IR-Baixo Amazonas accounted for the remaining 1 percent.

Chart 2.1.4-3 Added Value/Income Distribution and Product Destination in EcoSocioBio-PA's Annatto Chain



Source: Source: Annex 2, A.2.2, Table A.2.2.-4.

3.1.5 Honey

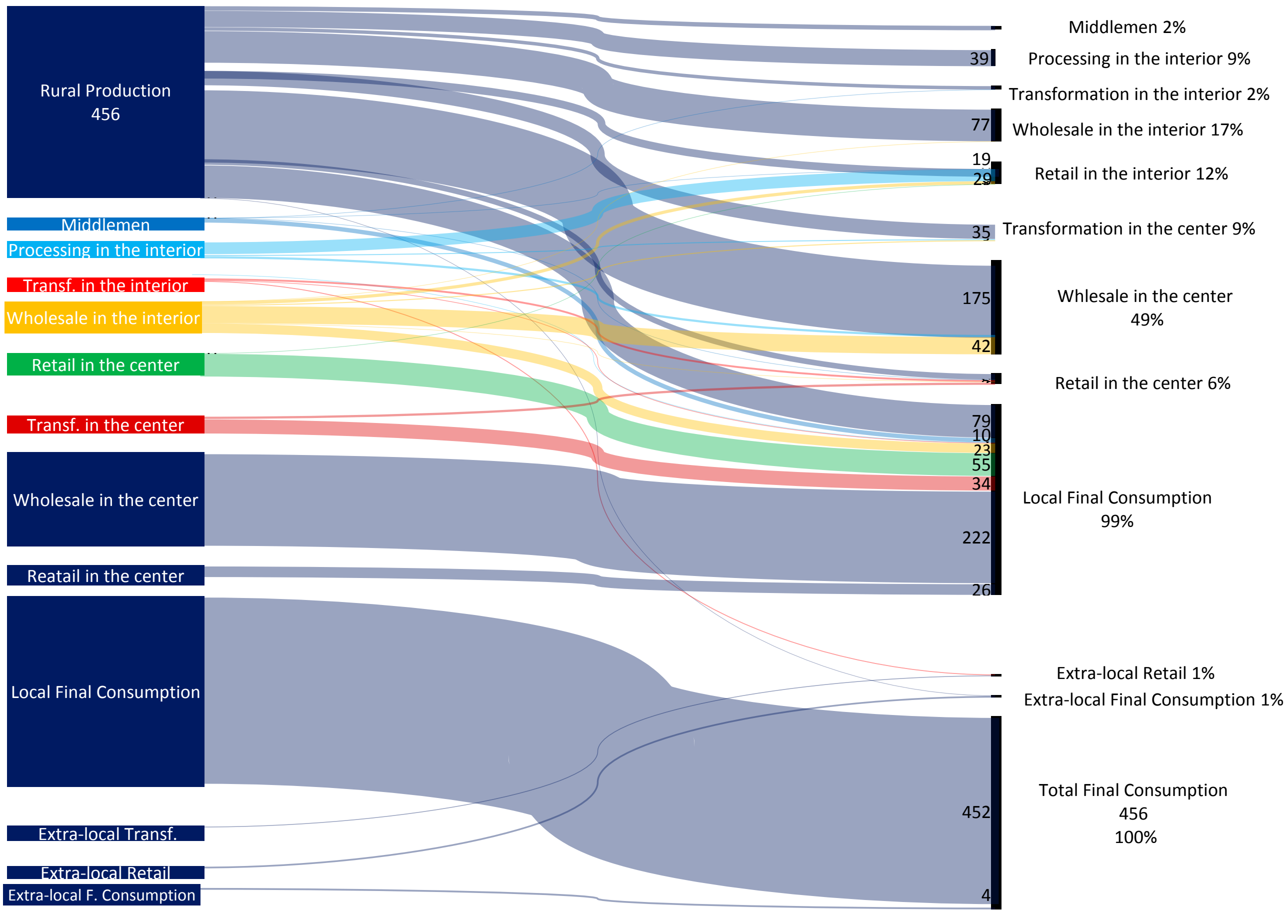
Since 2006, the gross value of the production of honey has grown at 6.4 percent p.a., reaching BRL5.8 million in 2019. As a result of an average increase of 7.4 percent p.a. over the same period, the amount produced in that year totaled 456 tons, which were distribute through the chains shown in Figure 2.1.5-1. The following characteristics stand out in this structure:

- Rural producers have multiple points of entry into short supply chains in both the interior and major centers of the local economy, which absorb 99 percent of production.
- Industrial processing, also in the interior, absorbs 9 percent of production; in large urban centers, another 9 percent undergo industrial transformation.
- This production is sold *in natura*, with the strong intermediation of wholesalers (49 percent). (Figure 2.1.5-1).

The *supply regime* of the rural production of honey is characterized by an inelastic production response, since the (current) price variation of 1 percent results in a 0.73 percent increase in the quantity produced; this is consistent with the -0.8 percent p.a. decrease in the actual price paid to the producer, thus indicating that supply has grown at a rate slightly higher than demand (Chart 2.1.5-1).

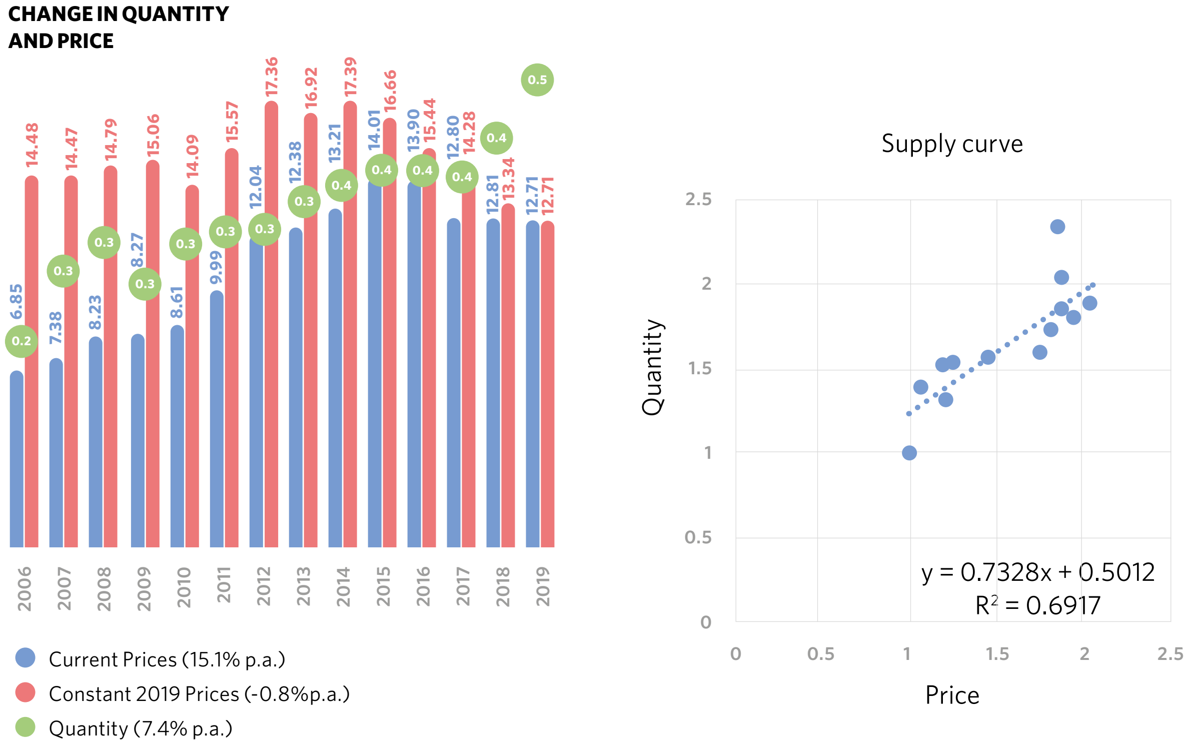
The highest markups are found in the industry in the interior – 109 percent in the processing industry and 77 percent in the transformation industry; the markup of their suppliers upstream, i.e., middlemen, was 59 percent, and in the case of their buyers downstream the network it ranged from close to

Figure 2.1.5-1- Product flows underlying honey value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census 2017); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.1.5-1- Change in honey quantity in 1,000 t and price in BRL1,000.00/t (in current values and constant 2019 values); honey supply curve: Quantity Index as a linear function of the Product Price Index, 2006 value = 1 for both



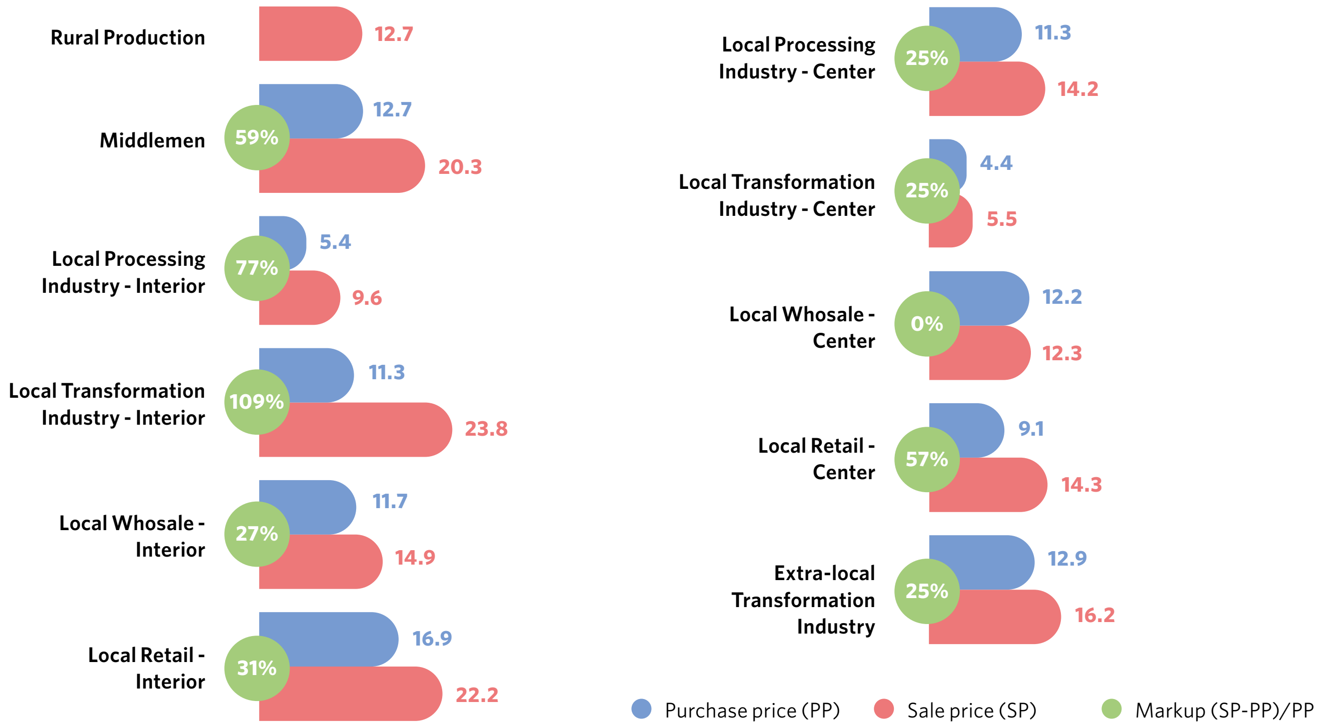
Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

zero for wholesale to 57 percent in retail in the center of the local economy, leading to the understanding that these two sectors work together (Chart 2.1.5-2).

The conditions described establish the mode of distribution of the total VA generated in 2019 along honey chains and their constitutive arrangements. The following stands out:

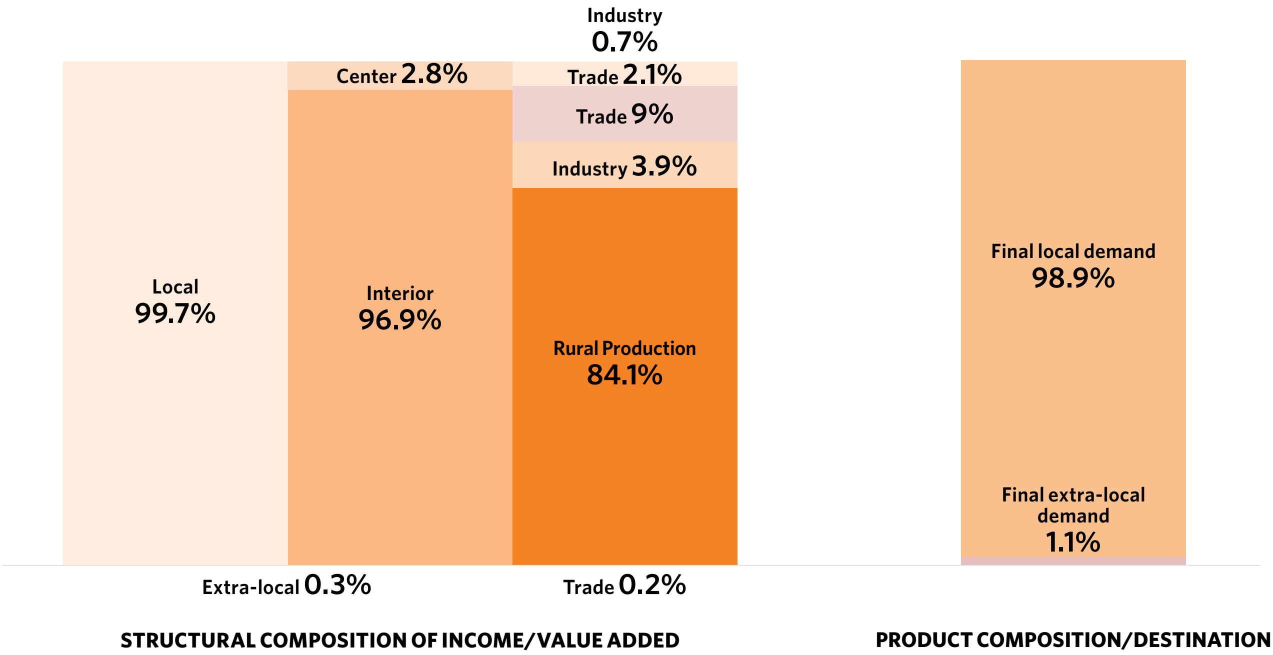
- The total VA generated of BRL6.9 million is 1.2 times the original value of the rural production of BRL5.8 million; this can be considered a primary chain multiplier (Table A.2.2-5).
- The arrangements that produce honey in the *local economy* accounted for 100 percent of the VA generated: these are, therefore, strongly *pro-local* chains (first column in Chart 2.1.5-3)
- The interior accounted for 97 percent of the local economy share – these are, therefore, strongly *pro-interior* chains (second column in Chart 2.1.5-3);
- In the interior, agricultural production accounted for 84 percent, industry for 4 percent and trade for 9 percent – these are, therefore, strongly *pro-rural producer* chains (third column in Chart 2.1.5-3);
- As much as 99 percent of production was consumed in the local economy. This characterizes the honey chain as oriented to the domestic needs of the local economy (first and fourth column in Chart 2.1.5-3).
- Employment associated with the chains totaled 508 workers distributed along the chain in a way similar to the VA (Table A.2.2-5, last row) .
- The main honey producing IRs are Guamá with 33 percent and Caeté with 29 percent, followed by Capim (11 percent), Baixo Amazonas (9 percent), Tocantins (8 percent), and Xingu (7 percent). Marajó has the lowest share (3 percent).

Chart 2.1.5-2-Price formation and markup along the honey value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

Chart 2.1.5-3 Value/Income Distribution and Product Destination in EcoSocioBio-PA's Honey Chain



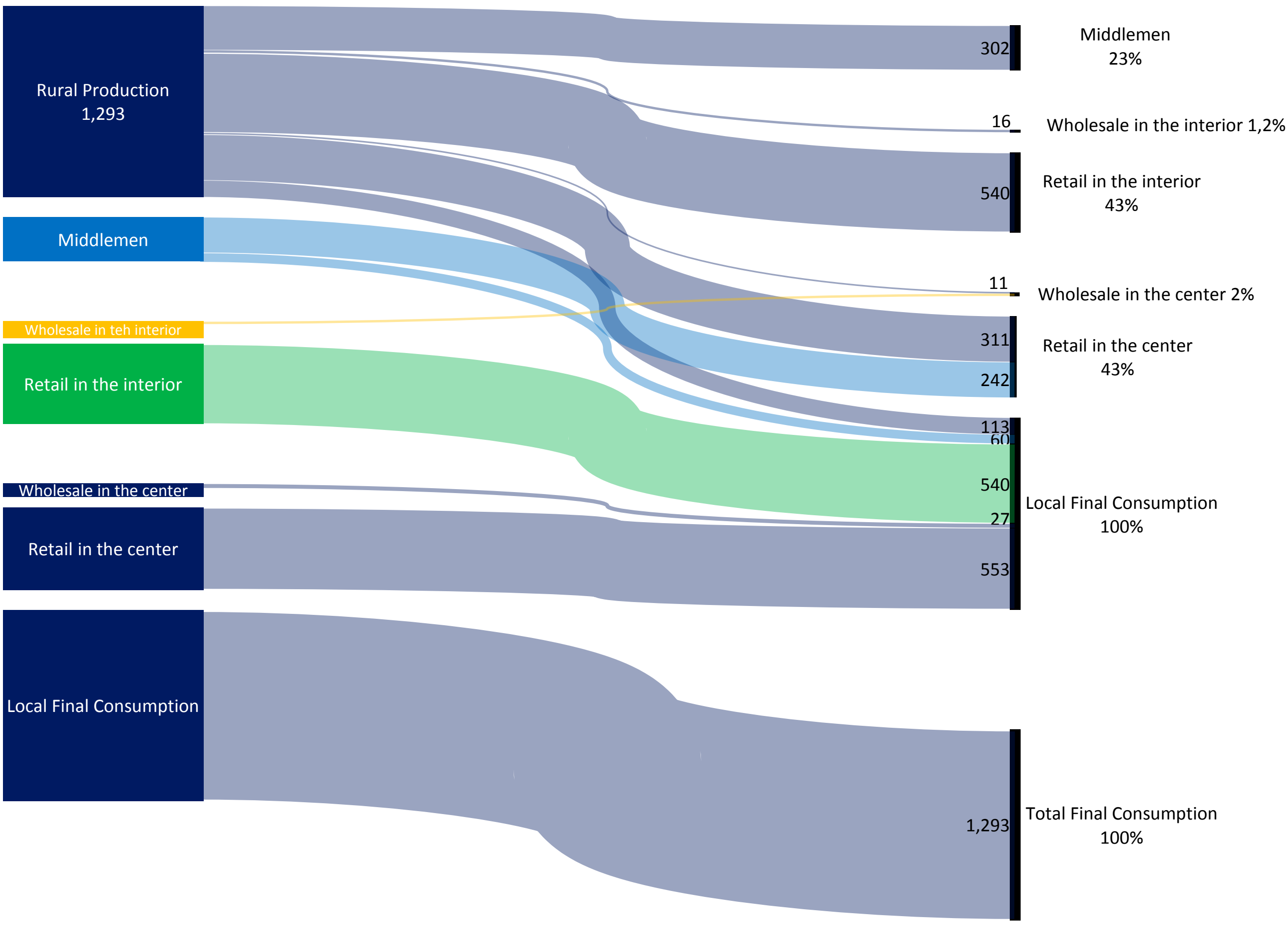
Source: Annex 2, A.2.2, Table A.2.2.-5.

3.1.6 Pupunha

Since 2006, the gross value of the rural production of pupunha has grown at 4.2 percent p.a., reaching BRL4.4 million in 2019. As a result of an average increase of 4.7 percent p.a. over the same period, production in that year totaled 1,300 tons, which were distributed through the chains shown in Figure 2.1.6-1. The following characteristics stand out in this structure:

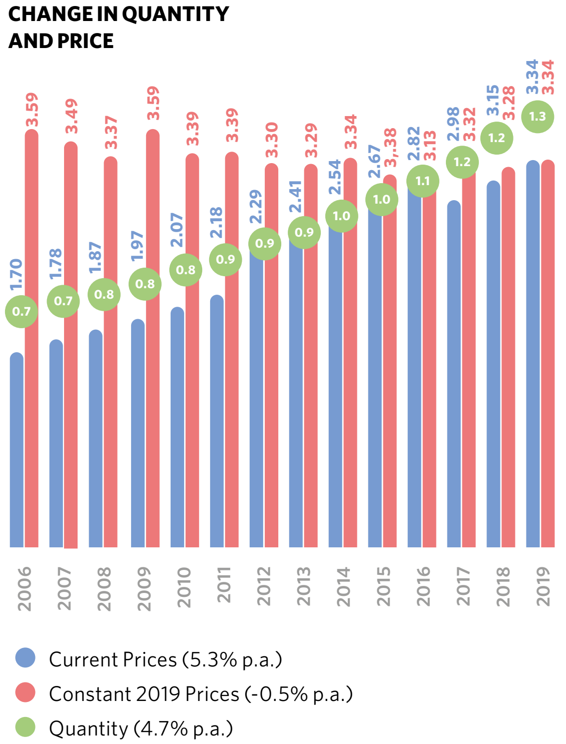
- Agricultural producers have different points of entry into short supply chains of fresh fruit to the local economy.
- A proportion of 43 percent of production is consumed already in the interior, with retail intermediation; the remaining 57 percent correspond to final consumption in large local urban centers (Figure 2.1.6-1).
- Only 23 percent of production is intermediated by middlemen (Chart 2.1.6-1).

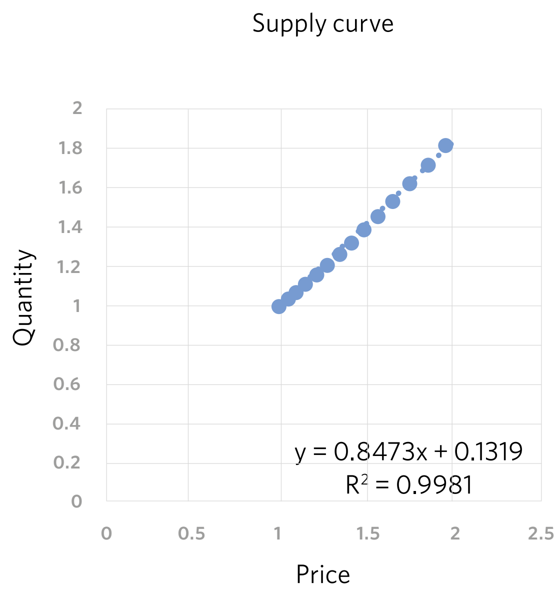
Figure 2.1.6-1-Product flows underlying pupunha value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.1.6-1 Change in pupunha quantity (1,000 t) and price (BRL1,000.00/t, current and constant 2019 values)





Source: IBGE, 2006 and 2017Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism survey. Methodological note: Values between census years and those after 2017 result from interpolation and projection based on the geometric growth rate between 2006 and 2017.

The *supply regime* of the rural production of pupunha is characterized by an inelastic production response, since the (current) price variation of 1 percent results in a 0.847 percent increase in the quantity produced. In turn, the -0.5 percent p.a. decrease in the actual price paid to the producer indicates that supply has grown at a rate slightly higher than demand (Chart 3.1.1-1).

The highest markup - 47 percent – was found in retail in large centers, a sector that seems to work jointly with wholesale; markups of other trade agents vary between 33 percent and 42 percent (Chart 2.1.6-2).

The conditions described establish the mode of distribution of the total VA generated in 2019 along pupunha chains and their constitutive arrangements. The following stands out:

- The total VA generated of BRL6.5 million is 1.5 times the original value of the rural production of BRL 4.4 million; this can be considered a primary chain multiplier (Table A.2.2-6).

- The arrangements that produce pupunha in the *local economy* accounted for 100 percent of the VA generated: these are, therefore, strongly *pro-local* chains (first column in Chart 2.1.6-3)

- The interior accounted for 88 percent of the local economy share – these are, therefore, strongly *pro-interior* chains (second column in Chart 2.1.6-3);

- In the interior, rural production and trade accounted 67 and trade 21 percent, respectively – these are, therefore, *pro-rural producer* chains, with the relevant participation of intermediation trade (third column in Chart 2.1.6-3);

- The production was entirely consumed in the local economy (first and fourth column in Chart 2.1.6-3);

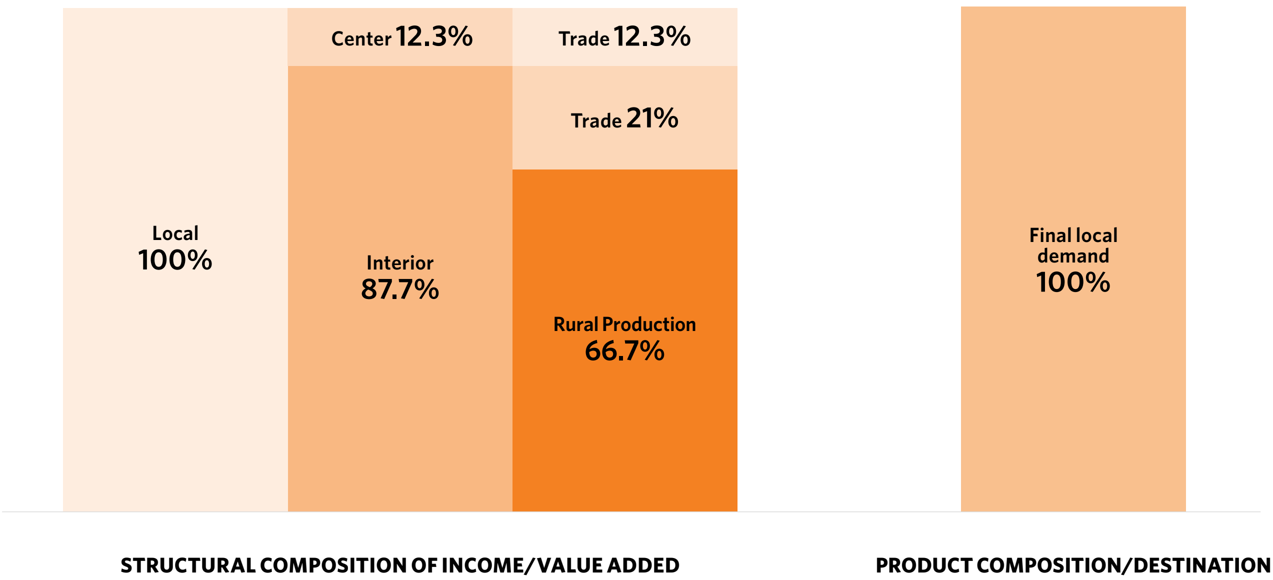
- Employment associated with the chains totaled 503 workers: 94 percent in rural production and the remainder in trade (Table A.2.2-6, last line).

- IR-Guamá concentrated production, with 50 percent of the total VA. IR-Tocantins comes next with 35 percent, followed by Rio Capim with 10 percent, and Marajó and Caeté with 2 percent each (Chart 3.2.2-6).

Chart 2.1.6-2-Price formation and markup along the pupunha value chain (BRL 1,000.00/t and % of purchase price)

Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

Chart 2.1.6-3 Added Value/Income Distribution and Product Destination in EcoSocioBio-PA's Pupunha Chain



Source: Annex 2, A.2.2, Table A.2.2.-6.

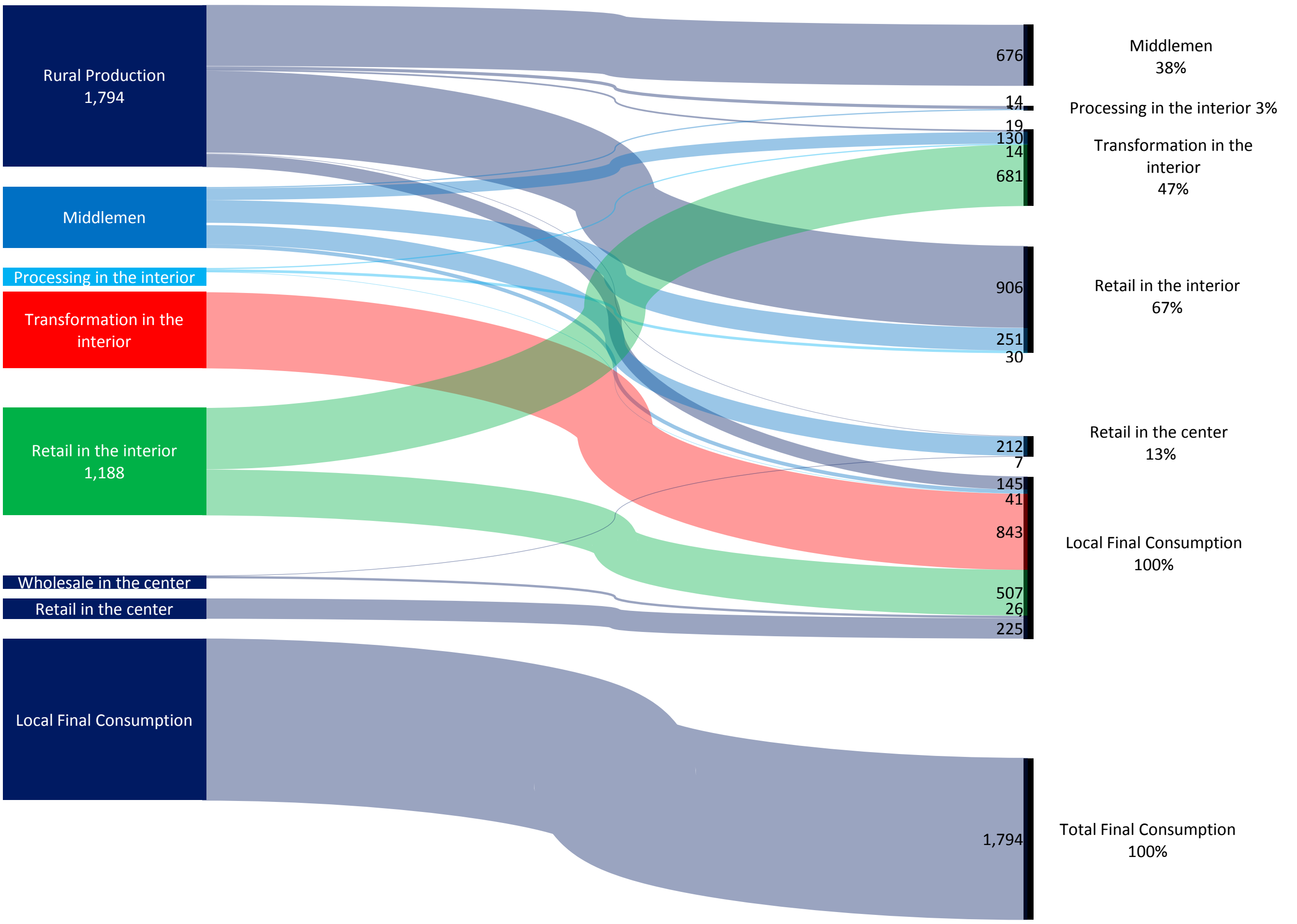
3.1.7 Bacuri

Since 2006, the gross value of the rural production of bacuri has grown at 8.2 percent p.a., reaching BRL3.3 million in 2019. As a result of an average increase of 4.4 percent p.a. over the same period, production in that year totaled 1,800 tons, which were distribute through the chains shown in Figure 2.1.7-1. The following characteristics stand out in this structure:

- The sold production of bacuri follows short local supply chains, mainly in the interior (87 percent), with the important mediation of industrial nodes that process 50 percent of production.

- Supply to the largest urban centers includes mainly fresh fruit. (Figure 2.1.7-1).

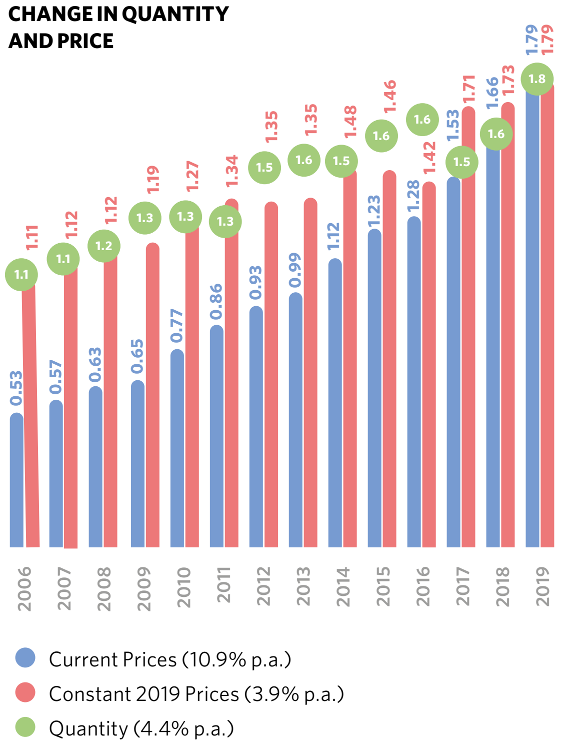
Figure 2.1.7-1-Product flows underlying bacuri value chains (t)

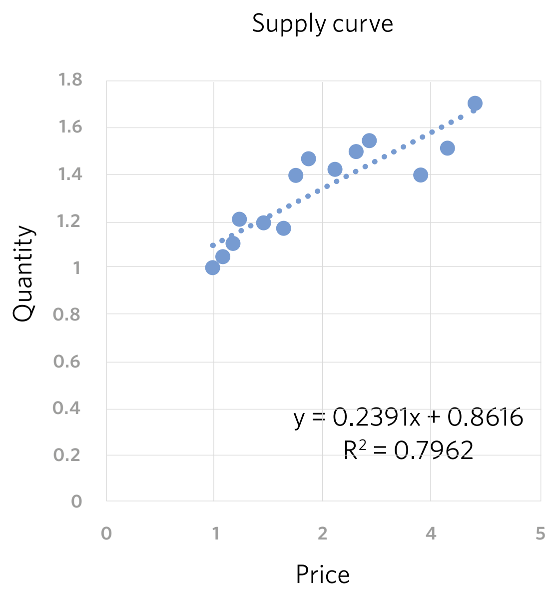


Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

The *supply regime* of the rural production of bacuri is characterized by a strongly inelastic production response, since the (current) price variation of 1 percent results in a 0.239 percent increase in the quantity produced. In turn, the 3.9 percent p.a. increase in the actual price paid to the producer indicates that supply has grown at a slower rate than demand (Chart 2.1.7-1).

Chart 2.1.7-1- Bacuri supply regime: a) Change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values); b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.





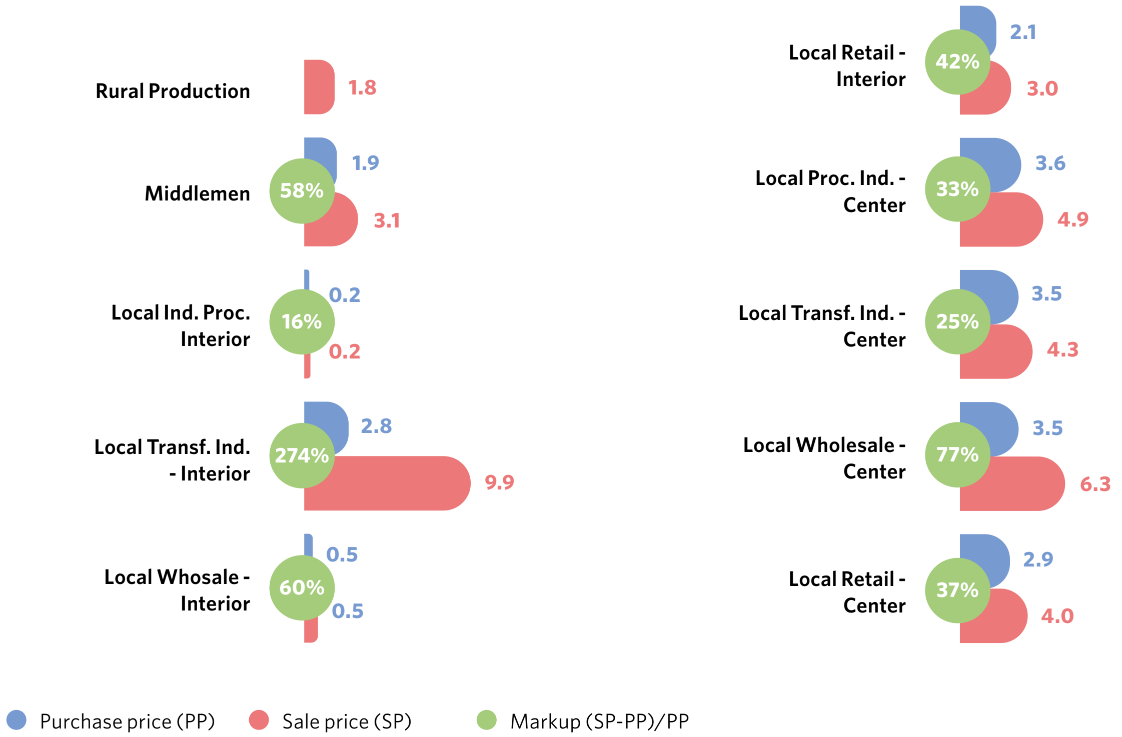
Source: IBGE, 2006 and 2017Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism survey.

The highest markups were found in the transformation industry in the interior (274 percent); the markup and its suppliers (middlemen) was 58 percent); the other industrial sectors showed much more modest markups, between 16 percent in processing in the interior and 33 percent in processing at the center of the local economy. Among the other trade margins, special mention should be made of wholesale in the center of the local economy, with 77 percent.

The conditions described establish the mode of distribution of the total VA generated in 2019 along the bacuri chain and its constitutive arrangements. The following stands out:

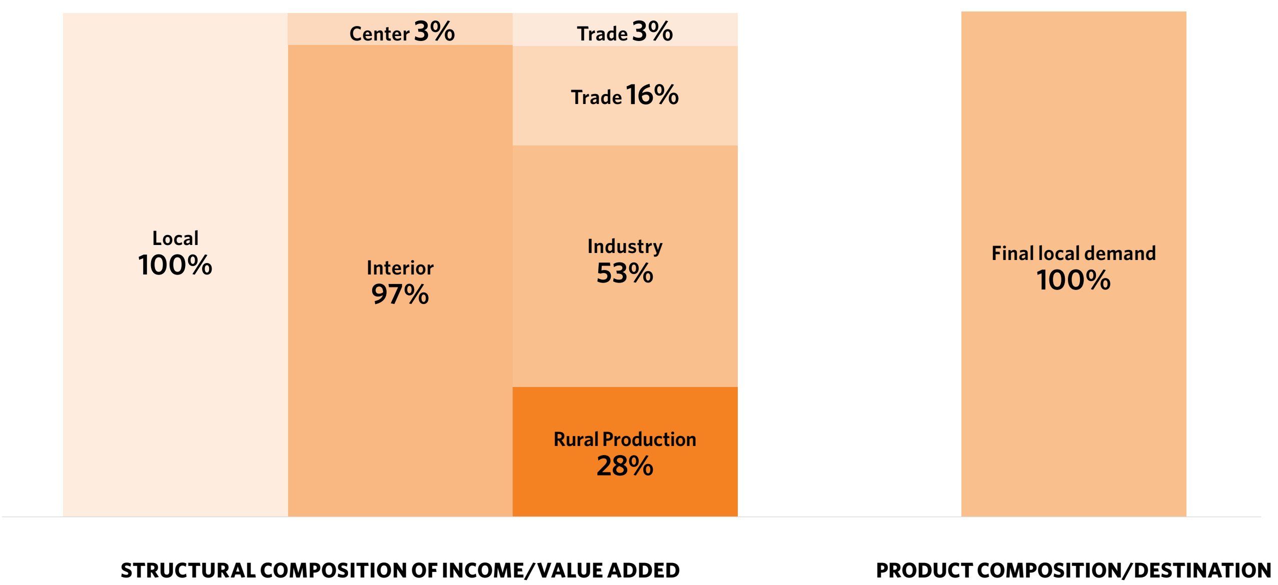
- The total VA generated of BRL11.5 million is 3.5 times the original value of the rural production of BRL3.3 million; this can be considered a primary chain multiplier (Table A.2.2-7).
- The arrangements that produce bacuri *in the local economy* accounted for 100 percent of the VA generated: these are, therefore, strongly *pro-local* chains (first column in Chart 2.1.7-3)
- The interior accounted for 97 percent of the local economy share – these are, therefore, strongly *pro-interior* chains (second column in Chart 2.1.7-3);
- In the interior, agricultural production accounted for 28 percent, industry for 53 percent and trade for 16 percent (third column in Chart 2.1.7-3);
- Production was entirely consumed in the local economy (first and fourth column in Chart 2.1.7-3);
- Employment associated with this production totaled 513 workers: 99 percent in the interior, with 89 in rural production, 5 percent in industry, and 5 percent in trade (Table A.2.2-7, last row).
- IR-Caeté accounts for 95 percent and Guamá for 5 percent of the total VA (Chart 3.2.2-6).

Chart 2.1.7-2 Price formation and value added (markup) along the bacuri value chain (BRL 1,000.00/t and % of purchase price)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA filed survey. CSα processing in the Netz System.

Chart 2.1.7-3 Value Added /Income Distribution and Product Destination in EcoSocioBio-PA's Bacuri Chain



Source: Annex 2, A.2.2, Table A.2.2.-7.

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3.2 Decadent products among the most relevant

3.2.1 Açai Palm

Since 2006, the gross value of the rural production of açai palm, which anks fifth among EcoSocioBio-PA's products has dropped at -1.4 percent p.a., reaching BRL8.4 million in 2019. As a result of an average decrease of -4.6 percent p.a. over the same period, production in that year totaled 4,900 tons, which were distribute through the chains shown in Figure 2.2.1-1. The following characteristics stand out in this structure:

- Agricultural producers have two points of entry into the açai palm chain: middlemen (17 percent of production) and the processing industry in the outskirts (in agricultural or urban areas of producing municipalities) (83 percent).
- Middlemen and part of the beneficiaries in the outskirts are, in turn, suppliers of the industry in the center of the local economy, through which flows 17 percent of the production to supply in part local markets (8 percent of total production) and in part extra-local markets (92 percent), in a direct link with extra-local retail.

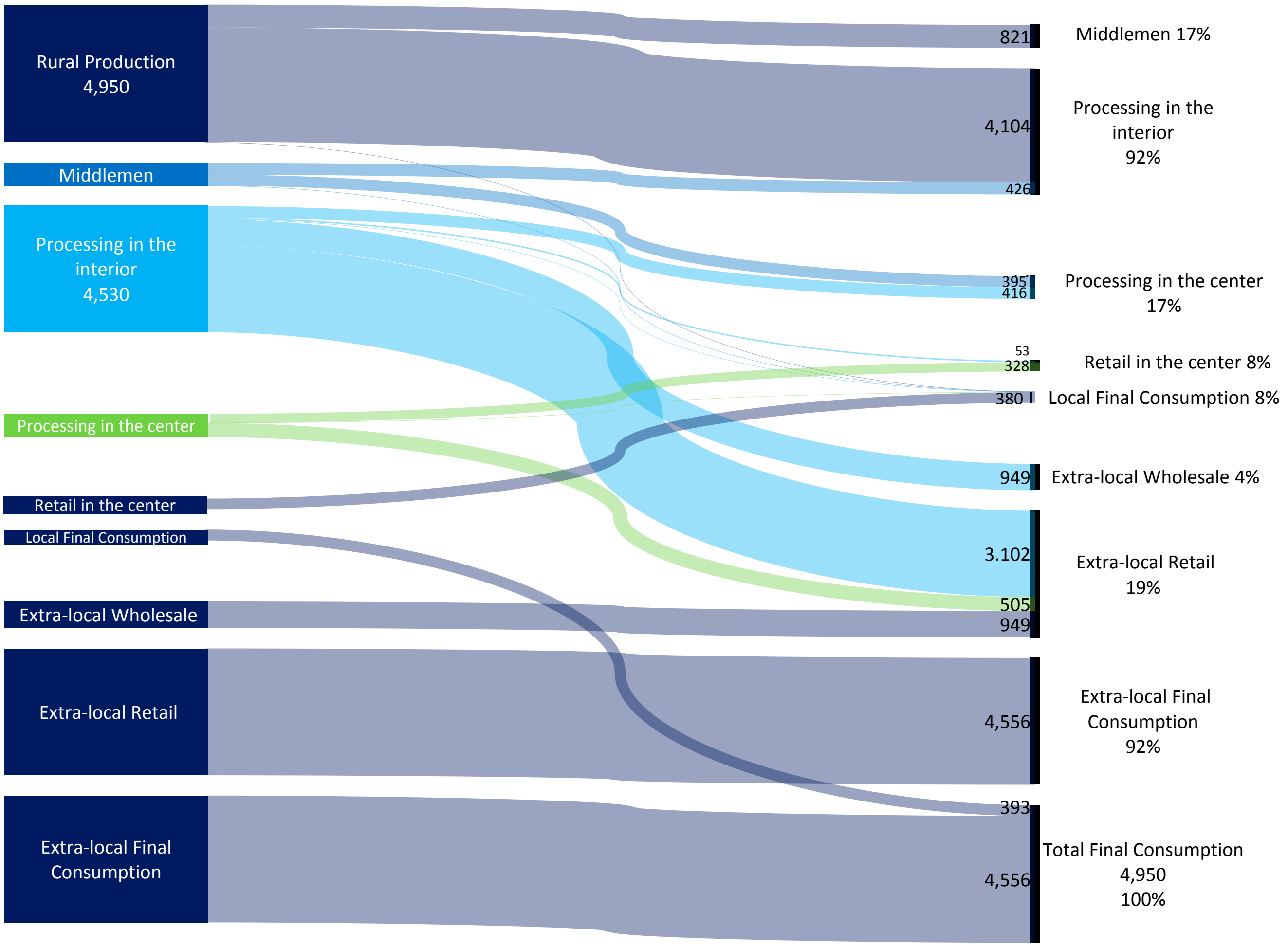
The chain is characterized by a fundamental centrality of the processing industry in the interior. In IR-Marajó, which is the main producer with 54.7 percent of the total production value, there are 17 of such industries, of which 10 - almost all of them located in Muaná - serve as hubs (central passage points) for other industries in Belém and Abaetetuba; in IR-Tocantins, which is the second most important producer and accounts for 43.6 percent of the production value, there are 14 industries, of which 8 serve as hubs: 6 in Abaetetuba, one in Limoeiro do Ajurú and one in Igarapé-Miri. It should be noted, however, that in both IR-Marajó and IR-Tocantins, these are mostly small companies (small plants) operated by local residents that work for larger processing companies that provide them with working capital, chemicals for the conservation of hearts of palm (citric acid) and packaging containers. This arrangement strongly limits the role of middlemen (Figure 2.2.1-2 and 2.2.1-3 and Table A.1.2-1).

Therefore, the internal polarity of the local economy is defined by the power of the joint work of these agents (sectors) and is expressed in the markups of industries in the interior (238 percent) and in the center (192 percent).

In the external polarity between local and extra-local economies, special mention should be made of the centrality of extra-local wholesale as regards networks based in IR-Marajó, and of retail (supermarkets) in the case of networks leaving from IR-Tocantins. It turns out that, at this level, the former are but hubs of the latter. Nevertheless, wholesale shows special power due to its markup level: a multiple between 2 and 3 compared to those of local industrial sectors, and an even more expressive multiple compared to that of extra-local retail (Chart 2.2.1-1).

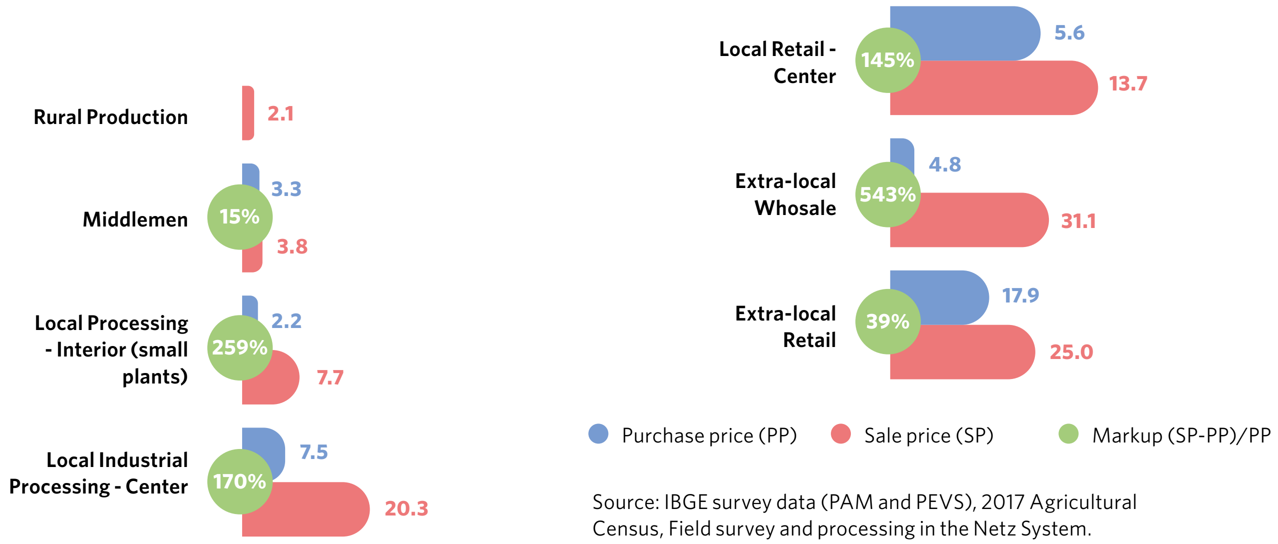
The *supply regime* of the rural production of açai palm is characterized by a negative elasticity production response, since the (current) price variation of 1 percent results in a -0.179 percent decrease in the quantity produced and by a 3.7 percent p.a. increase in the actual price paid to the producer, thus indicating the accumulation of unsatisfied demand (Chart 2.2.1-2).

Figure 2.2.1-1 Product flows underlying açai palm value chains (t)



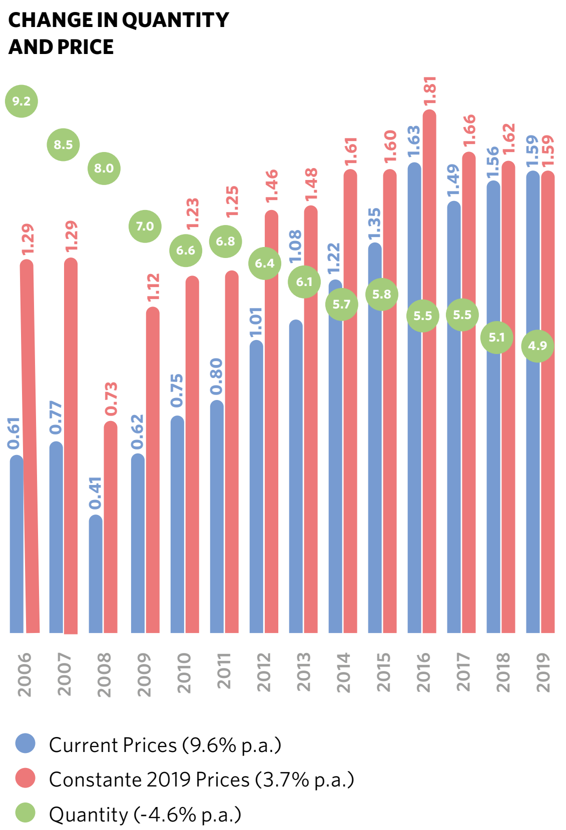
Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

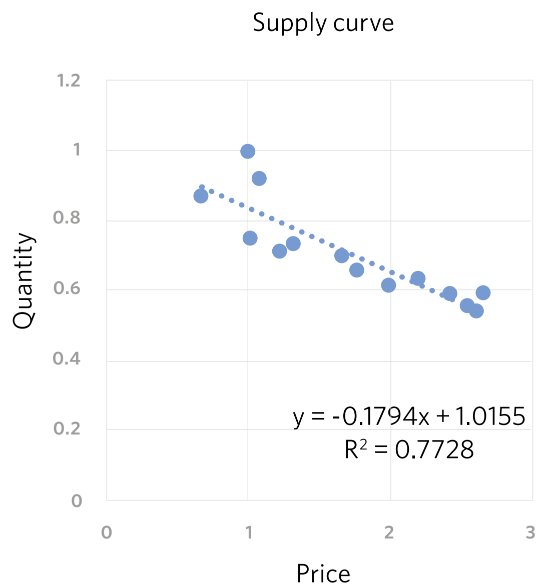
Chart 2.2.1-1-Price formation and markup along the açai palm value chain (BRL 1,000.00/t and % of purchase price)



Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

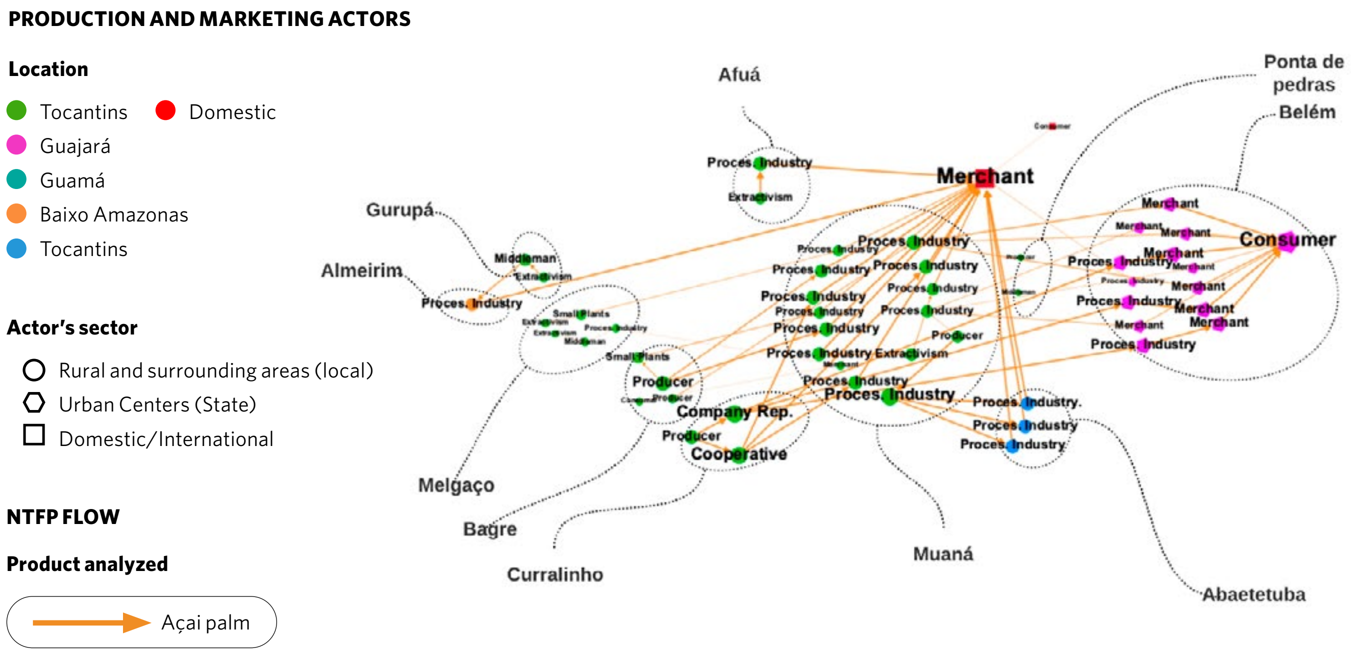
Chart 2.2.1-2 Açai palm supply regime: a) change over time in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values); b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.





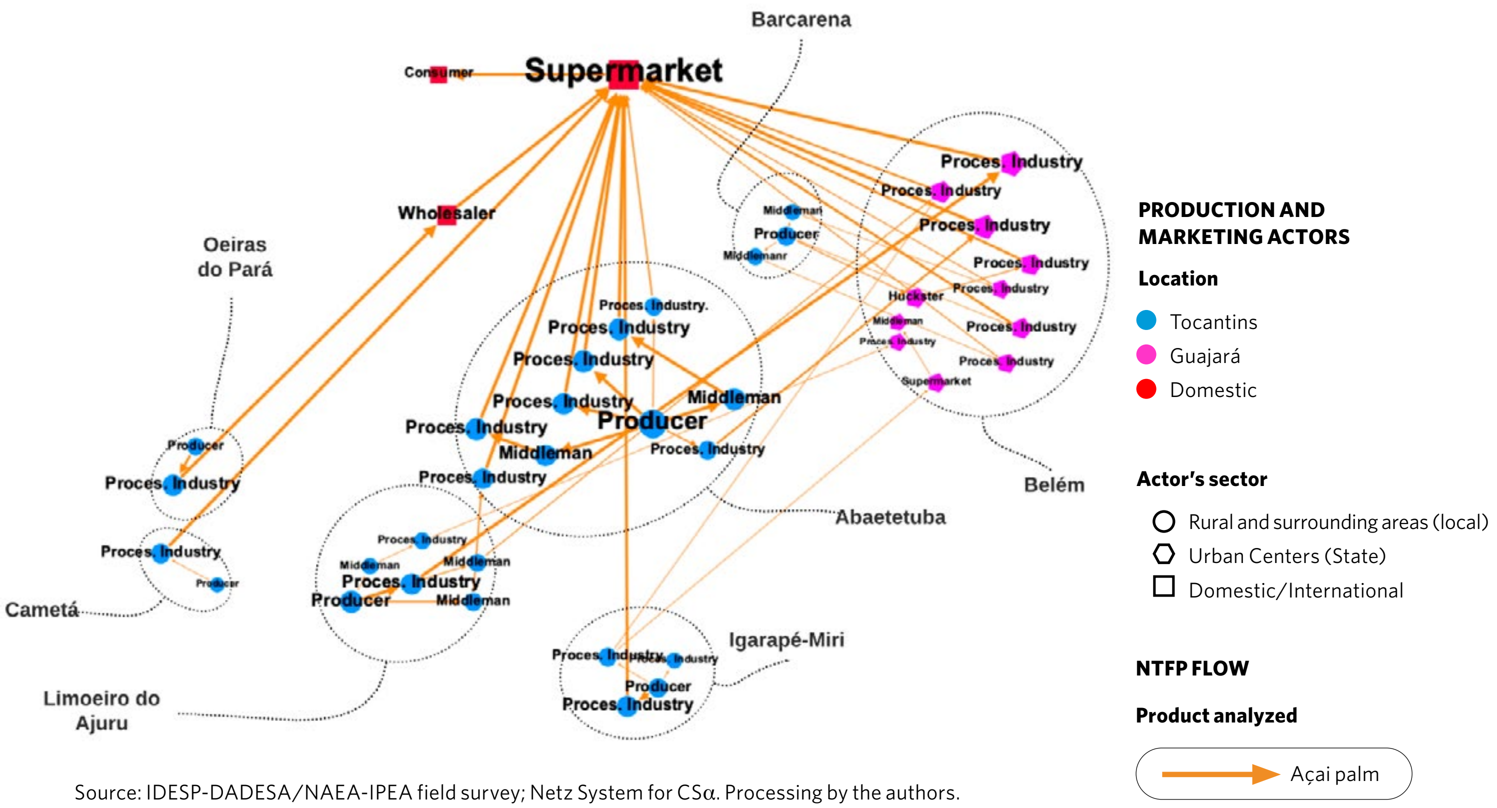
Source: IBGE, 2006 and 2017Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

Figure 2.2.1-2 Actors and their relations in the açai-palm chains in IR-Marajó by georeferenced geographical location (scale representation of weighted purchase and sale flows)



Fonte: Pesquisa de campo Idesp-Dadesa/NAEA-IPEA; Sistema Netz das CSα. Processamento dos autores.

Figure 2.2.1-3 Actors and their relations in the açai palm chains in IR-Tocantins by georeferenced geographic location (scale representation of weighted purchase and sale flows)

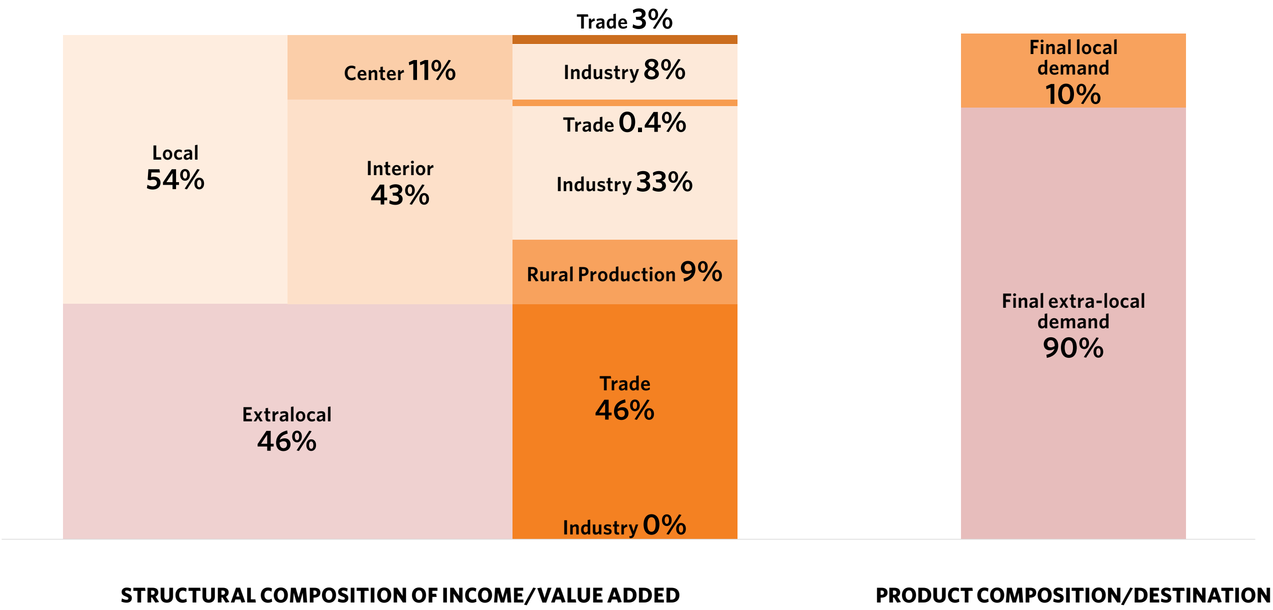


Source: IDESP-DADESA/NAEA-IPEA field survey; Netz System for CSα. Processing by the authors.

The conditions described establish the mode of distribution of the total VA generated in 2019 along açai palm chains and their constitutive arrangements. The following stands out:

- The total VA generated of BRL89.1 million is 10.6 times the original rural production value of BRL8.4 million (Table A.2.2-8).
- The arrangements that produce açai palm in the *local economy* accounted for 54 percent of the VA generated (first column in Chart 2.2.1-3)
- The interior accounted for 43 percent of the local economy share – these are, therefore, *pro-interior* chains (second column in Chart 2.2.1-3);
- In the interior, rural production accounted for 9 percent, middlemen for 0.4 percent, and the processing industry for 33 percent – these are, therefore, *anti-rural* production and industrial pro-processing chains (third column in Chart 3.1.1-5);
- Of the 11 percent that fell to the largest urban centers, the processing industry accounted for 8 percent and retail trade for 3 percent (third column in Chart 2.2.1-3);
- The extra-local economy, where 90 percent of the production value was allocated, accounted for 46 percent of the value added in wholesale and retail trade. This characterizes the açai economy of as an *export basis* of the local economy (first and fourth column in Chart 2.2.1-3), with a great predominance of last-resort buyers.
- Employment associated with the chains totaled 1,600 workers: 58 percent in rural production, 10 percent in the local industry and 30 percent in the extra-local economy trade (Table A.2.2-8, last line).
- IRs Marajó and Tocantins accounted for 99 percent of the VA of EcoSocioBio-PA's açai palm in 2019. IR-Guamá accounted for the remaining 1 percent.

Chart 2.2.1-3- Value Added Distribution in EcoSocioBio-PA's açai palm chain by local and extra-local economy sectors



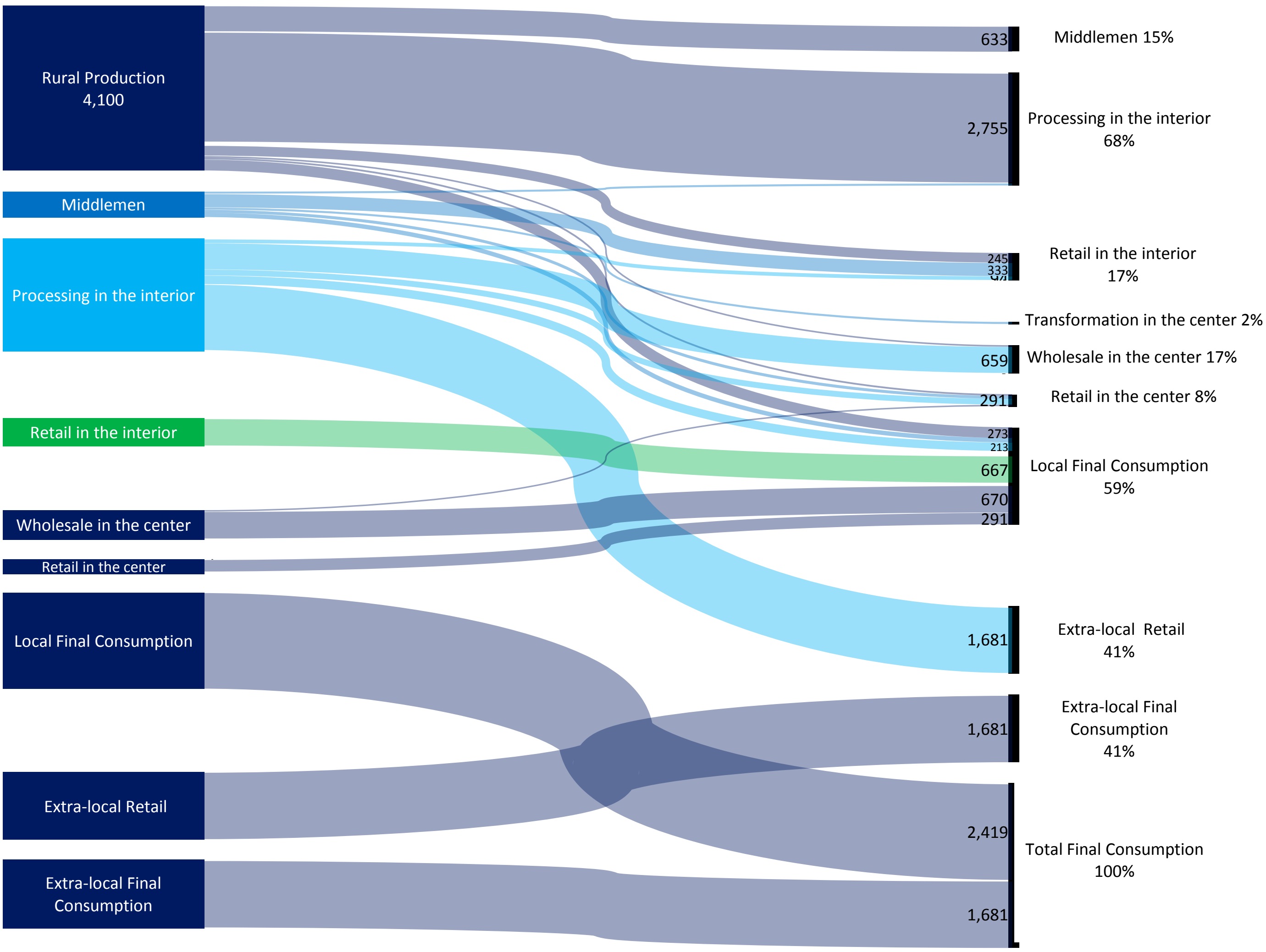
Source: Annex 2, A.2.2, Table A.2.2.-8.

3.2.2 Cupuaçu Berry

Since 2006, the gross value of the rural production of cupuaçu has grown at -2 percent p.a., reaching BRL13.2 million in 2019. As a result of an average increase of 0.9 percent p.a. over the same period, production in that year totaled 4,100 tons, which were distribute through the chains shown in Figure 2.2.2-1. The following characteristics stand out in this structure:

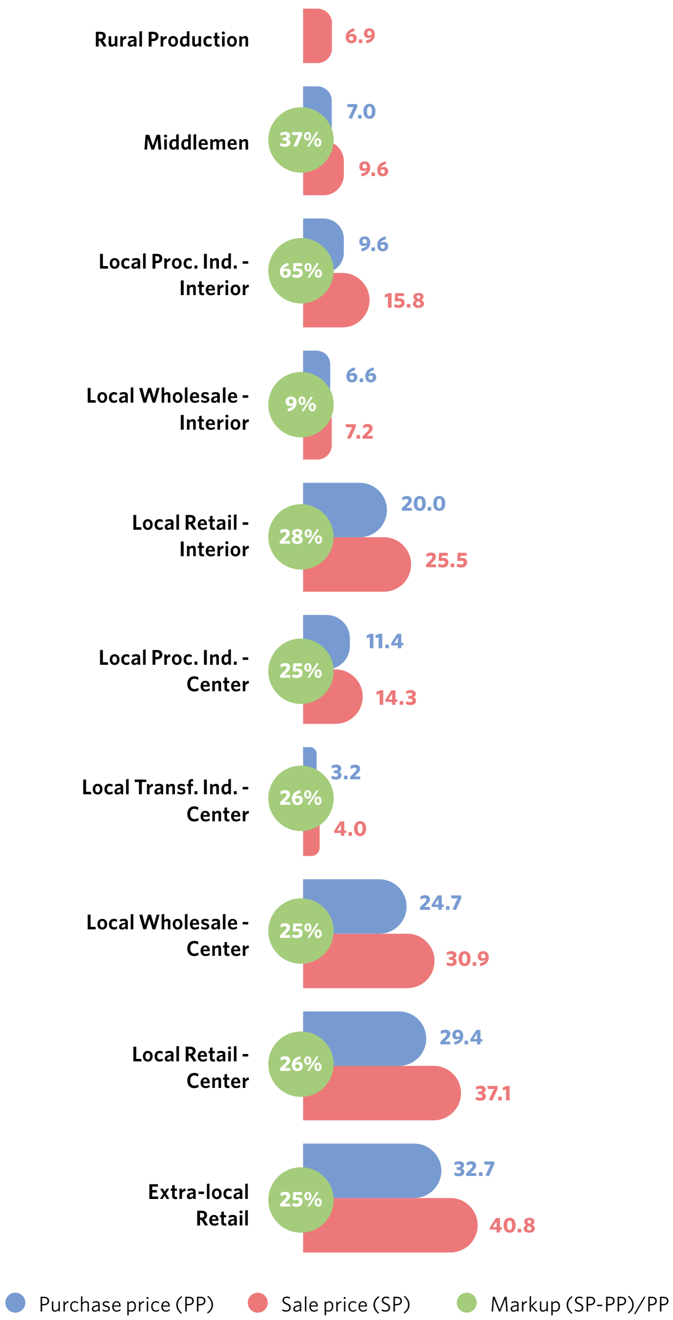
- The production of cupuaçu is distributed through short chains that supply local markets, at a proportion of 59 percent, with the intermediation of a dense market network;
- Approximately half of this domestic flow is processed, and the other half is sold as fresh fruit;
- 41 percent of the production is sold through long chains that supply extra-local markets, whose main node is industrial processing in the interior (Figure 2.2.2-1). The highest markup of all chains is found in this position (Chart 2.2.2-1).

Figure 2.2.2-1-Product flows underlying cupuaçu berry value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

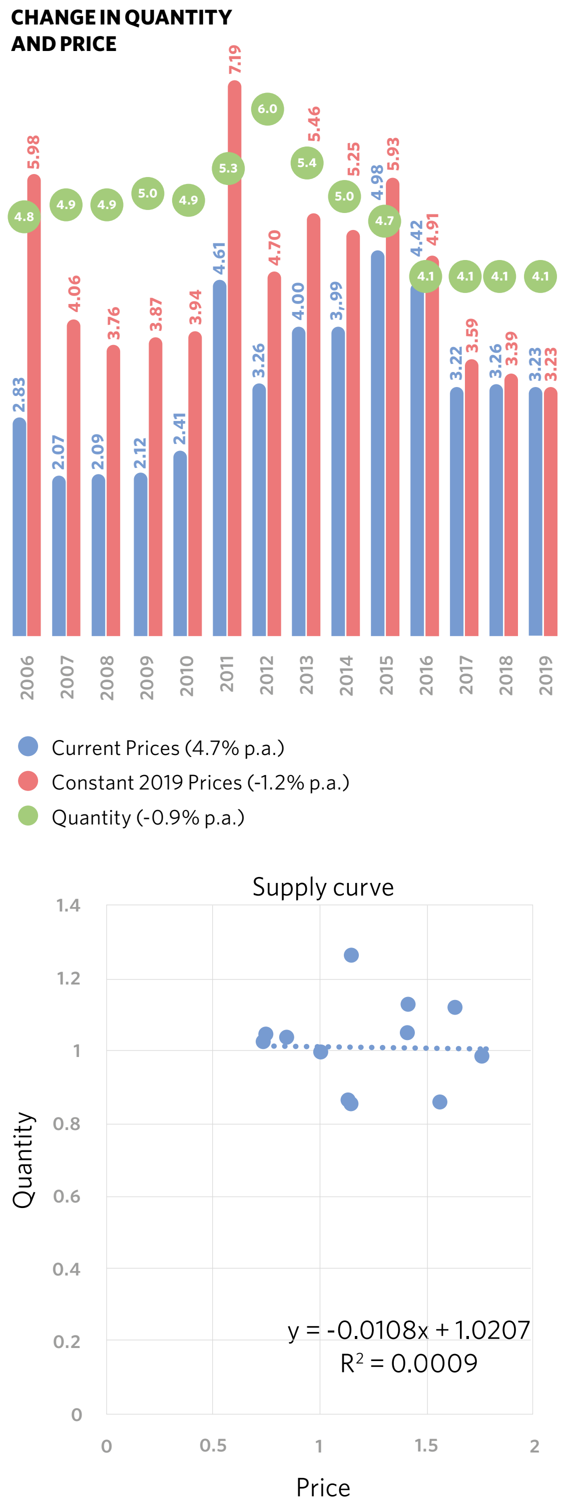
Chart 2.2.2-1-Price formation and markup along the cupuaçu berry value chain (BRL 1,000.00/t and % of purchase price)



Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

The *supply regime* of the rural production of cupuaçu berry is characterized by a slightly negative elasticity production response, since the (current) price variation of 1 percent results in a -0.01 percent increase in the quantity produced. In turn, the -1.2 percent p.a. decrease in the actual price paid to the producer indicates that supply has grown at a higher rate than demand (Chart 2.2.2-2).

Chart 2.2.2-2- Cupuaçu berry supply regime: a) change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values); b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.



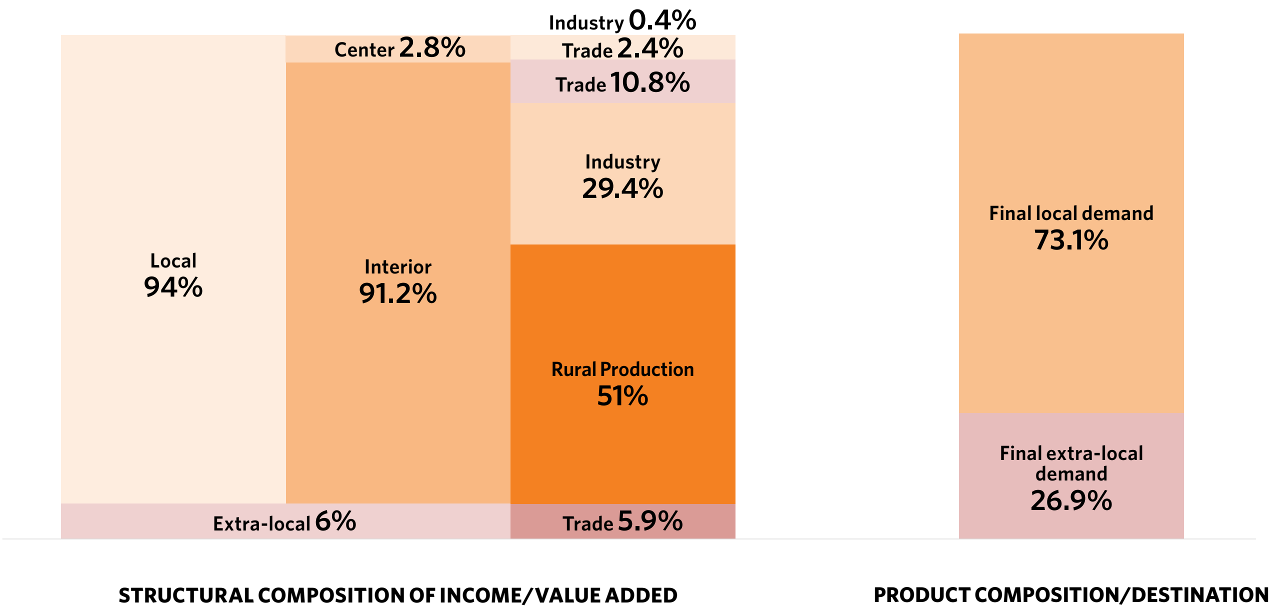
Source: IBGE, Agricultural Census 2006 and 2017; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Srvey (The IBGE office in Belém informs that for this product the values are tentaive and subject to review).

The conditions described establish the mode of distribution of the total VA generated in 2019 along the cupuaçu berry chain and its constitutive arrangements. The following stands out:

The total VA generated of BRL25.9 million is twice the original value of the rural production of BRL13.2 million; this can be considered a primary chain multiplier (Table A.2.2-9).

- The arrangements that produce cupuaçu berry in the *local economy* absorbed 94 percent of the VA generated (first column in Chart 2.2.2-3)
- The interior held 91 percent of the local economy share (second column in Chart 2.2.2-3);
- In the interior, agricultural production absorbed 51 percent, industry 29 percent and trade 11 percent (third column in Chart 2.2.2-3);
- In the center of the local economy, trade retained 2.4 and industry 0.4 percent of the total VA.
- The proportion of production consumed in the local economy was 73 percent - these are domestic chains, with significant export-base components (first and fourth column in Chart 2.2.2-3).
- Employment associated with this production totaled 1,200 workers: 97 percent in the local economy, with 95 percent in the interior – 88 percent in agricultural production, 4 percent in industry and 3 percent in trade (Table A.2.2-9,last line).
- Cupuaçu production occurs in all IRs of EcoSocioBio-PA. The most important are Rio Capim with 36 percent and Tocantins with 27 percent of the VA, followed by Guamá with 14 percent and Baixo Amazonas with 12 percent, and finally Xingu with 7 percent, Caeté with 3 percent and Marajó with 1 percent.

Chart 2.2.2-3 Value Added / Income Distribution and Product Destination in EcoSocioBio-PA's cupuaçu berry chain



Source: Annex 2, A.2.2, Table A.2.2.-9.

3.2.3 Andiroba

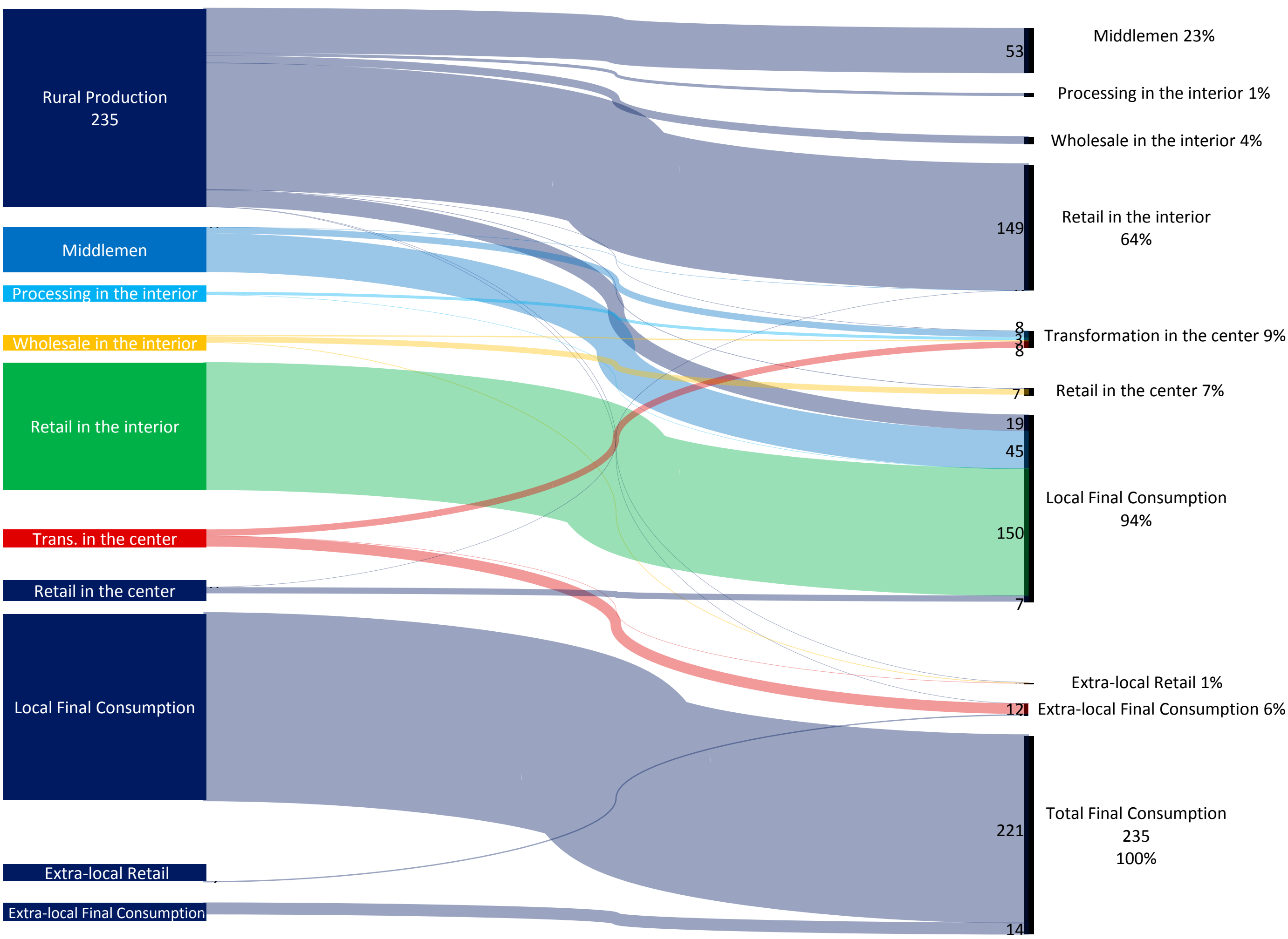
Since 2006, the value of the rural production of andiroba oil has dropped at -1.0 percent p.a., reaching BRL780,000 in 2019. As a result of an average decrease rate of -3.9 percent, production in that year totaled 235 tons, which were distributed through the chains shown in Figure 2.2.3-1.The following characteristics stand out in this structure:

- The andiroba production of approximately 235,000 liters is basically sold through short local supply chains (94 percent), mainly from the interior (64 percent), with low industrial intervention (1 percent for processing).

- 8 percent of the production reaches extra-local markets, with industrial processing mediation in the urban centers of the local economy (6 percent) (Figure 2.2.3-1).

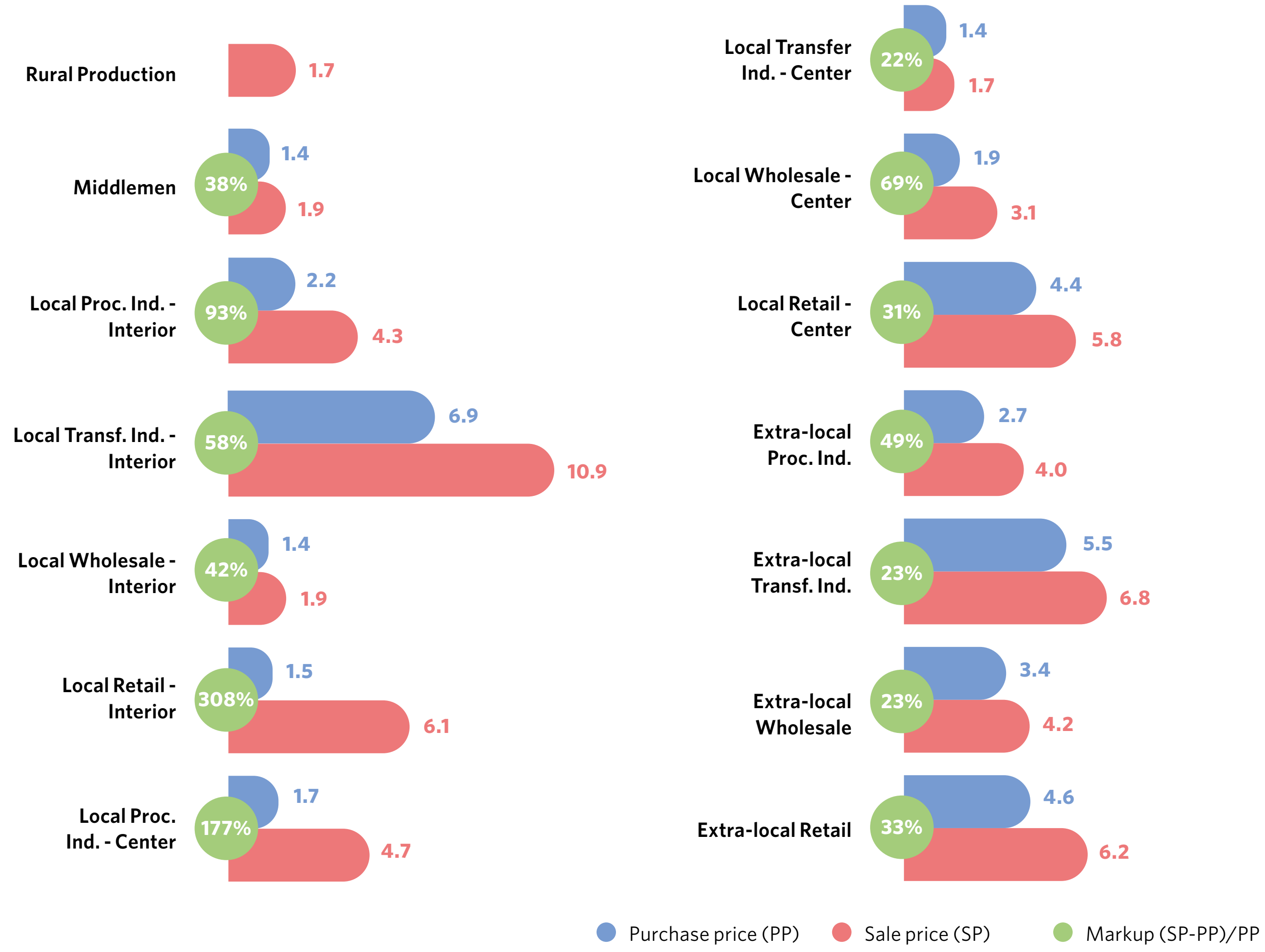
- Industrial markups are expressive (93 percent in processing, 58 percent in transformation in the interior, 177 percent in processing in the center), which are surpassed, however, by retail in the interior (308 percent) and in extra-local markets (327 percent) (Chart 2.2.3-1).

Figure 2.2.3-1-Product flows underlying andiroba value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

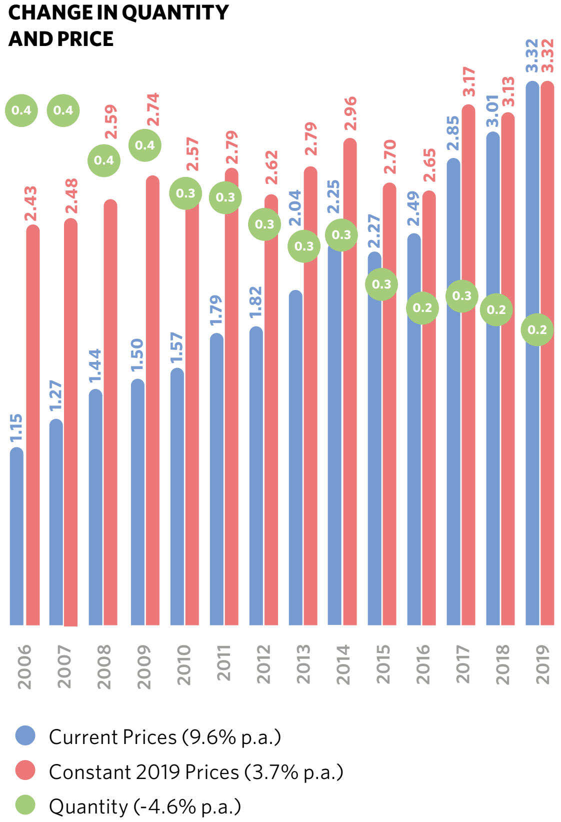
Chart 2.2.3-1-Price formation and markup along the andiroba value chain (BRL 1,000.00/t and % of purchase price)

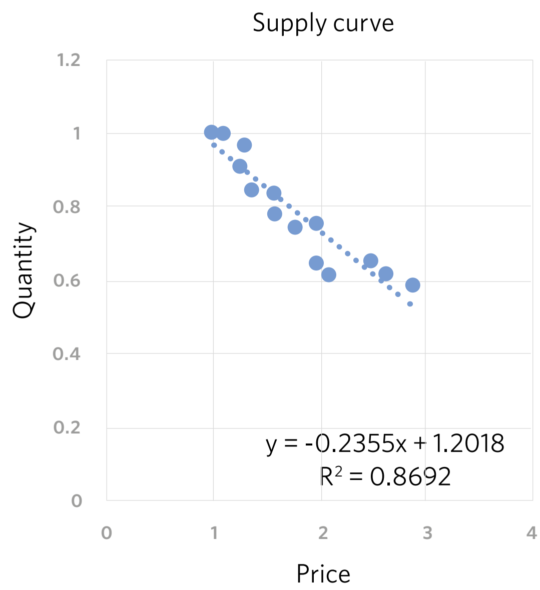


Source: IBGE, Agricultural Census 2006 and 2017; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The *supply regime* of the rural production of copaiba oil is characterized by a negative elasticity production response, since the (current) price variation of 1 percent results in a -0.2355 percent reduction in the quantity produced. In turn, the 2.7 percent p.a. increase in the actual price paid to the producer indicates that supply has grown at a lower rate than demand (Chart 2.2.3-2).

Chart 2.2.3-2- Change in andiroba quantity (1,000 l) and price (BRL 1,000.00/1,000 l, current and constant 2019 values)





Source: IBGE, Agricultural Census 2006 and 2017; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The conditions described establish the mode of distribution of the total VA generated in 2019 along the andiroba chain and its constitutive arrangements. The following stands out:

- The total VA generated of BRL1.3 million reais is 1.7 times the original value of the rural production of BRL780,000; this can be considered a primary chain multiplier (Table A.2.2-10).
- The arrangements that produce andiroba oil in the *local economy* accounted for 99.8 percent of the VA generated (first column in Chart 2.2.3-3)
- The interior accounted for 94.6 percent of the local economy share (second column in Chart 2.2.3-3);

- In the interior, rural production accounted for 58.1 percent, industry for 0.5 percent, and trade for 36 percent (third column in Chart 2.2.3-3);

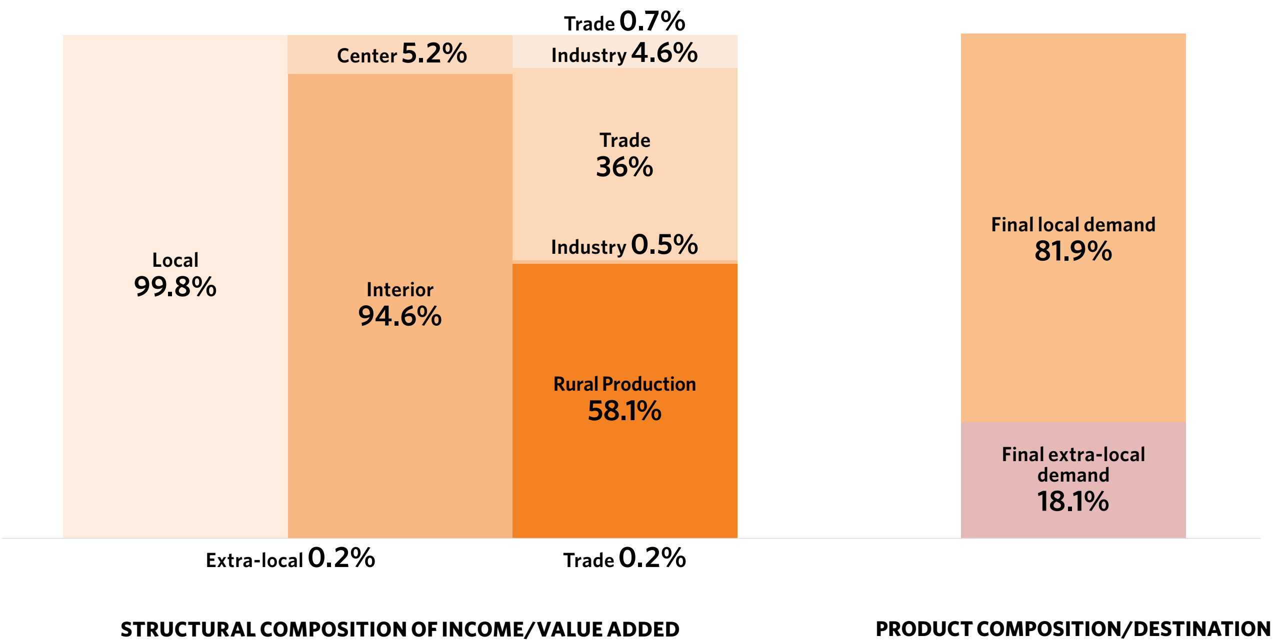
- Of the 5.2 percent share in the center of the local economy, industry and trade accounted for 4.6 percent and 0.7, respectively;

- Production was mainly allocated to local economies (81.9 percent); the domestic economy received only 18.1 percent of production and accounted for 0.2 percent of the VA - this is, therefore, a *basic (incipient) product of the export base.*

- Employment associated with andiroba totaled 190 workers, predominantly in the interior: 95 percent in rural production, with 4 percent in trade and the remaining in industry (Chart 3.2.5-5). (Table A.2.2-10, last row).

- The entire andiroba production came from IR Baixo Amazonas.

Chart 2.2.3-1 Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Andiroba Chain



Source: Annex 2, A.2.2, Table A.2.2.-10.

3.3 Low-scale and positive growth products (Promising)

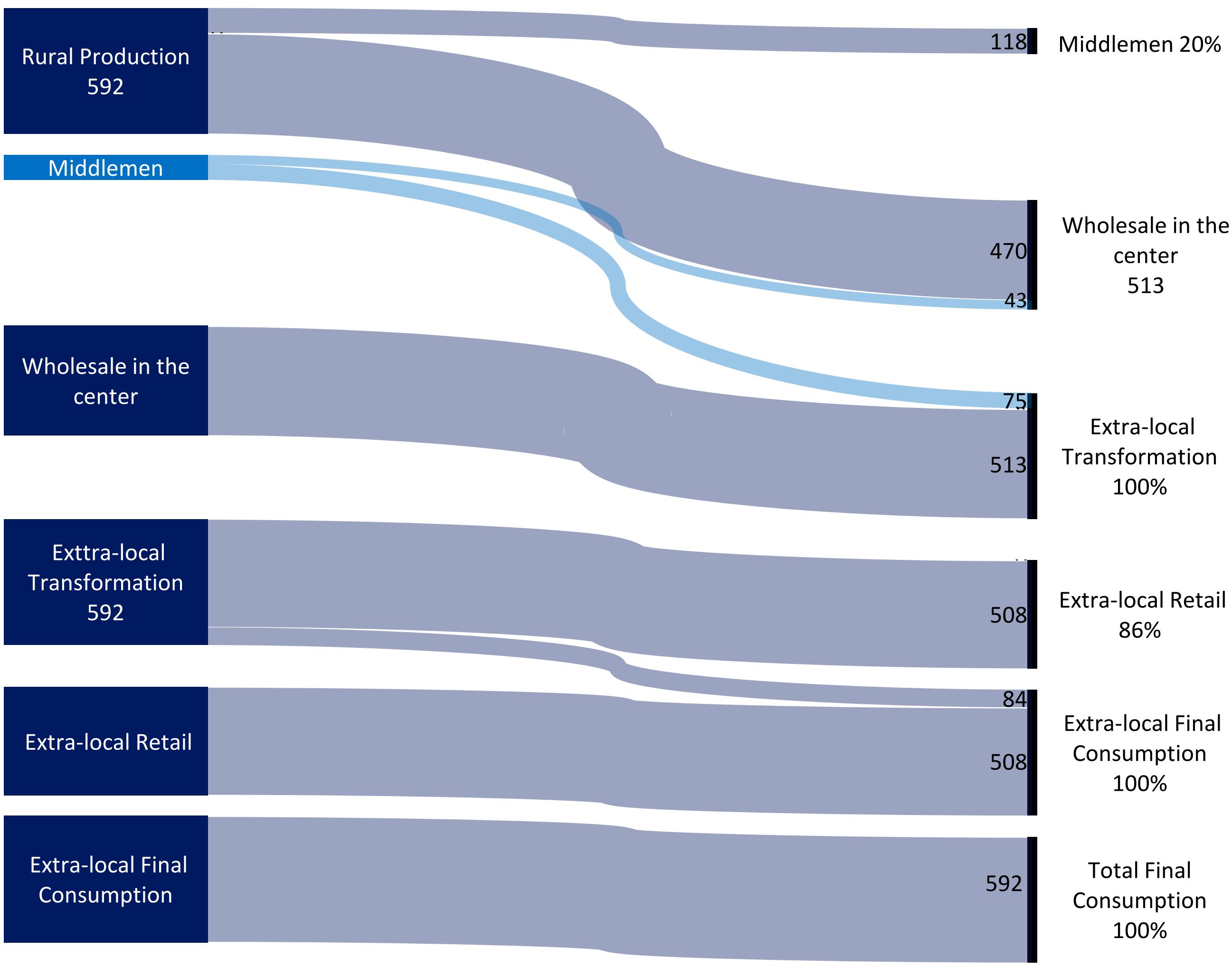
3.3.1 Rubber

Since 2006, the gross value of the rural production of rubber has grown at 12 percent p.a., reaching BRL2.1 million in 2019. As a result of an average increase of 8.4 percent p.a. over the same period, production in that year totaled 592 tons, which were distributed through the chains shown in Figure 2.3.1-1. The following characteristics stand out in this structure:

- With the mediation of middlemen in the interior (20 percent) and wholesalers in the urban centers of the local economy (87 percent), rubber production follows a long and simple chain up to industrial transformation in extra-local economies (100 percent) and consumption in the domestic market (Figure 2.3.1-1).

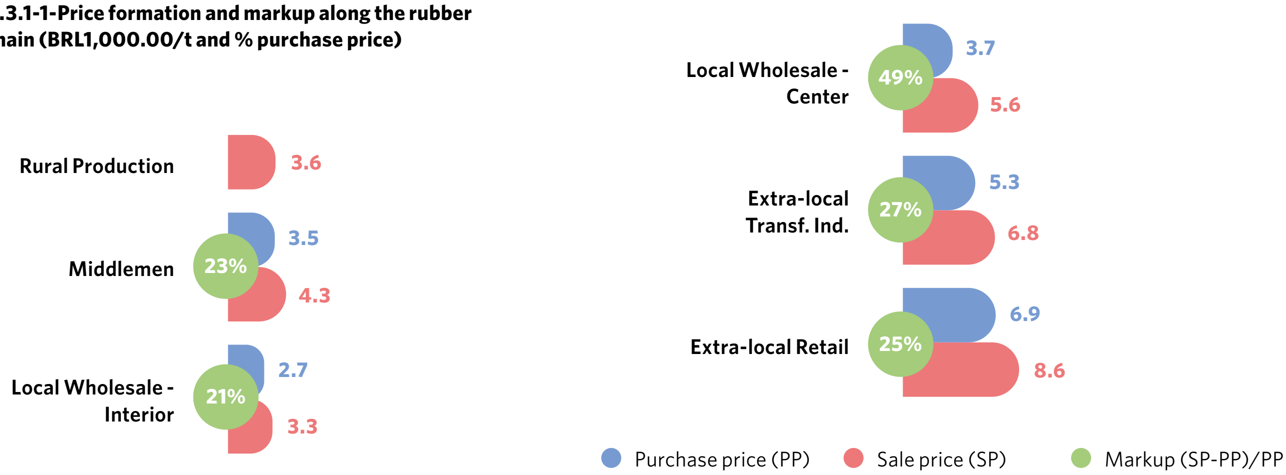
- The markup of wholesalers in urban centers stands out from those found in other nodes of the chain, which are rather homogeneous (at around 25 percent (Chart 2.3.1-1)).

Figure 2.3.1-1-Product flows underlying rubber value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. Processing for CSα in the Netz System.

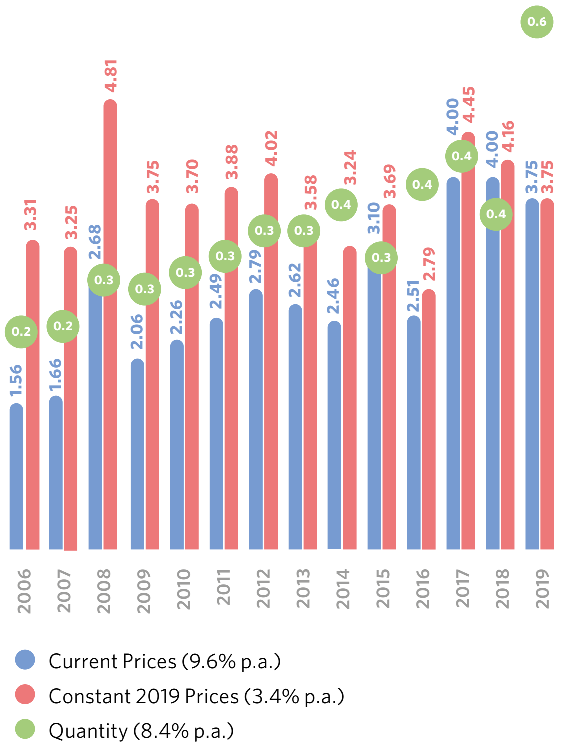
Chart 2.3.1-1-Price formation and markup along the rubber value chain (BRL1,000.00/t and % purchase price)

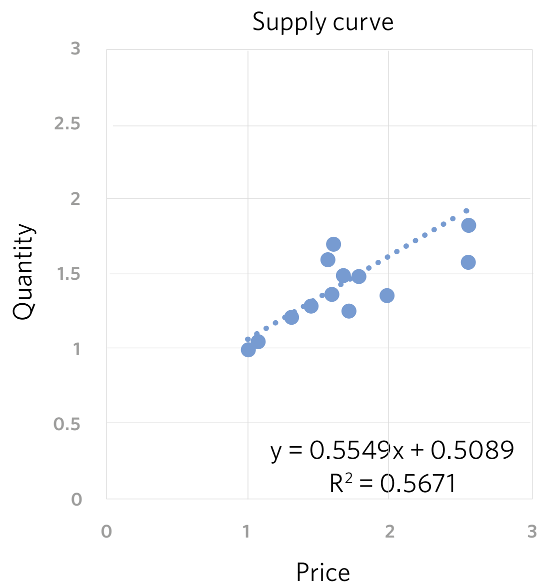


Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

The *supply regime* of the rural production of rubber is characterized by a moderately inelastic production response, since the (current) price variation of 1 percent results in a 0.55 percent increase in the quantity produced. In turn, the 3.4 percent p.a. increase in the actual price paid to the producer indicates that supply has grown at a lower rate than demand (Chart 2.3.1-2).

Chart 2.3.1-2- Rubber supply regime: a) change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019values); b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.



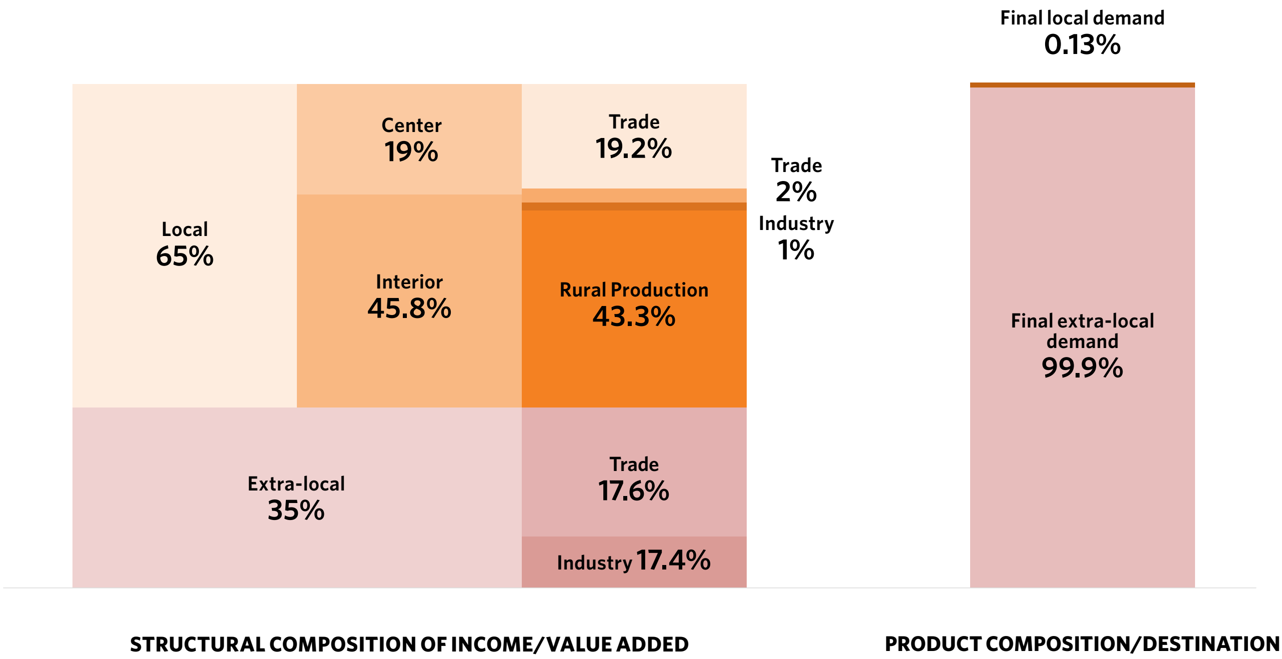


Source: IBGE, Agricultural Census 2006 and 2017; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The conditions described establish the mode of distribution of the total VA generated in 2019 along the rubber chain and its constitutive arrangements. The following stands out:

- The total VA generated of BRL4.9 million is 2.3 times the original value of the rural production of BRL2.1 million; this can be considered a primary chain multiplier (Table A.2.2-11).
- The arrangements that produce rubber in the *local economy* accounted for 65 percent of the VA generated (first column in Chart 2.3.1-3)
- The interior accounts for 46 percent of the local economy share (second column in Chart 2.3.1-3);
- In the interior, rural production accounted for 43 percent, industry for 1 percent and trade for 2 percent (third column in Chart 2.3.1-3);
- In the center of the local economy, trade accounted for 19 percent of the total VA.
- The local economy consumed 0.13 percent of production – this is, therefore, a totally *export base* chain (first and fourth columns in Chart 2.3.1-3);
- Employment associated with this production totaled 213.8 workers, with just over 86 percent in the interior of the local economy (79 percent in rural production and 1 percent in trade) and 6 percent in urban centers (Table A.2.2-11, last row).
- IR Rio Capim accounted for 90 percent of the rubber VA in EcoSocioBio-PA in 2019. Baixo Tocantins came second with 6 percent, followed by Xingu with 4 percent.

Chart 2.3.1-3 Value Added / Income Distribution and Product Destination in EcoSocioBio-PA's Rubber Chain



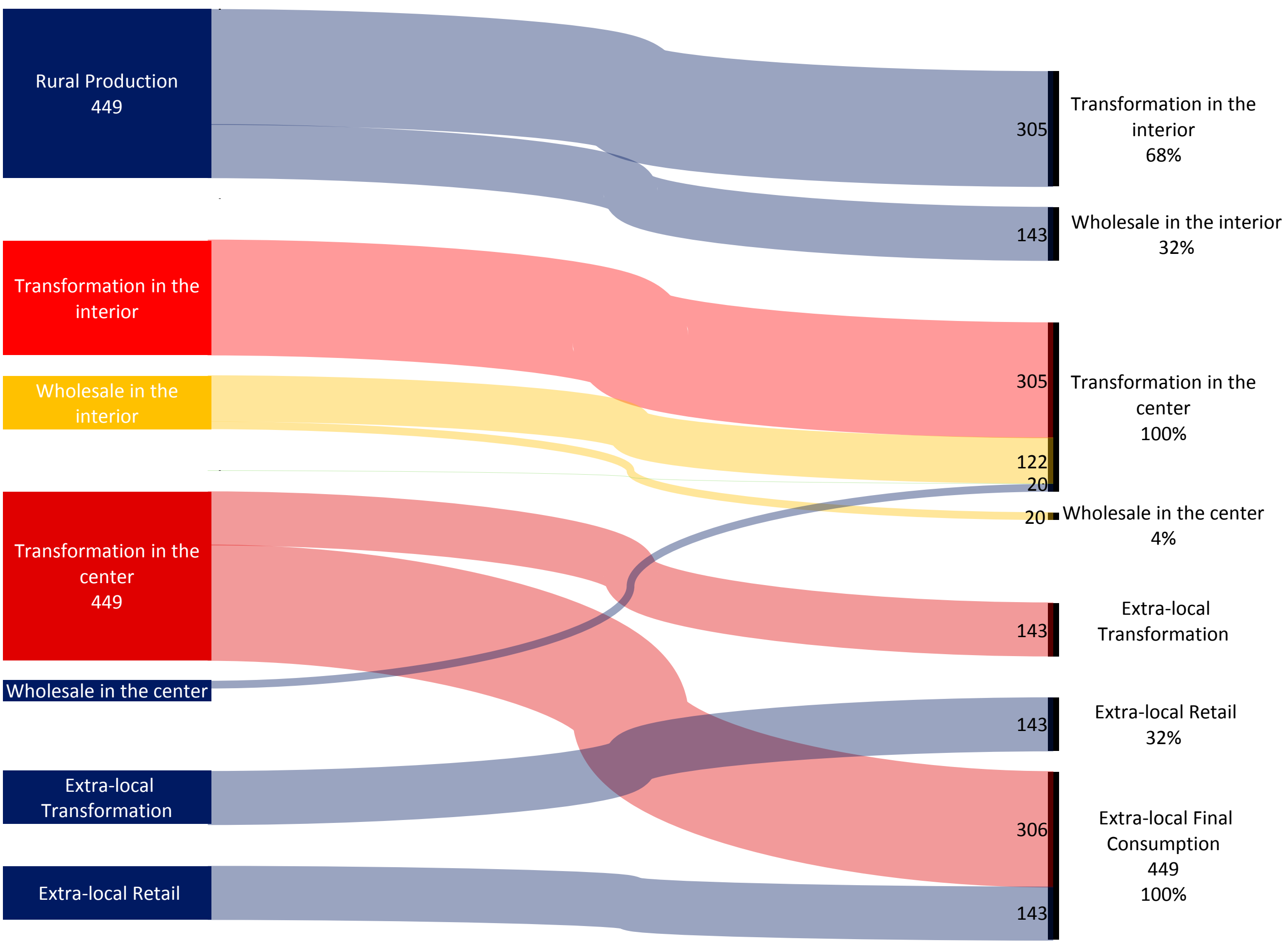
Source: Annex 2, A.2.2, Table A.2.2.-11.

3.3.2 Cupuaçu Almond

Since 2006, the gross value of the rural production of cupuaçu almond has grown at 9.6 percent p.a., reaching BRL301,000 in 2019. As a result of an average increase of 10.3 percent p.a. over the same period, production in that year totaled 449 tons, which were distributed through the chains shown in Figure 2.3.2-1. The following characteristics stand out in this structure:

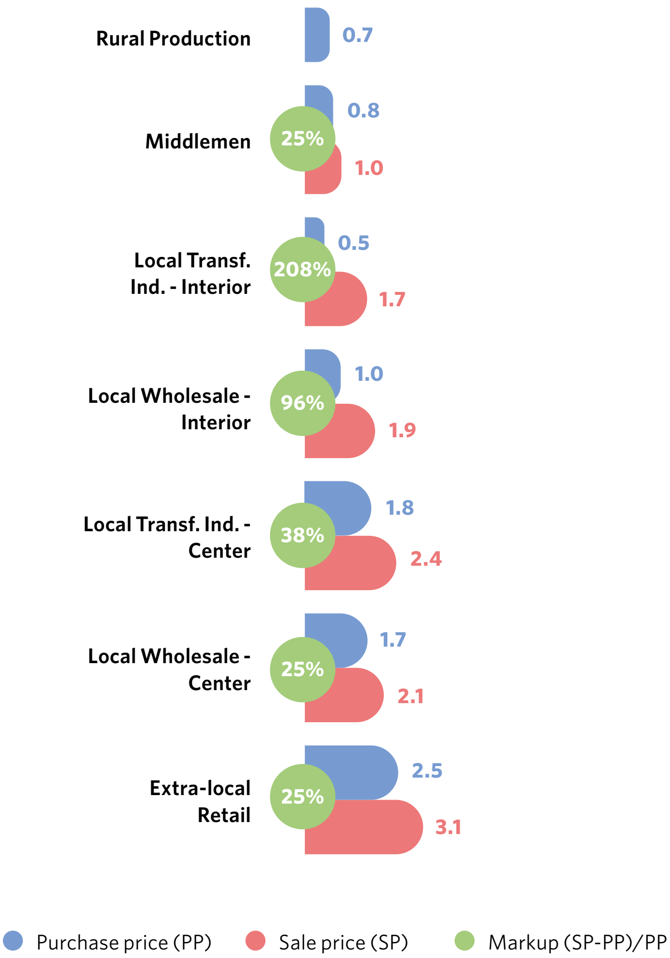
- The entire production of 449 tons was consumed in the extra-local market with the mediation of industrial transformation in the interior (68 percent) and in the centers of the local economy (62 percent, see Figure 2.3.2-1).
- The highest markup of the chain occurred in industrial transformation in the interior (209 percent); in the center, the industry markup was 38 percent (Chart 2.3.2-1);
- In trade, wholesale in the interior showed the highest markup; in the other trade sectors the markup was around 25 percent.

Figure 2.3.2-1-Product flows underlying cupuaçu almond chains



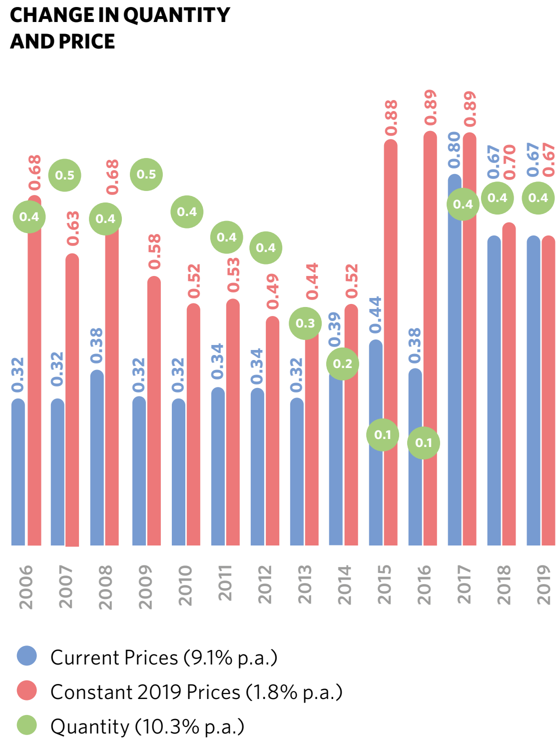
Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

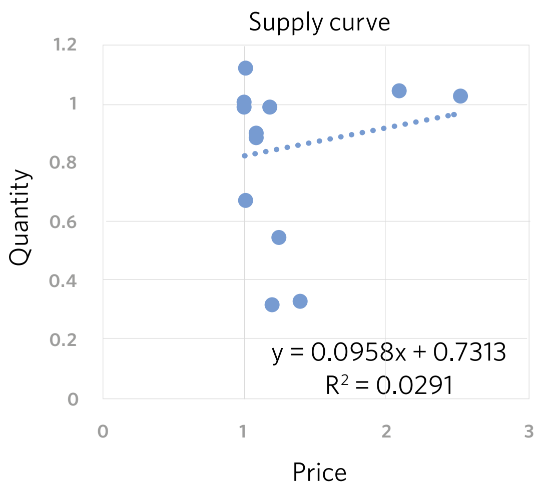
Chart 2.3.2-1-Price formation and mark-up along the cupuaçu almond value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

Chart 2.3.2-2 - Cupuaçu almond supply regime: a) change in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values of 2019; b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.





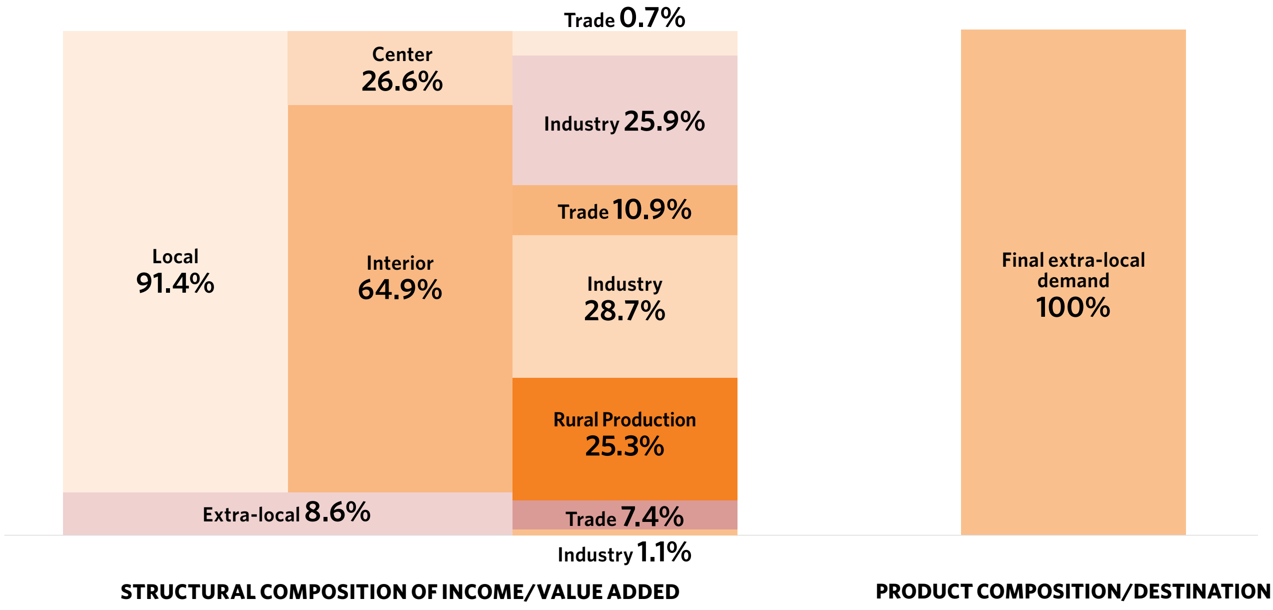
Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The *supply regime* of the rural production of cupuaçu almond production is characterized by a strongly inelastic production response since the 1 percent variation in the (current) price results in an increase of only 0.095 percent in the quantity produced. In turn, the 1.8 percent p.a. increase in the actual price paid to the producer indicates that supply has grown at a lower rate than demand (Chart 2.3.2-2).

The conditions described establish the mode of distribution of the total VA generated in 2019 along the cupuaçu almond chain and its constitutive arrangements. The following stands out:

- The total VA created of BRL1.2 million is 4 times the original value of the rural production of BRL300,000; this can be considered a primary chain multiplier (Table A.2.2-12).
- The arrangements that produce cupuaçu almond in the *local economy* accounted for 91 percent of the VA generated (first column in Chart 2.3.2-3)
- The interior accounted for 65 percent of the local economy share (second column in Chart 2.3.2-3);
- In the interior, rural production accounted for 25 percent, industry for 29 percent and trade for 11 percent (third column in Chart 2.3.2-3);
- In the enter of the local economy, industry accounted for 26 percent and trade for 1 percent of the 27 percent of the total VA (third column in Chart 2.3.2-3).
- The entire production went to the extra-local economies, which accounted for only 9 percent of the VA – this is an *export base* chain (first and fourth columns in Chart 2.3.2-3);
- Employment associated with this production totaled 29 workers (Table A.2.2-12, last row).
- IR-Rio Capim and IR-Marajó account for 60 percent and 39 percent of the cupuaçu almond VA respectively; the other RIs, with the exception of IR-Xingu, account for some 0.2 percent (Chart 3.1.6-7).

Chart 2.3.2-3 Added Value/Income Distribution and Product Destination in EcoSocioBio-PA's Cupuaçu Almond Chain



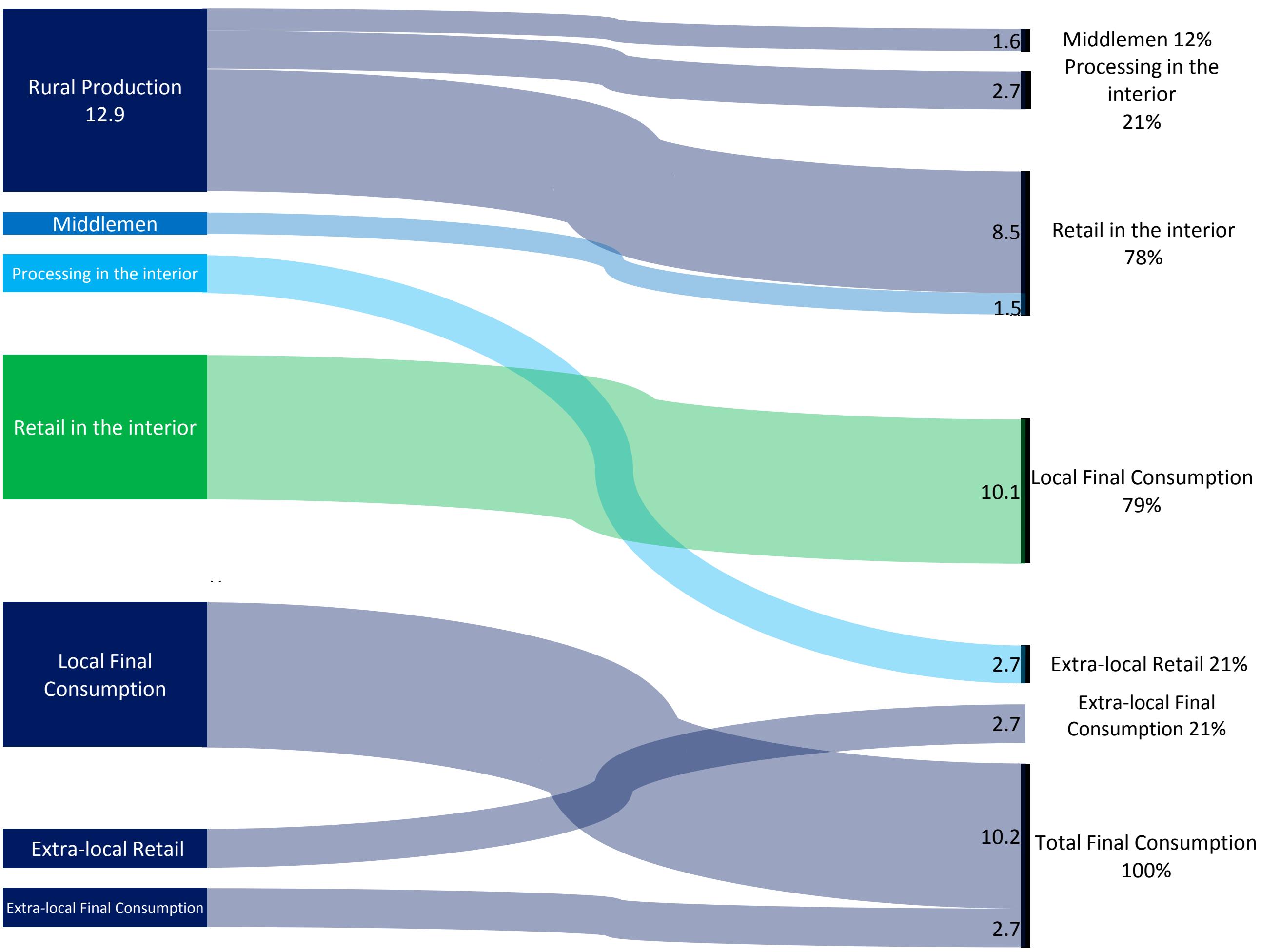
Source: Annex 2, A.2.2, Table A.2.2.-12.

3.3.3 Copaiba

Since 2006, the gross value of the rural production of copaiba oil has grown at 4.6 percent p.a., reaching BRL114.600 in 2019. As a result of an average increase of 2.9 percent p.a. over the same period, production in that year totaled12.9 tons, which were distributed through the chains shown in Figure 2.3.3-1. The following characteristics stand out in this structure:

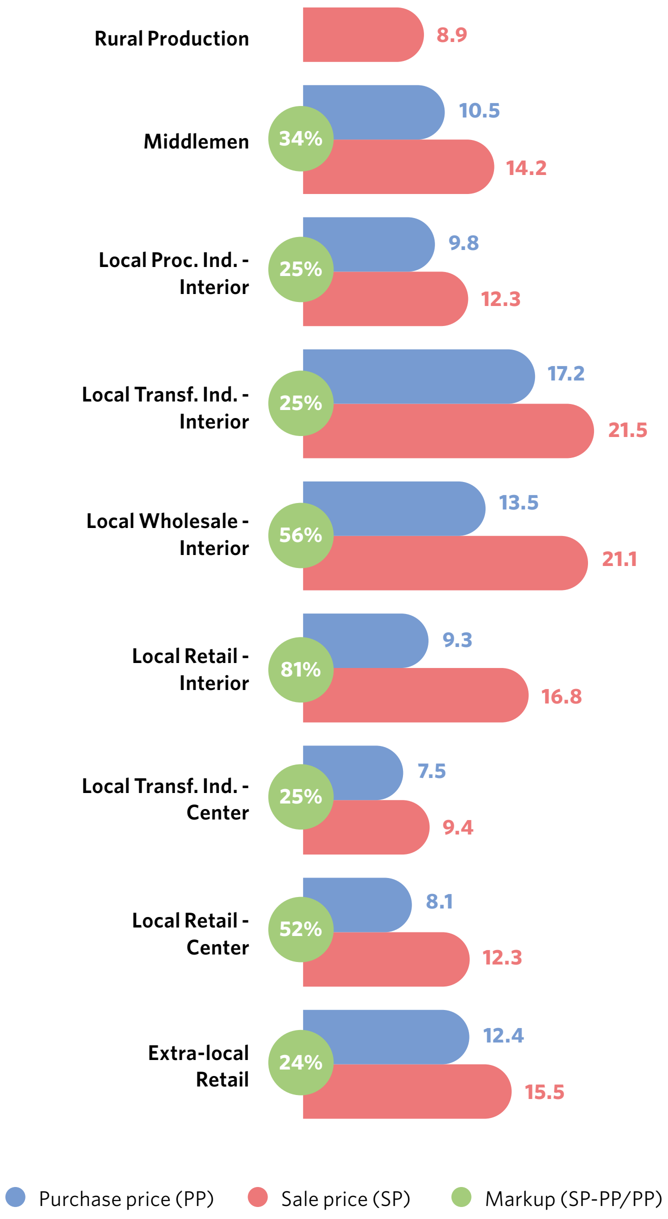
- Trough middlemen and retail, a branch of the chain supplies the local market with 79 percent of total production; in tune with its central role, local retail has the highest markup (Chart 2.3.3-1);
- Through the processing sector in the interior, another branch supplies the domestic market with 21 percent of production; in this case, trade also has the highest markup, but this time in retail in the center of the local economy.
- Extra-local retail markups are low, following in the footsteps of local economy markups, both with 25 percent.

Figure 2.3.3-1 -Product flows underlying copaiba value chains (t)



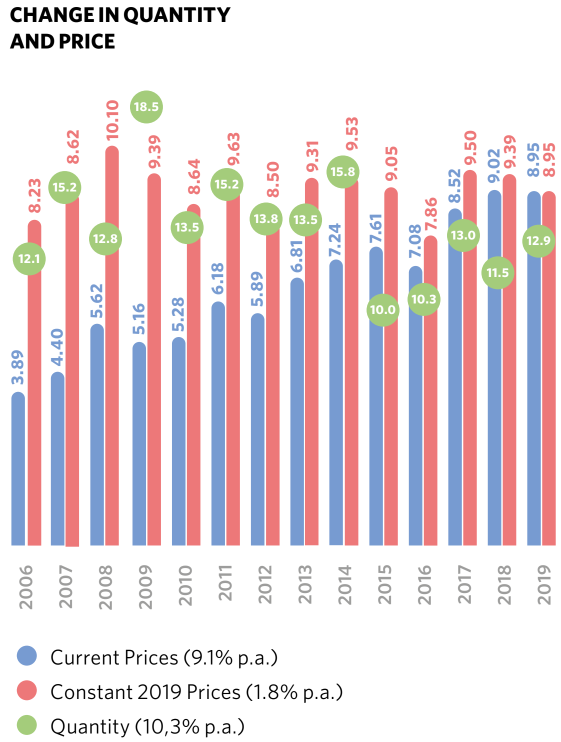
Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. Processing for CSα in the Netz System.

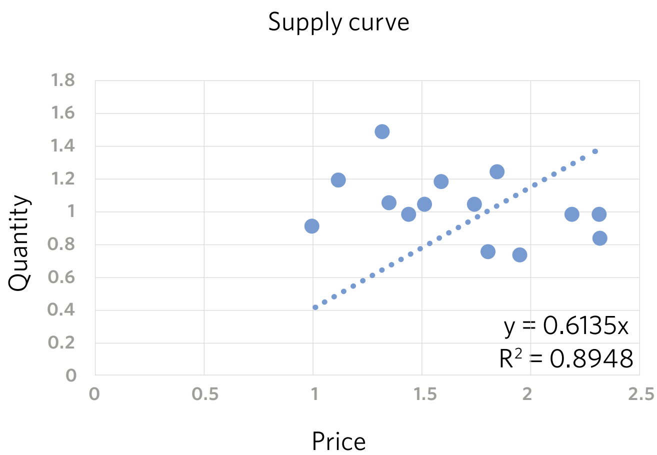
Chart 2.3.3-1-Price formation and markup along the copaiba value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. Processing for CSα in the Netz System.

Chart 2.3.3-2- Chart 3.1.1-1-Copaiba supply regime: a) increase in quantity (1,000 t) and price (BRL 1,000.00/t, current and constant 2019 values; b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.





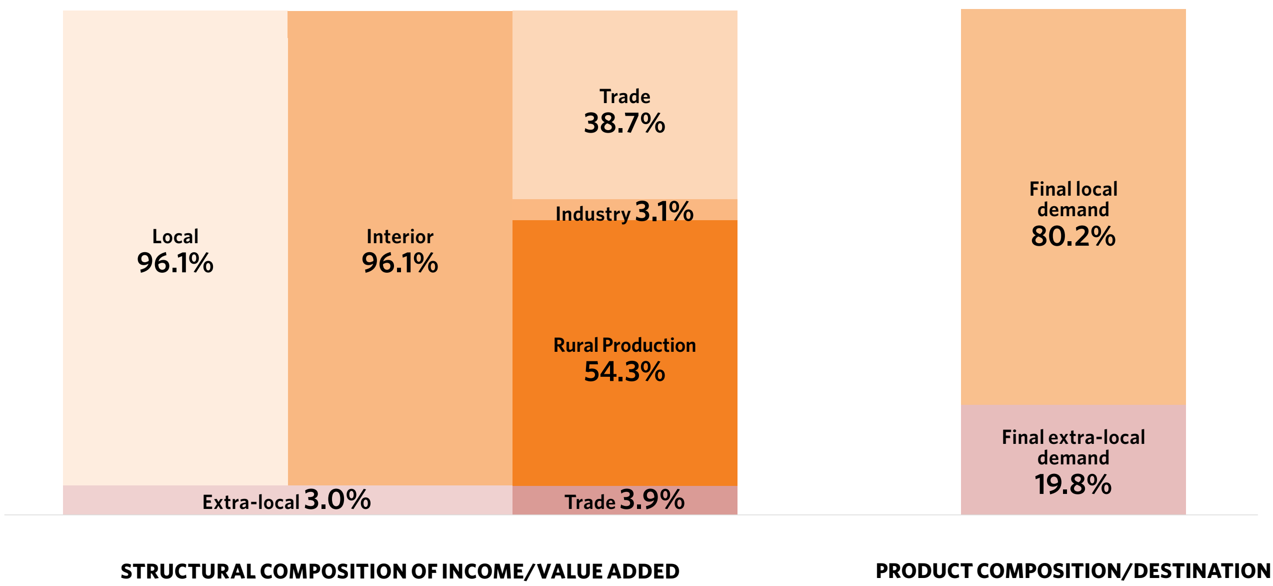
Source: IBGE, 2006 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.
Methodological note: The values were indexed starting in 2006 according to quantity and price indexers taken from PEVS.

The *supply regime* of the rural production of copaiba oil is characterized by a negative elasticity production response, since 1 percent variation in the (current) price results in a -0.17 percent decrease in the quantity produced. In turn, the 1.2 percent p.a. increase in the actual price paid to the producer indicates that supply has grown at a lower rate than demand (Chart 2.3.3-2).

The conditions described establish the mode of distribution of the total VA generated in 2019 along the copaiba oil chain and its constitutive arrangements. The following stands out:

- The total VA created of BRL211.0 million is 1.8 times the original rural production value of BRL114.600; this can be considered a primary chain multiplier (Table A.2.2-13).
- The arrangements that produce copaiba oil in the *local economy* accounted for 96 percent of the VA generated (first column in Chart 2.3.3-3)
- The interior accounted for the entirety of the local economy share (second column in Chart 3.1.1-5);
- In the interior, rural production accounted for 54 percent, industry for 3 percent and trade for 39 percent (third column in Chart 2.3.3-3);
- Production went mainly to local economies (80 percent); the domestic economy absorbed 20 percent and accounted for 4 percent of the VA - this is, therefore, an *(incipient) export base* (first and fourth columns in Chart 2.3.3-3)
- Employment associated with this production totaled 16 workers (Table A.2.2-13, last row).
- IR-Rio Capim is the main producer, with half of the VA, followed by IR-Baixo Amazonas with 32 percent, IR-Tocantins with 9 percent IR-Xingu with 3 percent (Chart 3.1.6-7).

Chart 2.3.3-3- Added Value/Income Distribution and Product Destination in EcoSocioBio-PA's Copaiba Oil Chain



Source: Annex 2, A.2.2, Table A.2.2.-13.

3.3.4 Buriti (moriche palm)

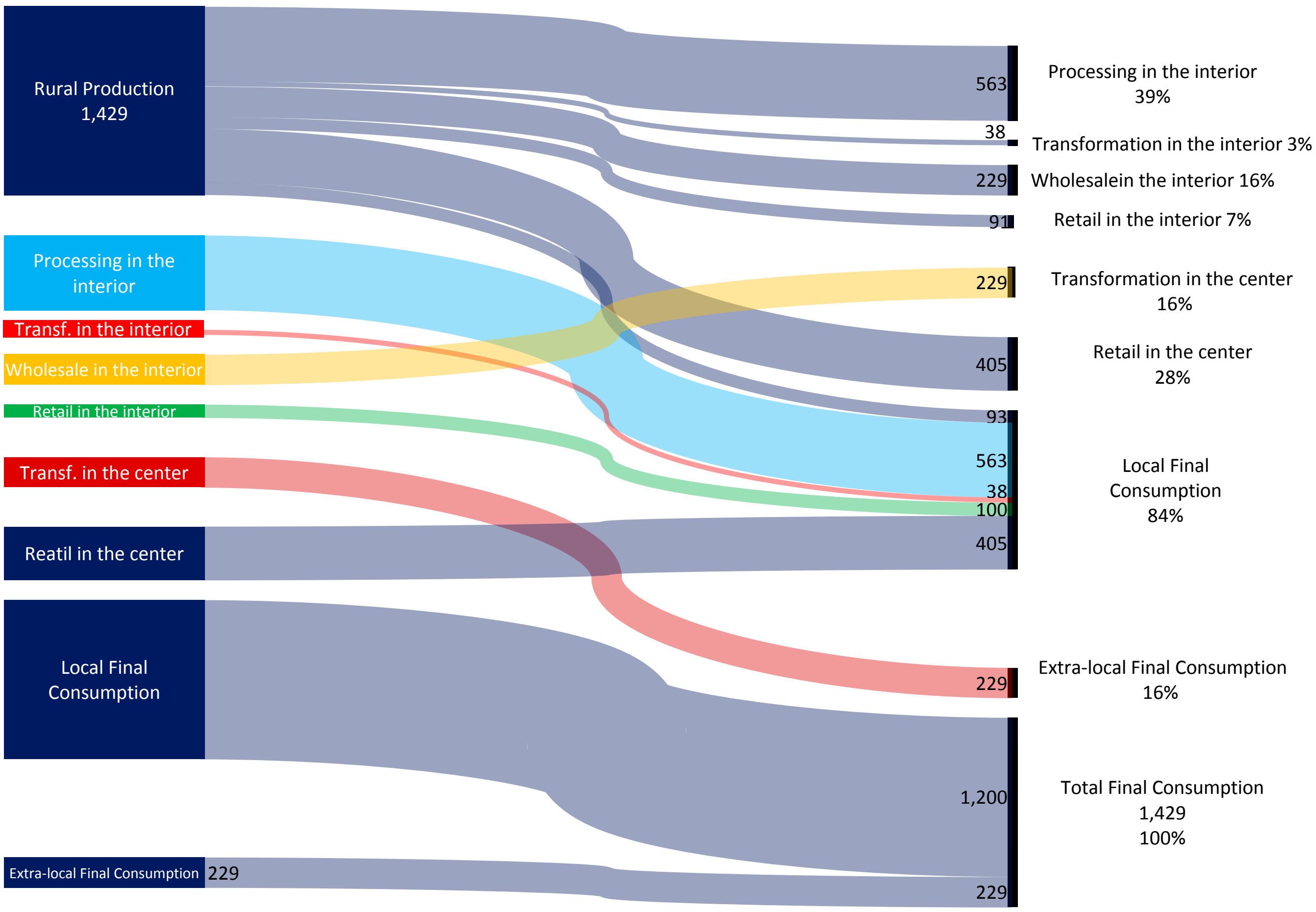
Since 2006, the gross value of the rural production of buriti has grown at 1.6 percent p.a., reaching BRL2.7 million in 2019. As a result of an average increase of 3.5 percent p.a. over the same period, production in that year totaled 1,400 tons, which were distributed through the chains shown in Figure 2.3.4-1. The following characteristics stand out in this structure:

- Producers have six different points of entry into the short local supply chains, which represent 84 percent of total production.

- The main node of these chains is industrial processing in the interior, through which flows 39 percent of the production with the highest markup of the chain (Figure 2.3.4-1 and Chart 2.3.4-1).

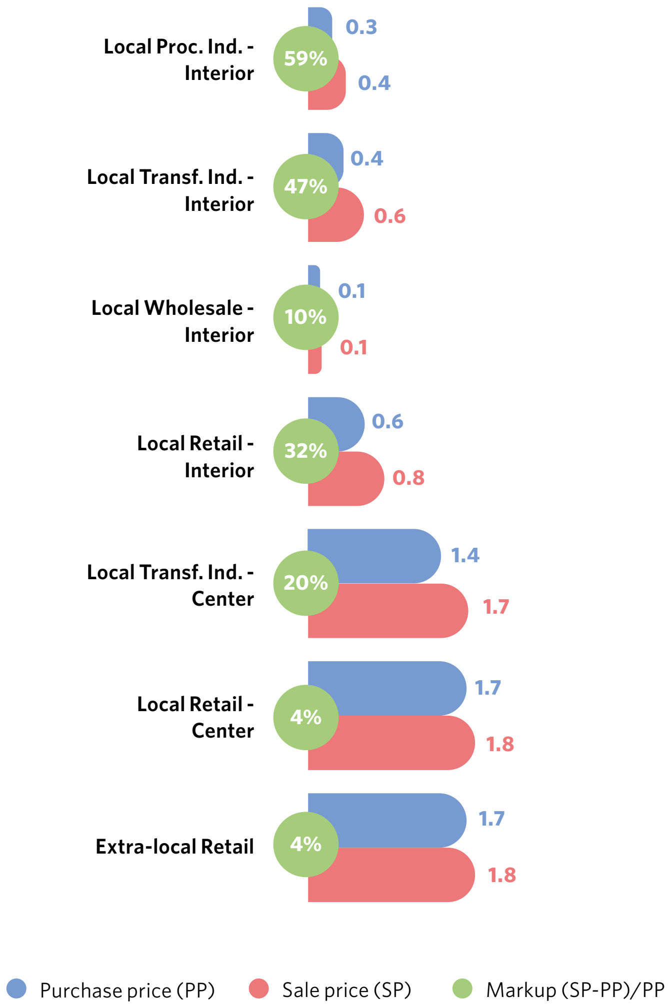
- Industrial transformation in the urban centers of the local economy, through which flow 16 percent of the production with a 20 percent markup is the base of the long chain that supplies the domestic extra-local markets (Figure 2.3.4-1 and Chart 2.3.4-1).

Figure 2.3.4-1-Product flows underlying buriti value chains (t)



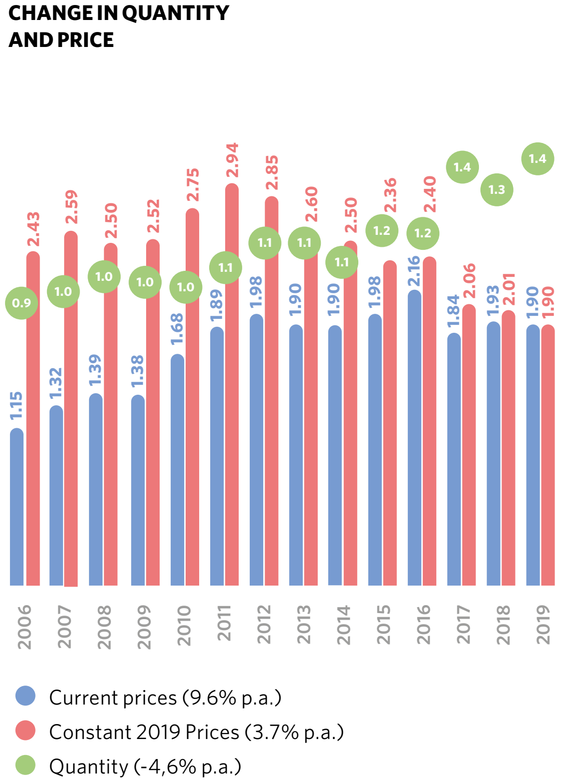
Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

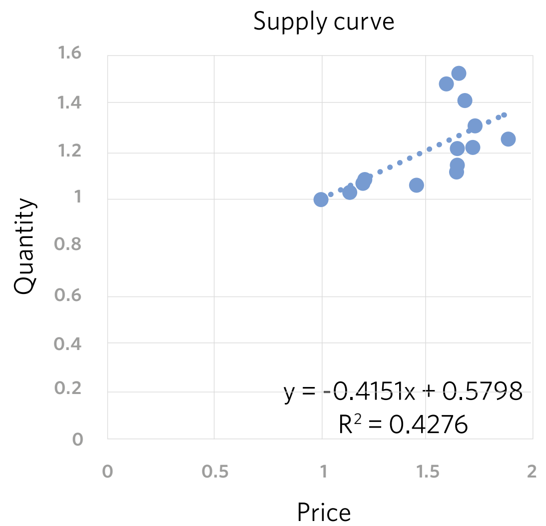
Chart 2.3.4-1-Price formation and markup along the buriti value chain (BRL1,000.00/t and % of purchase price)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.3.4-2- Buriti supply regime: a) change in quantity (1,000 t) and price (BRL1,000.00/t, current and constant 2019 values; b) supply curve: Quantity Index as a linear function of the Current Product Price Index, 2006 = 1.





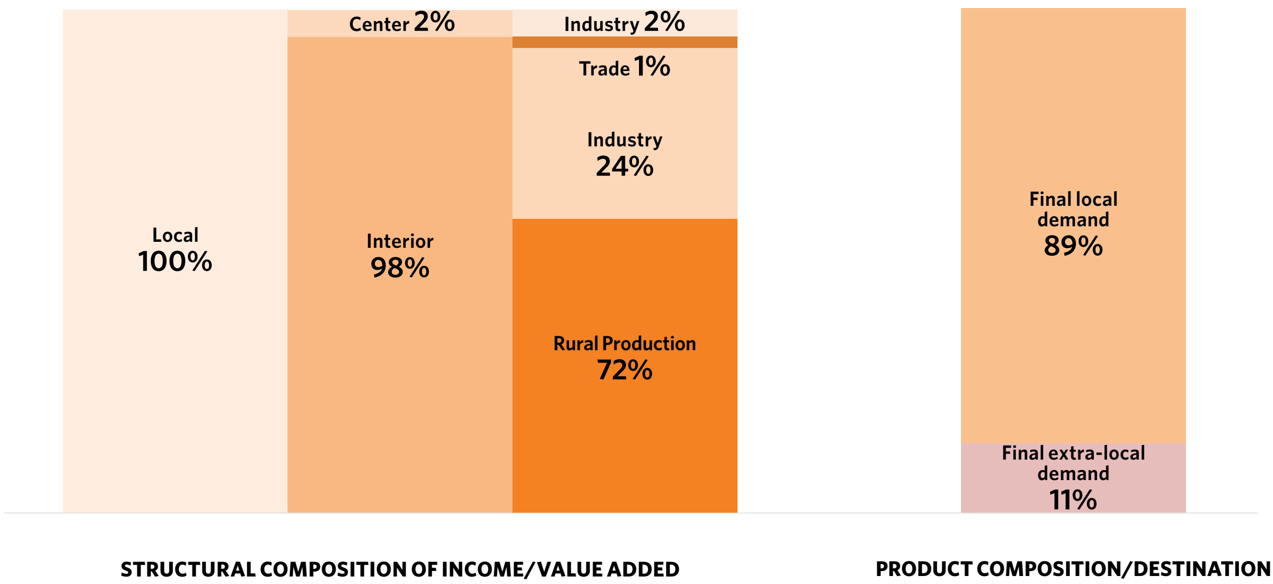
Source: IBGE, 2006 and 2017 Agricultural Census; IBGE, Municipal Agriculture Survey; IBGE, Plant Extractivism Survey.

The *supply regime* of the rural production of buriti is characterized by a moderately inelastic production response, since the (current) price variation of 1 percent results in a 0.415 percent increase in the quantity produced. In turn, the 1.7 percent p.a. decrease in the actual price paid to the producer indicates that supply has grown at a higher rate than demand (Chart 3.1.1-1).

The conditions described establish the mode of distribution of the total VA generated in 2019 along the buriti chain and its constitutive arrangements. The following stands out:

- The total VA generated of BRL3.8 million is 1.4 times the original value of the rural production of BRL2.7 million; this can be considered a primary chain multiplier (Table A.2.2-14).
- The arrangements that produce buriti in the *local economy* accounted for 100 percent of the VA generated (first column in Chart 2.3.4-3)
- The interior accounted for 98 percent of the local economy share (second column in Chart 2.3.4-3);
- In the interior, rural production accounted for 72 percent, industry for 24 and trade for 1 percent (third column in Chart 2.3.4-3);
- The local economy consumed 89 percent - these are domestic chains, with export base components (first and fourth columns in Chart 2.3.4-3).
- Employment associated with this production total 288 workers, with just over 95 percent rural production and 3 percent in industry in the interior (Table A.2.2-14, last row).
- RIs Baixo Tocantins with 66 percent, and Caeté with 26 percent of the total VA led the production of buriti in EcoSocioBio-PA in 2019, followed by Xingu with 5 percent and Baixo Amazonas with 3 percent.

Chart 2.3.4-3 Added Value/Income Distribution and Product Destination in EcoSocioBio-PA's Buriti Chain



Source: Annex 2, A.2.2, Table A.2.2.-14.

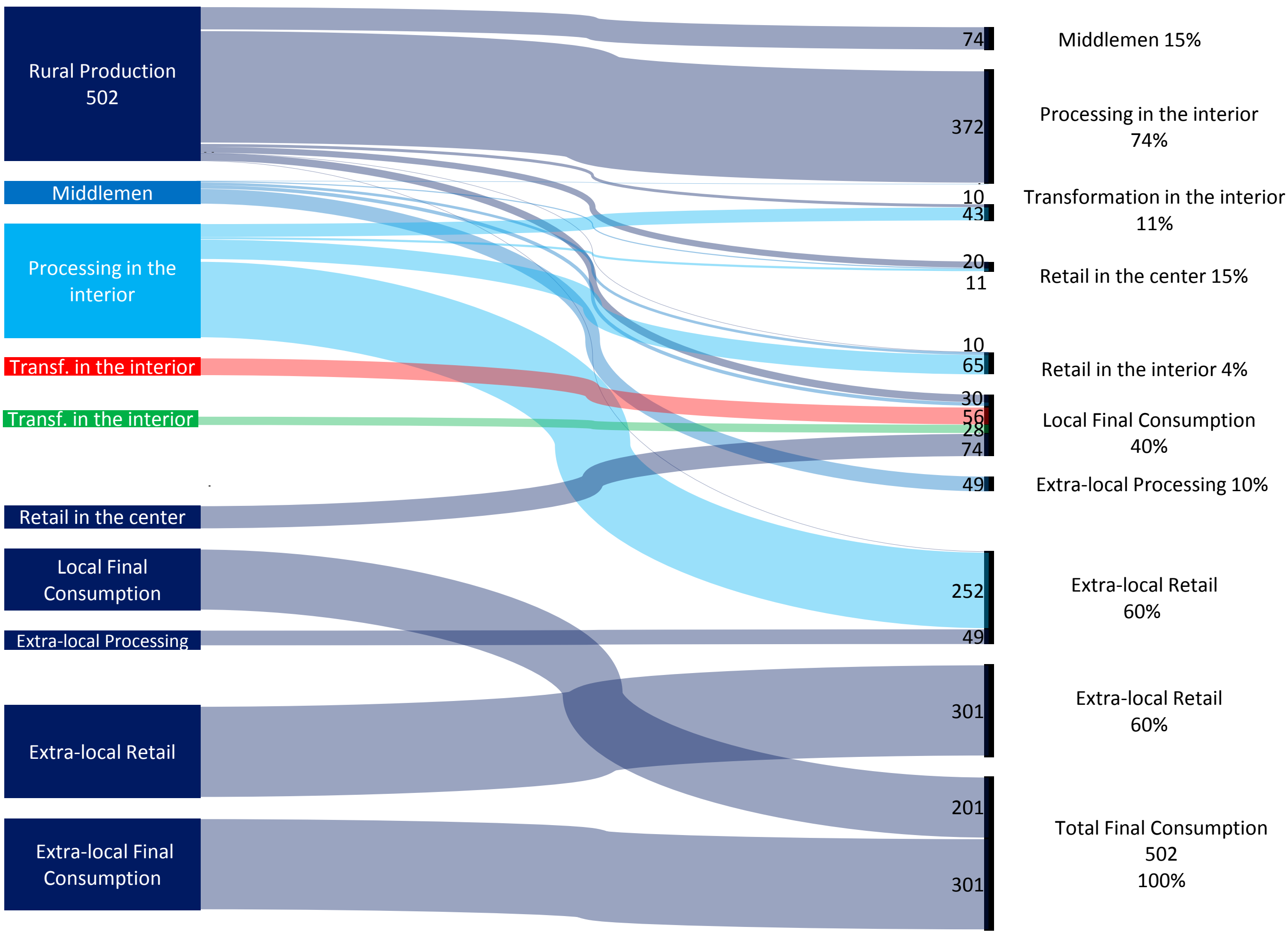
3.4 Products without information on scale or growth

3.4.1 Tapereba

Tapereba constitutes basically a short chain of fresh product for local supply, where 96 percent of the material production is consumed; 4 percent of processed products reach extra-local markets, for a price that accounted for 33 percent of the total (Figure 2.4.1-1). Trade and industry accounted for 8 percent and 1 percent of the VA, respectively. The total VA generated, of BRL 1.8 million, represents 2.8 times the original rural production value, of BRL 643.6 thousand.

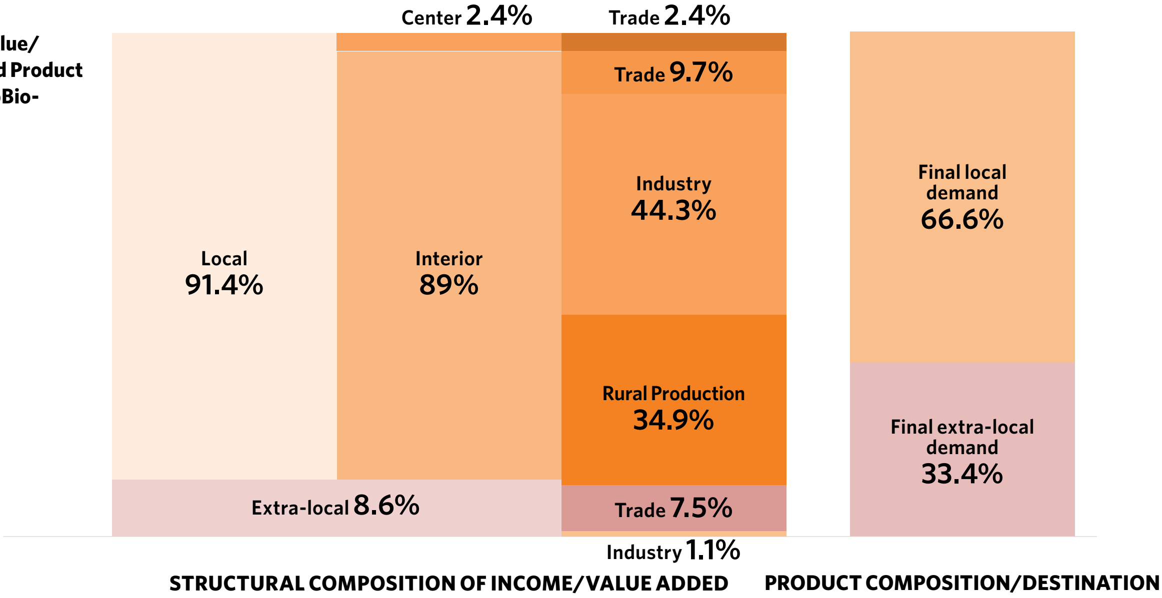
The local economy accounted for 91 percent of the VA, with 44 percent in industry in the center and the remainder in trade (Chart 3.4.15-1). The origin of the product is territorially diffuse, with emphasis on IRs Guamá (28 percent), Xingu (22 percent) and Capim (22 percent).

Figure 2.4.1-1- Product flow underlying tapereba value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.4.1-1 Added Value/ Income Distribution and Product Destination in EcoSocioBio-PA's Tapereba Chain

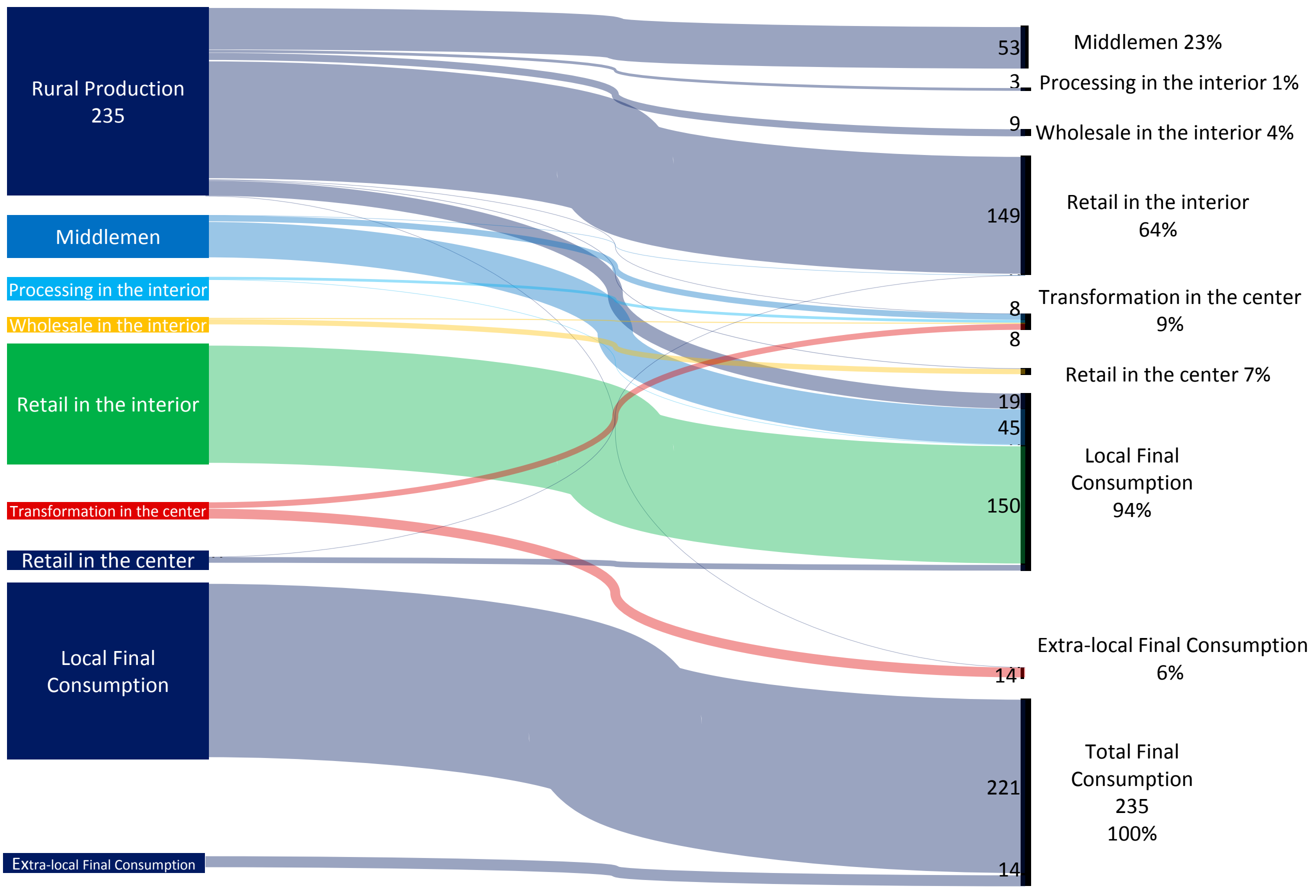


Source: Annex 2, A.2.2, Table A.2.2.-15.

3.4.2 Murici

EcoSocioBio-PA consists of the short local supply chains of fresh murici (64 percent in the interior and 7 percent in the center). A 9 percent share of the physical product reaches the domestic market after its industrial transformation in the center of the local economy (Figure 2.4.2-1), accounting for 0.4 percent of the product value. The total VA generated, of BRL 3.9 million, represents 2.3 times the original rural production value of BRL 1.7 million.

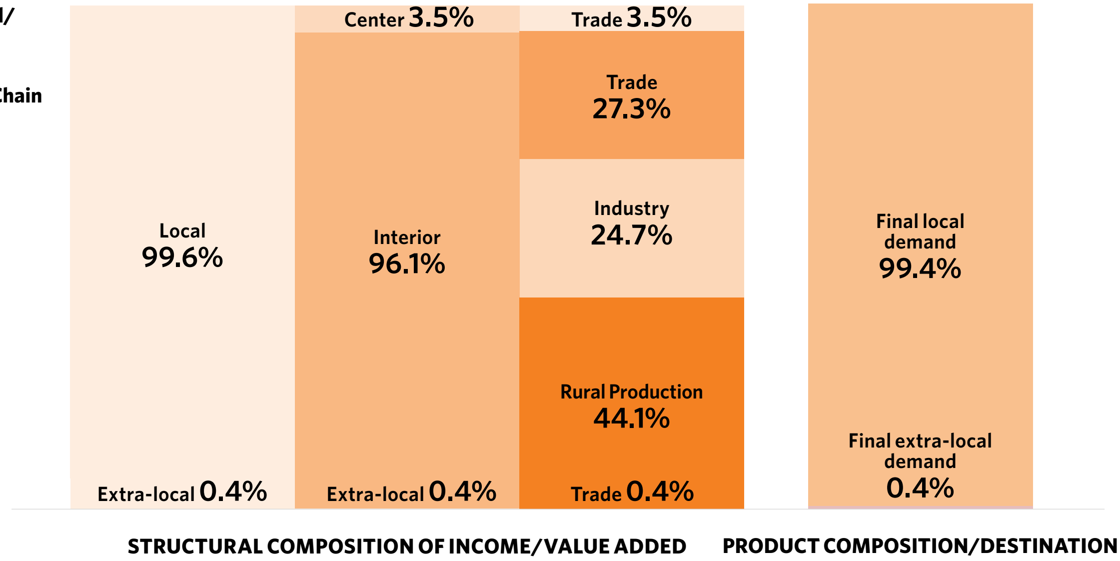
Figure 2.4.2-1- Product flows underlying murici value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

The interior accounts for as much as 94 percent of the VA, with 44 percent in rural production, 25 percent in processing, and 27 percent in trade (Chart 3.4.4-1). The chain is predominantly sustained by IR Rio Capim (62 percent), IR Guamá (19 percent), and IR Caeté (13 percent), as well as by IR Baixo Amazonas (3 percent) and IR Marajó (2 percent).

Chart 2.4.2-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Murici Chain

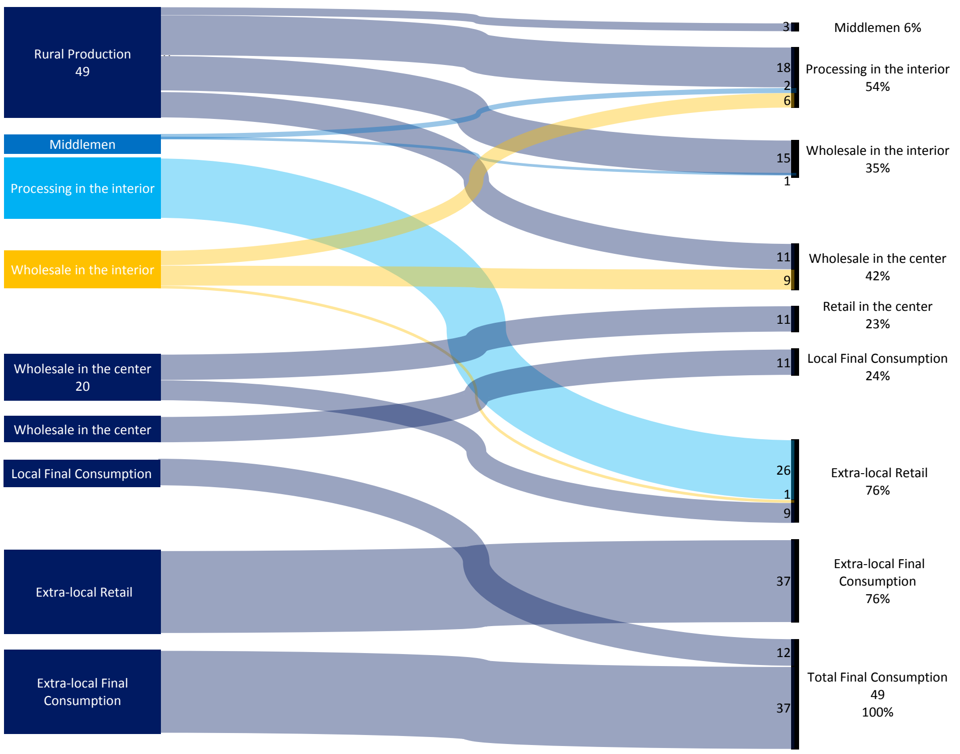


Source: Annex 2, A.2.2, Table A.2.2.-16.

3.4.3 Cumaru

The cumaru production of approximately 49 tons is distributed through short local supply chains (24 percent) and long extra-local supply chains (76 percent) (Figure 2.4.3-1). Of fundamental relevance is an industrial processing node in the interior through which flows 54 percent of production (Chart 3.3.2-4). Trade intermediation in wholesale and retail is important in the local economy (wholesale is 35 percent in the interior and 42 percent in the center; retail is 23 percent in the center) as well as in the extra-local economy (domestic retail is 76 percent). Retail nodes have the highest markup (Figure 3.3.2-1).

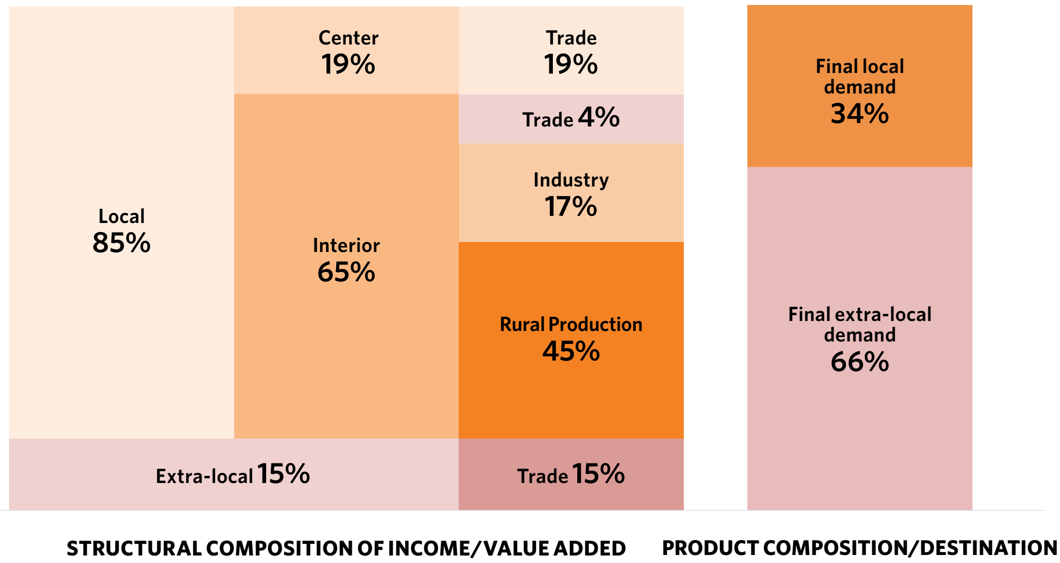
Figure 2.4.3-1-Product flows underlying cumaru value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

The total VA generated, of BRL 566.4 thousand, represents 2.2 times the original rural production value, of BRL 253.2 thousand. An 85 percent share of the total VA was distributed among local economy sectors, with 19 percent in the center and 65 percent in the interior: 45 percent for the rural sector, 17 percent for industry and the remainder for trade.

Chart 2.4.3-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Cumaru Chain

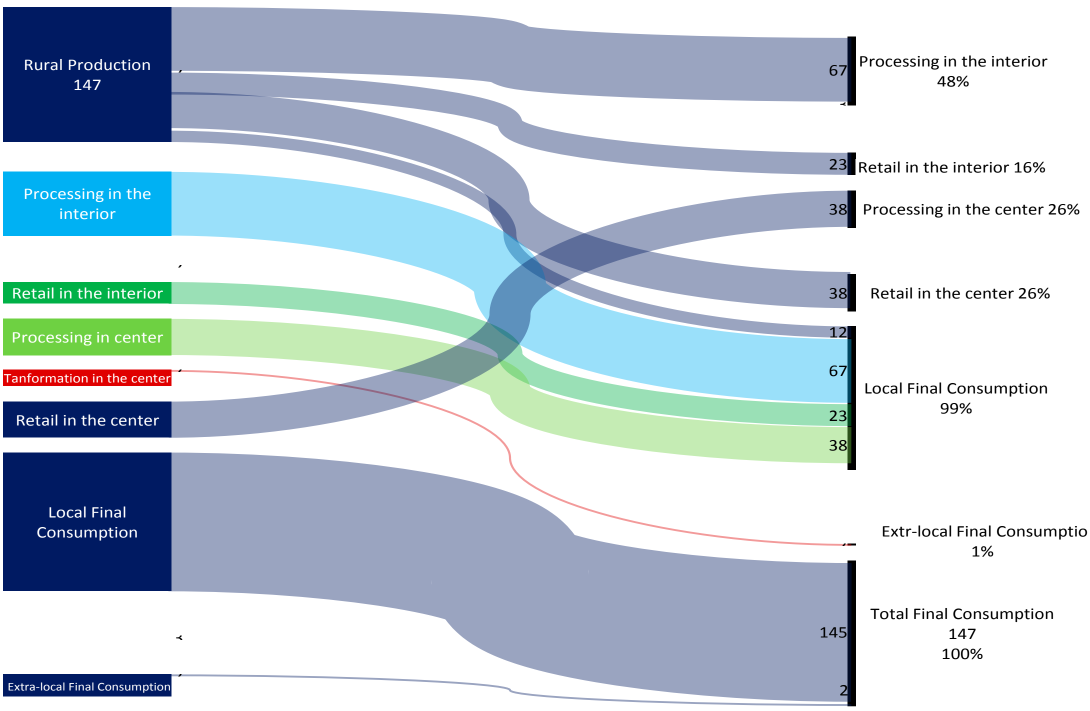


Source: Annex 2, A.2.2, Table A.2.2.-17.

3.4.4 Bacaba

EcoSocioBio-PA consists of short local supply chains of bacaba, both fresh (16 percent in the interior and 26 percent at the center) and processed (48 percent in the interior and 26 percent at the center). A small share (1 percent) reaches de domestic market after industrial transformation in the center of the local economy (Figure 2.4.4-1). Then interior accounts for as much as 84 percent of the VA, with 61 percent in rural production and 19 percent in processing (Chart 3.4.1-1). The total VA generated, of BRL 222.7 thousand, represents 1.6 times the original rural production value, of BRL 136.5 thousand.

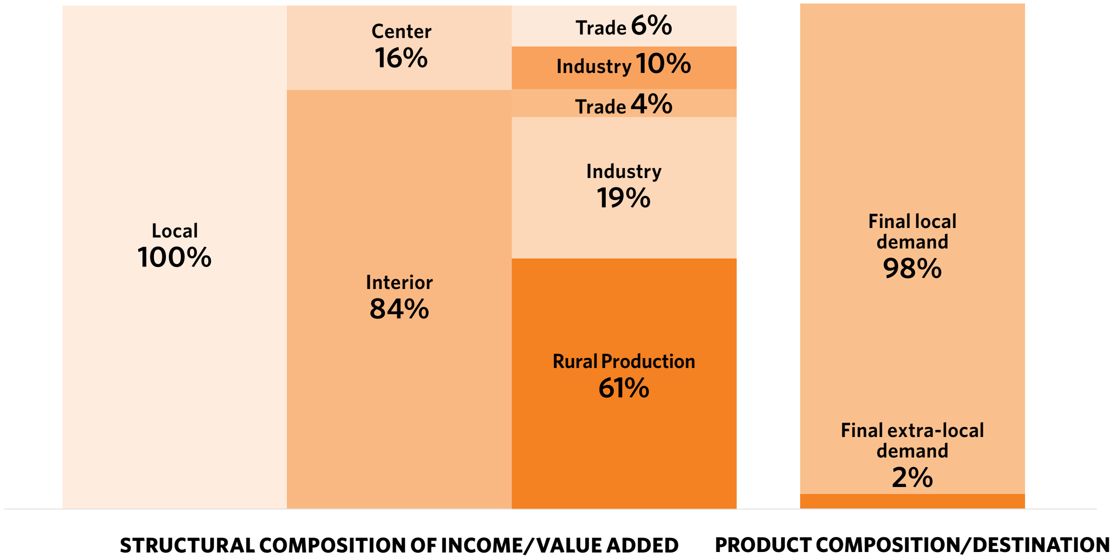
Figure 2.4.4-1-Product flows underlying bacaba value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

The chain is predominantly sustained by IRs Tocantins (55 percent) and Caeté (24 percent), as well as by RIs Baixo Amazonas (8 percent), Guamá (7 percent), Rio Capim (3 percent), and Marajó (3 percent).

Chart 2.4.4-1- Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Bacaba Chain

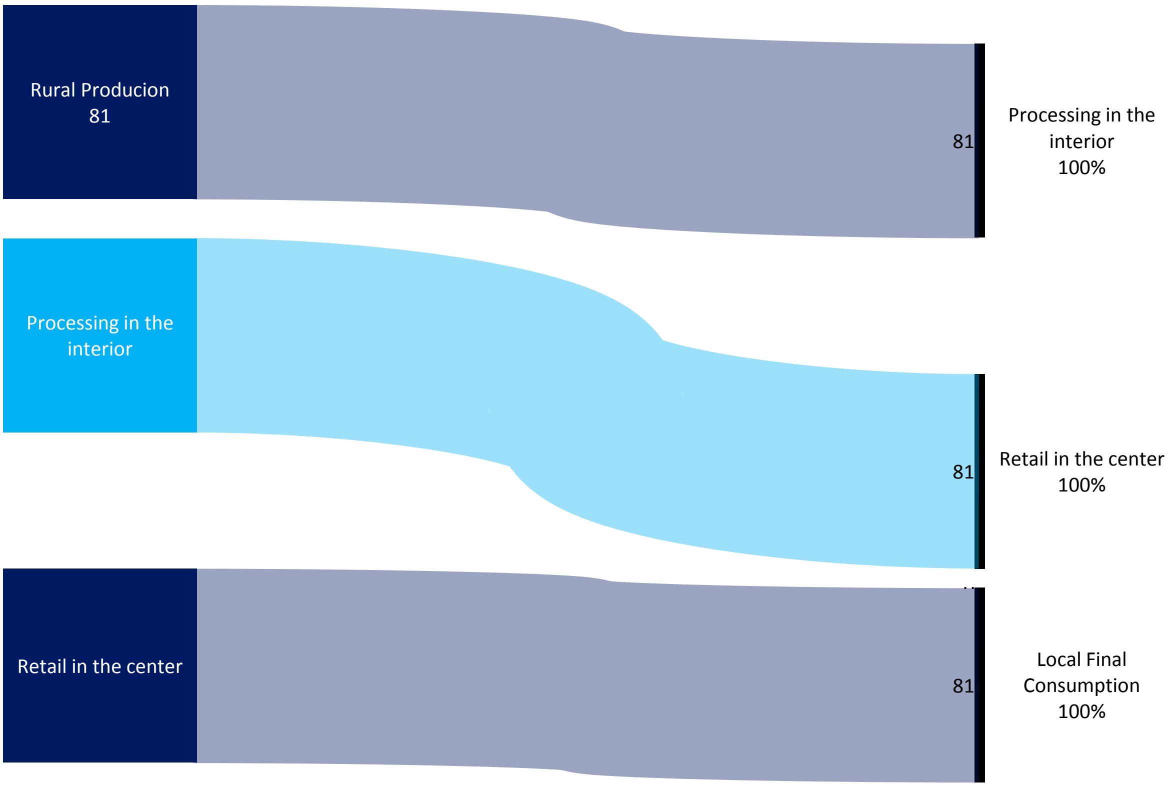


Source: Annex 2, A.2.2, Table A.2.2.-18.

3.4.5 Açai seed

EcoSocioBio-PA consists of a short chain of açai seed targeted at the local market with processing mediation in the interior (Figure 2.4.5-1).

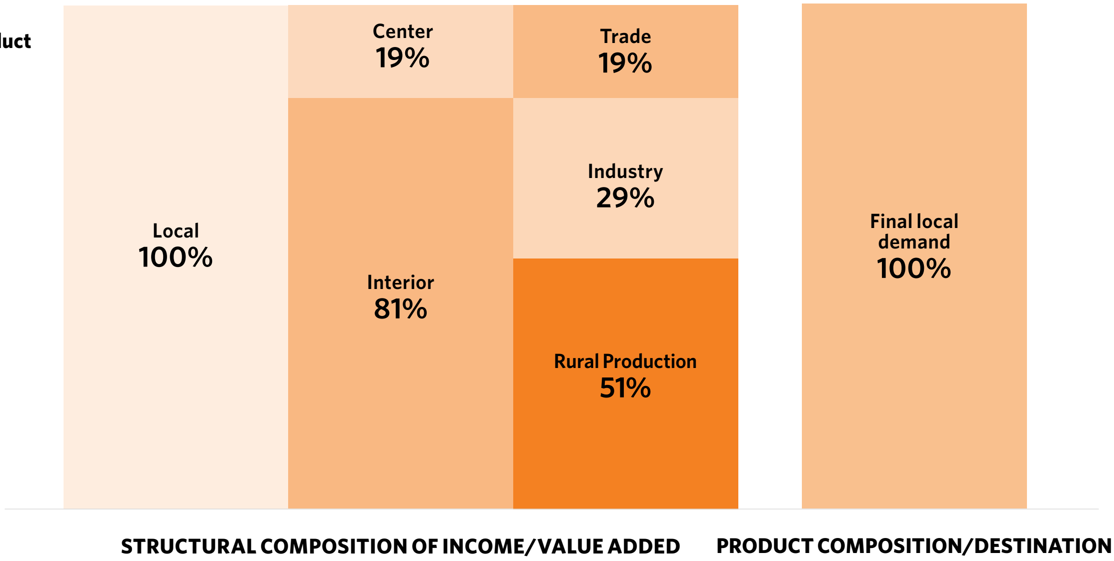
Figure 2.4.5-1-Product flows underlying açai seed value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

The interior accounts for as much as 80 percent of the VA, with 51 percent in rural production and 29 percent in processing (Chart 2.4.5-1). The total VA generated, of BRL 253 thousand, represents 1.9 times the value rural production, of BRL 129 thousand. The chain is predominantly sustained by IR Rio Capim (98 percent), as well as by IR Xingu (2 percent).

Chart 2.4.5-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's açai seed Chain

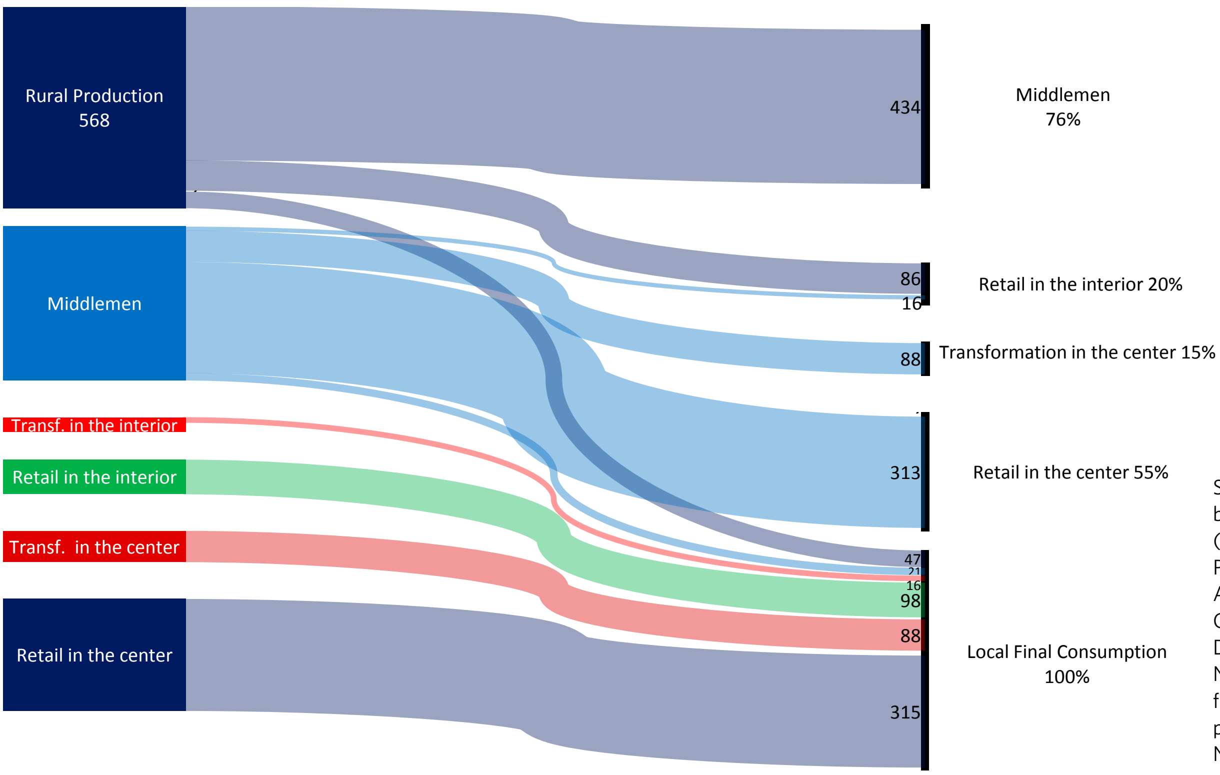


Source: Annex 2, A.2.2, Table A.2.2.-19.

3.4.6 Uxi

EcoSocioBio-PA consists of short supply chains of fresh uxi (20 percent in the interior and 55 percent in the center) and industrially transformed in the center of the local economy (15 percent) (Figure 2.4.6-1). The total VA generated, of BRL 60 thousand, represents 2.7 times the rural production value, of BRL 22 thousand. The local economy accounts for the totality of the VA generated,

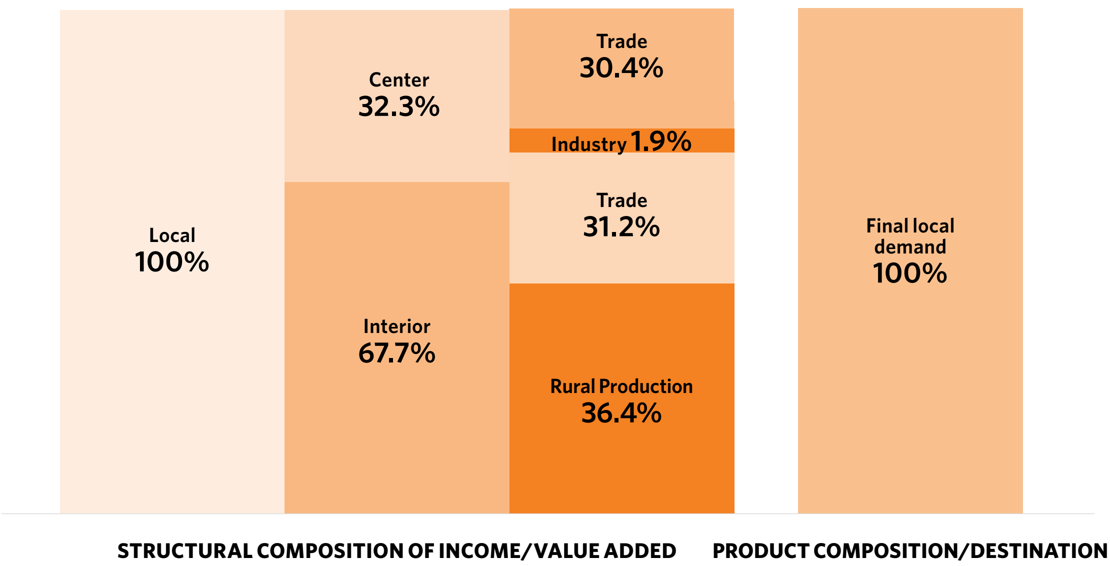
Figure 2.4.6-1 Product flows underlying uxi value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

with 67 percent in the interior (36 percent in rural production and 31 percent in trade) and 33 percent in the center (30 percent in trade and 3 percent in industry) (Chart 3.4.3-1). The chain is predominantly sustained by IRs Guamá (91 percent) and Caeté (24 percent), as well as by RIs Baixo Amazonas (3 percent) and Marajó (3 percent).

Chart 2.4.6-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Uxi Chain

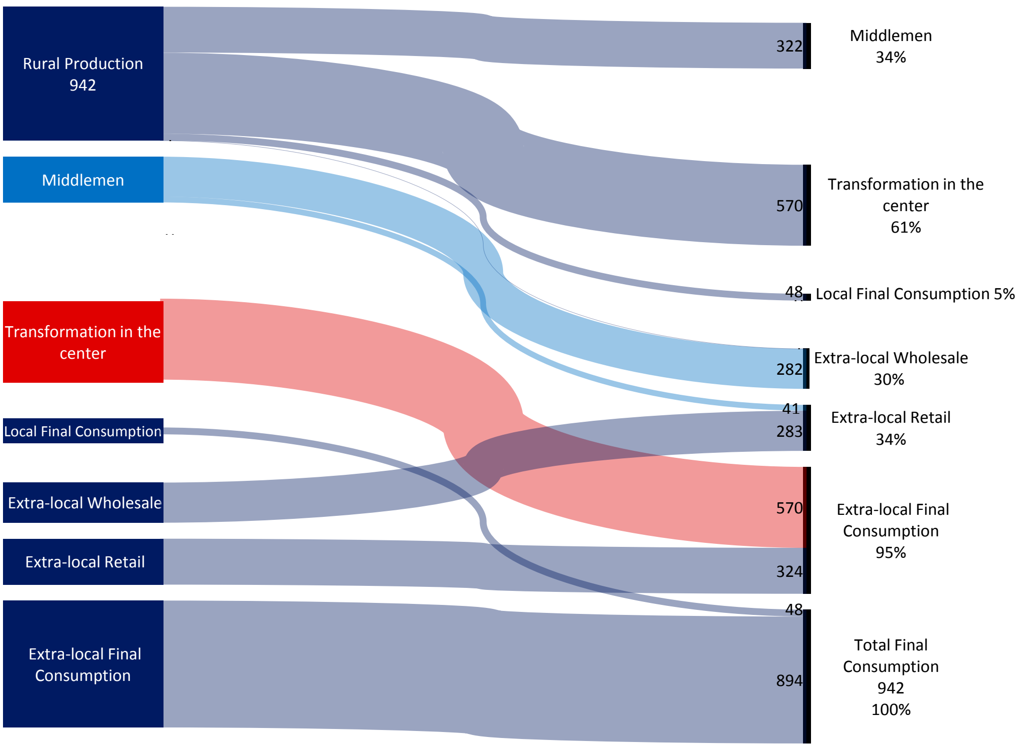


Source: Annex 2, A.2.2, Table A.2.2.-20.

3.4.7 Tucuman

EcoSocioBio-PA consists of long extra-local supply chains of tucuman both fresh (31 percent) and industrially transformed in the center of the local economy (61 percent of the material production). A 5 percent share is associated with the local fresh product market (Figure 2.4.7-1). The total VA generated, of BRL 1.9 million, represents 1.5 times the original value of rural production, R$1.3 million.

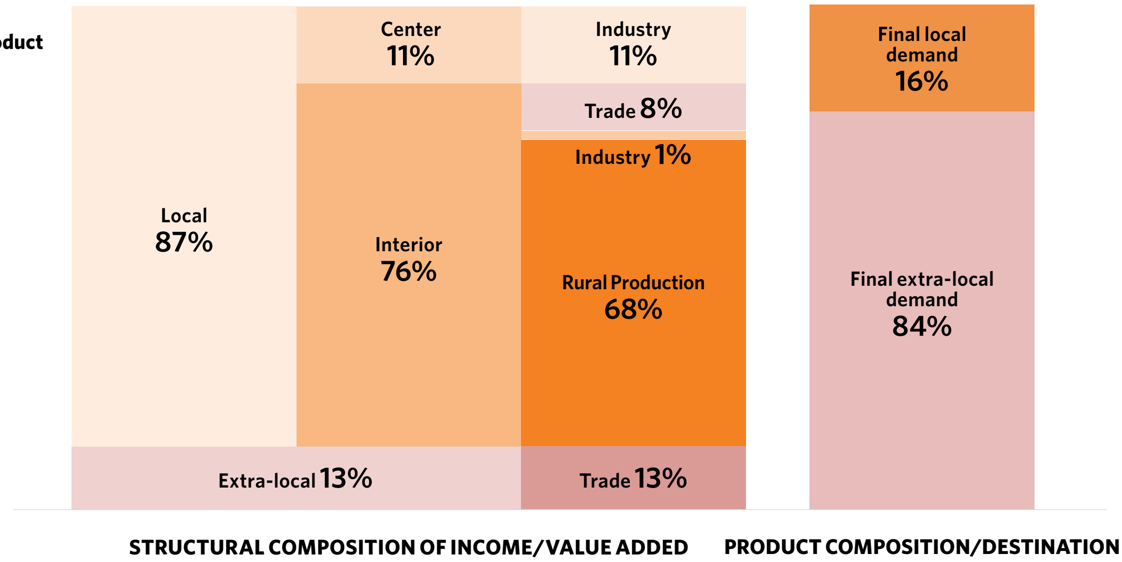
Figure 2.4.7-1 Product flows underlying tucuman value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

As a result, 84 percent of the product value corresponds to extra-local demand. The interior accounts for as much as 87 percent of the VA, with 68 percent in rural production,1 percent in industrial processing in the center and 8 percent in trade (Chart 3.4.5-1). The processing industry in the center accounted for 11 percent. The chain is sustained RIs Caeté (72 percent) and Baixo Amazonas (28 percent).

Chart 2.4.7-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Tucuman Chain

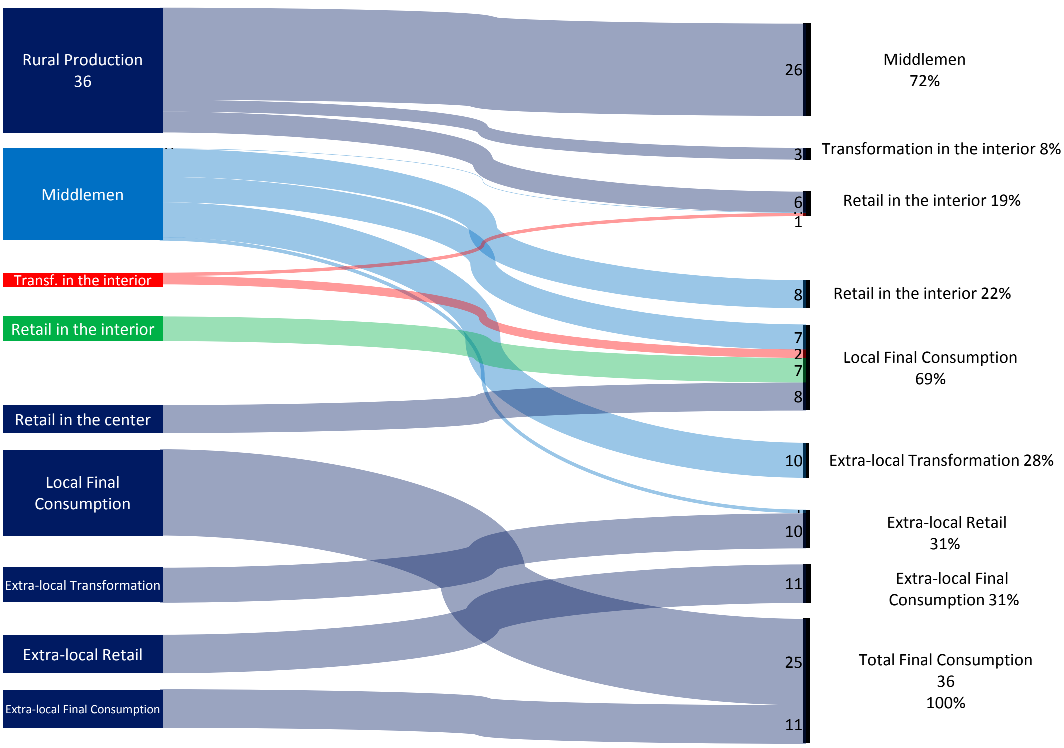


Source: Annex 2, A.2.2, Table A.2.2.-21.

3.4.8 Breu Branco

EcoSocioBio-PA consists of short local supply chains (69 percent of material product and 64 percent of product value) and long extra-local supply chains (31 percent and 36 percent) of breu branco resin. Some 8 percent of this production goes through industrial transformation in the center of the local economy and 28 percent in the extra-local economy (Figure 2.4.8-1), which accounts for 12 percent of the VA generated. The total VA generated, of BRL 119 thousand, represents twice the rural production value, of BRL 59 thousand.

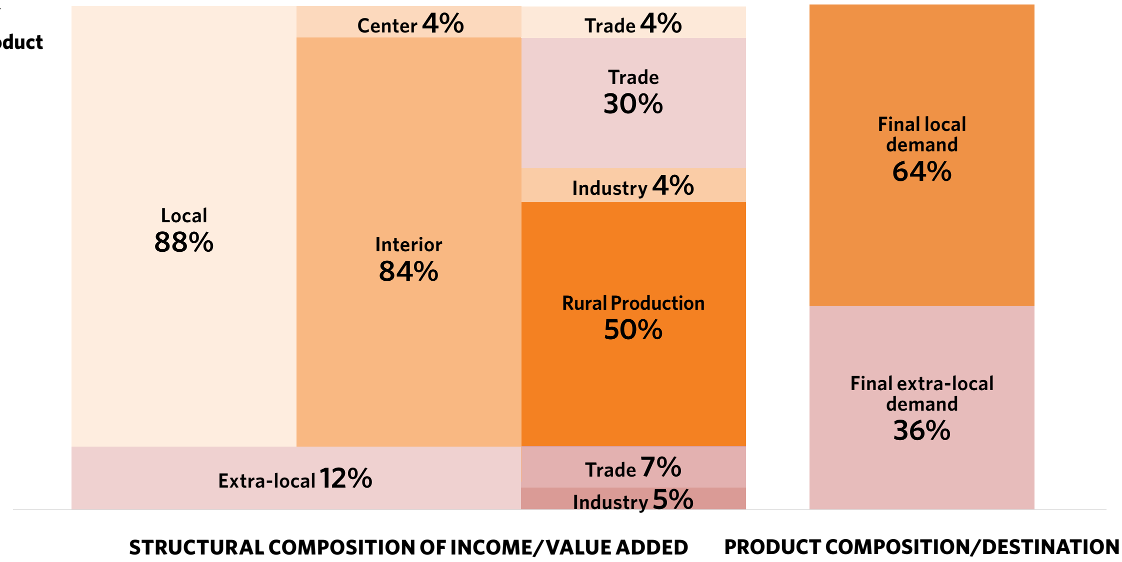
Figure 2.4.8-1 Product flows underlying breu branco value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

The local economy accounts for as much as 84 percent of the VA, with 50 percent in rural production, 4 percent in industrial processing and 34 percent in trade (Chart 3.4.6-1). The chains are predominantly sustained by IR Marajó (61 percent), as well as by RIs Baixo Amazonas and Guamá (11 percent), Caeté (10 percent) and Tocantins (5 percent).

Chart 2.4.8-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Breu Branco Chain

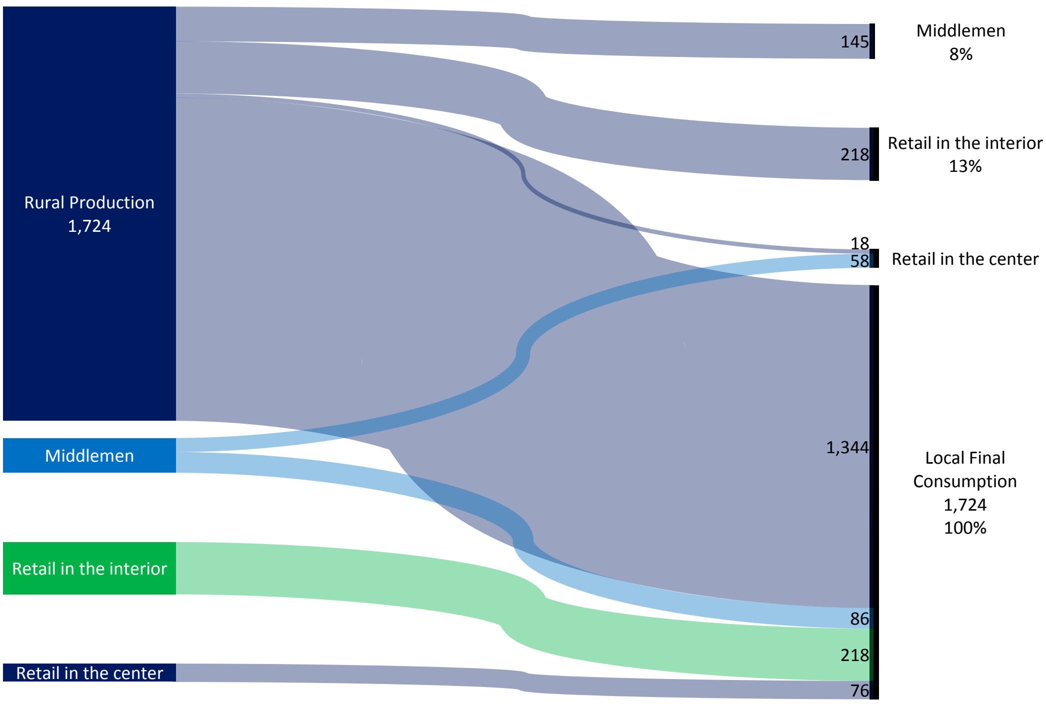


Source: Annex 2, A.2.2, Table A.2.2.-22.

3.4.9 Piquia

EcoSocioBio-PA consists of short local supply chains of fresh piquia (Figure 2.4.9-1). The interior accounts for as much as 84 percent of the VA, with 61 percent in rural production and 19 percent in processing (Chart 3.4.7-1). The total VA generated, of BRL 1.5 million, represents 1.5 times the original rural production value, of BRL 1 million.

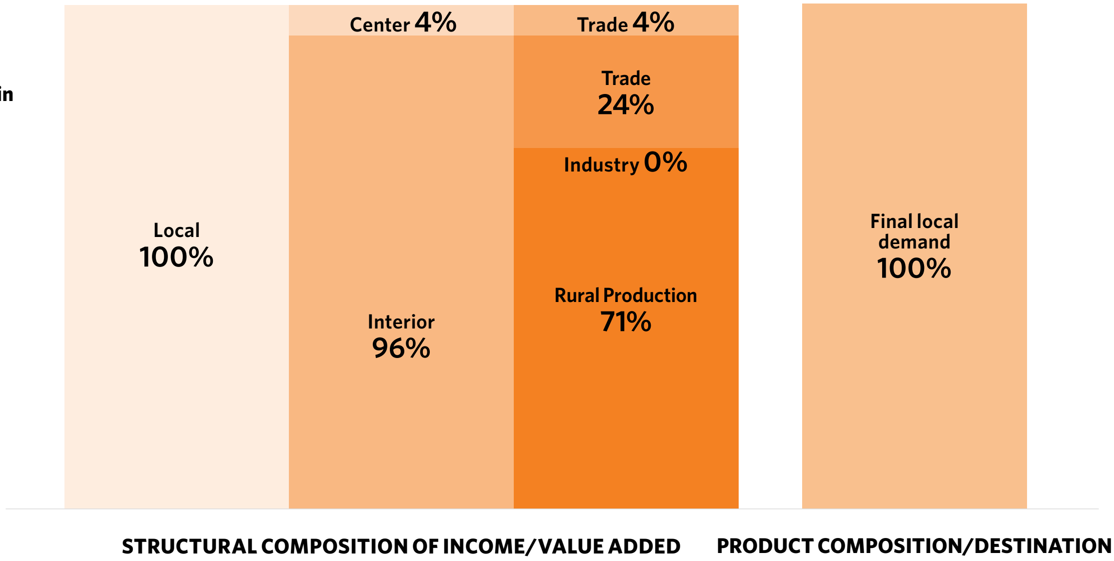
Figure 2.4.9-1 Product flows underlying piquia value chains (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

The chain is predominantly sustained by IRs Tocantins (55 percent) and Caeté (24 percent), as well as by RIs Baixo Amazonas (8 percent), Guamá (7 percent), Rio Capim (3 percent), and Marajó (3 percent).

Chart 2.4.9-1 - Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Piquia Chain

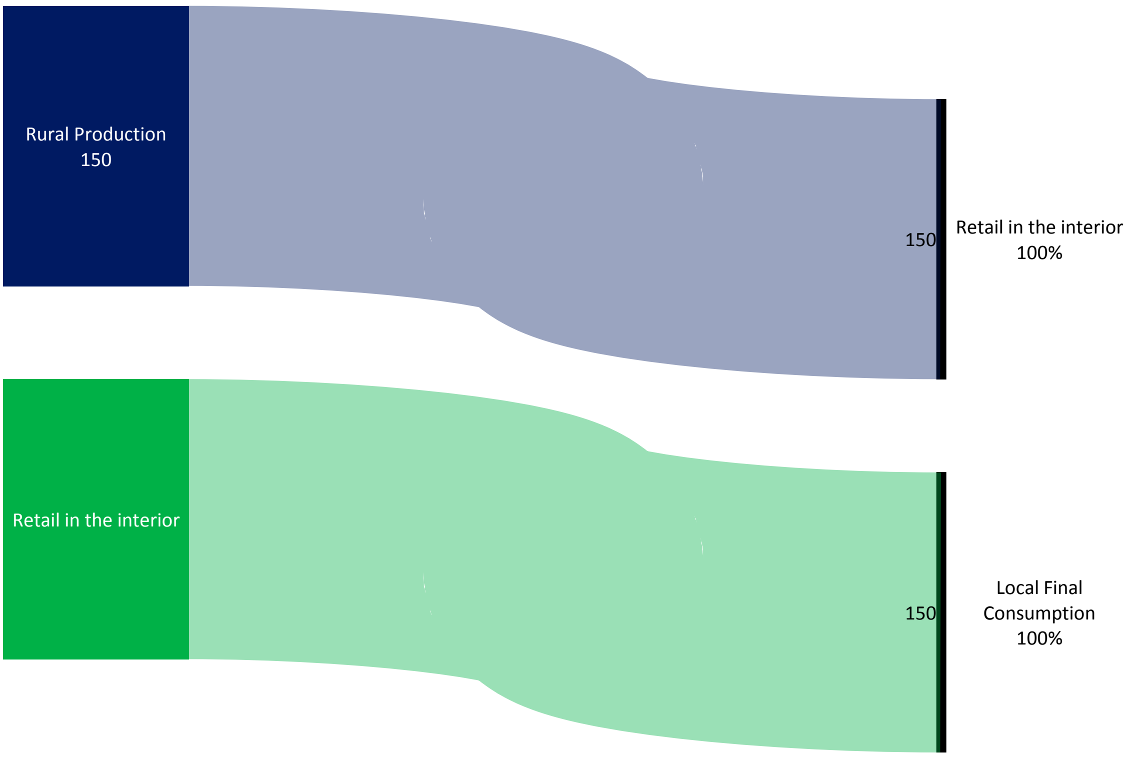


Source: Annex 2, A.2.2, Table A.2.2.-23.

3.4.10 Piquia oil

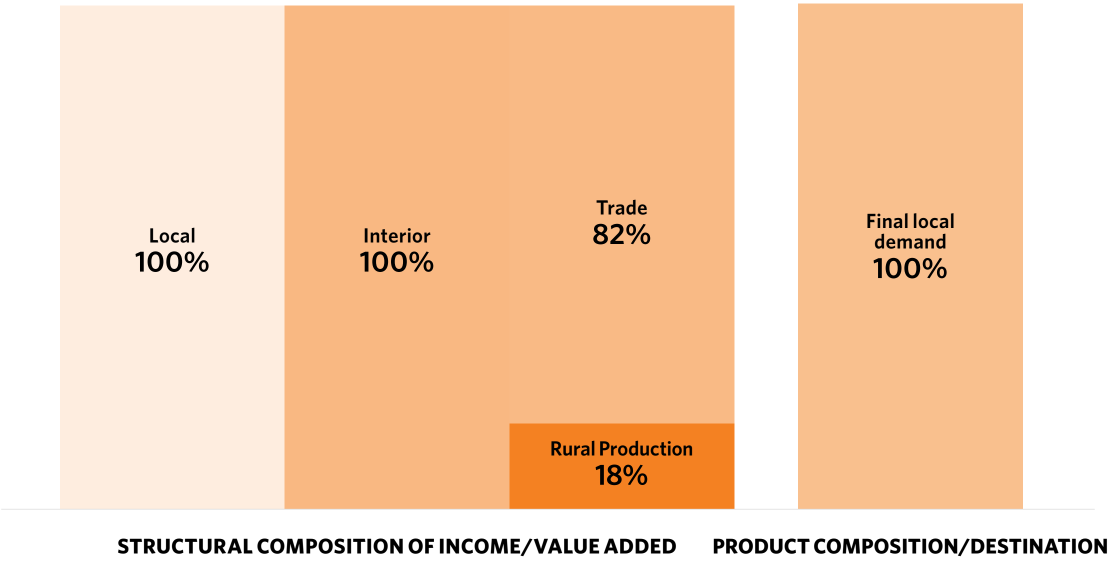
EcoSocioBio-PA consists of short local supply chains of piquia oil in the interior (Figure 2.4.10-1). The total VA generated, of BRL 17 thousand, represents 5.6 times the rural production value, of BRL 3 thousand. The interior of the local economy accounts for 100 percent the VA, with 18 percent in oil production and 82 percent in trade (Chart 2.4.10-1). The chain is predominantly sustained by IR Xingu (97 percent), as well as by IR Baixo Amazonas (3 percent).

Figure 2.4.10-1 Product flow underlying the piquia oil value chain (t)



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.4.10-1 Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Piquia Oil Chain



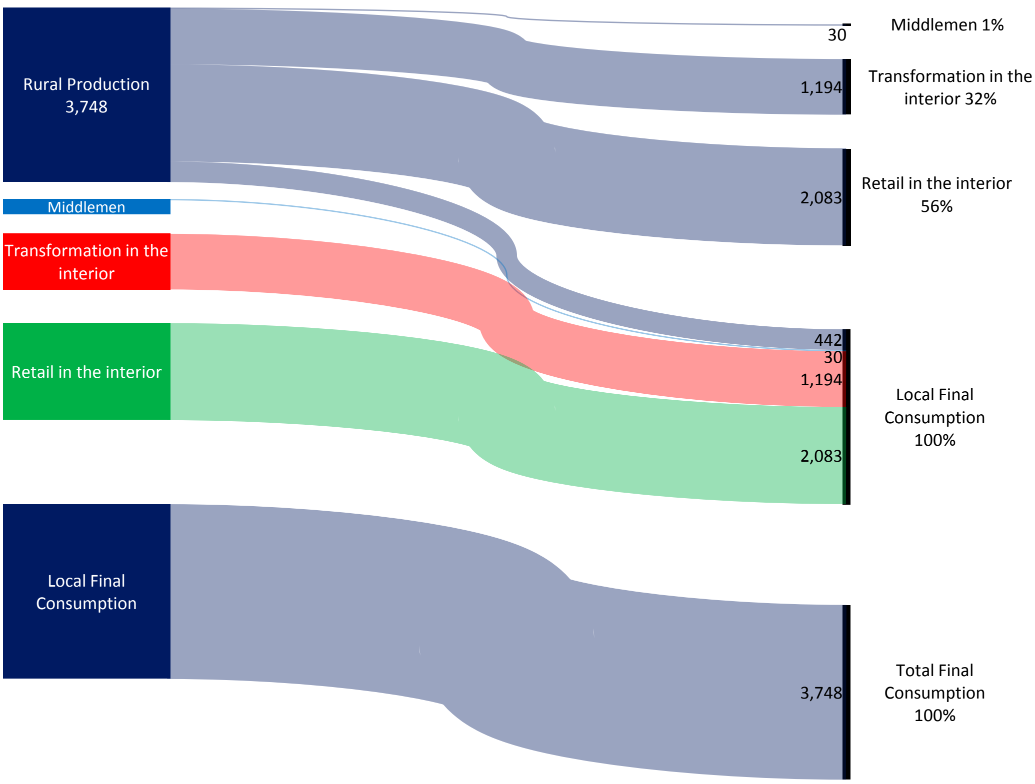
Source: Annex 2, A.2.2, Table A.2.2.-24.

3.4.11 Plant-Based Milks

EcoSocioBio-PA consists of short supply chains of plant-based milks and saps for nutritional and medicinal use (Figure 2.4.11-1). The total VA generated, of BRL 54.9 thousand, represents 1.6 times the rural production value, of BRL 34.5 thousand.

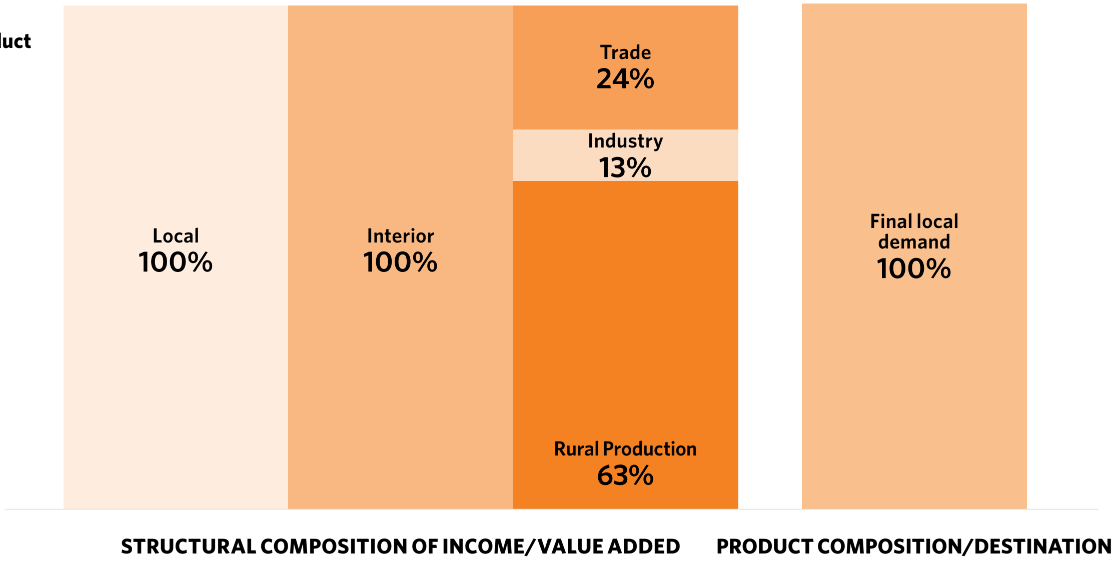
The interior of the local economy accounts for 100 percent of the VA, with 63 percent in production, 24 percent in trade and 13 percent in processing (Chart 2.4.11-1). The chain is predominantly sustained by IR Baixo Amazonas (74%), but also by IRs Xingu (13 percent), Tocantins (9 percent), and Caeté (4 percent).

Figure 2.4.11-1 Product flows underlying plant-based milk chains, in liters



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.4.11-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Plant-Based Milk Chain



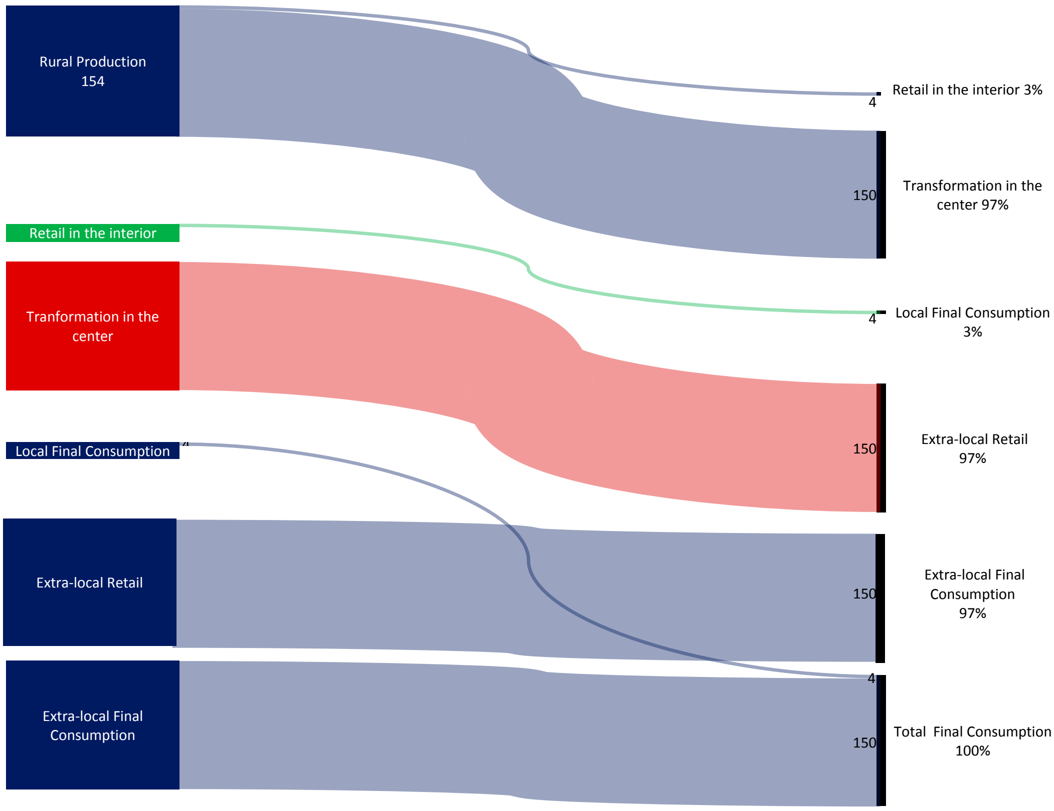
Source: Annex 2, A.2.2, Table A.2.2.-25.

3.4.12 Brazil Nut Oil

EcoSocioBio-PA consists of long extra-local supply chains of Brazil nut oil (97 percent of the material product and 84 percent of the product value), after transformation in the center of the local economy (Figure 2.4.12-1). The total VA generated, of BRL 6.7 thousand, represents 1.8 times the rural production value, of BRL 3.8 thousand.

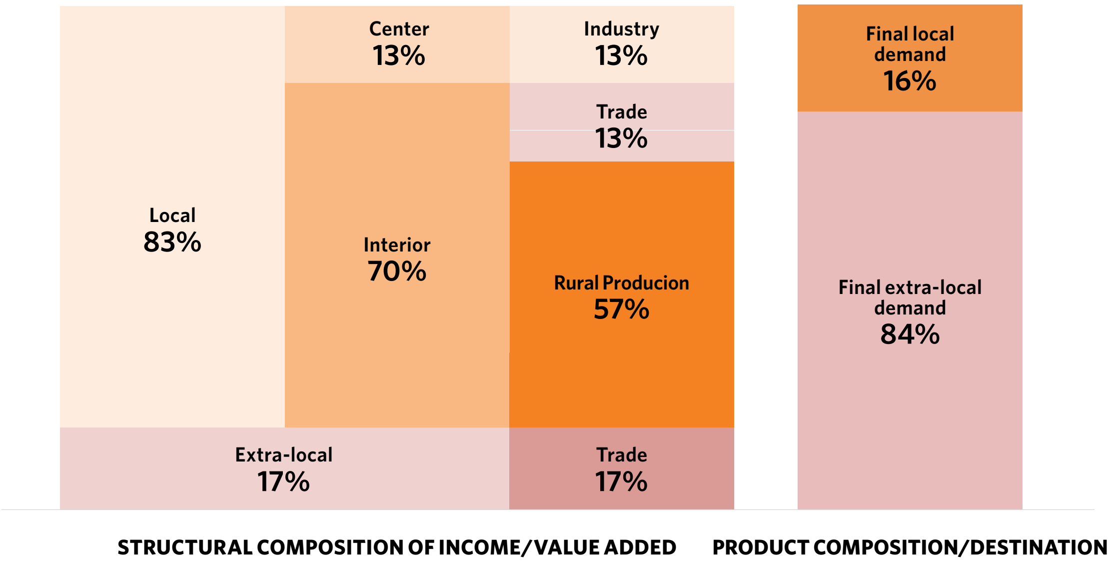
The interior of the local economy accounts for as much as 83 percent of the VA, with 57 percent in rural production and 13 percent in trade – and 13 percentage points in industry in the center (Chart 2.4.12-1). The chain is sustained by IRs Xingu (84 percent) and Baixo Amazonas (16 percent).

Figure 2.4.12-1 Product flows underlying Brazil nut oil value chains, in liters



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.4.12-1 Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Brazil Nut Oil Chain

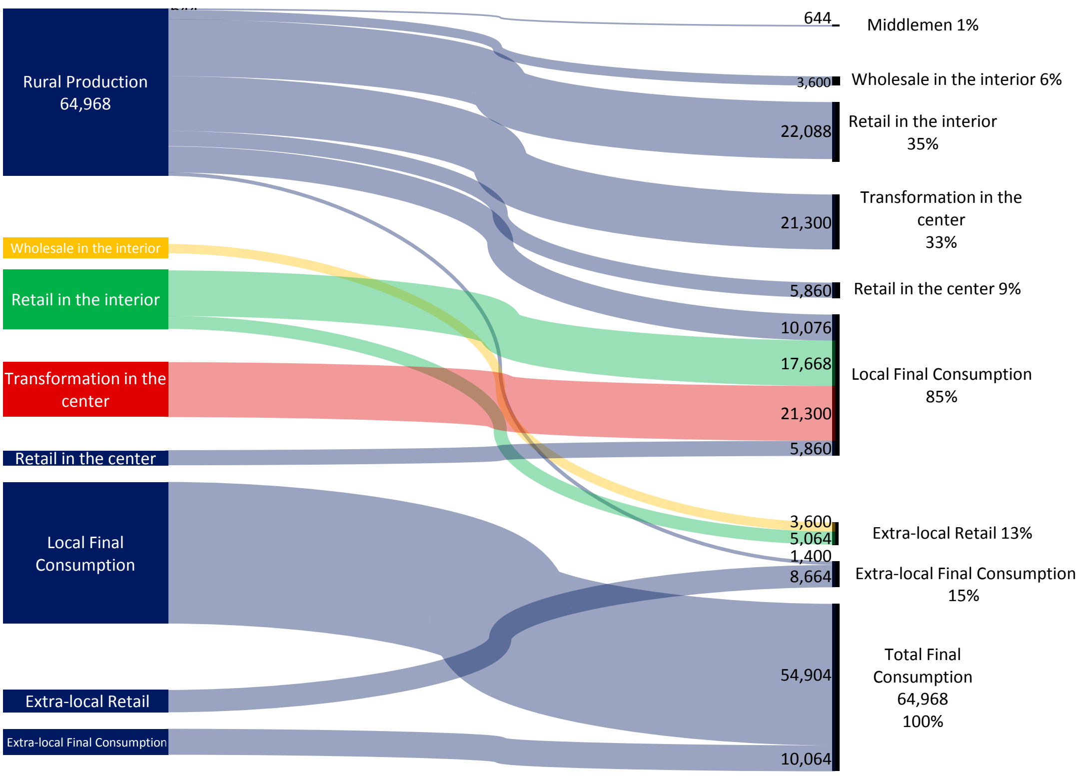


Source: Annex 2, A.2.2, Table A.2.2.-26.

3.4.13 Handicraft

EcoSocioBio-PA consists of short local supply chains (85 percent of the material product and 90 percent of the product value) and long extra-local supply chains (15 percent and 10 percent) of handicrafts using biodiversity materials. Around 33 percent of the material product undergoes some kind of transformation in the center of the local economy, accounting for 1 percent of the VA (Figure 2.4.13-1). The total VA generated, of BRL 981 thousand, represents 1.2 times the value rural production, of BRL 793,000.

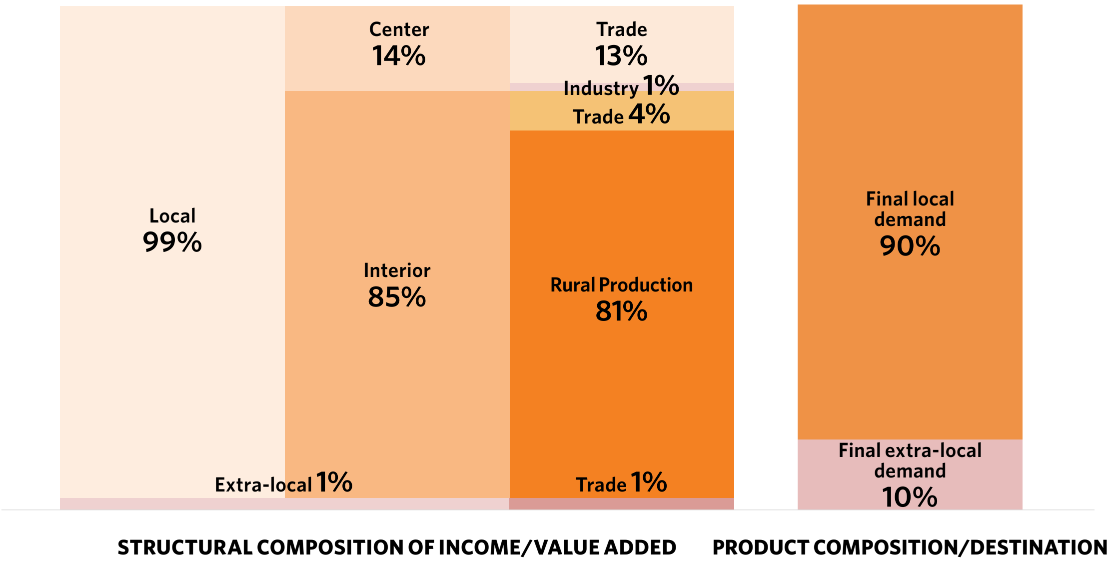
Figure 2.4.13-1 Product flows underlying handicraft value chains, in units



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

The interior of the local economy accounts for as much as 85 percent of the VA, with 81 percent in production and 4 percent in trade (Chart 2.4.13-1).

Chart 2.4.13-1 Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Handicraft Chain



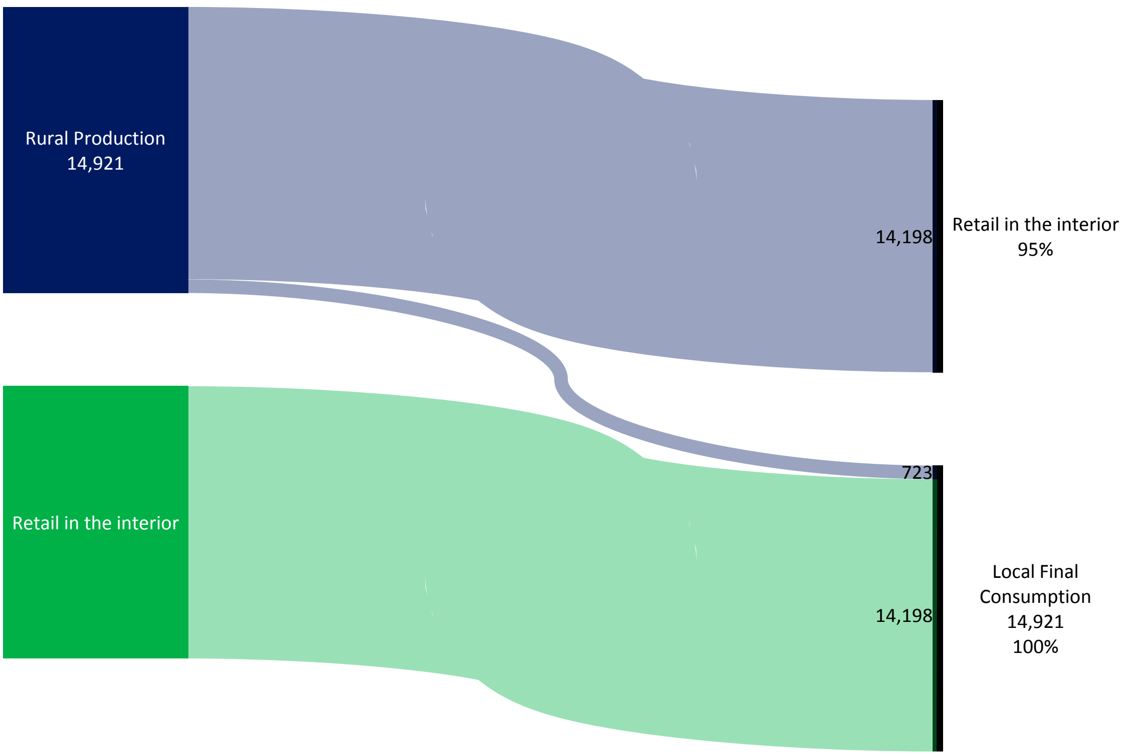
Source: Annex 2, A.2.2, Table A.2.2.-27.

3.4.14 Medicinal plants

EcoSocioBio-PA consists of short local supply chains of medicinal plants (Figure 2.4.14-1). The total VA generated, of BRL 405 thousand, represents twice the rural production value, of BRL 175 thousand.

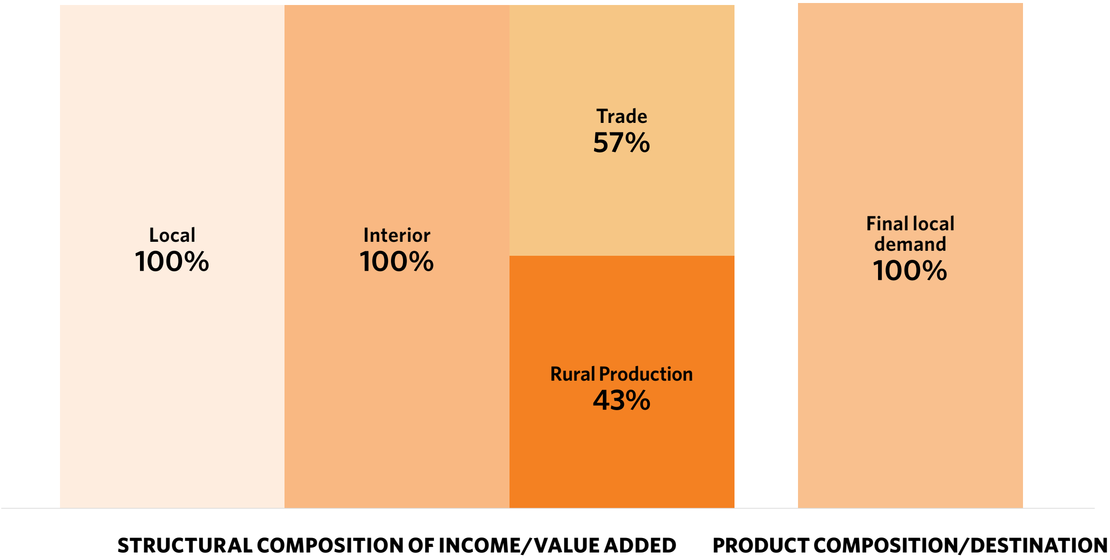
The interior local economy accounts for 100 percent of the VA, with 43 percent in production and 57 percent in trade (Chart 2.4.14-1).

Figure 2.4.14-1 Product flows underlying medicinal plants value chains, in units



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Chart 2.4.14-1 Value Added/Income Distribution and Product Destination in EcoSocioBio-PA's Medicinal Plants Chain

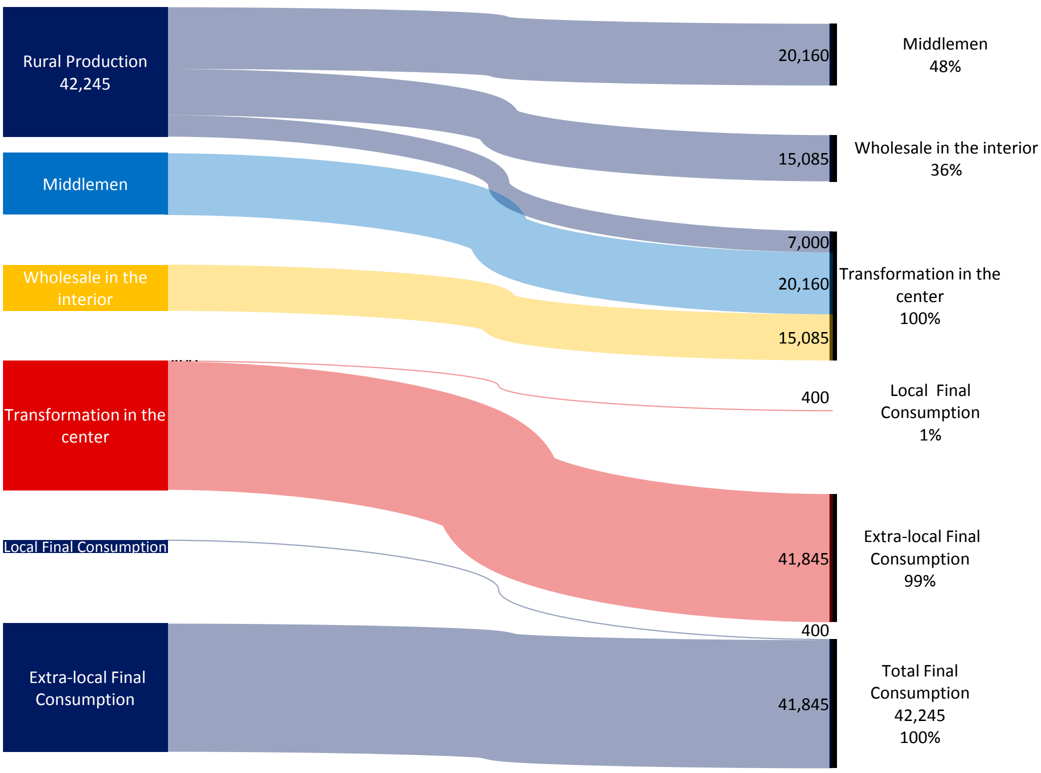


Source: Annex 2, A.2.2, Table A.2.2.-28.

3.4.15 Murumuru

EcoSocioBio-PA consists of long extra-local supply chains: 99 percent of the material product, 98 percent of the value of the murumuru product, after industrial transformation in the center of the local economy (Figure 2.4.15-1). The total VA generated, of BRL 96 thousand, represents twice the value rural production, of BRL 44 thousand.

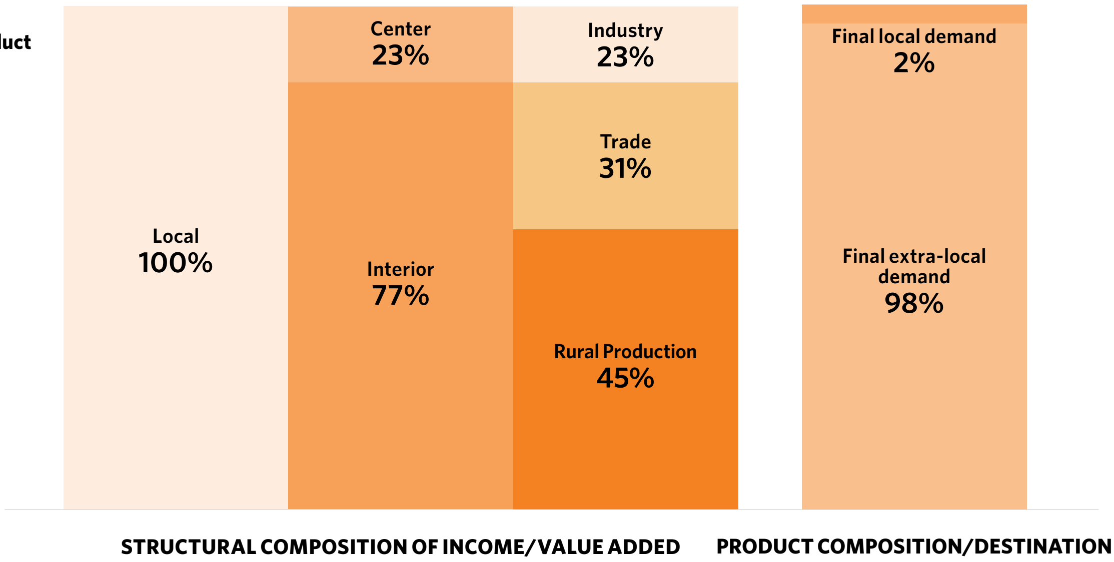
Figure 2.4.15-1 Product flows underlying murumuru value chains, in units



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

The local economy accounts for 100 percent of the VA the local economy, with 77 percent in the interior (45 percent in rural production and 31 percent in trade) and 23 percent in the industrial sector in the center (Chart 2.4.15-1).

Chart 2.4.15-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Murumuru Chain

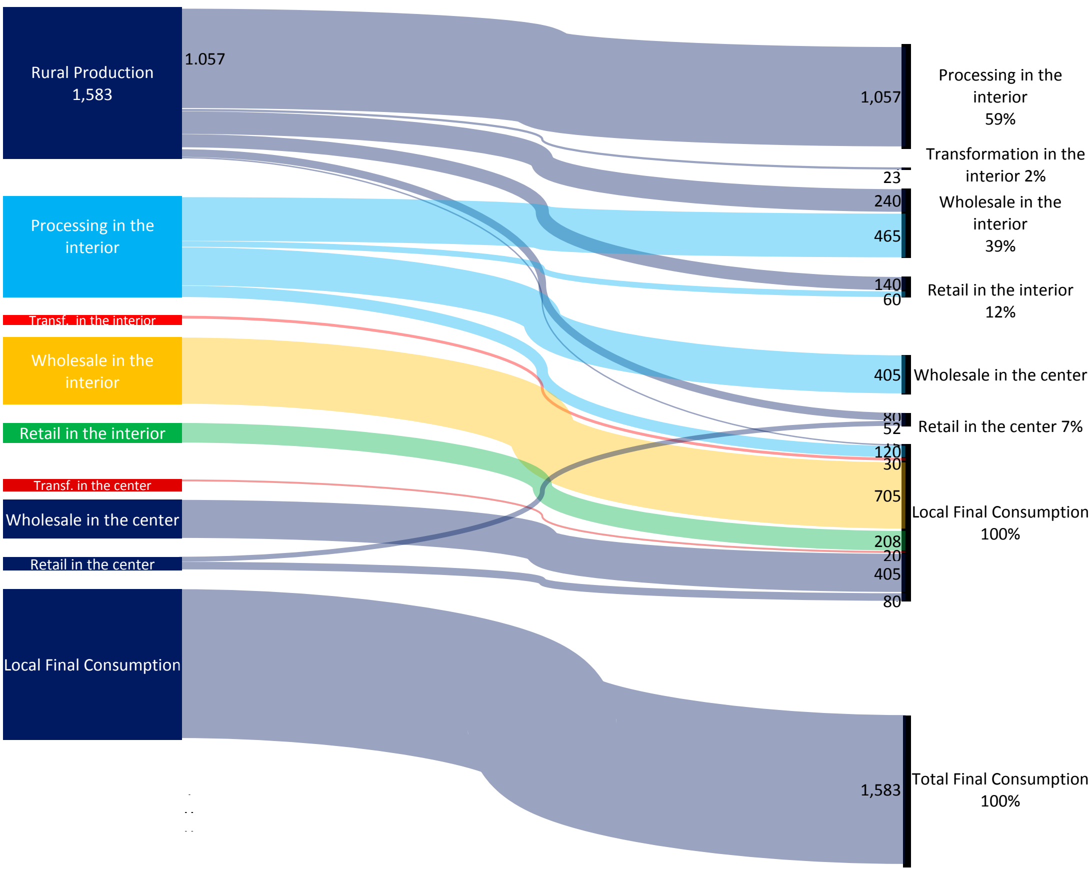


Source: Annex 2, A.2.2, Table A.2.2.-29.

3.4.16 Cocoa Fruit

A short chain of cocoa fruit was detected with the production of 1,600 tons consumed in the local market, with the mediation of processing in the interior (59 percent) (Figure 2.4.16-1). The total VA generated, of BRL 665 thousand, represents 16 times the value rural production, of BRL 41 thousand. The local economy accounted for 100 percent of the VA, with 62 percent in rural production and 27 percent in processing and 6 percent and 4 percent in trade in the interior and in the center, respectively.

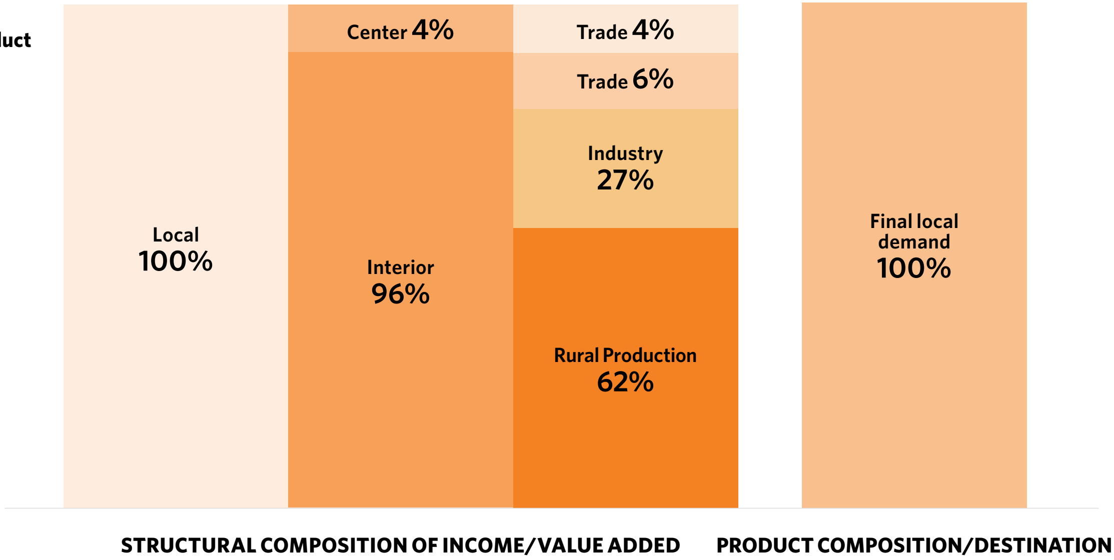
Figure 2.4.16-1- Product flow underlying cocoa fruit value chains



Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/ NAEA-IPEA field survey. CSα processing in the Netz System.

O VA total gerado, de R$ 665 mil, representa 16 vezes o valor original da produção rural, de R$ 41 mil. Todo o VA foi distribuído na economia local: 62% no rural, 27% no processamento, 6% no comércio do interior e 4% no do centro. A demanda final é integralmente local (Gráfico 2.4.16-1).

Chart 2.4.16-1 Value Added/ Income Distribution and Product Destination in EcoSocioBio-PA's Cocoa Fruit Chain



Source: Annex 2, A.2.2, Table A.2.2.-30.

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4. Territories and Productive Foundations of EcoSocioBio-PA

4.1 Baixo Tocantins

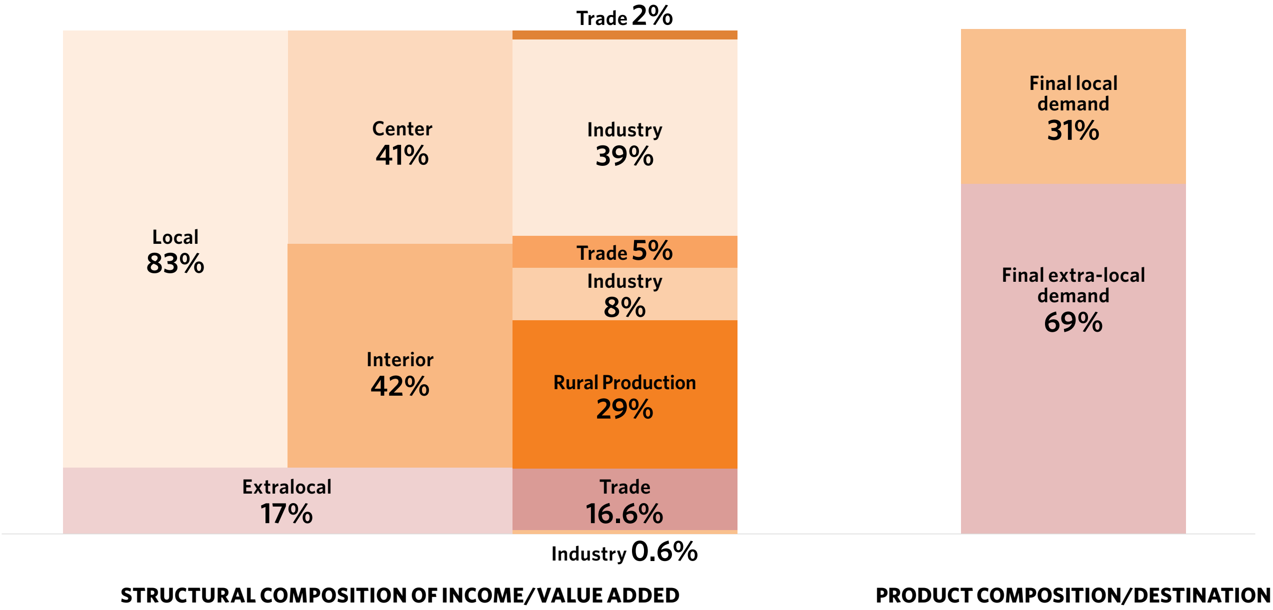
IR-Tocantins covers an area of 35,841.6 sq. km. distributed across 11 municipalities: Abaetetuba, Acará, Baião, Barcarena, Cametá, Igarapé-Miri, Limoeiro do Ajuru, Mocajuba, Mojú, Oeiras do Pará, and Tailândia. The Value Added (VA) of EcoSocioBio-Tocantins, of BRL 1.7 billion, represents 36 percent of EcoSocioBio-PA. EcoSocioBio-Tocantins is the main production base of EcoSocioBio-PA.

In the aggregate demand of EcoSocioBio-Tocantins, the extra-local component – domestic and rest of the world – accounts for 69 percent of the total production volume; local needs of IR-Tocantins and the rest of Pará absorbed 31 percent of the product generated (last column of Chart 3.1-1). Therefore, EcoSocioBio-Tocantins is essentially the export base of the economy of Pará.

The local economy of Pará accounted for 83 percent of the VA generated, divided between the interior (42 percent in the IR itself) and the metropolitan area of Belém (41 percent). A look at the sectors that organize the aggregate supply of EcoSocioBio-Tocantins (last column in Chart 2.1-2) shows that industry has a considerable weight, with 47 percent of the total VA (39 percent in the center of the economy of Pará, outside IR-Tocantins; 8 percent in the industry of the IR itself), followed by the rural sector, with 29 percent and trade within the IR itself, with 5 percent; the extra-local sector (domestic and rest of the world) contributes 16.6 percent through trade and the industrial sector with 0.6 percent of the total VA.

Employment associated with this production totals 82,100 workers: 89 percent in the IR itself, with 86 percent in rural production, 2 percent in trade and 1 percent in industry. Urban centers outside the IR concentrate 4 percent of the jobs, with 88 percent in the industrial sector and 12 percent in the trade sector. The extra-local economy, on the other hand, concentrates 6 percent of total employment, with 99 percent in the trade sector and 1 percent in the industrial sector (Table A.2.3-1).

Chart 3.1-1 Value Added/Income Distribution and Product Destination in EcoSocioBio-Tocantins



Source: Table 3.1.5-1.

4.1.1 Rural structures and production systems

The gross value of agricultural production (GVAP) at the base of EcoSocioBio-Tocantins grew at the average rate of 5.6 percent p.a. between 2006 and 2019: from BRL364.3 million in 2006 to BRL595.5 million – the equivalent of 39 percent of EcoSocioBio-Para's GVAP - in 2017, the year of the Agricultural Census. In 2019, IR-Tocantins' GVAP was estimated at BRL528.6 million.

The production of EcoSocioBio-Tocantins occurs in the context of the agrarian system of IR-Tocantins (SA-Tocantins), accounting for 38 percent of its total GVAP of BRL 1.4 billion in 2017.

SA-Tocantins consists of four technological trajectories among those defined by Costa for the North Region (see Costa, 2021), with a total of 52,968 rural establishments: T1-Peasant, with relatively specialized agriculture, T2-Peasant, with SAFs, T5-Commercial, led by plantation, and T7-Commercial, led by temporary crops.

In relation to EcoSocioBio-Tocantins, these trajectories have the following characteristics:

a) T2-Peasant with SAFs: 44,812 establishments (85 percent of SA-Tocantins' establishments), 99,830 workers-equivalent-year (77 of the workforce), and GVAP of BRL 826 million (66 percent of the SA total) make up the EcoSocioBio production base par excellence in SA-Tocantins, with the following characteristics:

1. Its production processes are based on SAFs-F, which start from the use of the original forest (26 percent of its GVAP comes from non-timber forest products (NTFP), see Chart 3.1.1-1; in turn, its NTFP production accounts for 90 percent the NTFP production of SA-Tocantins (Chart 3.1.1-2); they are also based on SAFs-A, which incorporate cultivated species (37 percent of their GVAP comes from permanent crops, which contributes 53 percent of the total SA production). Extractive and cultivated açai are produced in balanced proportions (52.6 percent and 47.4 percent, respectively); nevertheless, the production of other NTFPs is relevant, as well as the presence of black pepper, cocoa, and other permanent crops (Chart 3.1.1-3). The compositions, which are multiple and complex, are described in the literature as "roçados de várzea" (Box 3.1.1-1).

2. T2: In addition to being the base of EcoSocioBio-Tocantins, it is largely responsible for guaranteeing food availability in the IR, accounting for 77 percent of the GVAP of temporary crops, 70 percent of small animal

rearing and 58 percent of milk production (Chart 3.1.1-2; see, in Box 3.1.1-1, the underlying division of labor).

3. Their production systems are therefore highly diverse and complex: diverse because they involve 58 different products or activities, with a Shannon Diversity Index of 3.3; and complex because they are formed by dynamic extractivism, or SAFs resulting from the management of native species with plantations or from the interaction of permanent cultivated species that together become stronger over time, or through succession cultivation methods (Box 3.1.1-1).

b) T1-Peasant: With relatively specialized agriculture, a group of 3,468 establishments (6 percent of the SA total) and 6,627 workers (12 percent) a GVAP of BRL39.2 million (3 percent of the total), it has the following characteristics:

1. It deals with SAFs-F and contributes to the EcoSocioBio insofar as 34 percent of its GVAP comes from NTFPs, whose production, however, accounts for only 6 percent of the total value of NTFPs in the IR.

2. SAFs-A have a marginal presence in their productive systems;

3. Its main product, cassava flour, accounts for more than 2/3 of its GVAP and 7 percent of the GVAP of temporary crops in the SA; it contributes 3 percent of small animal production and 1 percent of milk;

4. I handles 21 products or activities and has a SDI of 1.4.

c) T5-Commercial led by plantation: 3,910 commercial establishments employing 20,000 workers, based predominantly on homogeneous plantations of permanent crops (72 percent of its GVAP), with emphasis on palm oil (44 percent of its GVAP), followed by bay coconut (16 percent) and cultivated açai (11 percent).

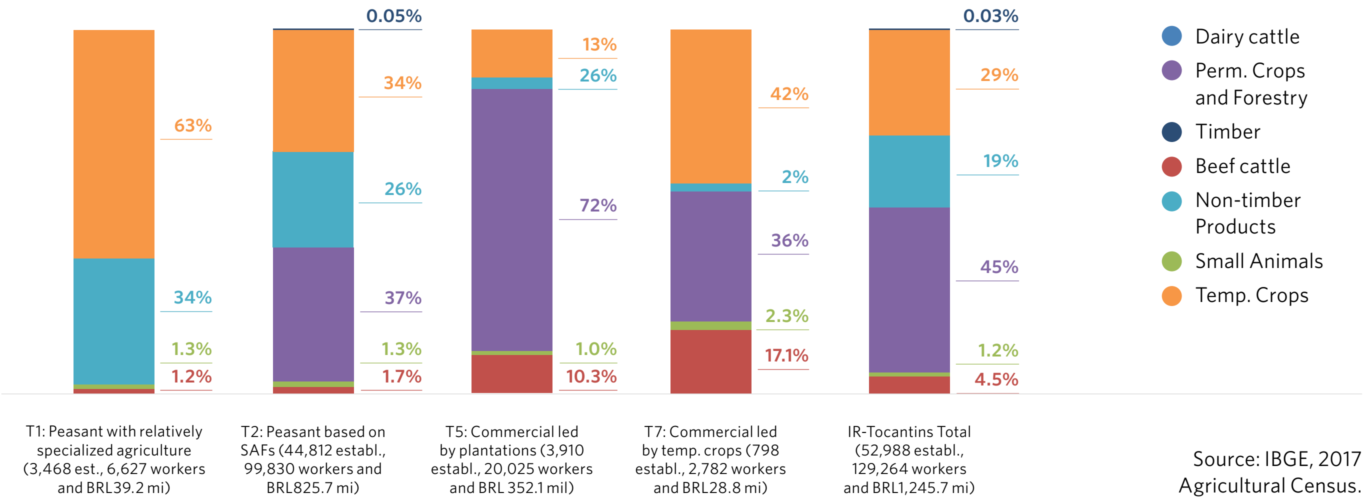
1. In T5, açai is grown on technological bases different from those T2 plantations in "roçados de várzea", in homogeneous plantations irrigated on firm land, which is a mechanical-chemical technological variant.

2. Açai here and thus obtained accounted for 14.5 percent of the açai grown and 8 percent of the açai obtained in all forms in SA-Tocantins.

3. T5 also includes temporary crops (13 percent of its GVAP) and beef cattle (10 percent).

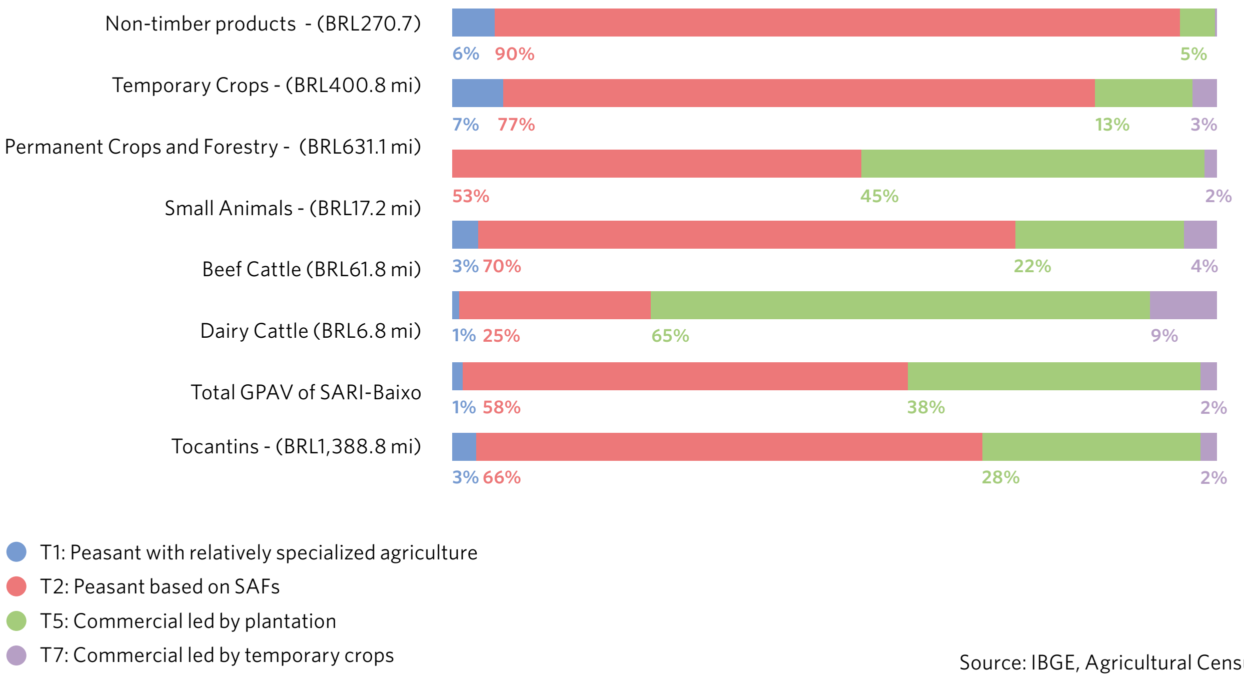
d) T7-Commercial led by temporary crops: A group of 798 commercial establishments employing 2,782 workers and a GVAP of BRL28.8 million, of which temporary crops (basically cassava) contributed 42 percent and permanent crops contributed 32 percent. Of this, cultivated açai accounted for 11.8 percent (Chart 3.1.1-3). The açai obtained here accounts for 1.3 percent of the açai grown and 0.7 percent of the total açai produced in SA-Tocantins.

Chart 3.1.1-1- Agrarian System of IR-Tocantins – composition of productive structures (% of the productive structure's total GVP)



Source: IBGE, 2017 Agricultural Census.

Chart 3.1.1-2 - Agrarian System of IR-Baixo Tocantins - Share of productive structures in groups of products (% of GVAP)



Source: IBGE, Agricultural Census 2017.

Box 3.1.1-1

The complexity of peasant systems with SAFs: "Forest Management", "Roçados de Várzea" and "Roças de Caboclo"

The management of forest resources is an ancestral capacity of Amazonian populations. In the first half of the 1990s, ground-breaking studies by the Emilio Goeldi Museum of Pará (MPEG) described practices of açai producers (Anderson and Jardim, 1989; Garden and Anderson, 1987; Anderson et alii, 1995) demonstrating management patterns of native açai plantations, in which increased fruit yield requires managing two main operations: a) the pruning of high, thin and low fruit yielding strains, reducing the clump to a number of 3 to 4 strains and b) thinning by cutting or ringing competing tree species of no or lower economic value. In a more precise evaluation, it was found that when only operation *a* is carried out, productivity per strain grows 50 percent from 4.4 kilos to 6.6 kilos; if operation *b* is performed, productivity increases by an additional14 percent from 6.6 to 7.5 kilos per strain (Anderson et alii, 1995). The interaction of these two variables creates a host of possibilities to increase production and productivity in the extractive activity.

The planting of permanent species, such as açai, as in the case of the increase in productivity of native açai plantations, results from procedures based on the tacit knowledge of peasants, which is deeply rooted in the local culture. Researchers at Indiana University have demonstrated how this has been occurring in Marajo over the past 20 years. They highlight the effectiveness of the techniques applied in the formation of "roçados de várzea": The "roçado de várzea" is an intensive system that combines annual, biannual and permanent crops in a spatiotemporal sequence that resembles stages of secondary succession" (Brondizio, 2008). The system starts with the planting of very short-cycle annual crops such as pumpkin and cucumber, together with longer-cycle annual crops such as rice and corn, associated with banana, sugarcane, açai, and forest essences. Pumpkin and cucumber are harvested in the second month, and rice and corn within another four months; the production of bananas, sugarcane and pineapple start at the end of the first year and will be repeated for another three years.

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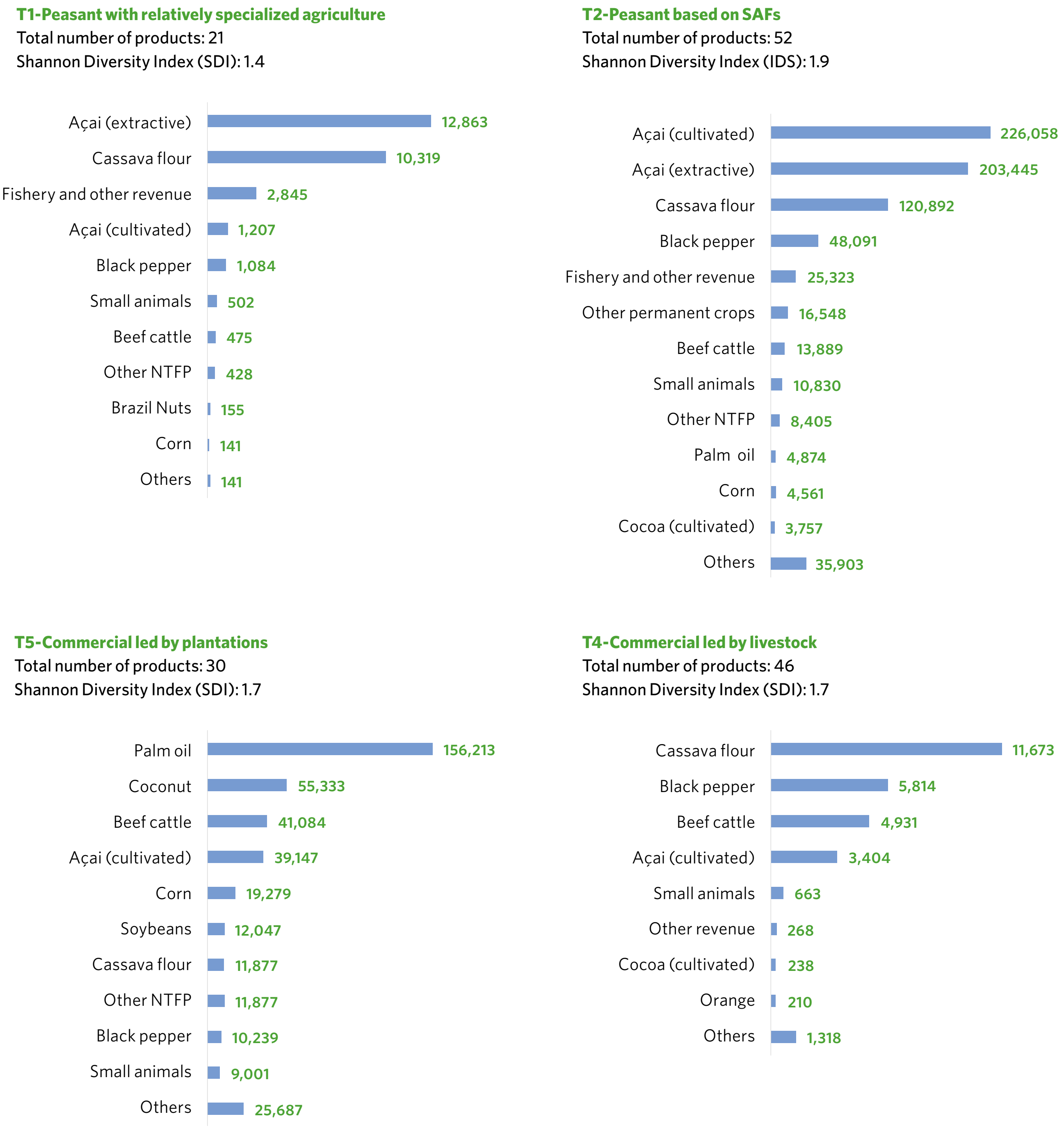
From the beginning of the second year, açai plantations, which are protected mainly by banana trees, begin to sprout and, from the third year onwards they go on to dominate the landscape. Production starts at approximately 3.5 years, reaching maturity at 5 years. In the meantime, production of other permanent crops such as coconut, cocoa and cupuaçu is started, so that in the fifth year the roçado will have the structure and composition of a consolidated agroforestry system (Brondizio, 2008, 218-220). Ultimately, each roçado is unique with regard to plant composition, since each producer, depending on their reproductive and productive strategy, in which the edaphoclimatic characteristics of the production site are considered, implements a specific spatiotemporal arrangement. However, the technological principles and techniques applied are similar among all producers (Hiraoka, 1994a, Hiraoka, 1994b).

Temporary crops such as cassava, are grown in "roças de caboclo" (Martins, 2005): slash-and-burn agriculture in which once an area has been used, it is cleared for natural regeneration: a SAF that combines, through succession, agriculture, and forest (Atangana et. al.,2013:41). The "roças caboclas" in the Amazon are a heterogeneous set of species, whose composition patterns are determined by "ecological combination skills": species with different architectures to maximize the use of aboveground solar energy are combined with species with root systems capable of exploring different soil depths, thus maximizing the intake of water and nutrients (Martins, op.cit.:209-210). The cycles of these "roças" vary, with 1-3 years of planting followed by 2-7 years or even more than 15 years of fallow agriculture. In this state, the "roças de caboclo" acquire secondary vegetation of increasing complexity, which within 1-2 years achieves a structure dominated by trees (Jakovac et. al., 2015; Uhl et al., 1981).

A *division of labor* became evident between two groups of peasants with SAFs on nine islands in the municipality of Cametá, in IR-Tocantins: The Riverine and Firm Land populations. Depending on the edaphoclimatic conditions of their territorial positions, the main product for the Riverine group was açai, which they produced in excess of their needs. On the other hand, their production of cassava flour was insufficient to meet their demand. Conversely, Firm Land establishments produced a surplus of flour but not enough açai – the deficits and surpluses were compensated for in local markets at different levels. Both groups produced similar proportions of fish and other proteins; both produced extractive or cultivated cocoa, in addition to black pepper as "export bases", which are noble items in the portfolio of alternatives in their relations with this institution of capitalism known as global market. The exchange between the groups in the local market occurred among the islands of Cameta, in a remarkable complementarity, the so-called "Tocantins diet" (Rogez, 2000), which consists of açai, cassava flour and fish. Each system, in turn, had a portfolio of commodities (a share of the açai, cocoa and black pepper production), which gave them access to the production of the rest of the world (Costa, 2015: 97-99; Soares, Costa, 2012: 246).

Chart 3.1.1-3 Main products and activities of peasant and commercial Ts in IR-Baixo Tocantins in 2017 (GVAP at BRL1,000.00)



Source: IBGE, 2017 Agricultural Census

4.1.2 Institutions, land resources and land use

Technological trajectories have an institutional dimension (Dosi, 1982; 1988) that is reflected in economic efficiency (Arthur, 1994). In rural areas, the formal and informal institutions that guarantee access to land and biome resources are decisive for the dynamics of the trajectories and their competitive capacities (Costa, 2013; Costa and Fernandes, 2016).

Access to the resources of the biome originating in SAFs-F operations and the control of areas where they are restored through SAFs-A, are key issues in the peasant trajectories underlying EcoSocioBio. Therefore, an essential agrarian dimension is emphasized with regard either to the private control of families over the lots on which they are settled or to the social control of common use and public areas.

4.1.2.1 Private land holdings

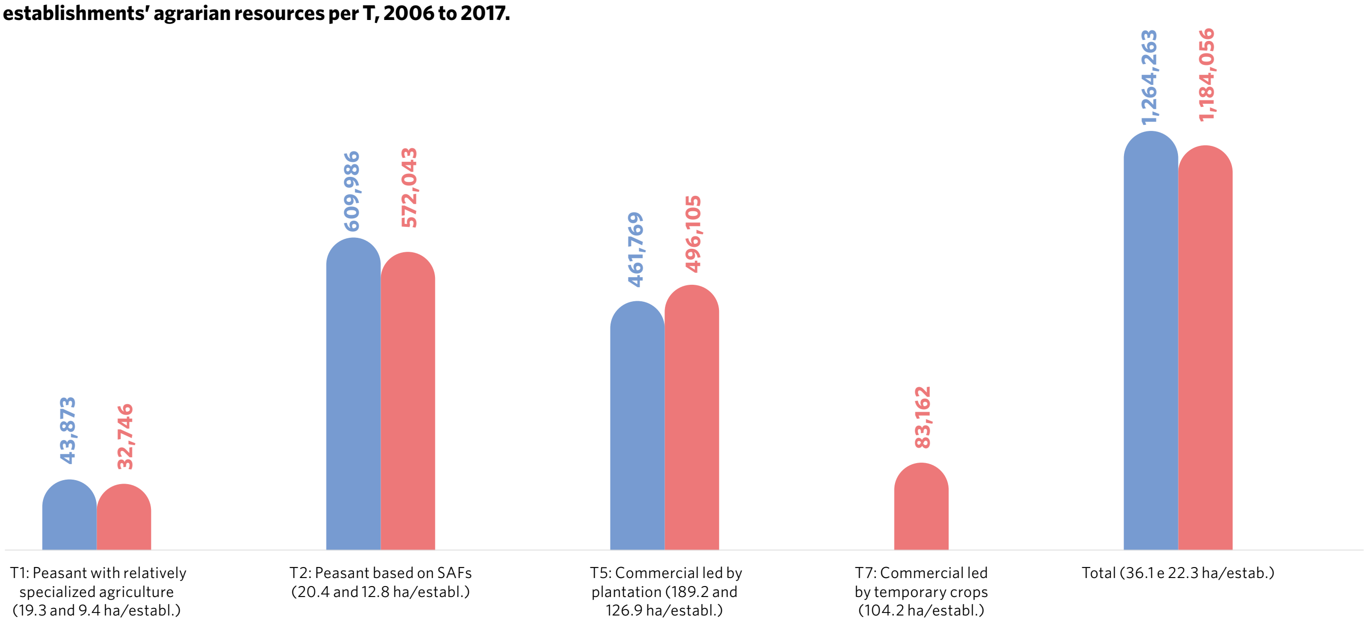
With the rural establishment as the information unit, the agricultural census provides information on the private agrarian domain of peasant families and rural companies or commercial units for the year surveyed. A comparison between censuses allows to assess land changes in specific territorial contexts. The changes that can be observed using census data in land holdings of the trajectories resulted from changes in social or technical relations that occurred in the establishments, which implied transitions between trajectories in different situations. In peasant trajectories, these metamorphoses may be due to the movement of establishments which, though maintaining their fundamentally familiar nature, migrated to another peasant trajectory by introducing technical changes in their productive systems: peasants more or less specialized in agriculture or livestock, for example, became SAFs managers or vice versa. On the other hand, it is possible to observe peasant establishments which, due either to changes in property relations (peasant families that used to be landowners, due to whatever mechanism were dispossessed of their lands, which became part of the holdings of commercial establishments) or in social relations (establishments in which the same landowner families became predominantly wage-earners), were converted into commercial establishments in one of their trajectories. Similar movements occur with commercial trajectories. Furthermore, both peasant and commercial trajectories can arise, or grow through the appropriation of public land; just as they can be reduced or disappear as a result of public expropriation acts.

In this study it is important to discern whether the agrarian dynamics indicates, in the IR, the strengthening or weakening of the trajectories on which EcoSocioBio is based. In the 2006 and 2017 agricultural censuses, the stocks of land under the control of the owners of the establishments surveyed in IR-Tocantins totaled 1.3 million and 1.2 million hectares respectively (Chart 3.1.2-1). The small reduction of -6 percent from one year to the other would possibly be explained by the movement of urban expansion and infrastructure formation observed in the period. However, this relative stability in the aggregate, which is historically explained by the condition of an ancient colonization region dating back to the beginning of the European colonization of the Amazon (Costa, 2019), is accompanied by significant losses and gains among the various SA trajectories.

In fact, T1 lost -25 percent of its lands, whose stock decreased from 43,900 to 32,800 ha; such loss may be explained by the conversion of establishments into T2. It so happens that the latter itself reduced its land stock by -6 percent, from approximately 610,000 to 572,000 ha. The balance indicates land transfer to T5, which increased its land holdings by 7 percent, from 461,700 to 496,100 ha, and to T7, which emerged in SA-Tocantins in the period, with 83,100 ha.

The dynamics exposed, combined with the increase in the number of establishments, led to the reduction of the average availability of land per T1 establishment from 19,300 to 9,400 ha, and from 20,400 to 12,800 ha per T2 establishment (Chart 3.1.1-1).

Chart 3.1.2-1- Average distribution and allocation of the establishments' agrarian resources per T, 2006 to 2017.



Source: IBGE, 2017 Agricultural Census.

The institutional coverage of the agrarian base of peasant families in SA-Tocantins is divided between those that participate in agrarian reform programs and the others. In the IR, agrarian reform settlement projects are important, and unlike in agricultural frontier areas were not designed to guide the occupation of new vacant lands, but rather to primarily recognize ancestral forms of land ownership by historic peasant, riverine and quilombola populations that have been in the IR since the eighteenth and nineteenth centuries (Costa, 2019). These family-establishment comprise, as a subset (of peasants participating in agrarian reform programs), the universe (total) of peasant establishments registered in the 2017 agricultural census, which make up the T1 and T2 presented above.

Until 2016, land had been reportedly designated, through different types of agrarian reform settlements, to 36,750 families, which would account for 76 percent of the total of 48,280 peasant establishments registered in 2017 in IR-Tocantins. Of these, the families associated with projects that explicitly targeted extractive populations (in Table 3.1.2-1, rows 3 to 6 totaled 33,755: 70 percent of all peasant establishments and 75 percent of those that make up T2, the fundamental structural base of EcoSocioBio in the IR).

Of the difference between the total number of registered establishments and those that are part of agrarian reform programs, there are 11,530 registered peasant establishments that should have institutional coverages different from those offered by agrarian reform programs: inheritance, purchase from private agents or public agencies, adverse possession, etc. (Table 2.2.2-1).

Table 3.1.2-1 Distribution of private, common use and public areas (ha) and associated carbon stocks (Mton)

	Peasant families (N)	Average per family (M)[3]	Private area (A)	Common use peasant areas in settlements (C) 7[4]	Area designated by agrarian reform (R)	Total (F)
Agrarian Reform Movement						
Settlement - INCRA	2,873	48.1	138,292	-	138,292	
Extractive Settlement - INCRA	27,930	7.7	213,740	-	213,740	
State Settlement	122	102.4	12,489	-	12,489	
Extractive Reserves - Incra[2,3,4]	1,098	10.8	11,904[2]	127,357	139,261	
Extractive Settlement - State[3,22]	279	10.8	3,025[2]	122,231	125,256	
Quilombolas - State	4,448	22.6	100,334	-	100,334	
Agrarian reform peasants	36,750	13.1	479,785		729,373	
Non-agrarian reform peasants[1,2]	11,530	10.8	125,004			
Land Stock						
Peasant establishments in the census (I)[5]	48,280	12.5	604,789			604,789
Common use peasant land in settlements (II)[6]				249,588		249,588
Peasants' work territory (III=I+II)						854,377
Commercial land in the census (IV)[5]						579,267
Indigenous Land (V)[7]						20,287
Conservation Units (VI)[7]						468,798
Other areas (VII=VIII-V-IV-III)						1,749,978
Total (VIII)[7]						**3,672,707**
Carbon stock						
Peasant establishments in the census (I)[8]						49
Common use peasant land in settlements (II)[9]						45
Peasants' work territory (III=I+II)						93
Commercial land in the census (IV)[10]						75
Indigenous Land (V)[11]						4
Conservation Units (VI)[11]						76
Other areas (VII=VIII-V-IV-III)						220
Total (VIII)[11]						**468**

Source: IBGE, 2017 Agricultural Census; INCRA and ITERPA, list of designations. Methodological notes: 1. Estimated number of families with declaration in the 2017 Agricultural Census that were not included in any formal settlement project: N1=No settlement=NCensus2017-NSettlerd2016, where N is the number of families-establishments in modality 1 of the i settlement modalities for which the volumes of respective areas are not known. 2. Assumed portions of areas Ai of the establishments corresponding to Ni: Ai=(Ni/WNi)*(The2017Census-WAj3i), where A2017Census is the total area of N2017Census establishments registered in 2017 and Aj3i is the area of each j modality of settlement that is not i. 3. Mi=Ai/Nn. 4.Ci=Ri-Ai. 5. See Chart 2.3.2-1. 6. Sum total of the above values in column 7. Obtained from image - see methodology in Annex I; for consigned and public areas, the values in Table A.I-1 were used; 8. Area above multiplied by the average carbon stock in establishments smaller than 100 ha in the IR, see Table A.I-2. 9. Area above multiplied by the average carbon stock in settlements in the IR, see Table A.I-1. 10. Carbon stock corresponding to indigenous land in the IR, see Table A.I-1. 11. Carbon stock corresponding to conservation units in the IR, see Table A.I-1.

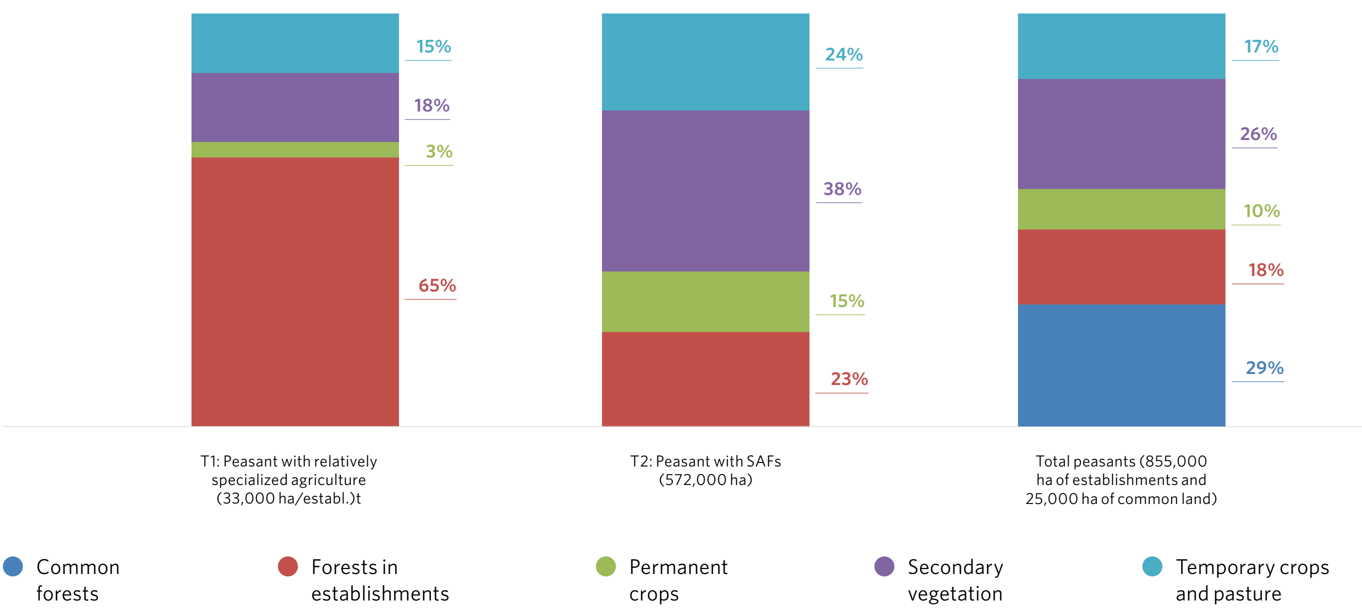
4.1.2.2 Uses of private and common use land: the "work territory" of the peasants of EcoSocioBio-Tocantins

Of its total internal availability of 33,000 ha (9.4 ha per establishment) T1 establishments maintain 82 percent of primary and secondary forests, reserving only 18 percent for planting, with 15 percent for temporary crops and 3 percent for permanent crops. Of the 572,000 ha (12.8/ha per establishment) those in T2 maintain 61 percent as primary (23 percent) and secondary (38 percent) forests and 39 percent for permanent (15 percent) and temporary (24 percent) crops (Chart 3.1.2-2).

In addition to the direct use of the establishments' resources by family owners, there are two forms of access to EcoSocioBio resources that go beyond the restriction of individual ownership. In the first, found in IR-Tocantins, the common use of private resources prevails, with families agreeing to the mutual exploitation of their establishments' resources (Nogueira, Costa, Adami, 2018). In the second, the private use (by each family) of common resources prevails in public or vacant areas or in areas designated for collective use. In either case, it appears that in EcoSocioBio's rural bases, the families' "work territories" extend beyond their respective lots.

The visualization of these territories, which is certainly a necessity in policy design, is indisputably a difficult task. Nevertheless, by combining information from the 2017 census and information from land authorities on settlements, it is possible to estimate what the (private) use areas of common resources would be.

Chart 3.1.2-2 Use of peasant establishment and common use land in IR-Baixo Tocantins



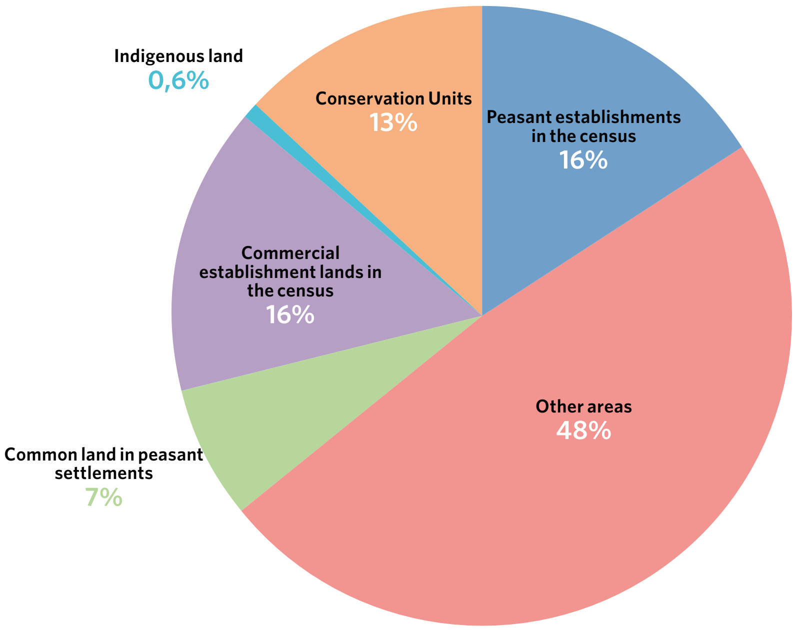
Source: 1-IBGE, 2006 and 2017Agricultural Censuses. Methodological notes for estimating secondary vegetation areas: 1) Secondary vegetations are of three types, which Costa (2016) called "capoeira sucata", "capoeira capital" and "capoeira reserva". The problem to be solved is that the 2006 and 2017agricultural censuses registered only areas considered by the respondent as "degraded", that is, "capoeira sucata". "Non- degraded" secondary vegetations include: 1.1) fallow areas linked to shifting cultivation, which used to be registered separately until the 1995 agricultural census; however, in the 2006 and 2017 censuses they were declared together with areas in use; Costa (2016) called this type of secondary vegetation "capoeira capital"; 1.2) areas not used by intensification in land use make up the "capoeiras reservas"; 2) "capoeiras reservas" are estimated as follows: 2.1) The variable ADDYear (t=2006) was considered = Deforested Area Declared in census of year t = [Areas declared in censuses with agricultural crops, horticulture and forestry + good pasture and poor pasture + degraded area]; 2.2) The following algorithm was processed: IF ADDYear(t)-ADDAYear(t-1)>0 THEN ADDYear(t)-ADDYear(t-1)= DeclaradeDeforestation2006_2017; IF ADDYear(t)-ADDYear(t-1)<0 THEN ADDYear(t)-ADDYear(t-1) = Capoeira Reserva [areas not used and not declared as such, with great probability of appearing, in images, for example, as secondary vegetation; 3) CapoeirasCapital=p1995*CTemp(t;t-1), for p1995=Fallow area in the 1995 census divided by Area with temporary crops in the 1995 census and CTemp (t;t-1)= Area with temporary crops in family establishments in the 2017 or 2006 census; 4) CapoeiraSucata = BadPastures + DegradedLands declared in the 2017 or 2006 census.

Families settled by agrarian reform programs were registered as establishments and, as such, declared the resources over which they had private control. Under the premise that the average of their land holdings did not exceed the average of all peasant establishments registered in IR-Tocantins and based on the total land granted, the total land holdings of these officially settled family-establishments is estimated at 479, 800 ha (see methodological notes in Table 3.1.2-1). Given that agrarian reform projects guaranteed these families access to 729,400 ha, the difference of 249,588 ha should be considered as formally recognized common resources. Thus, we can see a peasants' "work territory" that makes up the productive base of EcoSocioBio-Tocantins, comprising the establishments' areas (604,789 ha) plus the common use areas (249,588 ha), totaling 854,377 ha: 73 percent of forests, of which 29 percent are of common use and 44 percent are establishments – in the latter, 18 percent are primary forests and 26 percent are secondary forests; in addition to 27 percent of agriculture – 10 percent of permanent crops and 17 percent of temporary crops and pasture (see last column of Chart 3.1.2-2).

4.1.2.3 Private land, peasants' common use land, indigenous land, and public land

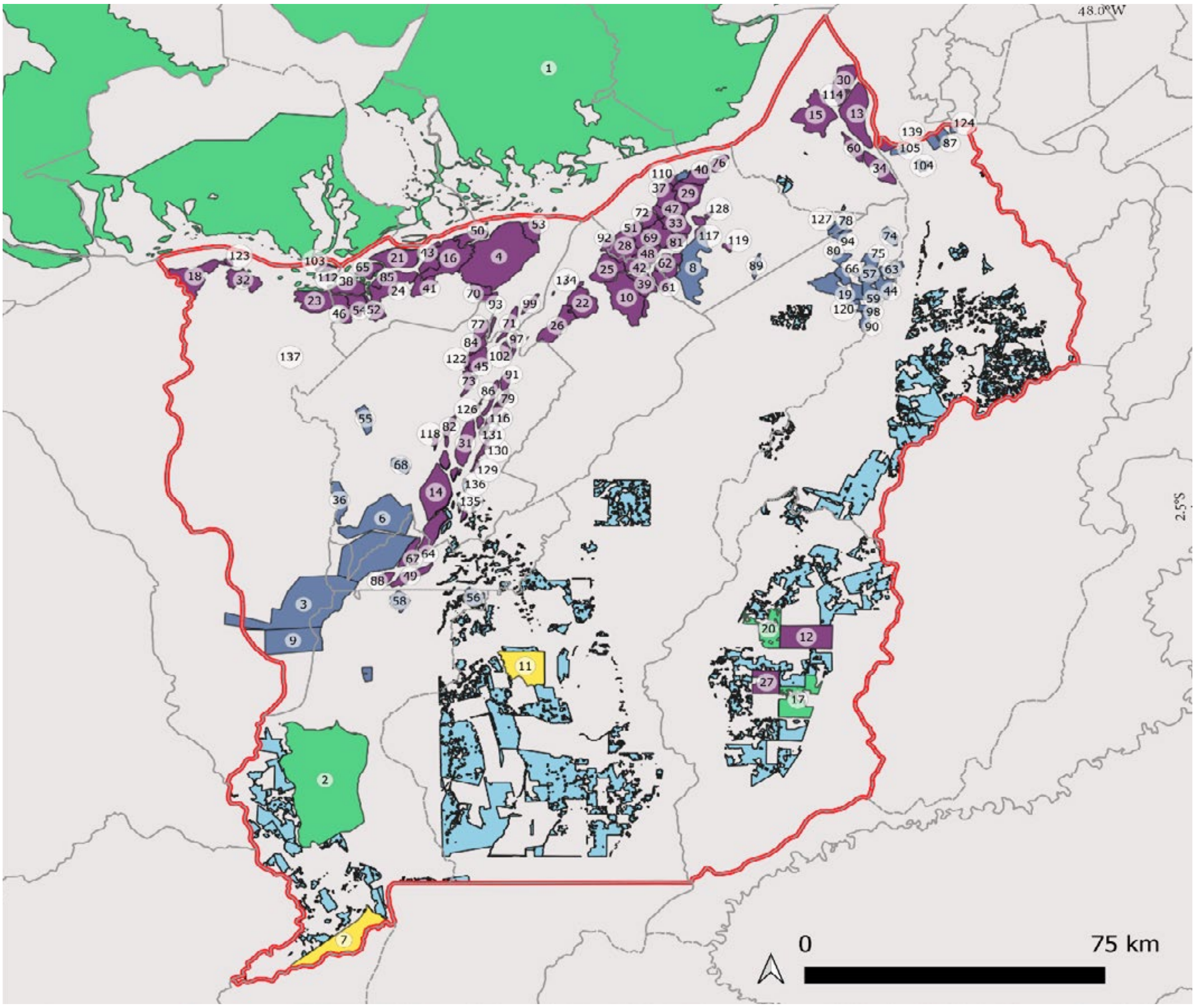
Once the distinction between (peasant and commercial) private land and land designated as of common use has been made, the assessment of land distribution in IR-Tocantins can be completed, as seen in the second part of Table 2.2.2-1 and Chart 2.2.2-3: peasant and commercial establishments together control 32 percent of the land in equal proportions; land of common use by settled peasants represents 7 percent; land in official reserves 13 percent and indigenous land 0.6 percent; there are also 48 percent of land in other situations, including vacant land in the IR. The spatial distribution of designated land in different situations, indigenous and reserve land and vacant public land is shown in Map 2.2.2-1.

Chart 3.1.2-3 Land situation of the total IR-Tocantins area



Source: See Table 2.3.2-1.

Map 3.1.2-1. Spatial distribution of designated land in different situations, indigenous and reserve land, and public vacant land in IR-Tocantins



- Settlements: PAE/PDS/PIC/PEAS/PEAEX
- Quilombola Territories
- Integral Protection Conservation Units
- Sustainable Use Conservation Units
- Indigenous Land
- Other Public Forests/National Registry of Public Forests

Limits

- Integration Region
- Municipalities
- State of Para

Source: Developed from the shapefiles of the National Register of Public Forests (CNFP/SFB) and Land Institute of Pará (ITERPA). Legend: Annex 3

4.1.3 Production and environment

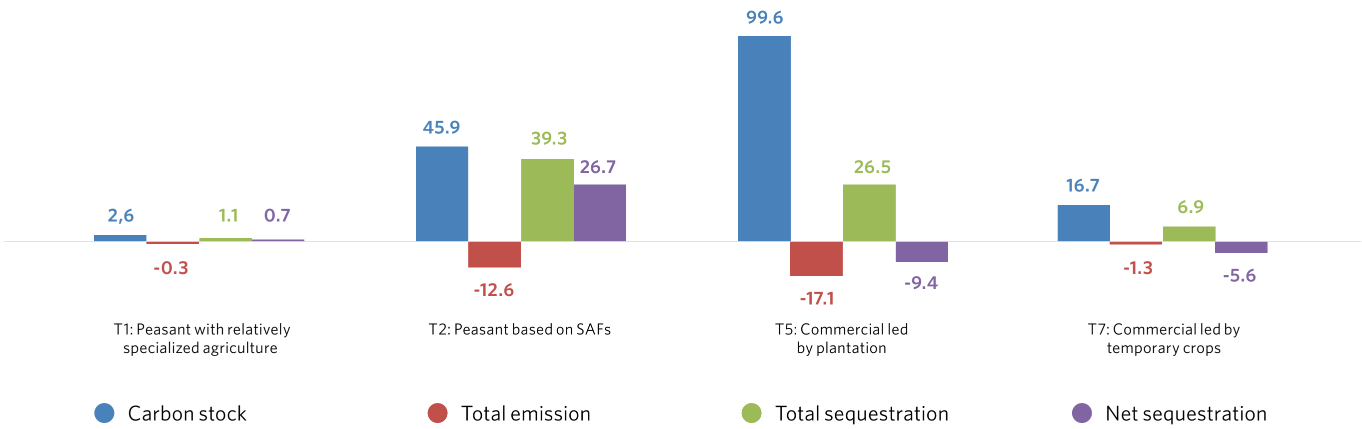
Rural production processes impact the natural environment based on the results of the balances between biome elimination/restoration, greenhouse gas emission/sequestration biodiversity destruction/restoration, soil compacting-leaching/aeration-regeneration, of underground aquifer pollution/cleaning. These balances tend to be very different, depending on the technological paradigm that underlies the technological solutions involved in this production.

How do the structures linked to EcoSocioBio in SA-Tocantins behave with regard to these crucial aspects? The limitations of this study in terms of time and resources do not allow to address the subject in all its dimensions, thus limiting us to the assessment of two closely linked aspects of the carbon issue: stocks and net balances of CO2 associated with EcoSocioBio production structures.

Carbon stocks are the accumulated results of the change in balances over time. We have comparable estimates, albeit obtained by different means and methods, of stocks and balances for all the RIs studied. In IR-Tocantins, georeferenced reading methodologies show that the average CO2 stock per hectare in properties smaller than 100 ha is 80.2 t and 129.8 t in properties bigger than 100 ha (see Annex 1, A.1.3, Table A.1.3-1). Understanding that these values are attributable, respectively, to peasant and commercial trajectories, results in 2.6 Mt of CO2 stock for T1 and 45.9 Mt for T2; as for commercial establishments, the stock is 99.6 in T5 and in 16.7 Mt in T7 (see Chart 3.1.3-1).

Additionally, values of the annual balance by trajectory can be achieved by using a model that works with the statistics of agricultural censuses (Costa, 2016): among peasant trajectories, T1 and T2 present net sequestrations of 0.7 Mt/year and 26.7 Mt/year, respectively; among commercial trajectories, net sequestration is 9.4 for T5 and 5.6 Mt for T7 (Chart 3.1.3-1).

Chart 3.1.3-1 CO2 stock and balance in private lands of the establishments that make up the productive structures linked to EcoSocioBio-Tocantins

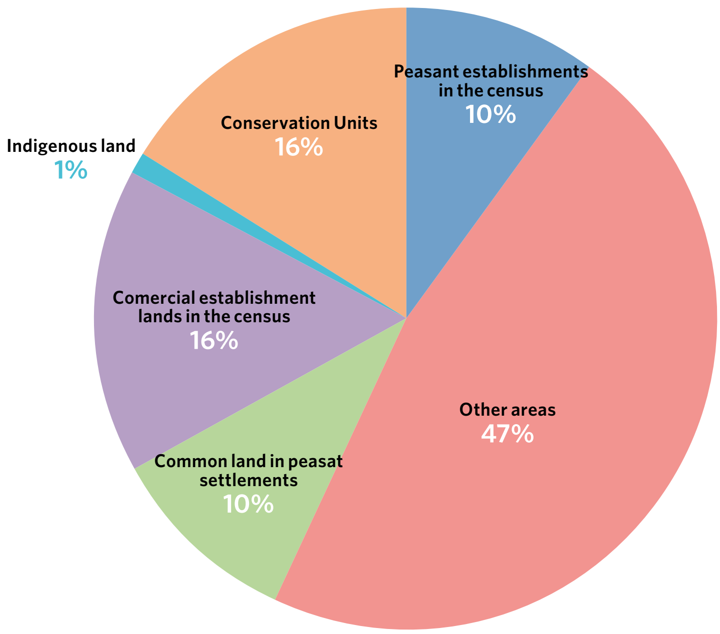


Source: 1-For stocks, see Annex I; parameters with the values of Table A.I-2; 2-For balance, IBGE, 2006 and 2017Agricultural Censuses. Methodological notes: 1) The deforestation area and different types of secondary vegetation (capoeiras) were estimated according to the methodological notes presented in Chart 3.3.2-1; 2) With the results of 1, Costa's model (2016) was applied, with the same parameters for emission and sequestration and for the dynamics of secondary vegetation; 3) The model was adjusted to calculate the variables for a period of several years; the results were divided by the number of years for obtaining an annual average.

Moreover, a total stock of 45 Mt associated with the common use land of peasant establishments linked to the agrarian reform was found: 249,548 ha (Table 3.1.2-1) at 179.6 t of CO2/ha (average of lands in agrarian reform modalities in IR-Tocantins, see Annex 1, A.1.3, Table A.1.3-1). The total CO2 stock associated with the "work territory" of IR-Marajo peasants is 93 Mt.

Carbon stocks were obtained for common use and public land in the IR, as well as for private land, allowing a comparative observation between the different modalities of land control and access (Table 3.1.2-1). Vacant lands would account for 47 percent of the carbon stock of IR-Tocantins; peasants, 10 percent on their private lands and an additional 10 percent in their common use land; commercial establishments, 16 percent; conservation units, 16 percent; and indigenous land, 1 percent (Chart 3.1.3-2).

Chart 3.1.3-2 Carbon stocks in different land situations in IR-Tocantins



Source: Table 3.1.2-1.

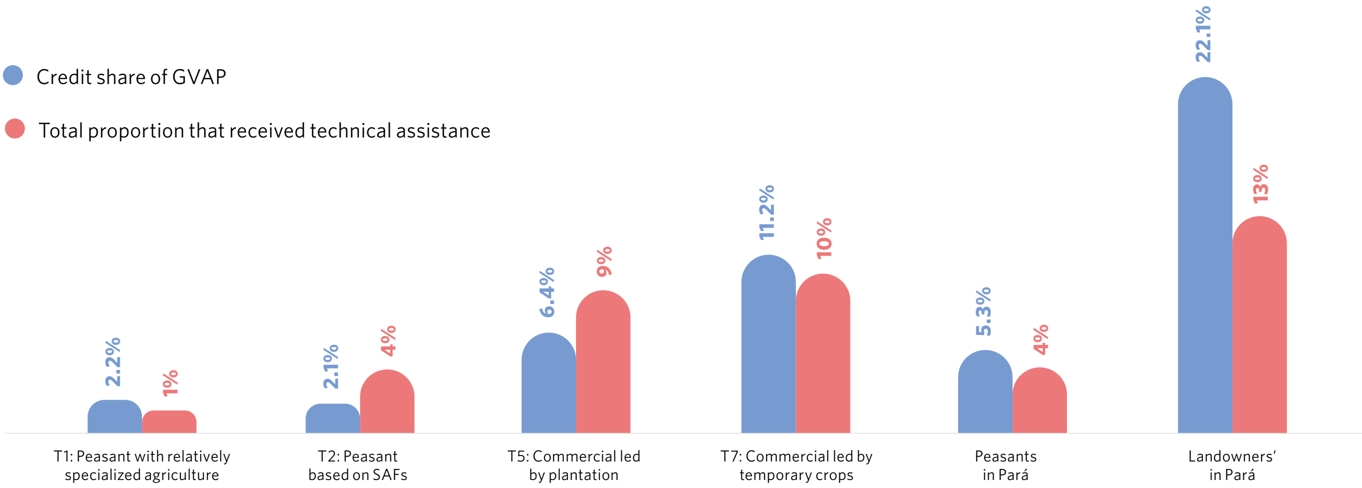
4.1.4 Institutions, credit and knowledge

Formal and informal institutions of access to capital and technological knowledge are fundamental to the dynamics of trajectories and their competitive capacities (Costa, 2013; Costa and Fernandes, 2016). Next we will see what is happening to funding credit and technical assistance in SA-Tocantins and its trajectories.

The amount of credit granted to T1 and T2 in SA-Tocantins in 2017 was equivalent to 2.2 percent and 2.1 percent of the respective GVAP in the same year. These proportions represent less than 1/3 of the T5 and less than 1/5 of the T7 in the SA and about half of that of peasants across the state of Pará. It should be noted that commercial establishments in SA-Tocantins proved to be remarkably disadvantaged compared to the average of their counterparts in Pará, which reached 22.1 percent - ten times the credit share in the production value of peasant establishments in SA- Tocantins (Chart 3.1.4-1).

The situation of technical assistance is also marked by asymmetries: 4.1 percent of the establishments in T2 (a proportion practically identical to that of the average among all peasants in Pará) and 2.2 percent of T1 receive technical assistance, against 9 percent and 10 percent of commercial trajectories in SA-Tocantins and 13.5 percent in all of Pará (Chart 3.1.4-1).

Chart 3.1.4-1 Indicators of production promotion policies in SA-Tocantins: proportion of credit in GVAP and proportion of establishments that received technical assistance, forms of peasant and commercial production, 2017

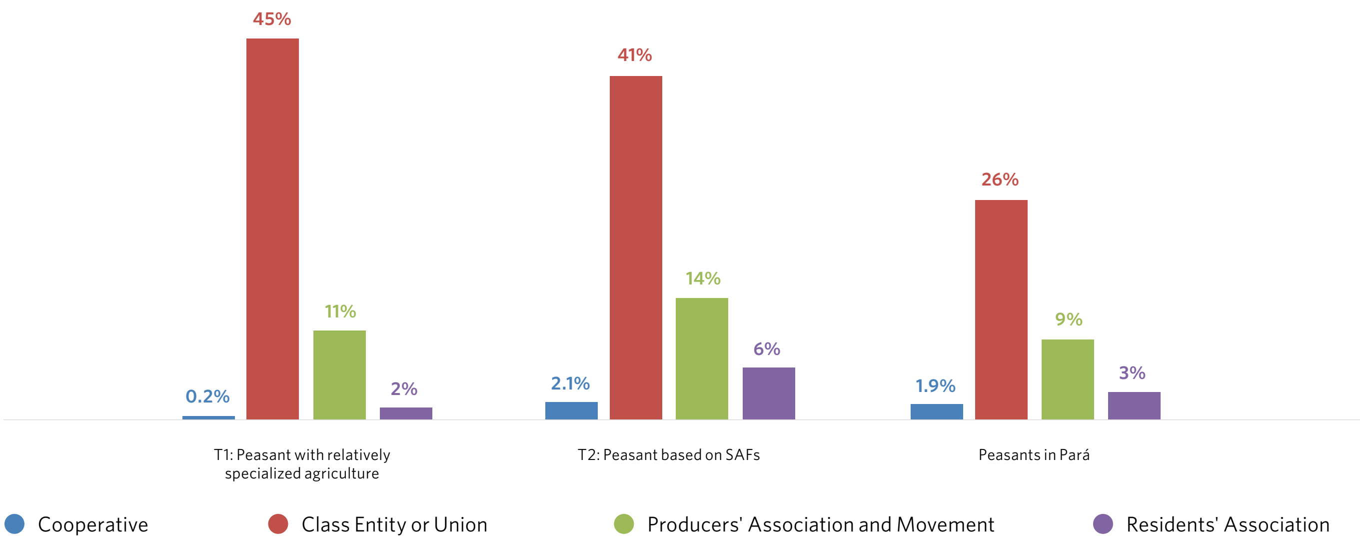


Source: IBGE, 2017 Agricultural Census. Central Bank of Brazil.

4.1.5 Producers' organization

Like in the rest of Pará, the level of cooperativism among the peasants of EcoSocioBio in SA-Tocantins is low. Those in T2 have the highest rate (2.1 percent), which is higher than that of peasants in Pará (1.9 percent). However, unionization rates are high at 45 percent and 41 percent in both trajectories, which is significantly higher than the average of peasants in Pará. A similar situation is found for participation in associations, since the 6 percent found for T2 in SA-Tocantins is twice the average of the state of Pará (Chart 3.1.5-1).

Chart 3.1.5-1 Indicators of producers' organization in SA-Baixo Tocantins, 2017

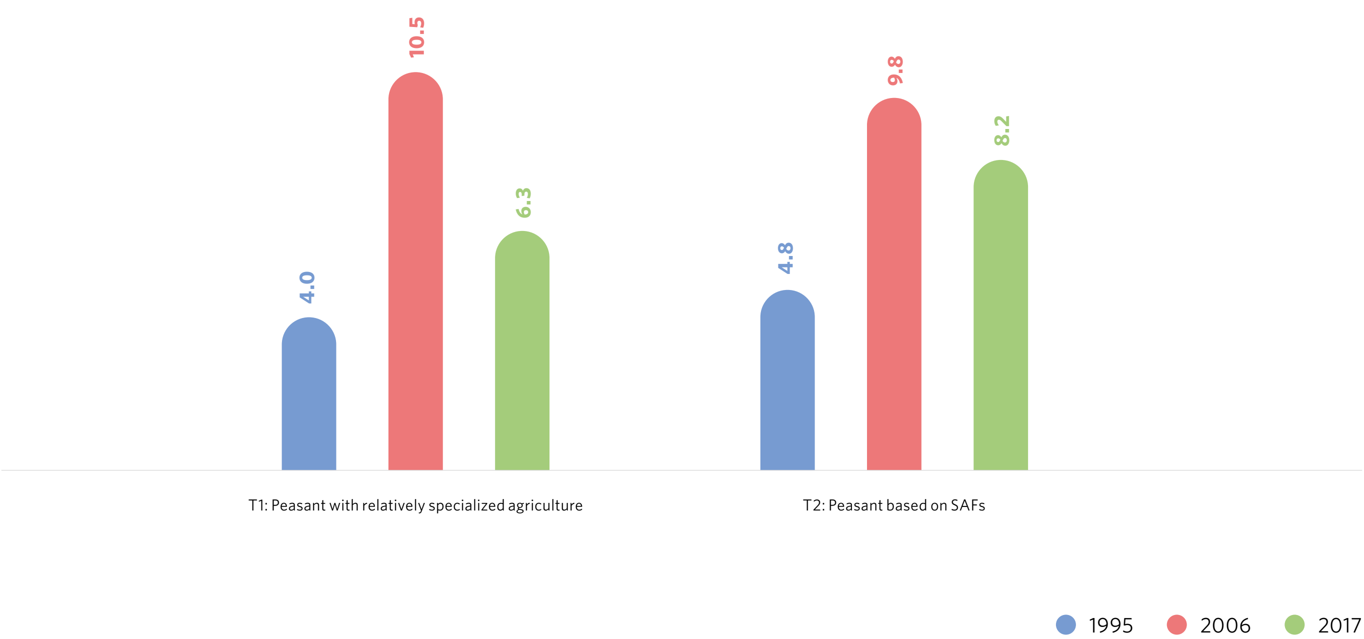


Source: IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations. Central Bank of Brazil.

4.1.6 Net income from work

The annual net income (NI, which is equal to GVAP minus the production costs declared in the censuses) per worker-family member equivalent -year (wf-eq-year) is a crucial indicator of the economic efficiency of peasant-based agricultural structures (Costa, 2012). In EcoSocioBio-Tocantins, the $NI_{wf\text{-}eq\text{-}year}$ of the underlying peasant trajectories have shown a marked volatility. A strong increase was observed between 1995 and 2006: The T2 $NI_{wf\text{-}eq\text{-}year}$ practically doubled, from BRL4,800 to BRL9,800; that of T1 was multiplied by a factor of 2.6, from BRL4,000 to BRL10,500. However, an important reduction was observed in the following period that was deeper for the latter (-40 percent), which reached BRL6,300 than for the former (-16 percent), which reached BRL8,300 in 2017 (Chart 3.1.6-1). The reasons for these movements are not completely clear. With regard to the first period, it is possible to infer that they are associated with the increase in the prices of products such as açai and cassava flour (Nogueira, Santana, Garcia, 2013; Santana and Costa, 2008); another possibility is an important growth in the physical productivity of açai per unit of work, as a result of efforts to intensify extractive management or of the agile establishment of cultivated açai in the "roçados de várzea" (see Box 3.1.1-1). In turn, an explanation for the fall in $NI_{wf\text{-}eq\text{-}year}$ seen in the most recent period awaits research. It should be said, however, that given the more or less general picture of increased prices of EcoSocioBio products to producers, special attention should be paid to the factors that influence the physical productivity of work.

Chart 3.1.6-1 Change in Net Income per worker-equivalent family member in SA-Baixo Tocantins (BRL1,000.00/wf-eq-year)



IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations.

4.2 Marajó

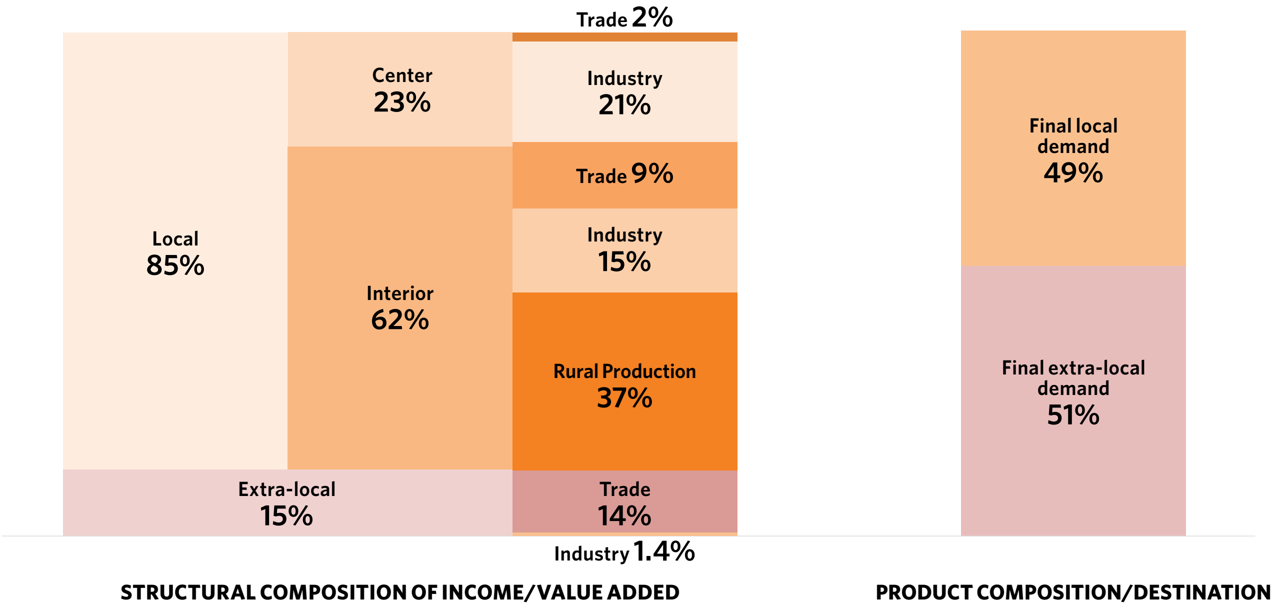
IR Marajó covers an area of 102,800 sq. km disributed across 17 municipalities: Afuá, Anajás, Bagre, Breves, Cachoeira do Arari, Chaves, Curralinho, Gurupá, Melgaço, Muaná, Ponta de Pedras, Portel, Salvaterra, Santa Cruz do Arari, São Sebastião da Boa Vista, and Soure. With a Value Added (VA) of BRL1.5 billion and a contribution of 27 percent of EcoSocioBio, it is its second most important productive base.

Pará accounted for 85 percent of the VA generated, divided between the interior (basically the IR itself, with 62 percentage points) and the center of the economy of Pará (basically the metropolitan area of Belém, with 25 percent). Considering all sectors (third column in Chart 3.2-1), the rural sector accounted for the highest VA proportion (37 percent), followed by the industrial sector in the center (i.e. in Pará, but outside IR-Marajó, predominantly in the Metropolitan Area of Belém) (15 percent), industry in IR-Marajó (21 percent), domestic trade (14 percent), and trade in the IR itself (9 percent) (Chart 3.2-1).

As regards final demand, 51 percent the production generated in EcoSocioBio-Marajó went to meet extra-local demand - domestic and rest of the world. The local needs of IR-Marajó and Pará absorbed the remaining 49 percent (last column in Chart 3.2-1). EcoSocioBio-Marajó is, therefore, like IR-Tocantins, an important export base for the economy of Pará; however, with a much higher participation as regards meeting local needs.

Employment associated with this production totaled 80,000 workers, with 92 percent in the IR itself, 87 percent in rural production, 3 percent in trade, and 2 percent in industry. Local Urban Centers outside the IR concentrate 3 percent of the jobs created: 93 percent in industry and 7 percent in trade. The Domestic Economy, in turn, concentrates 4 percent of total employment in domestic trade (Table A.2.3-2).

Chart 3.2-1-3 Value Added/Income Distribution and Destination of EcoSocioBio-Marajó's Production



Source: Table 3.1.5-1.

4.2.1 Rural production, structures and productive systems

The value of EcoSocioBio-Marajó's rural production, considering the products analyzed here, grew at the average rate of 13 percent p.a. between 2006 and 2019: from BRL318.4 million in 2006 to a maximum of BRL866.9 billion in 2016 and down to BRL566.8 million last year.

The production of EcoSocioBio-Marajó occurs in the context of the agrarian system of IR-Tocantins (SA-Tocantins), accounting for 74 percent of its total GVAP of BRL496.1 million in 2017 (Chart 3.2.1-2).

SA-Marajó consists of four technological trajectories among those defined by Costa (2021) for the Northern Region, with a total of 30,374 rural establishments: T1-Peasant with relatively specialized agriculture, T2-Peasant with SAFs, T5-Commercial led by livestock and T7-Commercial led by temporary crops.

In relation to EcoSocioBio-Tocantins, these trajectories have the following characteristics:

a) T2-Peasant is the production base par excellence of EcoSocioBio-Marajó, with SAAFs, a group of 26,142 establishments (86 percent of them in SA-Marajó), 58,287 workers-equivalent-year (83 percent of the workforce), and a GVAP of BRL826 million (85 percent of the total SA). T2, here, has the following characteristics:

1. Its production processes are primarily based on SAFs-F (66 percent of its GVAP comes from NTFP – Chart 3.2.1-1; in turn, its NTFP production accounts for 99 percent of the NTFP production in the SA - Chart 3.2.1-2) and also in SAFs-A (18 percent of its GVAP comes from permanent crops and forestry, to which total production in the SA contributes 93 percent). Special mention should be made of the production of açai berry, both extractive and cultivated, açai-palm, and other NTFPs (Chart 3.2.1-3), cattle ranching and fishing. As in SA-Tocantins, the compositions are multiple and complex (Box 3.1.1-1).
2. T2 is, in addition to the basis of EcoSocioBio-Marajó, is substantially responsible for guaranteeing food availability in the IR, accounting for 45 percent of the GVAP of temporary crops (especially cassava flour, see Chart 3.2.1-3), 76 percent of small animal rearing, 59 percent of meat production, and 16 percent of milk production (Chart 3.2.1-2).
3. Its production systems are similar in complexity and diversity to those of T2 in IR-Tocantins, albeit handling a smaller number of products and activities (38) and presenting a lower Shannon Diversity Index (SDI=1.6).

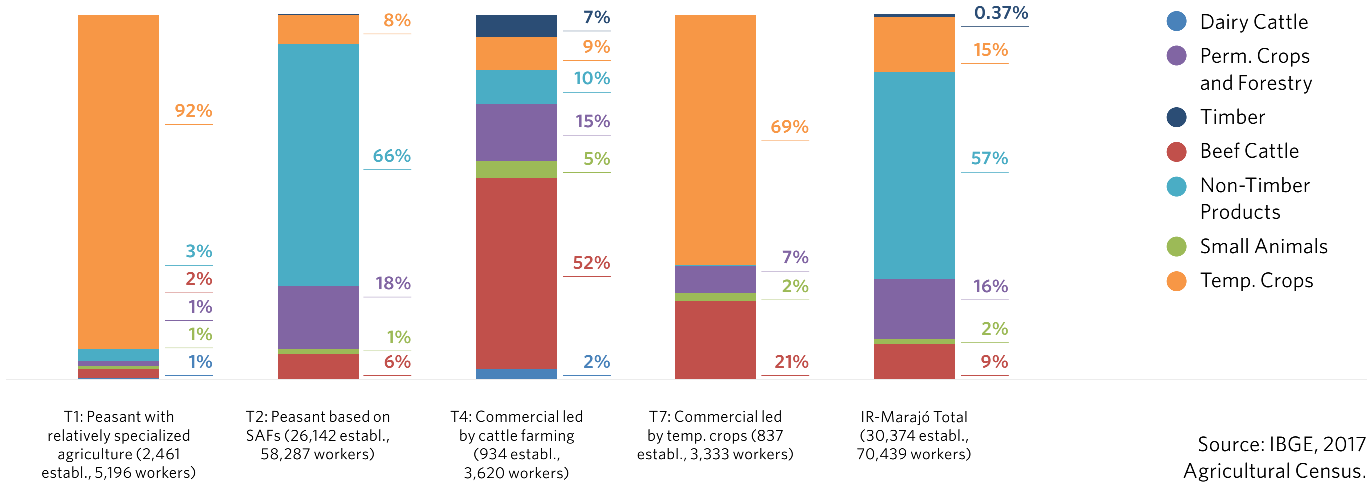
b) T1-Peasant with relatively specialized agriculture is a group of 2,461 establishments with 5,196 workers (respectively 8 percent and 7 percent of the SA total) that produces 3 percent of the SA's GVAP, with the following characteristics:

1. The production of temporary crops (cassava flour, pineapple, corn, and rice) accounts for 92 percent of its GVAP;
2. It marginally organizes SAFs-F, as it produces 3 percent of the GVAP of EcoSocioBio's NTFPs;
3. It handles 13 products or activities and has an SDI of 1.0.

c) T4-Commercial led by livestock, which has been traditional on the island since the beginning of colonization (Ximenes, 1997), contributes a mere 5 percent of the GVAP of SA-Marajó with 934 establishments and 3,620 workers, with productive systems dominated by beef cattle (52 percent of its GVAP; contributes 26 percent of the SA total), followed by permanent crops (15 percent of its GVAP; 4 percent of the SA total; the main crop is açai), non-timber forest products (10 percent of its GVAP; 1 percent of the SA GVAP) and temporary crops (9 percent; 3 percent; the main crop is pineapple);

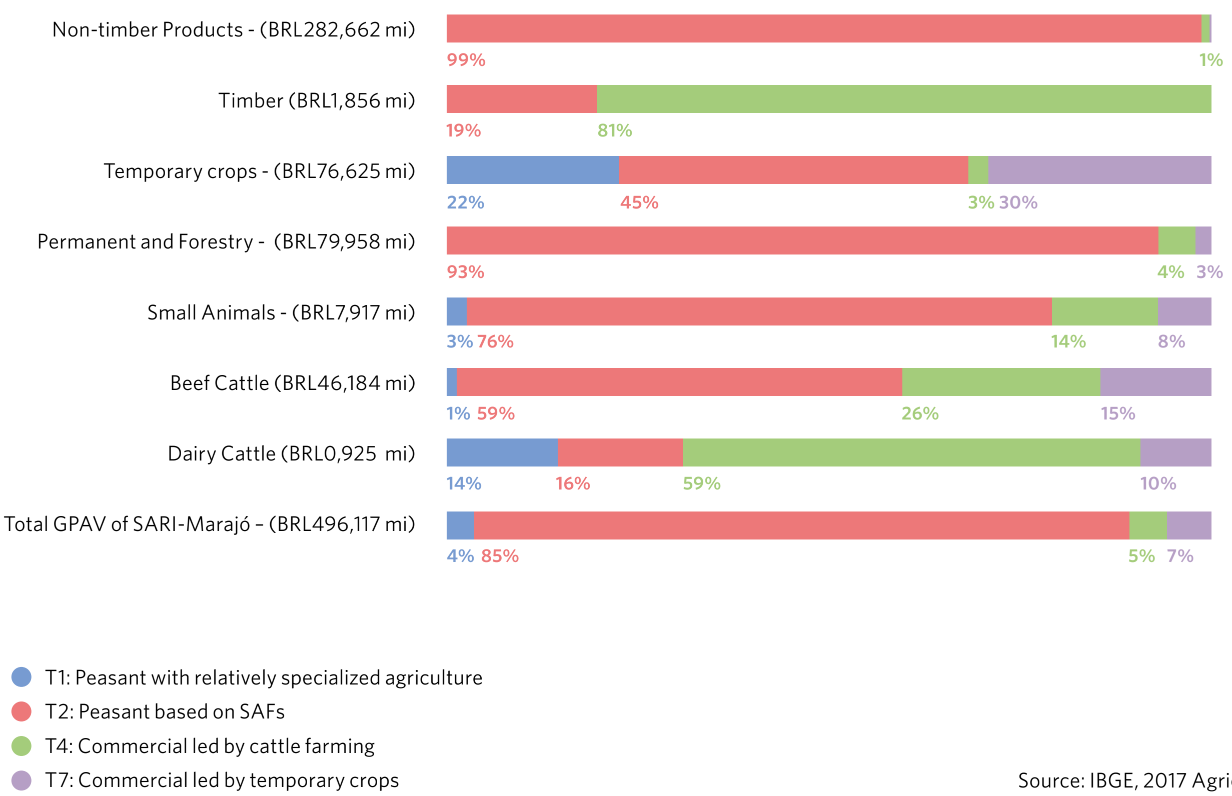
d) T5-Commercial led by temporary crops, consisting of 837 establishments employing 3,333,000 workers. It produces 5 percent of the SA GVAP with productive systems dominated by temporary crops (69 percent of its GVAP; 30 percent the SA's total), alongside beef cattle (21 percent) and permanent crops (7 percent of its GVAP; 3 percent of the SA total).

Chart 3.2.1-2 SA-Marajó Agrarian System - composition of productive structures (% of the GVAP of the total productive structure)



Source: IBGE, 2017 Agricultural Census.

Chart 3.2.1-2 SA-Marajó Agrarian System - Share of productive structures in groups of products (% of GVAP)

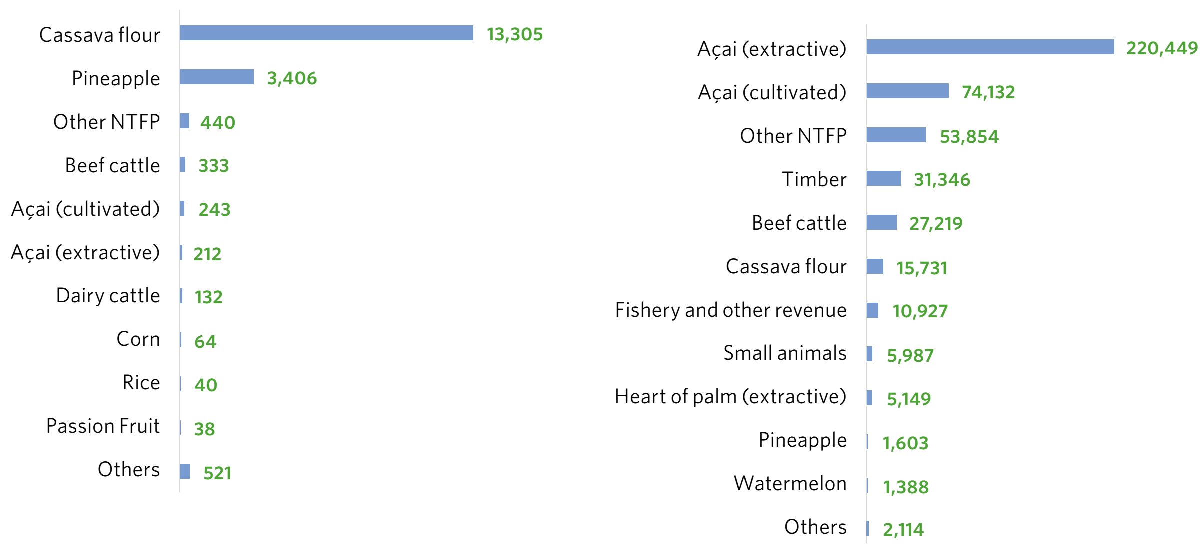


Source: IBGE, 2017 Agricultural Census.

Chart 3.2.1-3 Main products and activities of peasant Ts in IR-Marajó in 2017 (GO in BRL 1,000.00)

T1-Peasant with relatively specialized agriculture
Total number of products: 13
Shannon Diversity Index (IDS): 1.0

T2-Peasant based on SAFs
Total number of produCts: 38
Shannon Diversity Index (IDS): 1.6



Source: IBGE, 2017 Agricultural Census

4.2.2 Institutions, land resources and land use

4.2.2.1 Private land holdings

In the 2006 and 2017agricultural censuses, the stocks of land under the control of the owners of establishments registered in IR-Marajó totaled 1.7 million and 1.9 million hectares, respectively – an increase of 9.6 percent. This relatively modest increase in land stock accompanied a profound change in which: 1) T1 establishments migrated to T2, thus reducing the stock of the former by -70%, from 68.0 to 20,000 ha, while the latter, which is the foundation of EcoSocioBio in the IR, more than doubled its holdings from 305.600 to 718.400 ha in the period; 2) On the commercial side, most of the T7 became T4, since the former saw a decrease in its land volume from 735,000 ha in 2006 to 58,100 ha in 2017 (-92 percent), while the latter increased its holdings from 595.600 to 987.400 hectares. This dynamic was accompanied by a decrease in the average availability of land per T1 establishment from 27.8 to 8.1 ha, and an increase in T2 from 14.9 to 27.5 ha per establishment – an important growth of 84 percent (Chart 3.2.2-1).

Chart 3.2.2-1- Average distribution and allocation of the establishments' land resources per T in SA-Marajó, 2006 to 2017.

Source: IBGE, 2017 Agricultural Census.

Agrarian reform programs seem to have provided a broad institutional coverage of the land base of the peasant families of IR-Marajó. As in IR-Tocantins, important settlement projects have been carried out in IR-Marajó, with the aim of recognizing ancestral forms of ownership of this land, which is also a region occupied by historical peasantries since the eighteenth and nineteenth centuries.

By 2016, the different types of settlements under the agrarian reform reported having assigned land to 29,999 families, a number higher than the 28,603 peasant establishments registered in 2017 in IR-Marajó; practically all settlers were associated with projects that explicitly targeted extractive populations (Table 3.2.2-1, rows 2 to 5), those that make up T2, which is the fundamental EcoSocioBio structural base in the IR.

The negative difference between the total number of registered establishments and those that are part of reform programs totals 1,396 establishments favored by the agrarian reform, which no longer existed by the year of the census: either because they merged into the formation of larger peasant establishments, or because they were absorbed by commercial establishments – both possibilities are consistent with the results presented above (Table 3.2.2-1).

4.2.2.2 Uses of private and common use lands: the "work territory" of EcoSocioBio-Tocantins

Of their total internal availability of 20,000 ha (8.1 ha per establishment) T1 establishments maintain 69 percent of primary and secondary forests (respectively 2 percent and 67 percent), with only 21 percent set aside for planting - 24 percent for temporary crops and pasture and 7 percent for permanent crops. Those in T2, of a total of 718,000 ha (27.5/ha per establishment) maintain 80 percent as primary (66 percent) and secondary (14 percent) forests and 19 percent for permanent (10 percent) and temporary (9 percent) crops (Chart 3.2.2-2).

In addition to the direct use of the establishments' resources by owner families, there are also forms of access to EcoSocioBio resources that transcend the restriction of individual ownership, showing that in the rural bases of EcoSocioBio, the "work territories" of families extend beyond their respective plots.

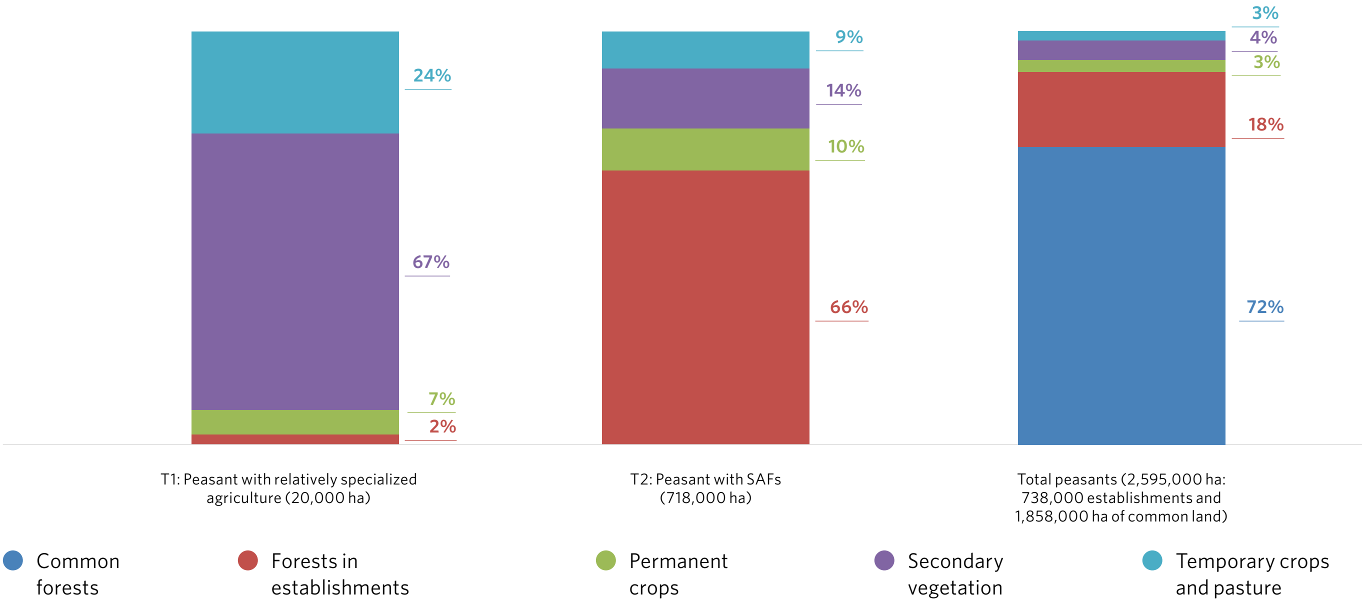
For this study, the visualization of these territories of common use was obtained combining information from the 2017 census and information from land agencies about the settlements. In fact, the families settled by agrarian reform programs were registered as establishments and, as such, declared the resources over which they had private control. Under the premise that the average of their land holdings did not exceed the average of all peasant establishments registered in IR-Tocantins and based on the total land granted, the total land holdings of these officially settled family establishments is estimated at 788.600 ha (see methodological notes in Table 3.2.2-1). Given that agrarian reform projects guaranteed these families access to 2.6 million ha, the difference of 1.9 million ha should be considered as formally recognized common resources of settled peasants. Thus, a peasants ' "work territory" can be seen, which makes up the productive base of EcoSocioBio-Marajó, comprising the areas of the registered establishments (738,322 ha) plus the areas of common use (1,856,841 ha), totaling 2,595,163 ha (Table 3.2.2-1): 90 percent of forests, of which 72 percent are of common use and 21 percent belong to the establishments – in the latter, 18 percent are primary and 3 percent are secondary forests; in addition, 6 percent are dedicated to agriculture – 3 percent to permanent crops and 3 percent to temporary crops and pasture (see last column in Chart 3.2.2-2).

Table 3.2.2-1 Distribution of private, common use and public areas (ha) and associated carbon stocks in IR-Marajó (Mton)

	Peasant families (N)	Average per family (M)[3]	Private area (A)	Common use areas of peasants in settlements (C) 7[4]	Areas designated by agrarian reform (R)	Total (F)
Agrarian Reform Movement						
Settlement - INCRA	19	50.1	952	-	952	19
Extractive Settlement - INCRA						
State Settlement	23,870	24.6	586,119	1,442,244	2,028,374	23,870
Extractive Reserves - INCRA[2,3,4]	4,075	24.6	100,060	414,587	514,647	4,075
Extractive Settlement - State[3,2]	224	71.6	16,037	-	16,037	224
Quilombola communities - State	1.811	47.2	85,469	-	85,469	1,811
Agrarian reform peasants	29,999	26.3	788,637		2,645,479	29,999
Non-agrarian reform peasants[1,2]	-1,396	36.0	-50,315			-1,396
Land Stock						
Peasant establishments in the census (I)[8]	28,603	25.8	738,322			738,322
Peasants' common use land in settlements (II)[9]				1,856,841		1,856,84
Peasants' work territories (III=I+II)						2,595,16
Land of commercial establishments in the census (IV)[10]						1,122,25
Indigenous Land (V)[11]						-
Conservation Units (VI)[11]						5,383,35
Other areas (VII=VIII-V-IV-III)						1,181,16
Total (VIII)[11]						**10,281,933**
Carbon stock						
Peasant establishments in the census (I)[5]						112
Peasants' common use land in settlements (II)[6]						370
Peasants' work territories (III=I+II)						482
Land of commercial establishments in the census (IV)[5]						195
Indigenous Land (V)[7]						-
Conservation Units (VI)[7]						870
Other areas (VII=VIII-V-IV-III)						90
Total (VIII)[7]						**1.637**

Source: IBGE, 2017 Agricultural Census; INCRA and ITERPA, list of designations. See notes in Table 3.1.2-1.

Chart 3.2.2-2 Use of peasant establishments and common use land in IR-Marajó

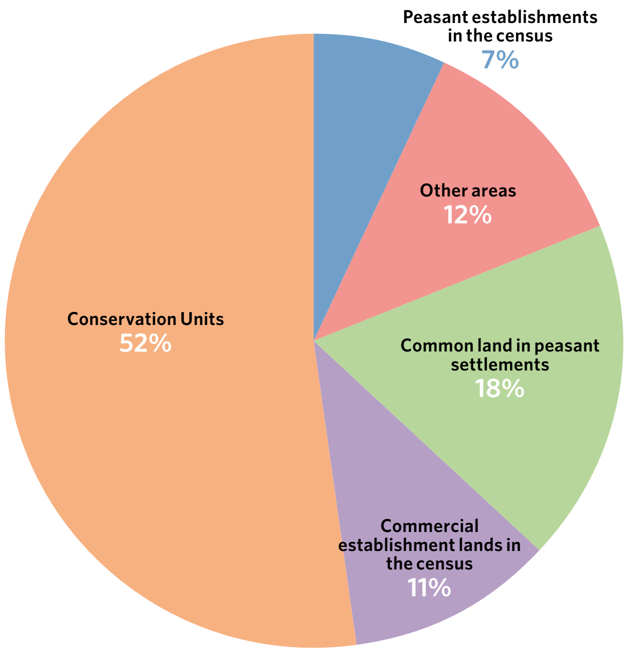


Source: 1-IBGE, 2006 and 201 Agricultural Censuses 7. See methodological notes in Chart 3.1.2-2.

4.2.2.3 Private land, peasants' common use land, indigenous land, and public land

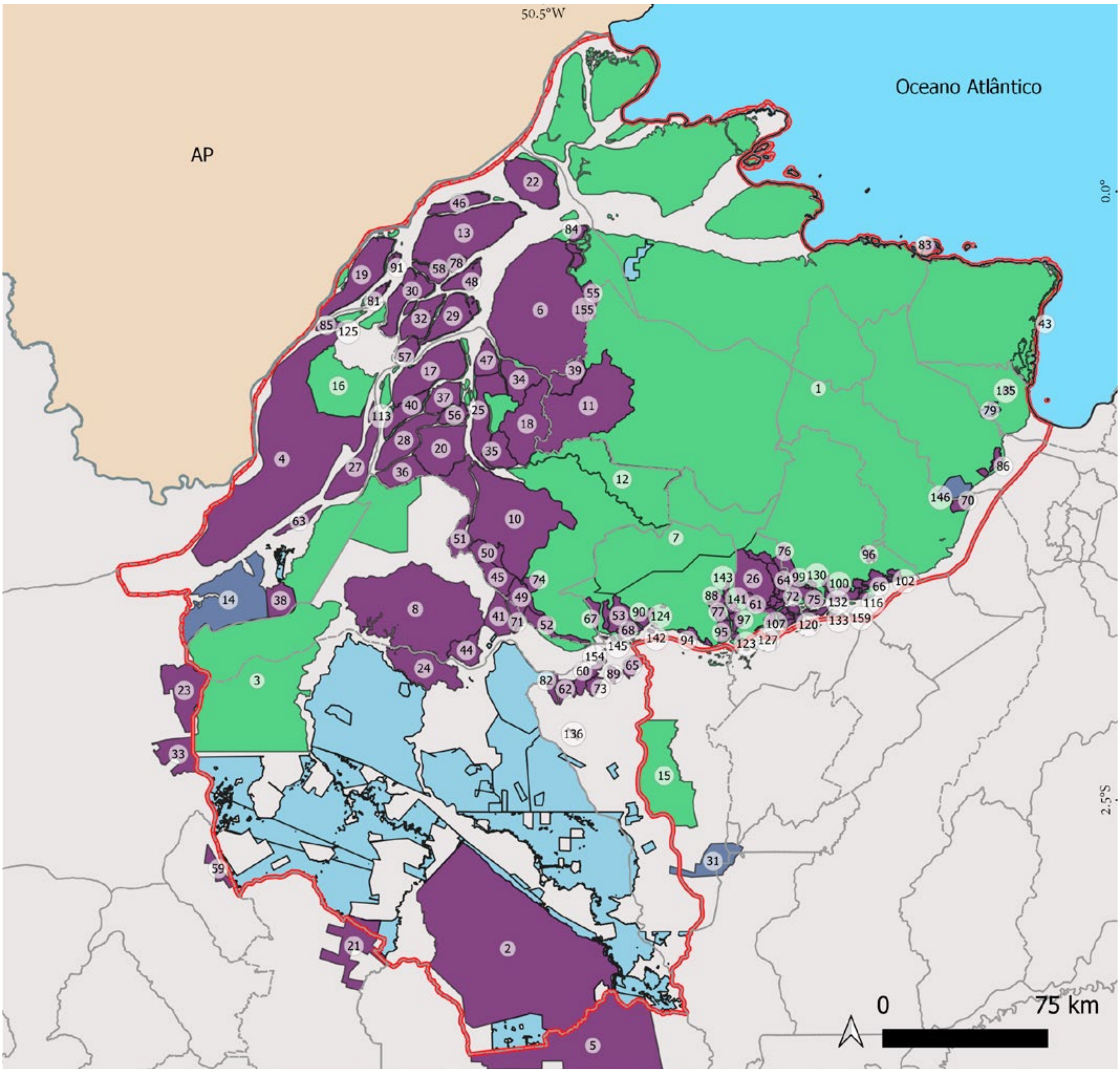
Once the distinction between (peasant and commercial) private land and land designated as peasants' common use land has been made, the balance of land distribution in IR-Marajó is concluded, as show in the second part of Table 3.2.2-1 and Chart 3.2.2-3: together, peasant and commercial establishments control 18 percent of the land, with 7 percent and 11 percent respectively; common use land used by settled peasants accounts for 18 percent; land in official reserves for 52 percent, and land in other situations, including IR's vacant land for 12 percent. The spatial distribution of designated land in different conditions, indigenous and reserve land, and public vacant lands is shown in Map 3.2.2-1.

Chart 3.2.2-3 Land situation of the total IR-Marajó area



Source: see Table 3.2.2-1.

Map 3.2.2-1. Spatial distribution of land designated in different situations, indigenous and reserve land, and public vacant land in IR-Marajó



- Settlements: PAE/PDS/PIC/PEAS/PEAEX
- Quilombola Territories
- Integral Protection Conservation Units
- Sustainable Use Conservation Units
- Indigenous Land
- Other Public Forests/National Registry of Public Forests

Limits

- Integration Region
- Municipalities
- State of Para

Source: Developed from the shapefiles of the National Register of Public Forests (CNFP/SFB) and Land Institute of Pará (ITERPA). Legend: Annex 3

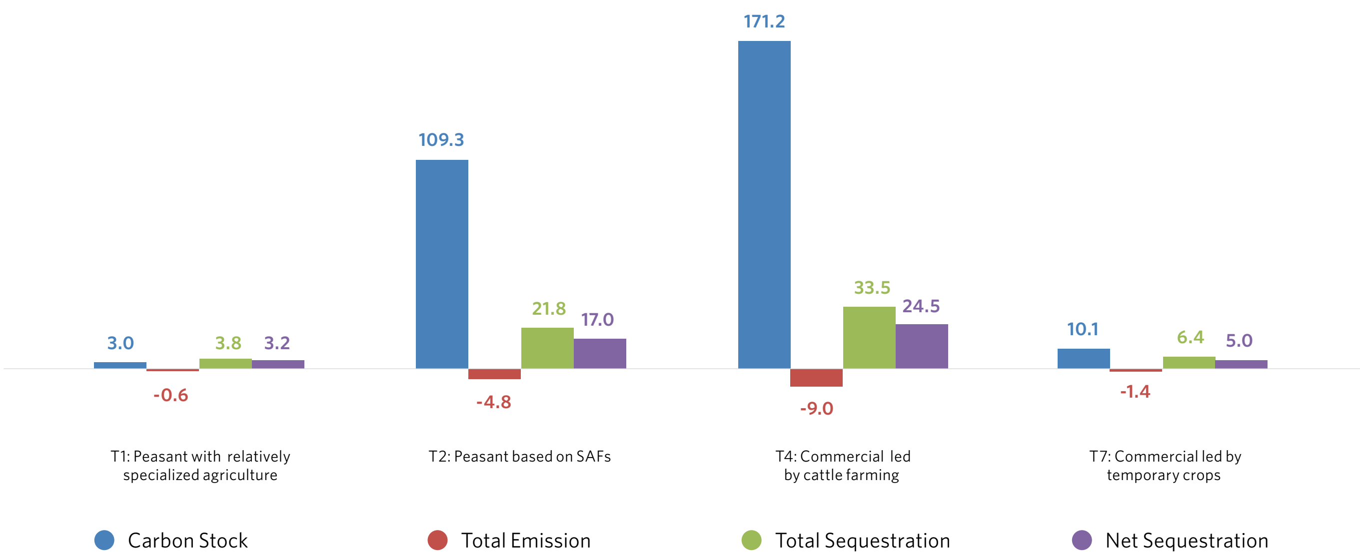
4.2.3 Production and environment

In IR-Marajó, the average CO2 stock per hectare in properties smaller than 100 ha is 140.6t and 173.4t in properties with more than 100 ha (Annex 1, A.1.3, Table A.1.3-1). Understanding that these values are attributable to peasant and commercial trajectories, respectively, and considering the land holdings of each one (Chart 3.2.3-1), the results are 3.0 Mt of CO2 stock for T1 and 109.3 Mt for T2; with regard to commercial trajectories, these stocks would be 171.2 for T4 and 10.1 Mt for T7. Among peasant trajectories, the carbon balance of T1 presents an emission of 0.6 Mt/year and a sequestration of 3.8 Mt/year, with a net sequestration of 3.2 Mt/year; T2, in turn, emits 4.8 Mt/year and sequesters 21.8 Mt/year, with a net sequestration of 17.0 Mt/year; among commercial trajectories, the net sequestration foT4 and T7 are 24.5 and 5 Mt, respectively (Chart 3.2.3-1).

Moreover, a total stock of 370 Mt is found, associated with the land of common use of peasant establishments linked to the agrarian reform: 1,856,841 ha (second part of Table 3.2.2-1) at 199.2 t of CO2/ha (land average in agrarian reform modalities in IR-Marajó, see Annex I, Table A.I-1). The total CO2 stock associated with the "work territory" of the peasants of IR-Marajó is 482 Mt.

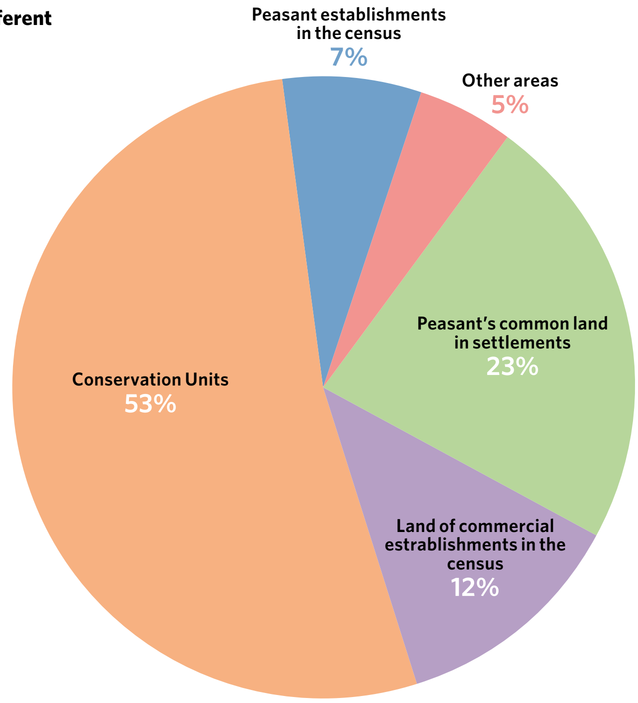
Carbon stocks were obtained for both private land of common use and public land in the IR, allowing for a comparative observation between the different modalities of land control and access (second part of Table 3.2.2-1). Vacant lands would account for 51 percent of the carbon stock of Tocantins; peasants for 4 percent in their private land and another 13 percent in common use land; commercial establishments for 6 percent; and conservation units for 6 percent (Chart 3.2.3-2).

Chart 3.2.3-1 CO2 balance and stock in private land of the establishments that make up the productive structures linked to EcoSocioBio-Marajó



Source: See notes in Chart 3.1.3-1.

Chart 3.2.3-2 Carbon stocks in the different land situations in IR-Marajó



Source: Table 3.2.2-1

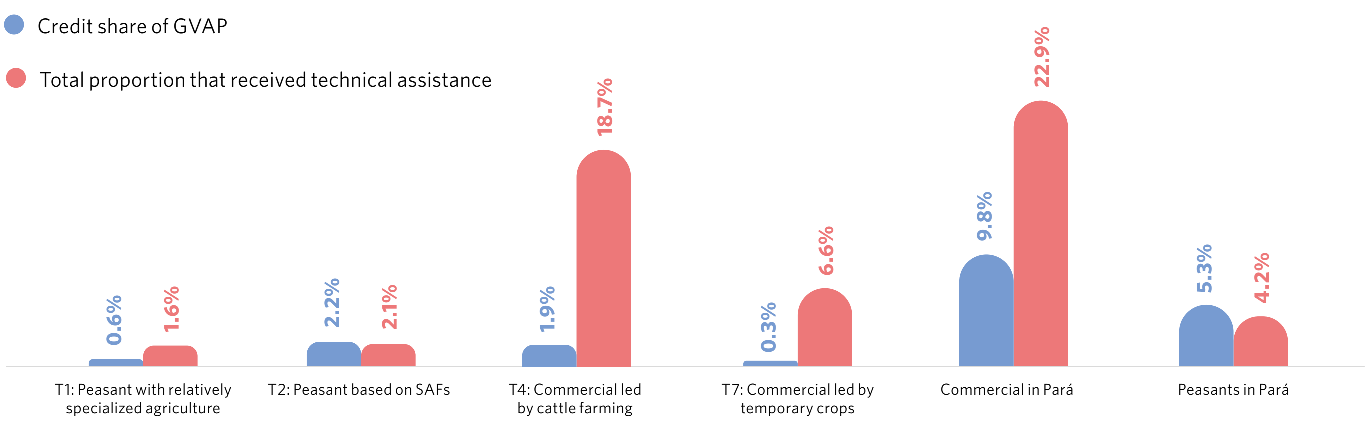
4.2.4 Institutions, credit and knowledge

Formal and informal institutions of access to capital and technological knowledge are fundamental to the dynamics of trajectories and their competitive capacities (Costa, 2013; Costa and Fernandes, 2016).

The amount of credit granted to T1 and T2 in IR-Marajó in 2017 was equivalent to 0.6 percent and 2.2 percent of the respective GVAP in the same year, while the proportions of T4 and T7 in the SA were 1.9 percent and 0.3 percent; the average across Pará was 5.3 percent for peasant and 22.1 percent for commercial establishments (Chart 3.2.4-1).

The asymmetries in terms of technical assistance are also striking across Pará: 1.5 percent of the establishments in T1 and 2.1 percent in T2 received technical assistance in 2017, against 4.2 percent and 13.2 percent of peasant and commercial trajectories, respectively (Chart 3.2.4-1).

Chart 3.2.4-1 Indicators of production promotion policies in IR-Marajó: proportion of credit in GVAP and proportion of establishments that received technical assistance, forms of peasant and commercial production, 2017

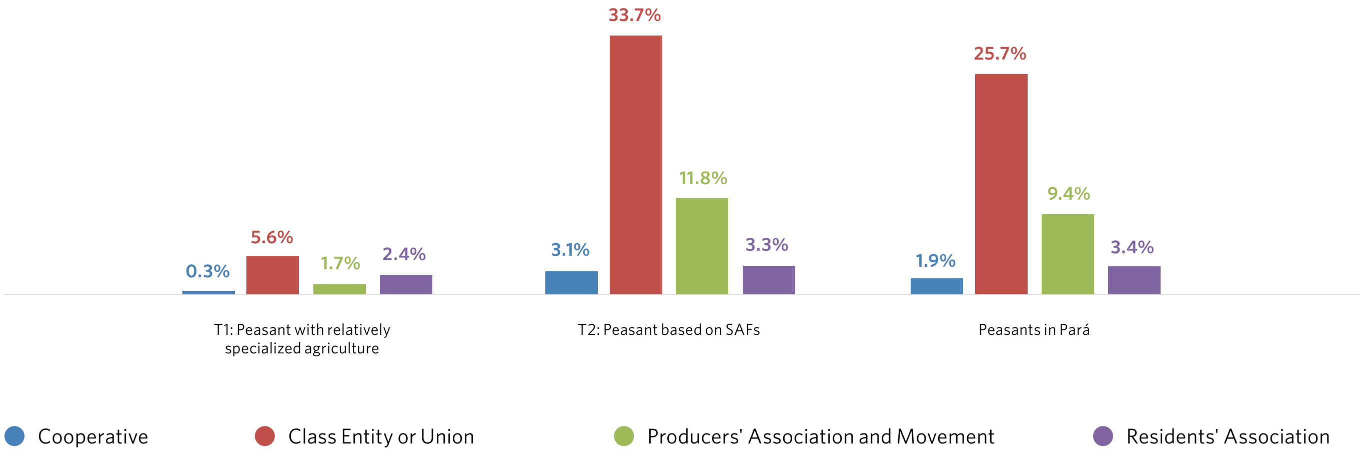


Source: IBGE, 2017 Agricultural Census.

4.2.5 Producers' organization

The level of cooperativism among the peasants of EcoSocioBio Pará is low. The highest level was found in T2 (3.1 percent), which is above that of peasants in Pará (1.9 percent). However, as in IR-Tocantins, the unionization rate in T2 (34 percent) is higher than that of the average among peasants in Pará. A similar situation is found for participation (12 percent) in T2 associations in IR-Marajó (Chart 3.2.5-1).

Chart 3.2.5-1-Indicators of producers' organization in SA-Marajó, 2017

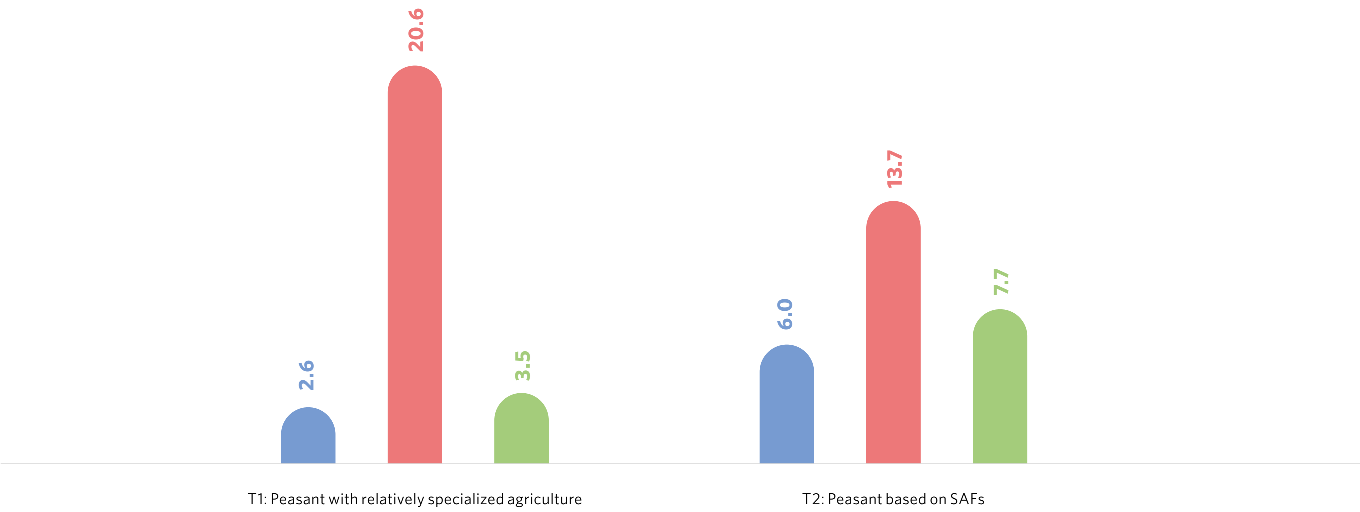


Source: IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations. Central Bank of Brazil.

4.2.6 Net income from work

The annual net income (NI, which is equal to GVAP minus the production costs declared in the censuses) per worker-equivalent family member-year (wf-eq-year) is a crucial indicator of the economic efficiency of peasant-based agricultural structures (Costa, 2012). In EcoSocioBio-Marajó, the of both underlying peasant trajectories has shown a high volatility. A strong increase occurred between 1995 and 2006, when the NI of T2 more than doubled, from BRL6,000 to BRL13,700; that of T1 was multiplied by a 7 factor, jumping from BRL2,600 to BRL20,600. However, an important reduction was observed in the following period that was deeper for the latter, which reached BRL3.5 than for the former, which fell to BRL7.7 million 2017 (Chart 2.3.5-1). The reasons for these movements are not completely clear. With regard to the first period, it is possible to infer that they are associated with the increase in prices of products such as açai and cassava flour (Nogueira, Santana, Garcia, 2013; Santana and Costa, 2008); another possibility is an important growth in the physical productivity of açai per unit of work, as a result of efforts to intensify extractive management or of the agile establishment of cultivated in the "roçados de várzea" (see Box 2.2.1-1). In turn, an explanation for the fall in the NIseen in the most recent period awaits research. It should be said, however, that given the more or less general picture of increased prices of EcoSocioBio products to producers, special attention should be paid to the factors that influence the physical productivity of work.

Chart 2.3.5-1 Change in Net Income per worker-family member equivalent in SA-Marajó (BRL 1,000.00/wf-eq-year)



Source: IBGE, 1995, 2006 and 2017Agricultural Census.

4.3 Baixo Amazonas

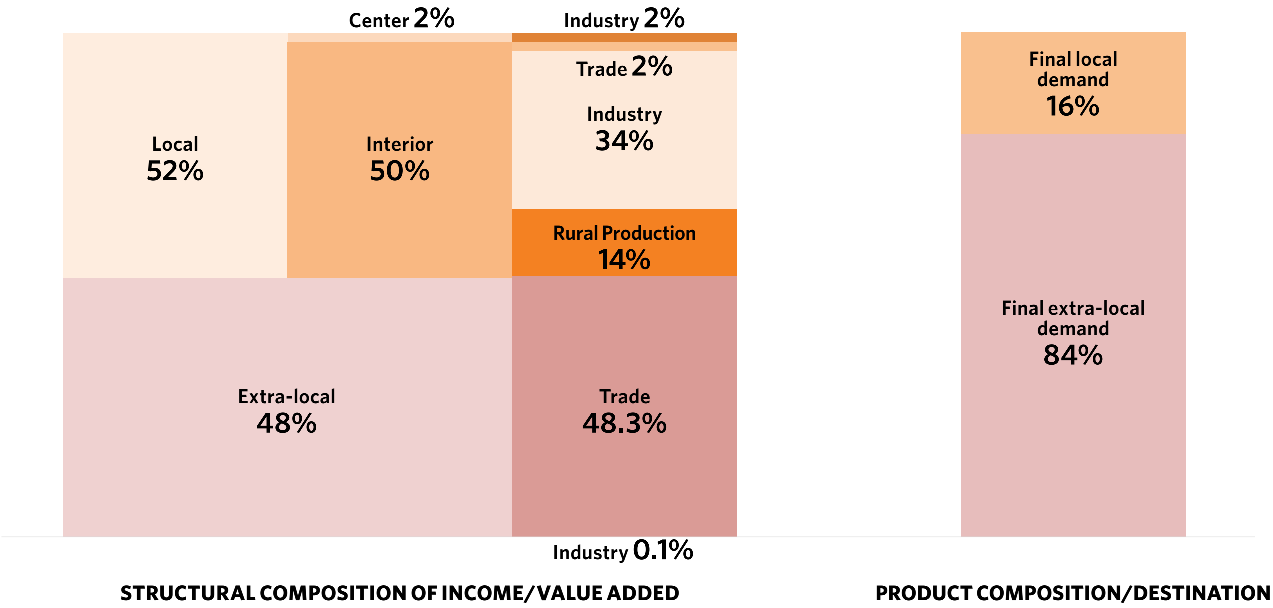
IR-Baixo Amazonas covers an area of 315,900 sq.km distributed across 16 municipalities: Alenquer, Almeirim, Belterra, Curuá, Faro, Juruti, Mojuí dos Campos, Monte Alegre, Óbidos, Oriximiná, Prainha, Santarém, and Terra Santa. With a Value Added (VA) of BRL220 million and a 4 percent share of EcoSocioBio, it is the RI's fifth most important productive base.

Local (state) production accounted for 52 percent of the VA generated, divided between the interior (the IR itself) (50 percent) and the center of the state economy (2 percent). Considering all sectors (third column in Chart 3.3-1), extra-local trade accounted for the highest proportion (48.3 percent), the industrial sector in the IR for 34 percent and the rural sector for14 percent; trade in the interior accounted for 2 percent and industry in the center for another 2 percent (Chart 3.3-1, third column).

With regard to final demand, as much as 84 percent of the production generated in EcoSocioBio-Baixo Amazonas went to meet domestic and global demands. The local needs of the IR itself absorbed 16 percent of the product generated, and those outside the IR absorbed the remaining 0.1 percent (Chart 3.3-1, fourth column). EcoSocioBio-Baixo Amazonas is therefore an important export base of the IR.

Employment associated with this production totaled 4,200 workers, with 80 percent in the IR itself; 70 percent in rural production; 8 percent in the industrial sector; and 1.3 percent in trade. In the Domestic Economy, trade concentrated 20 percent of the jobs (Table A.2.3-3).

Chart 3.3-1 Value/Income Distribution and Destination of EcoSocioBio-Baixo Amazonas Product



Source: Table 1-1.

4.3.1 Rural production, structures and productive systems

Between 2006 and 2019, the value of EcoSocioBio's rural production in Baixo Amazonas grew at the average rate of 9 percent p.a.: from BRL15.2 million in 2006 to a maximum of BRL71.9 million in 2016 and then dropping to a steady BRL28.0 million in the last two years.

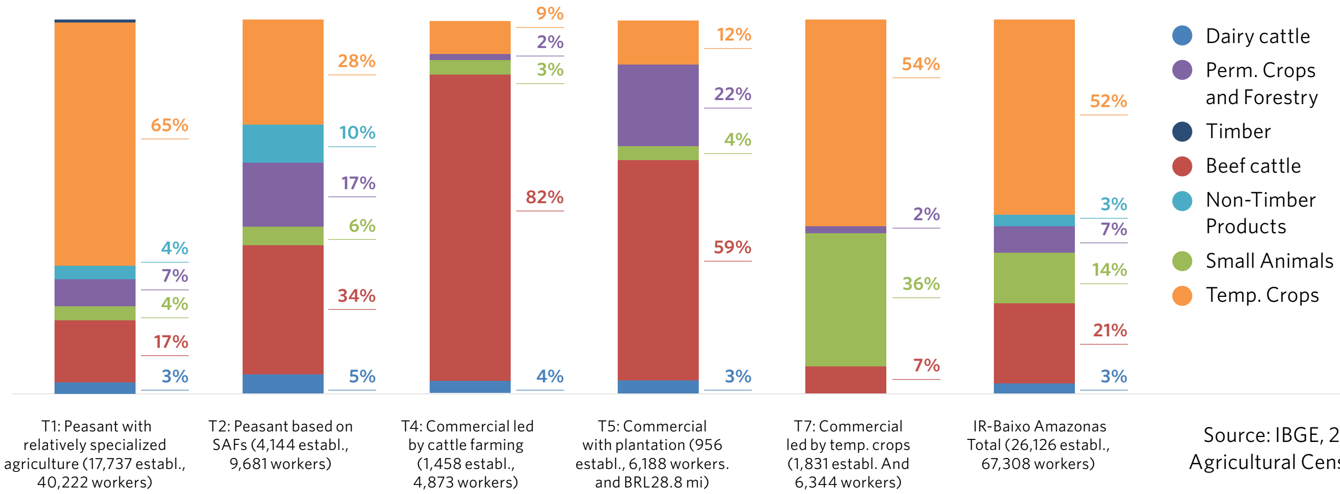
This production is organized in the context of the IR agrarian system (SA-Baixo Amazonas), accounting for 4.2 percent of its total GVAP of BRL 688.3 million in 2017. SA-Baixo Amazonas consists of 26,126 rural establishments grouped into five technological trajectories of the six defined by Costa (2009; 2021). They were:

1. T7 commercial. With a strong recent development in the IR, it accounts for 31 percent of the GVAP of SA-Baixo Amazonas generated by 1,831 establishments and 6,344 workers, with productive systems dominated by temporary crops (54 percent of its GVAP; 32 percent of the total SA GVAP), followed by poultry (36 percent; 80 percent), beef cattle (7 percent; 10 percent), and permanent crops (2 percent; 8 percent) (Chart 3.3.1-1 and 3.3.1-2);
2. T4 commercial. Led by a group of 1,458 commercial establishments that employed 4,837 workers, it accounted for 6 percent of the SA GVAP, with productive systems dominated by beef cattle (82 percent of its GVAP; 23 percent of the activity in the SA GVAP), alongside temporary crops (9 percent); small animals (3 percent); milk (2 percent); and permanent crops (2 percent);
3. T5 commercial. Comprised of 956 employer establishments that employed 6,188 workers, it's share of the SA GVAP was 5 percent, based on permanent crops (22 percent of its GVAP); beef cattle (59 percent); temporary crops (12 percent); and small animals (4 percent);
4. T1 peasant. With a group of 17,737 family establishments with 40,222 workers, whose systems were relatively specialized in temporary crops (65 percent of GVAP), it produced some beef cattle (17 percent), while collecting a small proportion of non-timber forest products (4 percent of GVAP); permanent crops (4 percent); small animals (4 percent); and milk (1 percent); and

5. Finally, T2 peasant. With a group of 4,144 establishments with 9,681 workers responsible for 10 percent of the SA-Baixo Amazonas's GVAP, whose production processes are based on agroforestry systems (AFS), especially those that use the original forest (10 percent of its GVAP comes from non-timber forest products), but also those that incorporate cultivated species (17 percent of its GVAP stems from permanent crops); in SA-Baixo Amazonas, this T developed a peculiar systems of lowland livestock farming, which accounts for 34 percent of its GVAP; temporary crops are found in any of these trajectories (28 percent of the GVAP) (Chart 3.3.1-1).

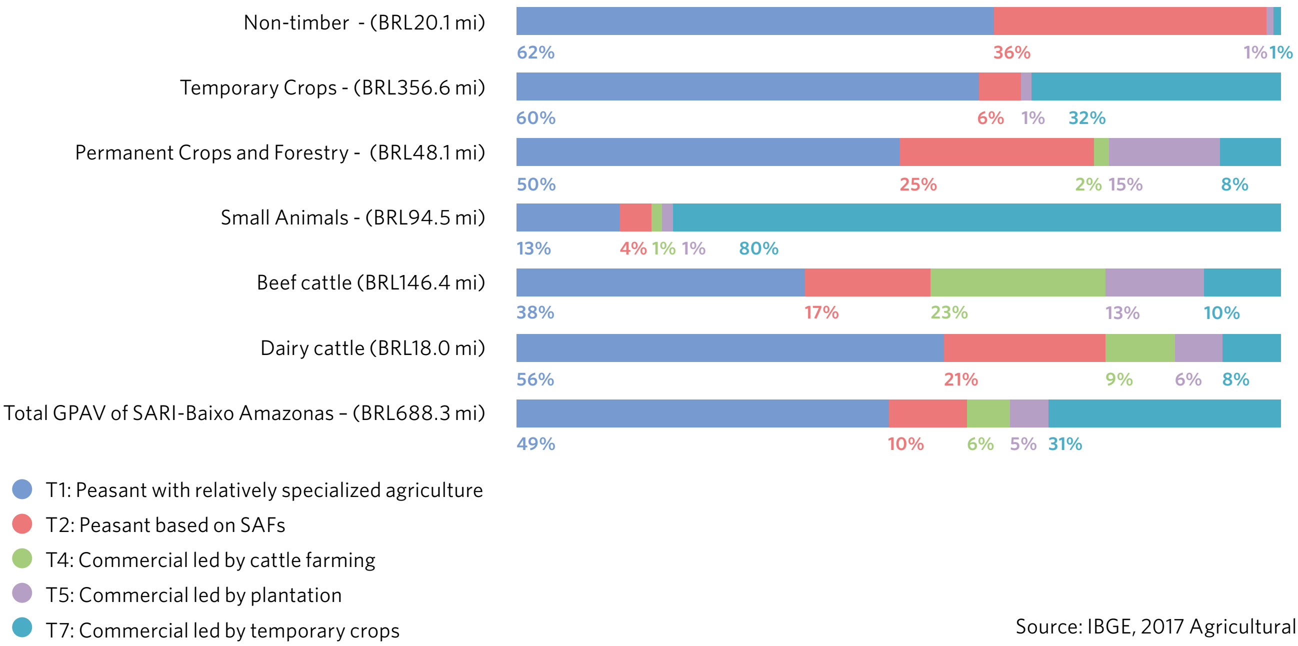
Unlike IR-Tocantins and IR-Marajó, in this case T2 shares with T1 the production of NTFPs (36 percent and 63 percent of NTFPs' GVAP, respectively, Chart 3.3.1-2) and permanent crops (25 percent and 50 percent of permanent crops' GVAP, respectively). They also share the responsibility for guaranteeing food availability in the IR, the former with a much more important participation than the latter: 60 percent and 6 percent of temporary crops' GVAP, 13 percent and 4 percent of small animal rearing, and 56 percent and 21 percent of milk production. The productive systems of both handle 57 and 36 products respectively; nevertheless, the former presented a smaller Shannon Diversity Index (SSI=3.6) than the latter (7.0) (Chart 3.3.1-2).

Chart 3.3.1-1 Agrarian System of SA-Baixo Amazonas - composition of the productive structures (% of the total GVP of the productive structure)



Source: IBGE, 2017 Agricultural Census.

Chart 3.3.1-2 Agrarian System of SA-Baixo Amazonas - Participation of productive structures in groups of products (% of the GVP)



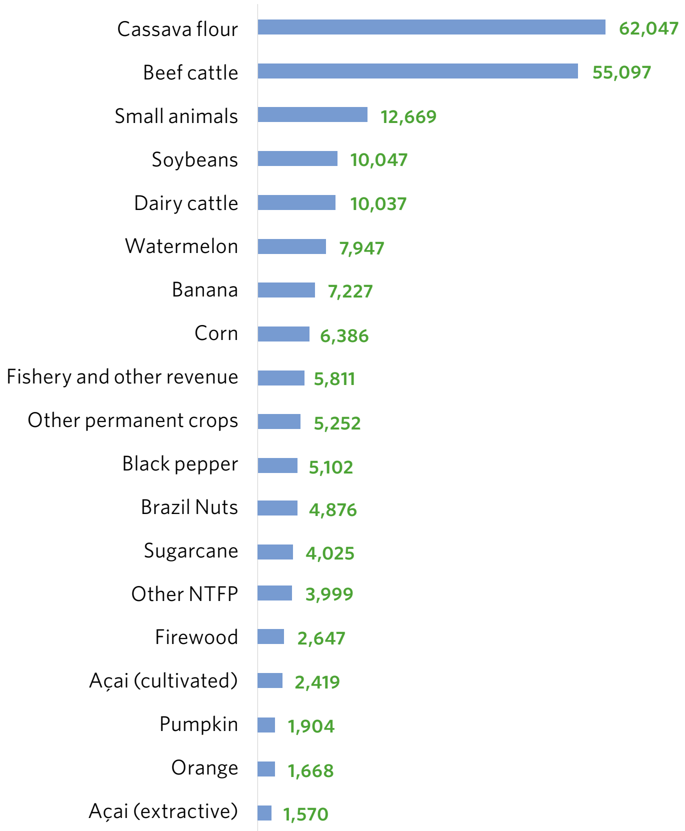
Source: IBGE, 2017 Agricultural Census.

Chart 3.3.1-3 Main products and activities of peasant and commercial Ts in IR-Marajó in 2017 (GVAP at BRL 1,000.00)

T1-Peasant with relatively specialized agriculture

Total number of products: 53

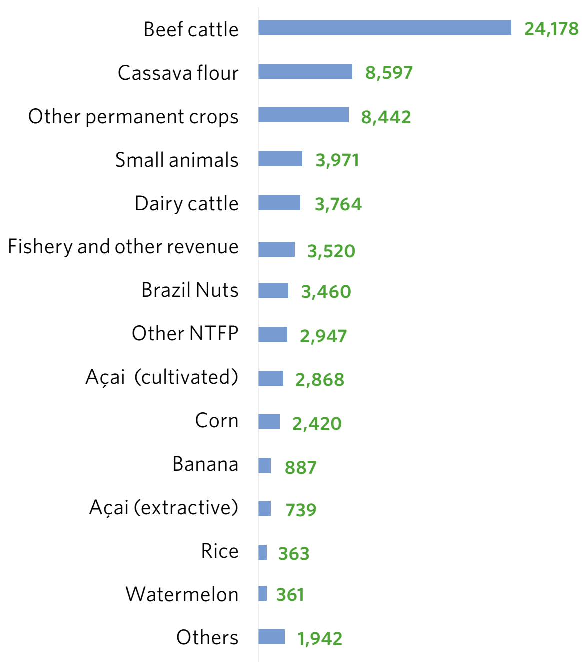
Shannon Diversity Index (SDI): 2.5



T2-Peasant based on SAFs

Total number of products: 32

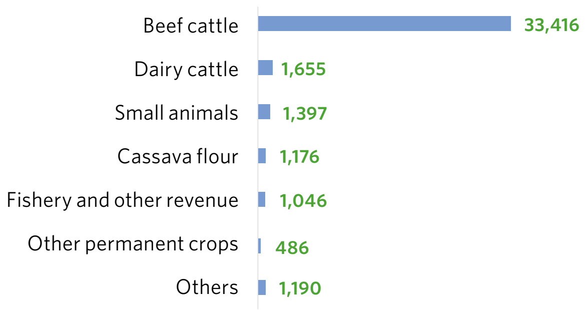
Shannon Diversity Index (IDS): 2.2



T4-Commercial led by livestock:

Total number of products: 26

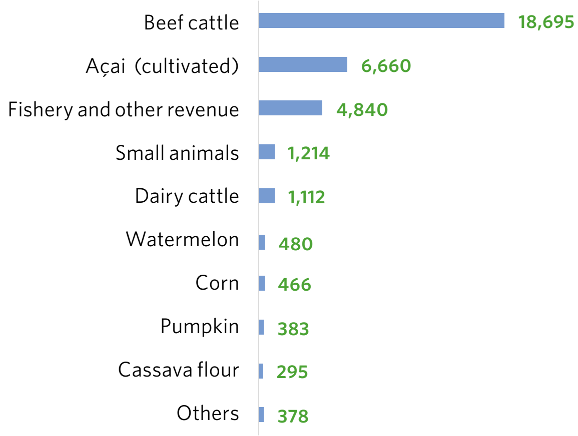
Shannon Diversity Index (SDI): 0.9



T5-Commercial led by plantations

Total number of products: 23

Shannon Diversity Index (SDI): 1.5



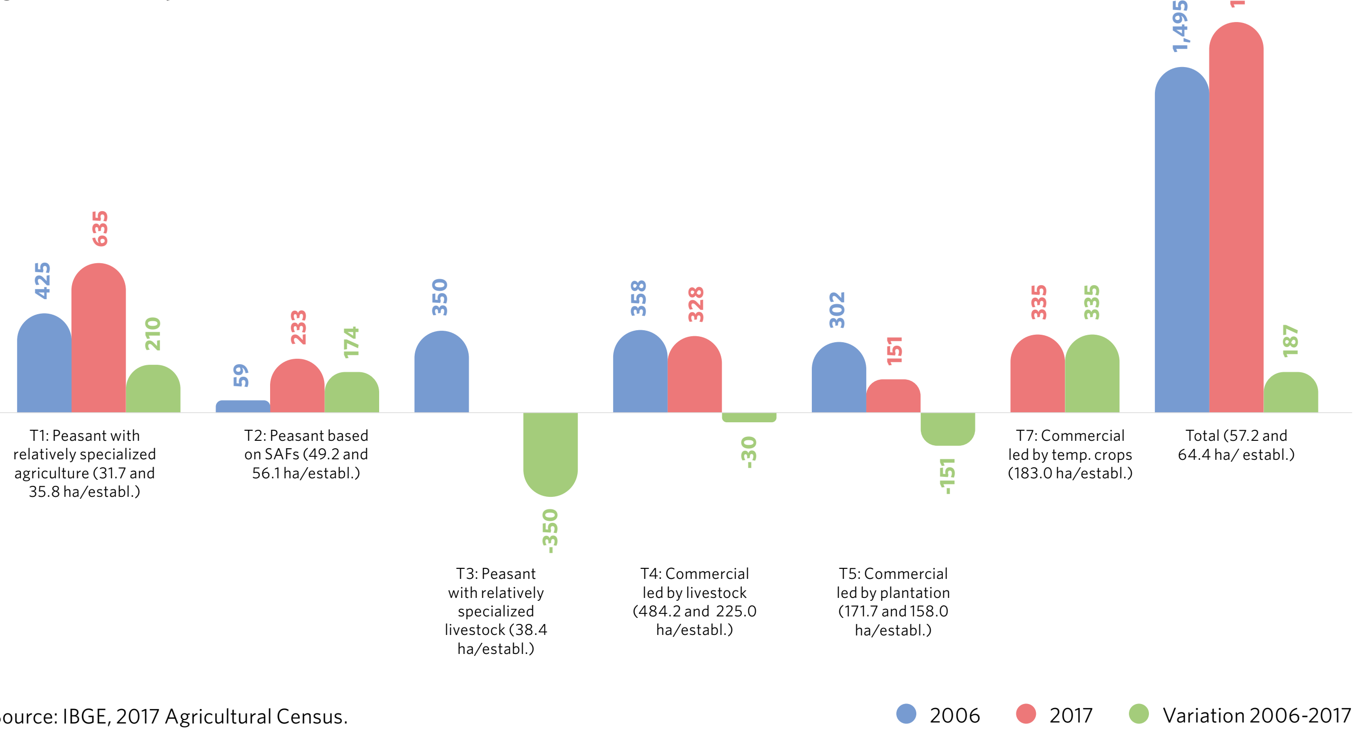
Source: IBGE, 2017 Agricultural Census

4.3.2 Institutions, land resources and land use

4.3.2.1 Private land holdings

In 2006 and 2017, the land under the control of rural establishments in IR-Baixo Amazonas totaled 1.5 and 1.7 million hectares respectively: a total increase of 12 percent or 186,000 hectares. Together, the peasant trajectories saw their land holdings grow by a mere 4 percent. However, there were fundamental changes with the full conversion of T3 establishments into T1 establishments, which added a total of 210,000 ha to their holdings, thus increasing the average size of the establishment from 31.7 to 35.8 ha (50 percent and 13 percent increases, respectively), and in T 2, whose land stock grew by 174,000 ha (nearly a three-fold increase) and the average portion of the establishment grew from 49,200 to 56,100 ha (14 percent). T7 was consolidated over the period, ending up with 335,000 hectares, which came in part (151,000 ha) from T5, in part from T4 (30,000 ha), and in part yet (6,000 ha) from the incorporation of new (public) land and old (peasant and indigenous) land (Chart 3.3.2-1).

Chart 3.3.2-1- Average distribution and allocation of the establishments' agrarian resources per T in SA-Baixo Amazonas, 2006 to 2017.



Source: IBGE, 2017 Agricultural Census.

The agrarian reform programs seem to have provided a broad institutional coverage of the land base of the peasant families of IR-Baixo Amazonas. As in IR-Tocantins and IR-Marajó, important settlement projects have been implemented in IR-Baixo Amazonas with the aim of recognizing forms of ancestral (riverside), ancient (peasant community established in the Santarém plateau after the bankruptcy of rubber tree plantations) and recent (formed around large highways) settlements.

By 2016, the different settlement modalities of the agrarian reform reported having designated land for 28,726 families - a number higher than the 21,881 peasant establishments registered in 2017 in IR-Baixo Amazonas.

The negative difference between the total number of registered establishments and those that are part of reform programs is 6,845 establishments favored by the agrarian reform that no longer existed by the census year: either because they merged to make up larger peasant establishments or because they were absorbed by commercial establishments – both possibilities are consistent with the results presented above (Table 3.3.2-1).

Table 3.3.2-1 Distribution of private, common use and public areas (ha) and associated carbon stocks (Mton)

	Peasant families (N)	Average per family (M)[3]	Private area (A)	Common use areas of peasants in settlements (C) 7[4]	Areas designated by agrarian reform (R)	Total (F)
Agrarian Reform Movement						
Settlement - INCRA	5,521	39.7	218,952	495,274	714,226	
Extractive Settlement - INCRA	14,895	39.7	590,663	237,954	828,617	
State Settlement	296	39.7	11,738	417,862	429,600	
Extractive Reserves - INCRA[2,3,4]	4,954	39.7	196,454	662,898	859,352	
Extractive Settlement - State[3,2]	2,118	39.7	83,991	191,723	275,714	
Quilombola communities - State	942	39.7	37,356	423,852	461,207	
Agrarian reform peasants	28,726	39.7	1,139,155		3,568,717	
Non-agrarian reform peasants[1,2]	-6,845	39.7	-271,448			
Land Stock						
Peasant establishments in the census (I)[5]	21,881	39.7	867,707			867,707
Peasants' common use land in settlements (II)[6]				2,429,563		2,429,563
Peasants' work territories (III=I+II)						3,297,270
Land of commercial establishments in the census (IV)[5]						814,151
Indigenous Land (V)[7]						9,888,806
Conservation Units (VI)[7]						13,954,957
Other areas (VII=VIII-V-IV-III)						3,845,475
Total (VIII)[7]						**31,800,659**
Carbon stock						
Peasant establishments in the census (I)[8]						64
Peasants' common use land in settlements (II)9						331
Peasants' work territories (III=I+II)						395
Land of commercial esta-blishments in the census (IV)[10]						119
Indigenous Land (V)[11]						1,992
Conservation Units (VI)[11]						2,832
Other areas (VII=VIII-V-IV-III)						383
Total (VIII)[11]						**5,721**

Source: IBGE, 2017 Agricultural Census; INCRA and ITERPA, list of designations. See notes in Table 3.1.2-1.

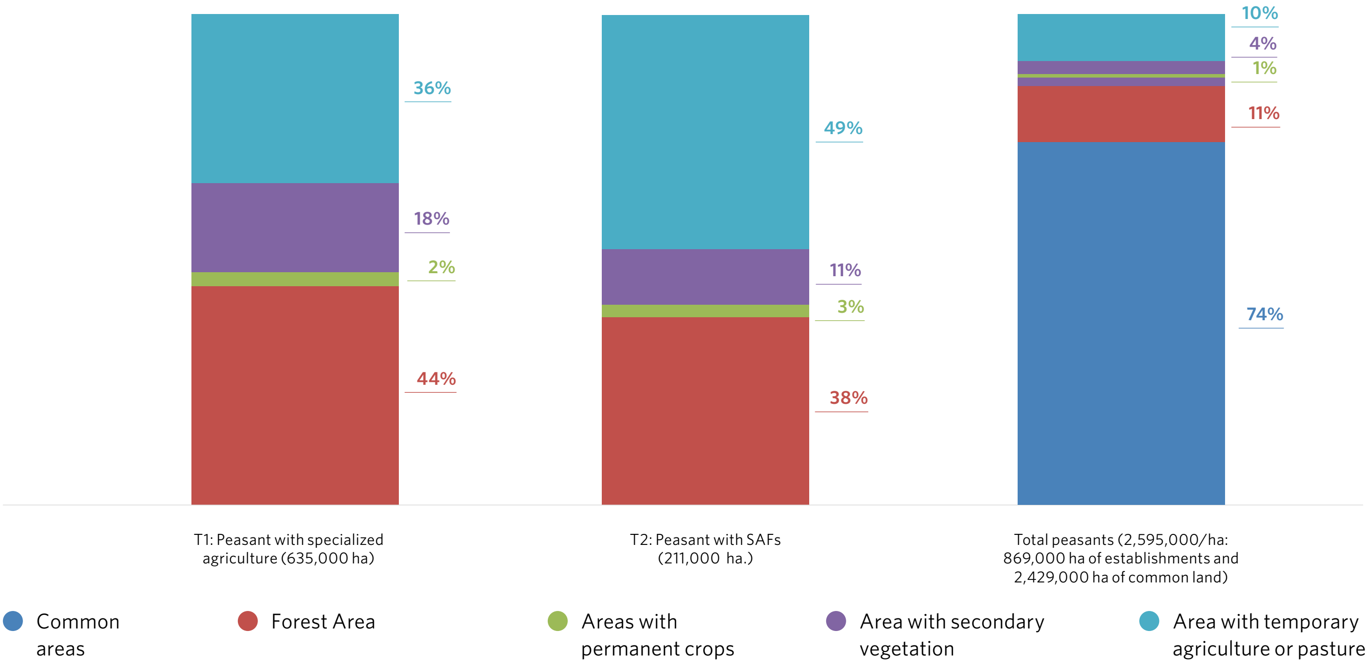
4.3.2.2 Uses of private and common use land: the "work territory" of EcoSocioBio-Baixo Amazonas

Of their total internal availability of 635,000 ha (35.8 ha per establishment), T1 establishments hold 62 percent of primary (44 percent) and secondary (18 percent) forests, with 38 percent set aside for planting, 36 percent for temporary crops and pasture, and 2 percent for permanent crops. Of the stock of 233,000 ha (56.1/ha per establishment), those in T2 hold 49 percent of primary (38 percent) and secondary (11 percent) forests and 3 percent of permanent (10 percent) and temporary crops, and pasture (49 percent) (Chart 3.3.2-2).

In addition to the direct use of establishment resources by owner families, there are also forms of access to EcoSocioBio resources that transcend the restriction of individual ownership, with the rural bases of EcoSocioBio showing that the families' "work territories" extend beyond the respective lots.

For this study, the visualization of these territories of common use was obtained by combining information from the 2017 census and information from land agencies about the settlements. In fact, the families settled by agrarian reform programs were registered as establishments, declaring, in this capacity, the resources over which they had private control. Under the premise that the average of their land holdings did not exceed the average of all peasant establishments registered in IR-Baixo Amazonas, the total land holdings of thee family-establishments is estimated at 1.1 million ha (see methodological notes of Table 3.1.2-1). Given that land reform projects have guaranteed these same families access to 3.6 million ha, the difference of 2.5 million ha should be considered as formally recognized common resources. Thus, we can see a peasants' "work territory" that makes up the productive base of EcoSocioBio-Baixo Amazonas, comprised of the establishments' areas (867,700 ha) plus the areas of common use (2.4 million ha), totaling 3.3 million ha: 89 percent of forests, of which 74 percent are of common use and 15 percent belong to the establishments – the latter has 11 percent of primary and 4 percent of secondary forests, in addition to 11 percent of agriculture – 1 percent of permanent crops and 10 percent of temporary crops and pasture (see last column of Chart 3.3.2-2).

Chart 3.3.2-2 Use of peasant establishments' land and common use land in IR-Baixo Amazonas



Source: 1-IBGE, 2006 and 2017Agricultural Censuses. See methodological notes in Chart 3.1.2-2.

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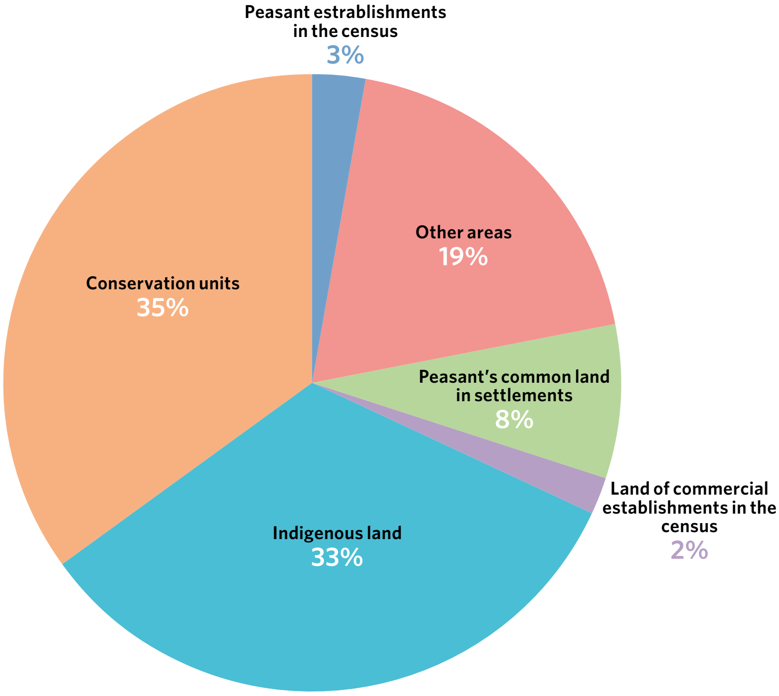
4.3.2.3 Private land, peasants' common use land, indigenous land, and public land

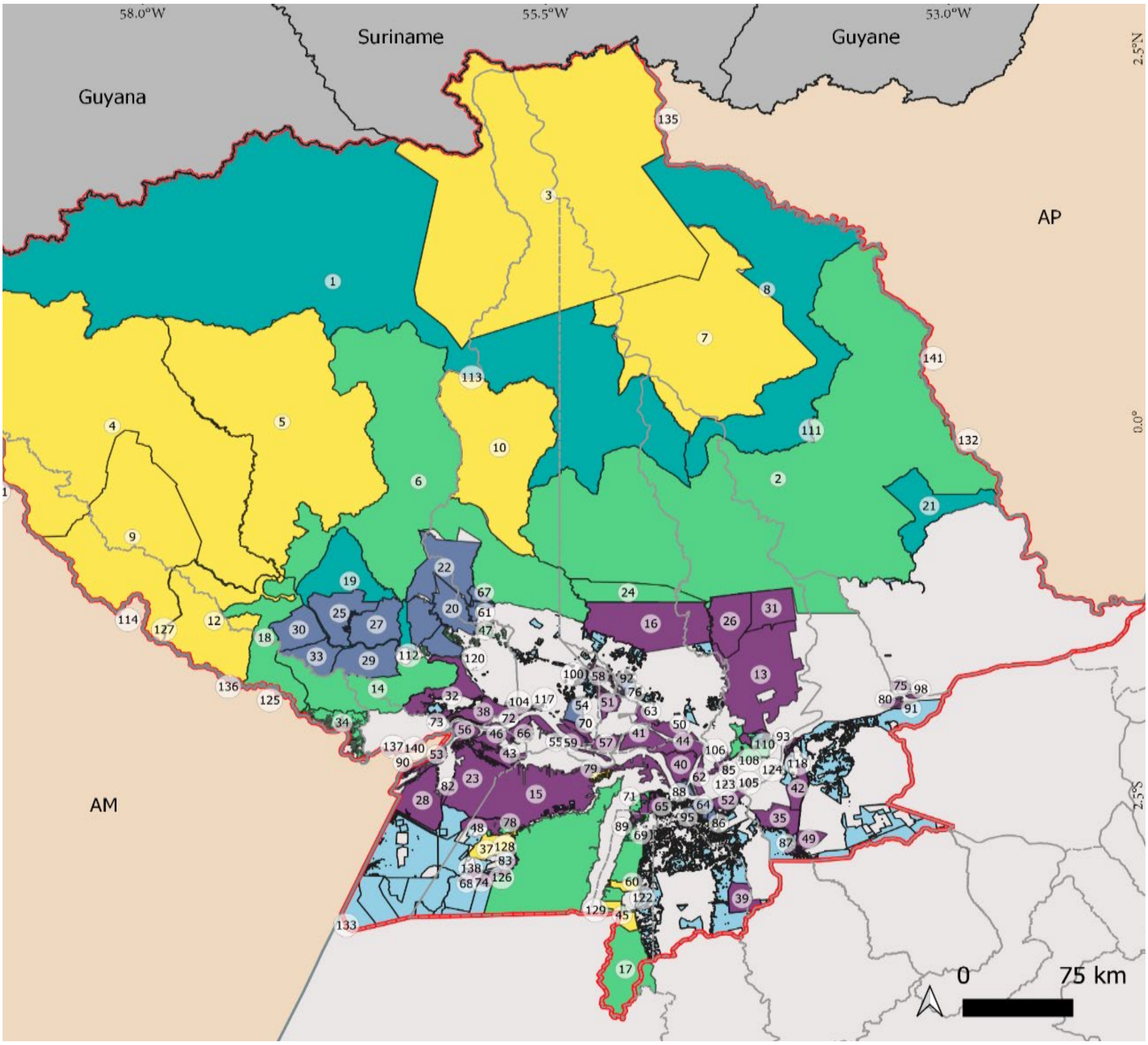
Once the distinction between (peasant and commercial) private land and land designated as peasants' common use land has been made, the balance of land distribution in IR-Baixo Amazonas is concluded, as shown in the second part of Table 3.2.2-1 and Chart 3.3.2-3: together, peasant and commercial establishments control 5 percent of the land, with 3 percent and 2 percent respectively; common use land used by settled peasants accounts for 8 percent; land in official reserves for 35 percent, and land in other situations, including RI's vacant land for 19 percent. The spatial distribution of designated land in different situations, indigenous and reserve land, and public vacant land is shown in Map 3.2.2-1.

Chart 3.3.2-3 Land situation of total the IR-Baixo Amazonas area



Source: Table 3.3.2-1.

Map 3.3.2-1. Spatial distribution of land designated in different situations, indigenous and reserve land, and public vacant land in IR-Baixo Amazonas



- Settlements: PAE/PDS/PIC/PEAS/PEAEX
- Quilombola Territories
- Integral Protection Conservation Units
- Sustainable Use Conservation Units
- Indigenous Land
- Other Public Forests/National Registry of Public Forests

Limits

- Integration Region
- Municipalities
- State of Para

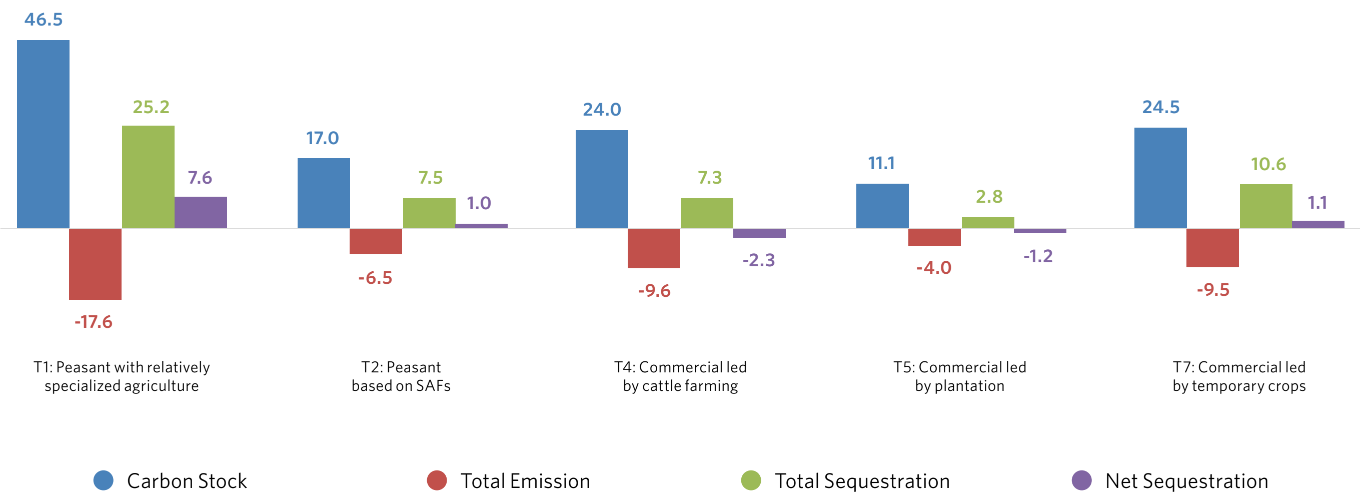
Source: Developed from the shapefiles of the National Register of Public Forests (CNFP/SFB) and Land Institute of Pará (ITERPA). Legend: Annex 3

4.3.3 Production and environment

Using georeferenced reading methodologies it is possible to see in IR-Baixo Amazonas, that the average CO2 stock is 73.2 t per hectare in properties smaller than 100 ha and 146.7 t in those bigger than 100 ha. Applying these parameters to peasant and commercial trajectories, respectively, results in a total stock of 46.5 Mt for T1; 17.0 Mt for T2; 24 Mt for T4; 11 Mt for T5; and 24.5 Mt for T7 (see Chart 4.2.3-1). Carbon balances, in turn, show a net sequestration of 7.6 Mt for T1; 1.0 Mt for T2; a net emission of 3.2 Mt for T4 (the negative sign indicates net emission); a net emission of 1.2 Mt for T5; and a net sequestration of 1.1 Mt for T7(Chart 3.3.3-1).

Furthermore, a total stock of 331 Mt was found associated with common use land of establishments linked to agrarian reform: 2,429 million ha (Table 3.3.3-1) at 136.37 Mt of CO2/ha (average of the land under agrarian reform modalities in IR-Baixo Amazonas, see Annex 1, Table A.I-1). The CO2 stock associated with EcoSocioBio's "work territory" in the IR would total 395 Mt.

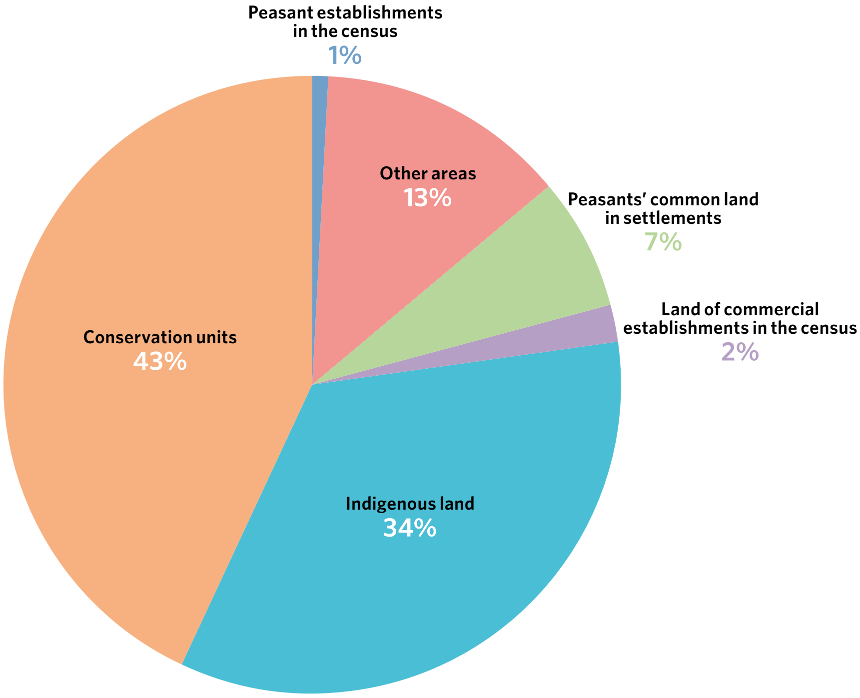
Chart 3.3.3-1 CO2 stock and balance in private land of the establishments that make up the productive structures linked to EcoSocioBio-Baixo Amazonas



Source: See notes in Chart 3.1.3-1.

Carbon stocks were obtained for common use and public land in the IR, as well as for private land, allowing a comparative observation between the different modalities of land control and access. Conservation units account for 43 percent of the carbon stock; indigenous land for 34 percent, common use land of settled peasants for 7 percent, commercial establishments in the census for 2 percent; and peasants for 1 percent. The other areas in the IR, including vacant land, would hold 13 percent of the carbon stock of Baixo Amazonas (Chart 3.3.3-2).

Chart 3.3.3-2 Carbon stocks in different land situations in IR-Baixo Amazonas



Source: Table 3.3.2-1.

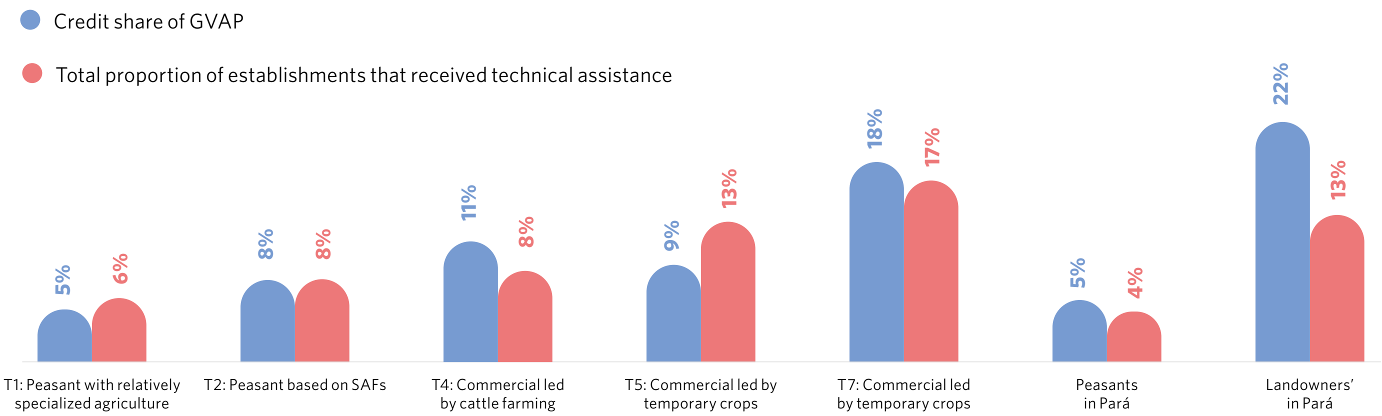
4.3.4 Institutions, credit and knowledge

Formal and informal institutions of access to technological knowledge and capital are fundamental for the dynamics of the trajectories and their respective competitive capacities (Costa, 2013; Costa and Fernandes, 2016).

The amount of credit granted to T1 and T2 in IR-Baixo Amazonas in 2017 was equivalent to 4.7 percent and 7.5 percent of the respective GVAP in the same year. Asymmetry, as in other RIs, is extraordinarily high in relation to commercial trajectories in Pará, and to T7 in the IR. However, special attention should be paid the fact that differently from the other IRs, the T2 here is positive and substantially differentiated when compared to the average of peasant trajectories in Pará (Chart 3.3.4-1).

The proportion of establishments that received technical assistance in the IR is strongly correlated to what was seen in credit: 6 percent of T1 and 8 percent of T2 establishments received technical assistance in 2017, against 4.0 percent of peasant trajectories and 13 percent of commercial trajectories across Pará (Chart 3.3.4-1-1).

Chart 3.3.4-1 Indicators of production promotion policies in IR-Baixo Amazonas: proportion of credit in GVAP and proportion of establishments that received technical assistance, forms of peasant and commercial production, 2017

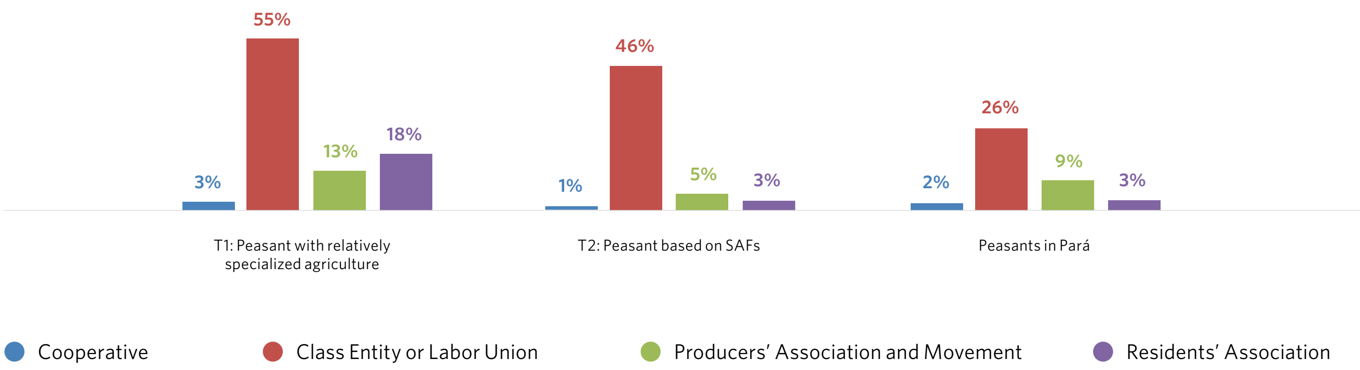


Source: IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations. Central Bank of Brazil.

4.3.5 Producers' organization

The level of cooperativism among peasants of EcoSocioBio in IR-Baixo Amazonas is low. On average, it is equivalent to that of the rest of Pará. However, the unionization rate is high in both T1 (55 percent) and T2 (46 percent) and higher than among the average of peasants in Pará. A similar situation is found for participation in T2 associations in IR-Baixo Amazonas (13 percent) (Chart 3.3.5-1).

Chart 3.3.5-1 Indicators of producers' organization in SA-Baixo Amazonas, 2017

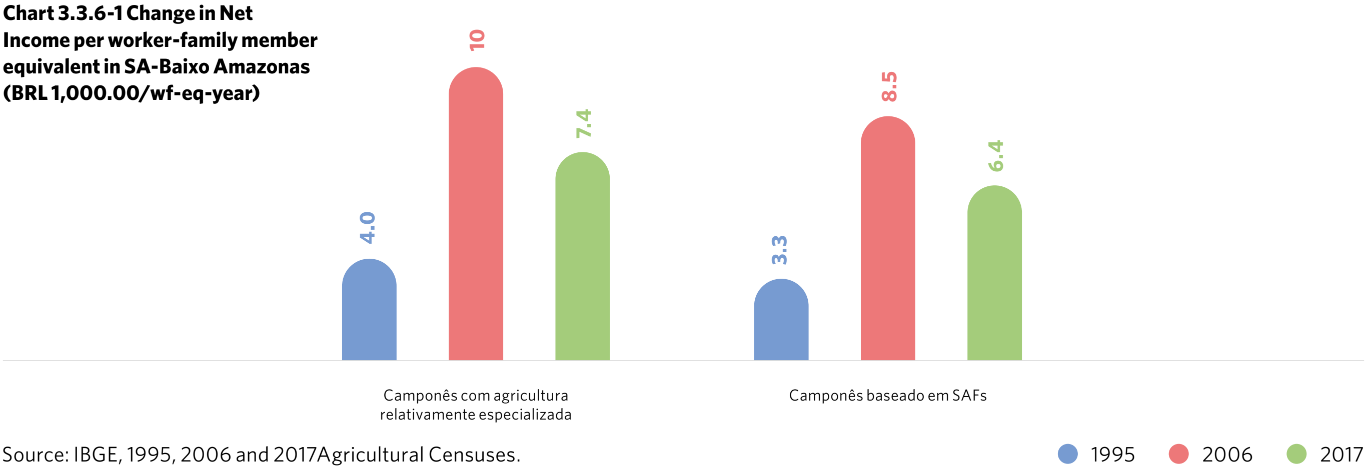


Source: IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations.

4.3.6 Net income from work

The annual net income (NI, which is equal to GVAP minus the production costs declared in the censuses) per worker-family member equivalent-year (wf-eq-year) is a crucial indicator of the economic efficiency of peasant-based rural structures (Costa, 2012). In EcoSocioBio-Baixo Amazonas, the $NI_{wf\text{-}eq\text{-}year}$ of both underlying peasant trajectories has shown a high volatility. A strong increase was recorded between 2006 and 2017, when the $NI_{wf\text{-}eq\text{-}year}$ of T1 more than doubled, from BRL4,000 to BRL10,000; that of T2 increased from BRL 3,300 to BRL8,500. However, an important reduction to BRL7,400 in the former and to BRL6,400 in the latter was observed in the following period (Chart 3.3.6-1). The reasons for these movements in the IR await research.

Chart 3.3.6-1 Change in Net Income per worker-family member equivalent in SA-Baixo Amazonas (BRL 1,000.00/wf-eq-year)



Source: IBGE, 1995, 2006 and 2017Agricultural Censuses.

4.4 Xingu

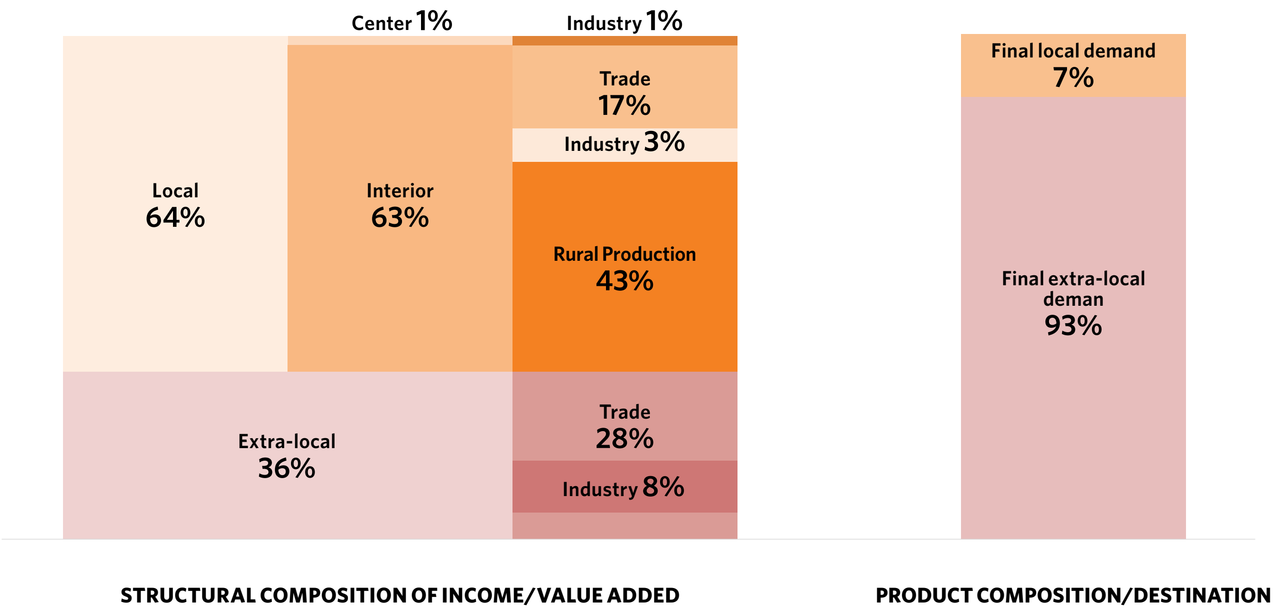
IR-Xingu covers an area of 250,800 sq. km distributed across 10 municipalities: Altamira, Anapu, Brasil Novo, Medicilândia, Pacajá, Placas, Porto de Moz, Senador José Porfírio, Uruará, and Vitória do Xingu. With a Value Added (VA) of BRL1.3 billion and a 22 percent share of EcoSocioBio-PA, it is the RI's third most important productive base.

Local production accounted for 64 percent of the VA generated, divided between the IR itself (63 percent) and the center (1 percent). Considering all sectors (third column in Chart 3.4-1), the rural sector had the highest share (43 percent), followed by extra-local trade (28 percent), and extra-local industry (8 percent); trade in the IR itself accounted for 17 percent and industry for 3 percent (Chart 3.4-1).

With regard to final demand, as much as 93 percent of the production generated in EcoSocioBio-Xingu went to meet domestic and global demands. Local needs absorbed 7 percent of the product generated (fourth column of Chart 3.4-1). EcoSocioBio-Xingu is therefore an important export base for the IR.

Employment associated with this production totaled 39,700 workers, with 80 percent in the IR itself; 82 percent in rural production; 17 percent in trade; and 0.7 percent in industry. The Domestic Economy, in turn, concentrated 20 percent of all jobs in the trade sector (Table A.2.3-4).

Chart 3.4-1 Value Added/Income Distribution and Destination of EcoSocioBio-Xingu Product



Source: Table 5.1-1.

4.4.1 Rural production, structures and productive systems

The value of the rural production of EcoSocioBio-Xingu, considering the products analyzed here, grew between 2006 and 2019 at the average rate of 14 percent p.a.: from BRL208.4 million in 2006 to a maximum of BRL1.1 billion in 2016 and then down to BRL577.6 million last year.

This production is organized in the context of the IR-Xingu Agrarian System (SA-Xingu), representing 32 percent of its total GVAP in 2017. With 25,596 rural establishments, SA-Xingu is formed around four technological trajectories:

1. T4 commercial. With 2,993 establishments and 9,814 workers, it accounts for 30 percent of SA-Xingu's GVAP. Its productive systems are dominated by beef cattle (79 percent of its GVAP, followed by temporary crops (12 percent) and permanent crops (4 percent); and milk (4 percent) (Chart 3.4.1-1 Chart);

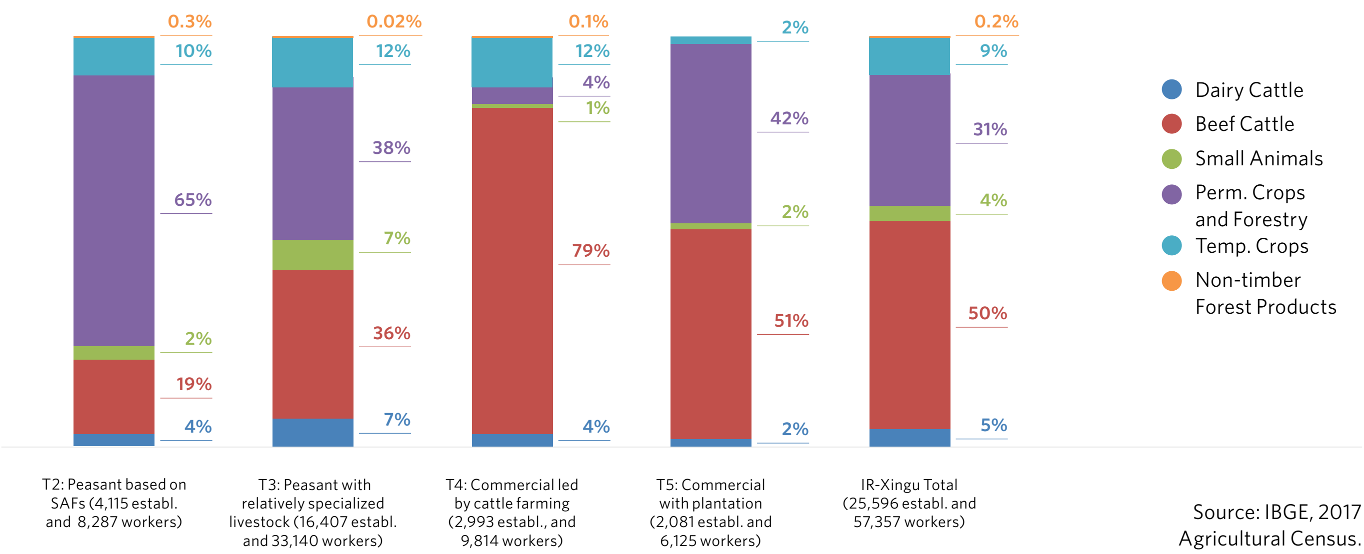
2. T5 commercial. With 2,081 commercial establishments that employ 6,125 workers and a 22 percent share of the SA's GVAP, it is based mainly on homogeneous plantations of permanent crops (42 percent of its GVAP) and beef cattle (51 percent);

3. T2 peasant. With a group of 4,115 establishments and 8,278 workers who are responsible for 10 percent of SA-Xingu's GVAP, its production processes are based on SAFs-A, cultivated species (65 percent of its GVAP stems from permanent crops; 46 percent of the SA's total GVAP); beef cattle (19 percent); temporary crops (10 percent); and dairy farming (4 percent);

4. T3 peasant. With beef cattle farming, it presents a peculiar characteristic in IR-Xingu: permanent crops (38 percent of its GVAP) share with beef cattle farming (36 percent of the GVAP) the primacy of production in systems that also include temporary crops (12 percent), small animals (7 percent), and dairy farming (7 percent) (Chart 3.4.1-1 and Chart 3.4.1-2).

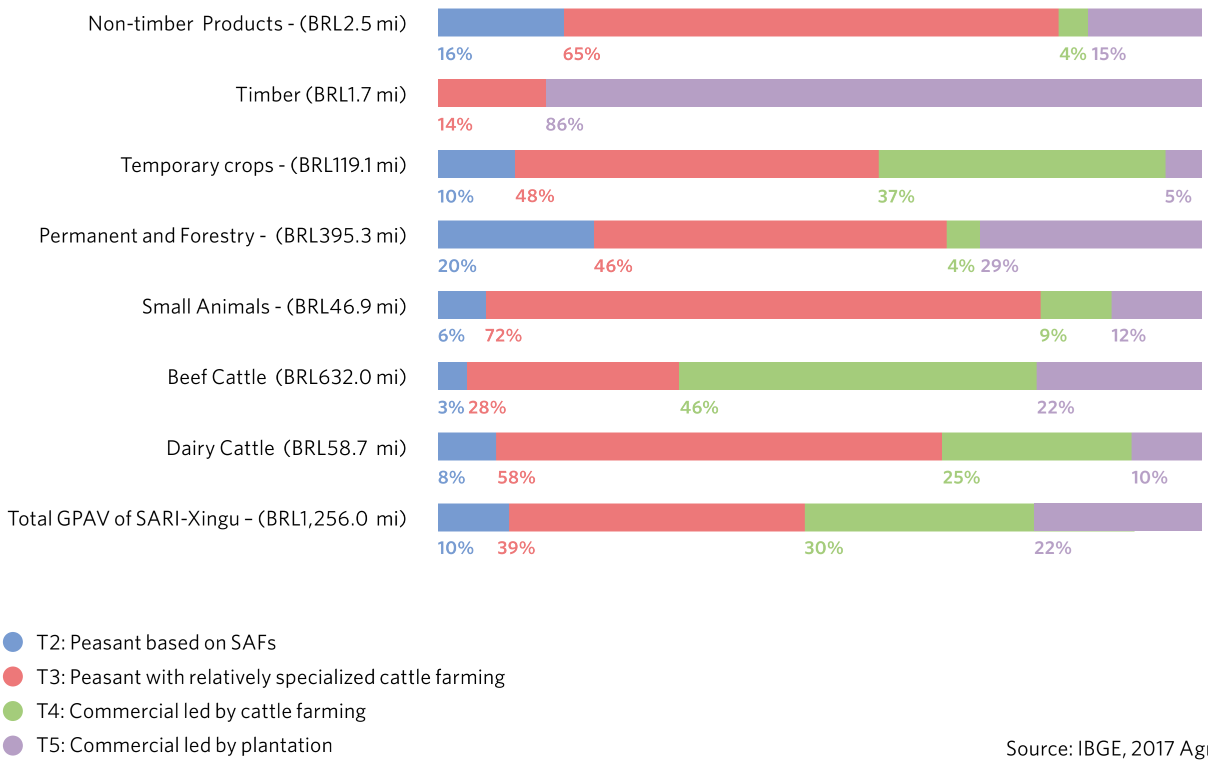
The two peasant trajectories mentioned are the foundation par excellence of EcoSocioBio-Xingu, accounting for 66 percent of its products' GVAP. As the rural base of EcoSocioBio, they are significantly responsible for guaranteeing food availability in the IR, since they account for 58 percent of the GVAP of temporary crops (cassava, corn, and beans), 78 percent of small animal rearing and 66 percent of milk production. Its productive systems are similar in complexity and diversity to those of T2 in IR-Tocantins, handling a high number of products and activities (34 and 50) and with a relatively high SDI (2.1 and 2.8) (Chart 3.4.1-3).

Chart 3.4.1-1-1 SA-Xingu's Agrarian System – composition of productive structures (% of total GVAP of the productive structure)



Source: IBGE, 2017 Agricultural Census.

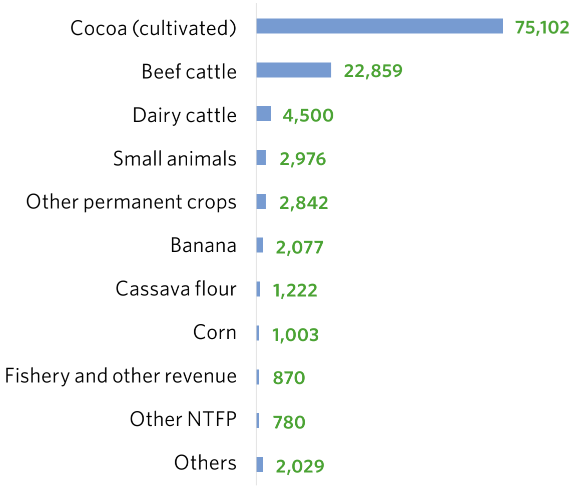
Chart 3.4.1-1-2 IR-Xingu's Agrarian System - Share of productive structures in groups of products (% of GVAP)



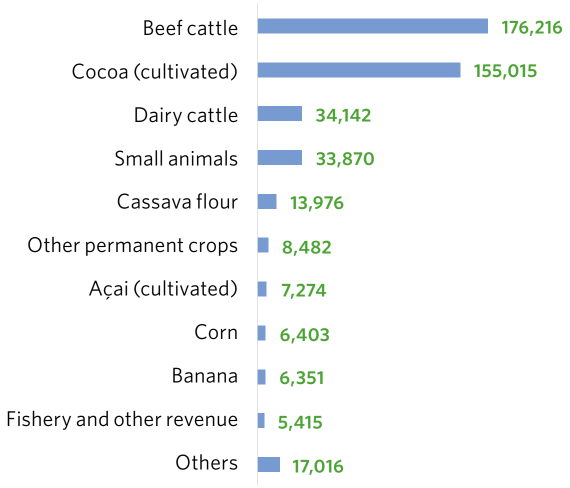
Source: IBGE, 2017 Agricultural Census.

Chart 3.4.1-1-3 Main products and activities of peasant and commercial Ts in Xingu in 2017 (GVAP at BRL 1,000.00)

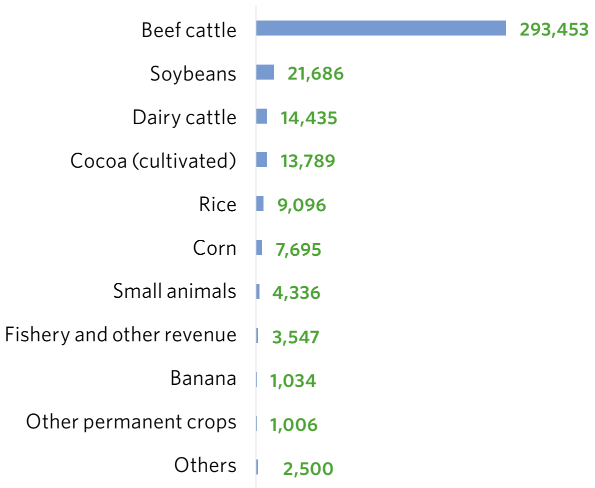
T2-Peasant based on SAFs
Total number of products: 34
Shannon Diversity Index (IDS): 2.1



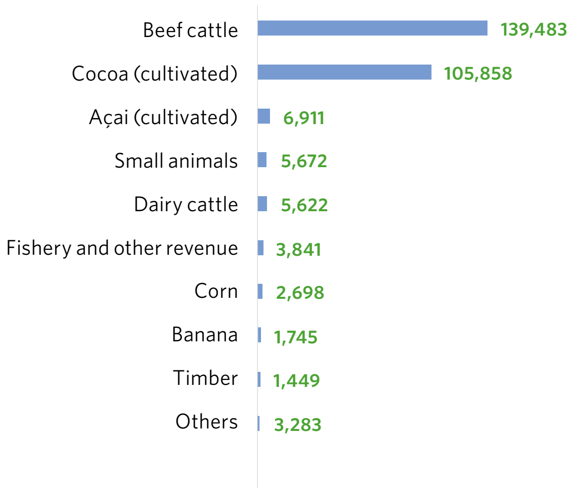
T3-Peasant wtih relatively specialized livestock
Total number of products: 50
Shannon Diversity Index (IDS): 2.8



T4-Commercial led by cattle farming:
Total number of products: 32
Shannon Diversity Index (SDI): 1.5



T5-Commercial led by plantations
Total number of products: 31
Shannon Diversity Index (SDI): 2.0



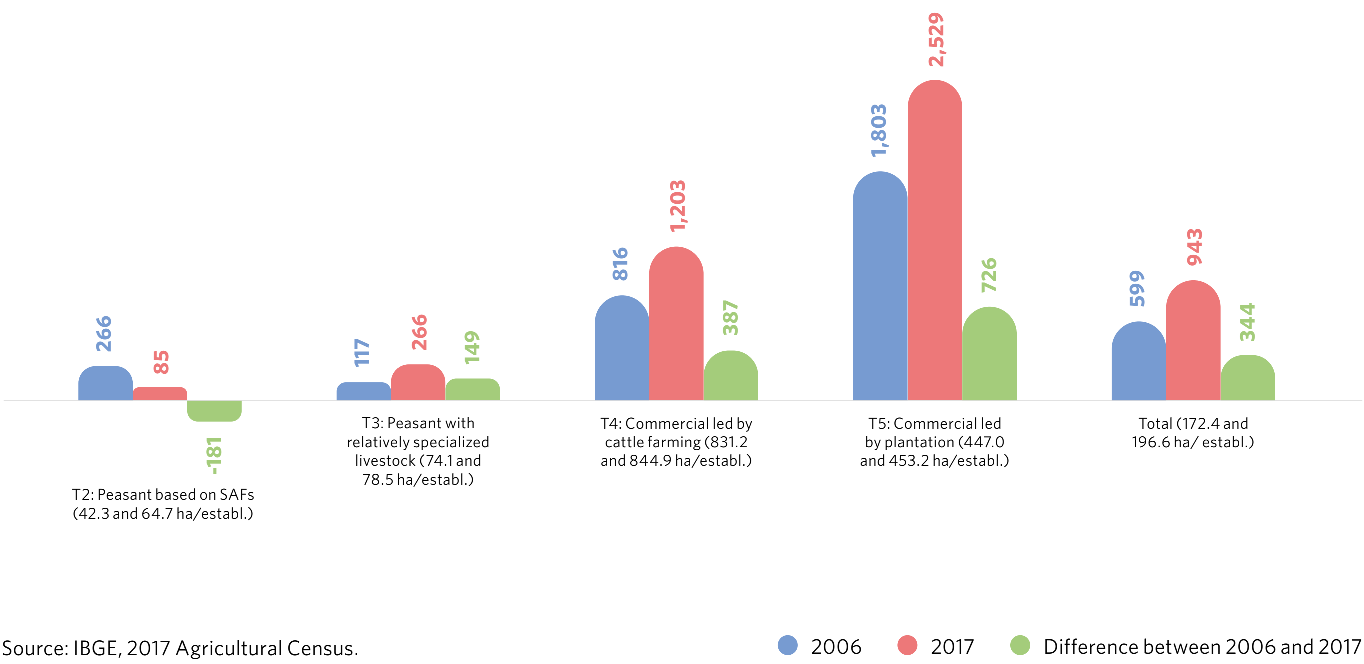
Source: IBGE, 2017 Agricultural Census.

4.4.2 Institutions, land resources and land use

4.4.2.1 Private land holdings

With the agricultural establishment as an information unit, agricultural censuses provide information about the private land domain of rural families and businesses. In the 2006 and 2017 agricultural censuses, the stocks of land under the control of the owners of establishments registered in IR-Xingu totaled 3.6 million and 5.0 million hectares, respectively: a 40 percent increase. In relative terms, T2 land holdings grew the most (127 percent), followed by T5 (57 percent), T3 (47 percent), and T4 (40 percent). (Chart 3.4.2-1).

Chart 3.4.2-1-Distribution and average allocation of land resources of establishments by trajectory in SA-Xingu, 2006 to 2017, in 1,000 ha.



Source: IBGE, 2017 Agricultural Census.

The agrarian reform programs provided a partial institutional coverage of the land base of the peasant families of IR-Xingu. By 2016, the different settlement modalities of agrarian reform reported having designated land for 14,722 families, which accounts for 39 percent of the 20,522 peasant establishments registered in the IR in 2017. There are 14,722 registered peasant establishments that should have institutional coverages different from those offered by agrarian reform programs: inheritance, purchase from private agents or public agencies, adverse possession, etc. (Table 3.4.2-1).

Table 3.4.2-1 Distribution of private, common use, and public areas (ha) and associated carbon stocks (Mton) in IR-Xingu

	Famílias camponesas (N)	Média por família (M)[3]	Área privada (A)	Áreas comuns de camponeses em assentamentos (C) 7[4]	Áreas designadas pela reforma agrária (R)	Total (F)
Agrarian Reform Movement						
Settlement - INCRA	3,277	103.7	339,728	-	339,728	
Extractive Settlement - INCRA	2,013	75.7	152,429	431,276	583,705	
State Settlement	510	73.4	37,416	-	37,416	
Extractive Reserves - INCRA[2,3,4]						
Extractive Settlement - State[3,2]						
Quilombola communities - State						
Agrarian reform peasants	5,800	91.3	529,572	431,276	960,849	
Non-agrarian reform peasants[1,2]	14,722	39.7	583,812	14,722		
Land Stock						
Peasant establishments in the census (I)[5]	20,522	75.7	1,552,972			1,533,972
Peasants' common use land in settlements (II)[6]				431,276		431,276
Peasants' work territory (III=I+II)						1,985,248
Land of commercial establishments in the census (IV)[5]						3,472,001
Indigenous Land (V)[7]						9,701,593
Conservation Units (VI)[7]						10,455,827
Other areas (VII=VIII-V-IV-III)						-
Total (VIII)[7]						**25,614,669**
Carbon stock						
Peasant establishments in the census (I)[8]						145
Peasants' common use land in settlements (II)[9]						88
Peasants' work territory (III=I+II)						233
Land of commercial establishments in the census (IV)[10]						417
Indigenous Land (V)[11]						1,883
Conservation Units (VI)[11]						1,780
Other areas (VII=VIII-V-IV-III)						-
Total (VIII)[11]						**4,305**

Source: IBGE, 2017 Agricultural Census; INCRA and ITERPA, list of designations. See notes in Table 3.1.2-1.

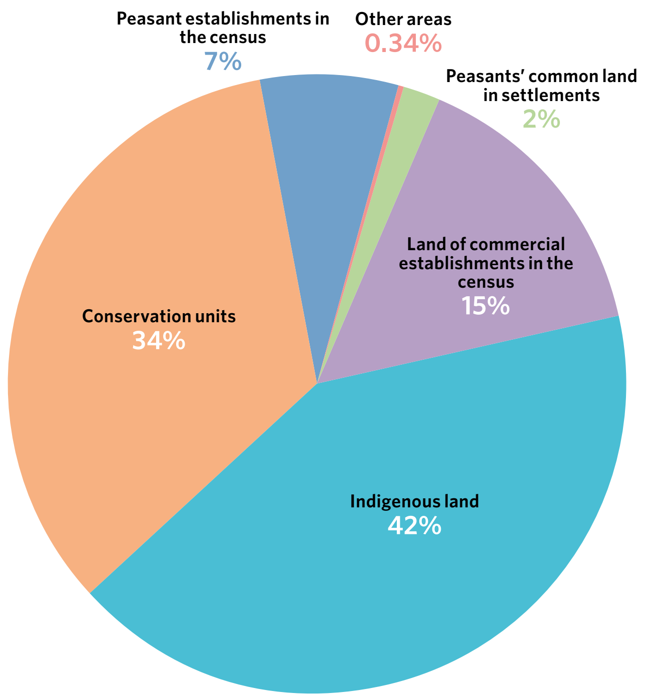
4.4.2.2 Uses of private and common use lands: the "working territory" of EcoSocioBio-Xingu

Families settled by agrarian reform programs were registered as establishments and, as such, declared the resources over which they had private control. Under the premise that the average of their land holdings did not exceed the average of all peasant establishments registered in IR-Xingu and based on the total land granted, the total land holdings of these officially settled family establishments is estimated at 529,600 ha (see methodological notes in Table 3.4.2-1). Given that agrarian reform projects guaranteed these families access to 960,800 ha, the difference of 431,300 ha should be considered as formally recognized common resources. Thus, a peasants' "work territory" can be seen, which makes up the productive base of EcoSocioBio-Xingu, comprising the establishments' areas (1.554,000 ha) plus the common use areas (431,300 ha), totaling 1.985,200 ha.

4.4.2.3 Private lands, common use peasants' land, indigenous land, and public land

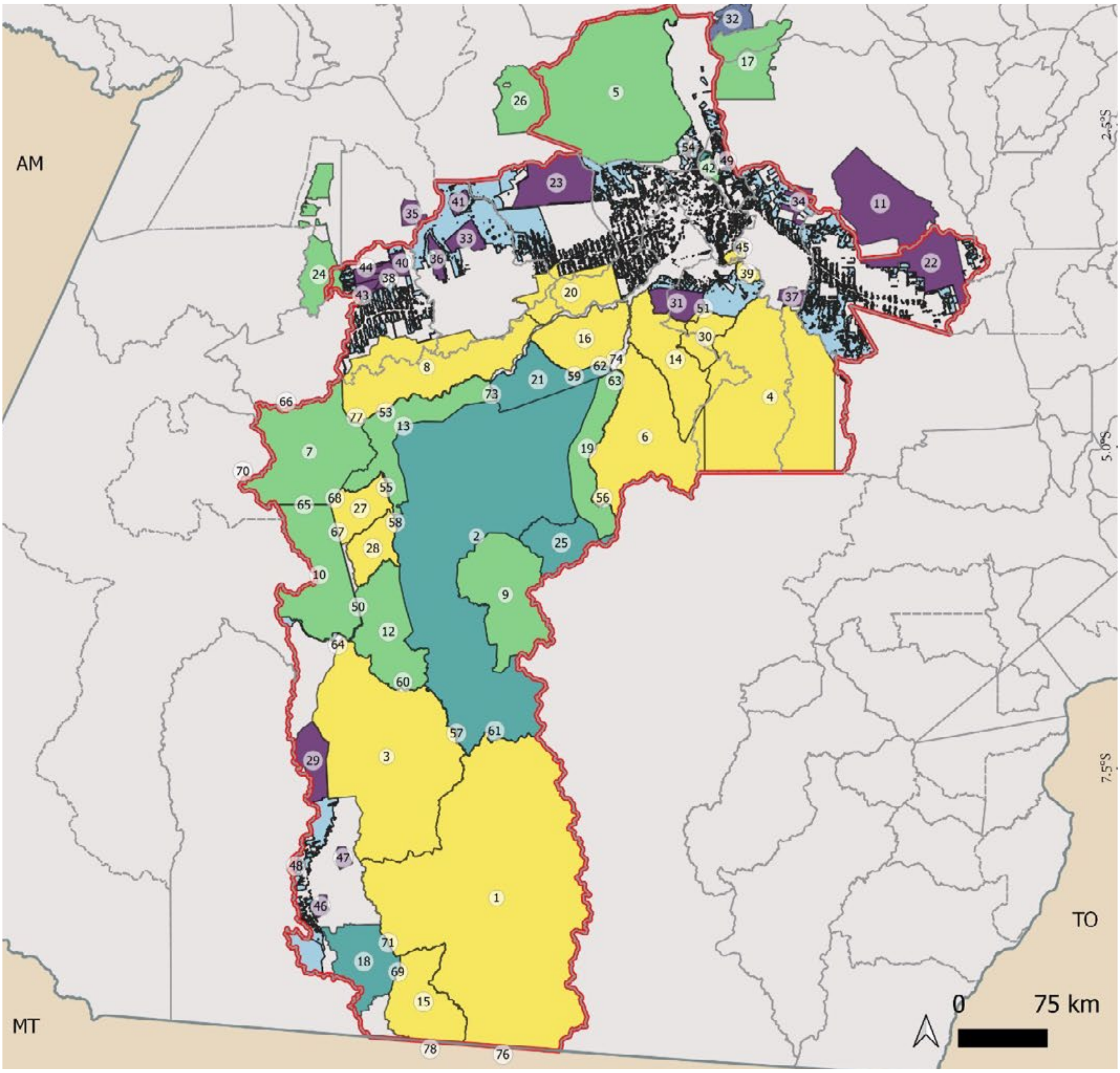
Once the distinction between (peasant and commercial) private land and land designated as peasants' common use land has been made, the balance of land distribution in IR-Xingu, is concluded, as show in the second part of Table 3.4.2-1 and Chart 3.4.2-3: together, peasant and commercial establishments control 22 percent of the land, with 7 percent and 11 percent respectively; common use land used by settled peasants accounts for 2 percent; land in official reserves for 34 percent and indigenous land for 42 percent; there is also a residual of 0.34 percent of land in other situations, including vacant land in the IR. The spatial distribution of designated land in different situations, indigenous and reserve land, and public vacant land is shown in Map 3.4.2-1.

Chart 3.4.2-3 Land situation of the total IR-Xingu area



Source: see Table 2.3.2-1.

Map 3.4.2-1. Spatial distribution of designated land in different situations, indigenous and reserve land, and public vacant land in IR-Xingu



- Settlements: PAE/PDS/PIC/PEAS/PEAEX
- Quilombola Territories
- Integral Protection Conservation Units
- Sustainable Use Conservation Units
- Indigenous Land
- Other Public Forests/National Registry of Public Forests

Limits

- Integration Region
- Municipalities
- State of Para

Source: Developed from the shapefiles of the National Register of Public Forests (CNFP/SFB) and Land Institute of Pará (ITERPA). Legend: Annex 3

4.4.3 Production and environment

Using georeferenced reading methodologies it is possible to see in IR-Xingu, that the average CO2 stock is 93.3 Mt per hectare in properties smaller than 100 ha and 120.2 Mt in those bigger than (Table A.1.3-1). Applying these parameters to peasant and commercial trajectories, respectively, results in a total stock of 7.9 Mt for T1, 24.8 Mt for T2 and 112.2 Mt for T3; 303.9 Mt for T4, and 113.4 Mt for T5 (Chart 3.4.3-1). Carbon balances, in turn, show the following net emissions: 4.8 Mt for T2 (the negative sign indicates net emission), 38.8 Mt for T3, 115.3 for T4, and 30.6 Mt for T5.

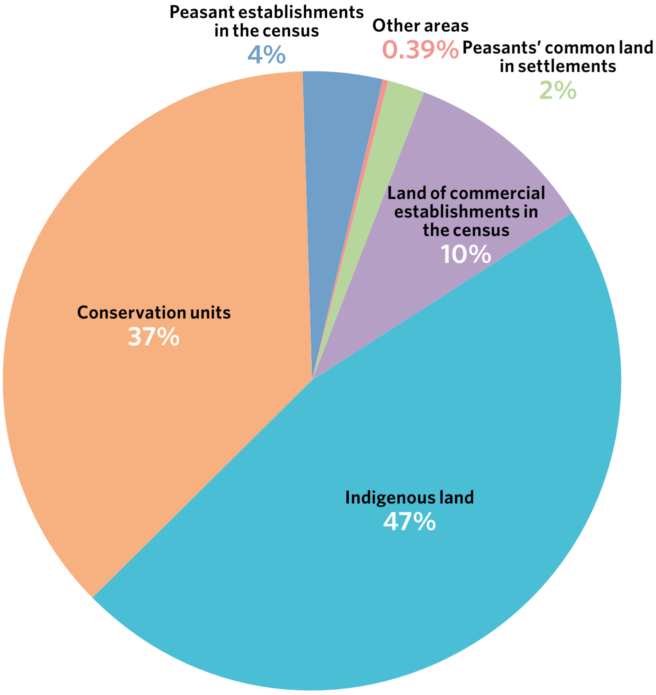
Furthermore, a total stock of 88 Mt was found associated with common use land of establishments linked to agrarian reform (Table 3.4.3-1; CO2 parameter Table A.1.3-1). The total CO2 stock associated with EcoSocioBio's "work territory" in IR-Xingu would reach 233 Mt.

Chart 3.4.3-1 CO2 stock and balance in private land of the establishments that make up the productive structures linked to IR-Xingu

Source: See notes in Chart 3.1.3-1.

Carbon stocks were obtained for common use and public land in the IR, as well as for private land, allowing a comparative observation between the different modalities of land control and access. Conservation units account for 37 percent of the carbon stock; indigenous land for 47 percent; common use land of settled peasants for 2 percent; commercial establishments in the census for, 10 percent, and peasant settlements for 4 percent. The remaining areas in the IR, including vacant land, would account for 0.39 percent of the carbon stock in Xingu (Chart 3.4.3-2).

Chart 3.4.3-2 Carbon stocks in different land situations in IR-Xingu



Source: Table 5.2.2-1.

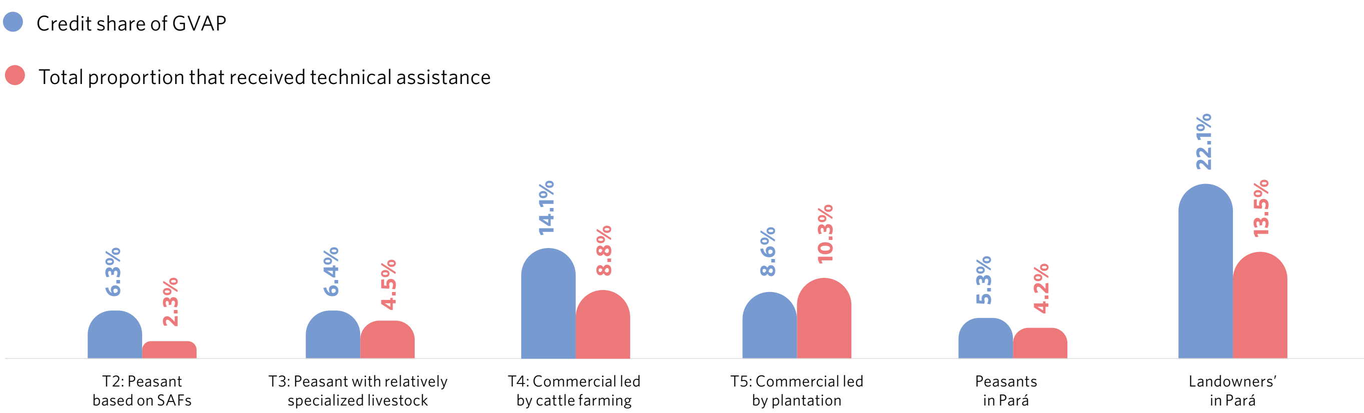
4.4.4 Institutions, credit and knowledge

Formal and informal institutions of access to technological knowledge and capital are fundamental for the dynamics of the trajectories and their respective competitive capacities (Costa, 2013; Costa and Fernandes, 2016).

The amount of credit granted to T2 and T3 in IR-Xingu in 2017 was equivalent to 6.3 percent and 6.4 percent of the respective GVAP in the same year, while the T5 and T4 proportions were 8.6 percent and 14.1 percent, respectively; the average in the whole of Pará was 5.3 percent for peasants and 22.1 percent for commercial (Chart 3.4.4-1).

The asymmetries with regard to technical assistance are also striking: 2.3 percent of T2 and 4.5 percent of T3 establishments received technical assistance, against 8.3 and 10.3 percent of T4 and T5 commercial establishments; the averages for peasant and commercial establishments in Pará are 4.2 percent and 13.5 percent, respectively (Chart 3.4.4-1).

Chart 3.4.4-1 Indicators of production promotion policies in IR-Xingu, forms of peasant and commercial production, 2017

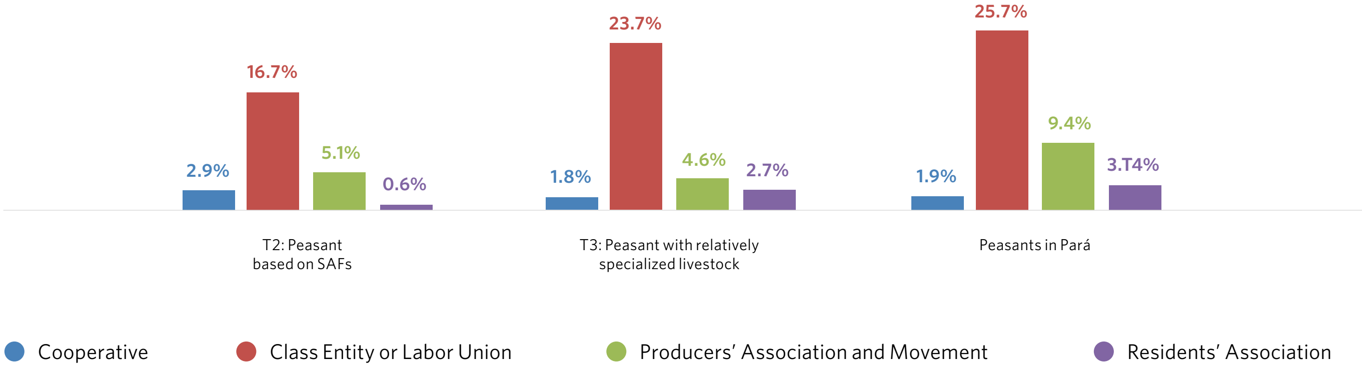


Source: IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations. Central Bank of Brazil.

4.4.5 Producers' organization

The level of cooperativism among peasants of EcoSocioBio in IR-Xingu is low. The higher level is found among those in T2 (2.9 percent), which is above that of peasants in Pará (1.9 percent). However, the unionization rate is 16.7 percent in T2 and 23.7 percent in T3, both below the average for peasants in Pará. A similar situation is found for participation in associations in IR-Xingu (Chart 3.4.5-1).

Chart 3.4.5-1-Indicators of producers' organization in SA-Xingu, 2017



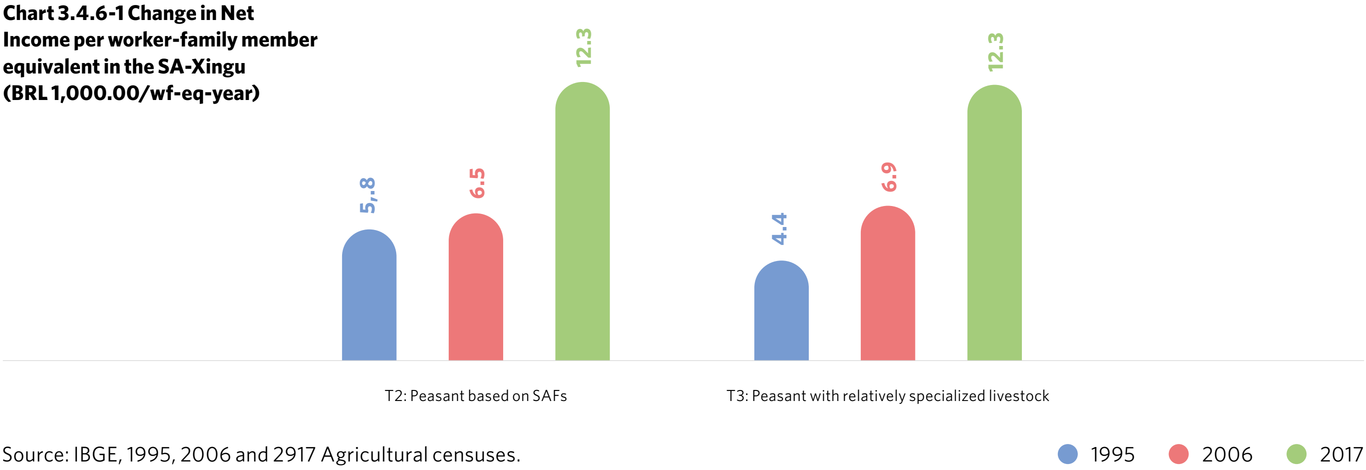
Source: IBGE, 2017 Agricultural Census. GPDadesaNAA database and special tabulations. Central Bank of Brazil.

4.4.6 Net income from work

The annual net income (NI, which is equal to GVAP minus the production costs declared in the censuses) per worker-family member equivalent -year (wf-eq-year) is a crucial indicator of the economic efficiency of peasant-based agricultural structures (Costa, 2012). In EcoSocioBio-Xingu, the $NI_{wf\text{-}eq\text{-}year}$ of both underlying peasant trajectories has shown continued growth.

A modest increase was recorded between 1995 and 2006, when *the* $NI_{wf\text{-}eq\text{-}year}$ of T2 went from BRL5,800 to BRL6,500 and that of T3 jumped from BRL4,400 to BRL6,900. However, in the following period a stark increase of practically twofold was observed in both trajectories (Graph 3.4.6-1).

Chart 3.4.6-1 Change in Net Income per worker-family member equivalent in the SA-Xingu (BRL 1,000.00/wf-eq-year)



Source: IBGE, 1995, 2006 and 2917 Agricultural censuses.

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Hortmix
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Part 2

Public policy applied to the value chains of EcoSocioBio-PA products and development of potential value scenarios

1. Introduction

Economies based on Non-Timber Forest Products in the State of Pará are dynamically structured in the Peasant Technological Trajectory "T2-Peasant based on SAFs", guided by technical solutions founded either on the management of resources from the biome, which we call Type F Agroforestry Systems (SAFs-F), or on "agro-silvicultural systems" that seek to reproduce the ecological functions of the biome, which we refer to as Type A Agroforestry Systems (SAFs-A). The stimulus of these trajectories should be the fundamental strategy of public policies that strive to ensure the sustainable development of the Amazon through a bioecological bioeconomy model.

T2 is responsible for one of the economies that has grown the most in Pará in the past three decades (COSTA, 2020). It generates employment and income in rural and urban areas, has low emission levels and a high carbon fixation capacity in addition to a low impact in terms of environmental degradation. Moreover, it maintains the original characteristics of the biome and is indispensable to its regeneration through various forest restoration strategies in SAFs. The great dynamism of T2, expressed in the high growth rates of the economy it drives, unfolds into a complex web of relations between peasants, merchants, industries, and urban markets, from the most localized space circuits to the (sometimes) long circuits that involve domestic and international urban-industrial markets (Costa, 2015).

The great dynamism and upward movement of T2 in the context of the economy of Pará is based mainly on the investment capacity of farmers or on access to credits arising from the relations woven with players of the commercial system and the industrial sector. Productive activities unfold into arrangements and production chains that, in turn, generate effects of income transfer to the rural sector. But it should be noted that this movement occurs despite the fact that T2 is the trajectory with the lowest rate of participation in public policies that often fail to properly reach the players of this trajectory. It is, in fact, the rural economy driven by the technological trajectory with the lowest institutional density (COSTA, 2012; 2013).

To correct this reality, policies should focus on the specificities of T2 economies, so that they are able to stimulate the phenomenon described in COSTA (2020, 2013, 2012), according to which in the past 20 years there have been statistically and spatially relevant transitions of peasant trajectories based on agriculture and livestock (T1 and T3) to T2, mainly through forest restoration initiatives in SAF. In this regard, existing policies and others that may stimulate T2 knowledge, products, chains, and productive arrangements should be improved or created so as to cater to type F Agroforestry Systems (SAFs-F) or type A Agroforestry Systems (SAFs-A), which are the fundamental technical bases of EcoSocioBio-PA.

In order to provide public policy guidelines to the value chains of EcoSocioBio-PA products, this volume starts by making a detailed presentation of public policies applied to socio-biodiversity products at the federal and state levels (Section 2). Next, public policy recommendations are made in six major Strategic Areas, whose implementation requires their concomitant development to enable achieving scale and effectiveness in the desired transformation (Section 3).

Finally, in order to indicate the importance of future income generation by the value chains of EcoSocioBio-PA products, as well as potential outcomes from the implementation of the recommended public policies, an exercise to project the potential economic value will be conducted for ten products selected as strategic, namely: i) açai; ii) Brazil nuts; iii) açai palm; iv) honey; v) cupuaçu; vi) buriti; vii) cocoa; viii) copaiba; ix) andiroba; and x) cumaru (Section 4).

The methodology proposed for calculating the potential value is based on the development of trend and public policy-based economic scenarios, considering the contextual statistics of EcoSocioBio-PA's production as well as of the results of Alpha Social Accounts, that is, the Input-Output Matrices that describe the value chain at the local (state of Pará) and national level.

As in other segments of the economy, the projection of the future economic results of a given market has uncertainties associated with several factors, such as the difficulty in predicting the behavior of the players that make up the product supply and demand sides, as well as the exogenous factors that interfere with them and the real effects of a given economic policy for the sector. The scenarios are projections that lack total control over the variables that interfere in the market of EcoSocioBio-PA products, so they provide an approximation of the expected value.

In order to estimate the impact of some recommended policies that could be implemented, the authors developed scenarios based on two components. The first component entails observing the behavior trend of quantitative production (in terms of tons) and monetary production variables (in terms of price) over the past 14 years, i.e., from 2006 to 2019. This stage enabled developing the trend scenario, which as expected projects the contextual behavior of quantity and price by 2040 and, therefore, estimates the value added of the links of the value chain of the analyzed products. The second component was based on assumptions that portray different political development goals based on two objectives: i) verticalization or integration between the links of the processing and transformation industry based on cost reduction policies with intermediate inputs, thus contributing to the strengthening of certain links of the chain and to the redistribution of the income generated between domestic and local economy players; ii) sharing of the value associated with the climate regulation guaranteed by carbon stock of forest conservation, as predicted by Perman et al. (1996) and Porter and Kramer (2011).

2. Existing public policies applied to socio-biodiversity products

2.1 The Institutionalization of NTFPs in Federal Public Policies in Brazil

In different countries and contexts, the phrase "non-timber forest products" (NTFP) has been coined to show opposition, independence, or complementarity to the realm of thought and political action centered on logging in tropical forests. It is a political construction created from different references and interests by conservationists, corporations, social movements, governments, and academics (LAIRD et al, 2015).

Although the notion of ecosystem service is contemporary to that of NTFP - both date back to the 1980s -, it was only in the late 1990s that it began to influence the public debate about forests (and other ecosystems). Ecosystem services would be the conditions and processes through which natural ecosystems, and the species that make them up, sustain

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and fulfil human life. These services maintain biodiversity and the production of ecosystem goods such as such as seafood, forage, timber, biomass fuels, natural fibers, and pharmaceuticals, among others (DAILY, 1997).

The search for the "construction of meanings" regarding the place of NTFPs in sustainable development possibilities made headway in the field of public policy. The process of disputes over the construction of "meanings" influenced the definition of the problems to be tackled as a priority, the strategies to be adopted and the means to implement public action in different national spaces. The attempt to value the capacity of NTFP-based economies to outweigh the opportunity costs of land uses that promote deforestation was not without dissent. Often, interpretations have been contradictory about how to assess and project gains of scale and scope and how to interpret the role of and plan incentives for key players and sectors of NTFP-based economies.

In an effort to review the results of the implementation of public policies for NTFPs in different countries, Laird et al (2010) comment that policies that directly or indirectly target NTFPs are generally a complex and often confusing mix of measures developed over time with little coherence or coordination and are rarely a coordinated body of structural and sectoral policies. According to the authors, the regulation of NTFPs have often been excessively bureaucratic and too difficult to be understood by peasants. Moreover, local, state, and federal laws and policies have been poorly integrated. For the authors, many policies were the result of the coordination of dominant groups (capitalized farmers, commercial sectors, etc.) to increase their control over the production and trade of NTFPs, such as policies that subsidized the domestication and agricultural intensification of NTFP species through credits and technological development based on the mechanical-chemical paradigm directed to commercial sectors (LAIRD et al, 2010).

In Brazil, federal and state governments have launched an increasing number of policies to promote forest conservation and the sustainable development of the Amazon by incentivizing NTFPs. Environmental conservation and the economic uses of biodiversity were left out of the major regional development programs for the Amazon between the 1950s and 1990s. Such programs focused on making public investments in infrastructure (transport, energy, urban projects) and concessions, tax incentives and credit facilities for livestock, logging and mining projects. Public and private colonization projects that resulted in the spontaneous migration of thousands of peasants from other regions to the Amazon were also prioritized. An increase in the heterogeneity of peasant and commercial structures in the regional agrarian base was recorded in the period, as historical forest and wetland (*várzea*) peasantries were joined by agricultural peasantries from other regions while traditional oligarchic elites were strengthened by capitalist farmers and entrepreneurs (COSTA, 2012).

As a result, numerous conflicts linked to competition for space and use of natural resources were recorded over the period, characterized by the clash between the implementation of the private property logic promoted in large projects and the forms of land appropriation used by local populations that relied on the direct use of natural resources (BUNKER, 1985; FOWERAKER, 1981; MACHADO, 1998; MARTINS, 1997; SCHMINK; WOOD, 1984). The attempt to alleviate land conflicts led to the implementation of a partial and incomplete agrarian reform (HÉBETTE, 2004), (LOUREIRO; PINTO, 2005) through the regularization of the land tenure of agricultural peasants in the form of agrarian reform settlements (TORRES, 2012). A significant change in this context began to occur in the 1980s due to the planetary ecological crisis, one of the main explanatory elements of which was the deforestation of the Amazon.

Deforestation and intense and violent territorial and land conflicts contributed to highlight the environmental issue in the Amazon starting in the 1980s (ALMEIDA, 2004; WEDGE; ALMEIDA, 1999; LE TOURNEAU, 2006). Widespread in society, the environmental issue was absorbed by social movements, giving rise in a particular way in the region to the so-called "social environmentalism" which, in general, refers to situations in which environmental movements coordinate politically with social, indigenous, and forest-based peasant movements (SANTILLI, 2005) to seek the recognition of rights and the valorization of social and ecological diversity in the region.


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The notion that the economic use of the forest would be one of the main alternatives for reducing deforestation was pivotal for the emergence of new territorial categories in the state apparatus. These innovations occurred both in state organizations responsible for policies and programs related to environmental conservation (IBAMA and later ICMBio) and in the sectors responsible for the agrarian reform (INCRA) (ALEGRETTI, 1994; ARAÚJO; LÉNA, 2010). In practice, these institutions sought to respond to the great socio-ecological mobilizations unleashed in the Amazon in the 1970s. As in the case of rubber tappers in Acre, who spearheaded by the trade unionist Chico Mendes gained international repercussion with the clashes (ALMEIDA, 2004) that led to the first Extractive Settlement Projects implemented in Amapá in 1987 and in the first RESEX established in Acre in 1989. In 1996, INCRA introduced the PAE modality to replace the extractive settlement (LE TOURNEAU; BURSZTYN, 2010) and in 2000 the Brazilian National System of Conservation Units was finely established.

These territorial modalities emerged to sustain the "socio-environmental pact" between Brazilian society and traditional populations, with a view to ensuring the socio- environmental sustainability of the Amazon (ARAÚJO; ALVES, 2008; WEDGE; ALMEIDA, 2001). Thanks to the political impacts of this pact and to the pressure of the international agenda, the Brazilian government implemented political measures that favored the recognition of land rights and land uses linked to the so-called "traditional populations". Considering that their means of subsistence was the ecological management of the forest for extractive and agroforestry activities, they were chosen as the main agents of environmental conservation. In this sense, these traditional populations should maintain and improve the ecological management due to its ability to simultaneously ensure their social production and reproduction and keep the forest standing. It is precisely in these populations, through the maintenance of the original characteristics of the regional ecosystems – and in the latter, through the maintenance of the forest cover – that lies the socially shared interest in providing them with political support.

In the Amazon in particular, the conservationist movement that emerged around "social environmentalism" understood that social groups (indigenous people, forest-based peasantries, hereafter called "traditional populations") that managed the original ecosystems (forests, wetlands) would be structurally and culturally conservationists and therefore interested in the survival of extractivism and its structures that had been regarded as dormant for generations. The conservationist movement chose indigenous people and extractive peasants as partners and saw agricultural peasants as agents of deforestation, without distinguishing them from commercial agriculture. Agricultural peasant structures were considered as a large and unique structural unit that was both inefficient from the economic perspective and destructive from the environmental perspective and, therefore, undesirable in regional development sustainability-based plans, programs, and policies (COSTA, 2012). Considerations of this nature would change in the first two decades of the 20th century with the political expansion of the agroecological movement and forest restoration agendas, as we shall see below.

In addition to the land regularization initiatives already mentioned, many sustainable development projects began to earmark unprecedented investment flows for indigenous and "traditional" populations, as a result of large international cooperation projects, such as the Pilot Program for Tropical Forests in Brazil (PPG7), whose experiences were evaluated by Becker (2010). Since then, attempts have been made to associate the management of NTFPs with the identities of indigenous, quilombola, riverine, and wetland populations as well as of nut pickers, rubber tappers, andiroba pickers, and babassu coconut breakers among others, as a conservation strategy based on "socio-biodiversity".

Decree No. 4,339 of August 2002 (BRAZIL, 2002) launched the National Biodiversity Policy, with a view to promoting biodiversity conservation and the sustainable use of its components, with the fair and equitable distribution of benefits derived from the use of genetic resources, genetic heritage components and associated traditional knowledge. Four years later, Decree 6,040 of 2007 created the National Policy for the Sustainable Development of Traditional Peoples and Communities (PNPCT), with the objective of promoting the sustainable development of traditional peoples and communities and family farmers (PCTAFs), with emphasis on the recognition, strengthening and guarantee of their territorial, social, environmental, economic, and cultural rights and on the coordinated participatory construction of community development plans, in addition to regional and local forums (BRAZIL, 2007).

In 2008, some NTFPs were included in the Minimum Price Guarantee Policy (PGPM-BIO), which defined criteria for granting economic and minimum price subsidies through the instrument called Direct Subsidy to the Extractive Producer

(SDPE). The payment of subsidies was based on reference values of minimum prices based on the variable cost of production. From 2009 to 2017, approximately 70 percent of minimum prices were set at the same level as their variable costs (SOUZA, 2018 apud Brasil, 2019).

In 2009, two other important decrees were issued. Decree No. 6,874 of June 5, 2009 established the National Program for Community and Family Forest Management (PMCF), with the objective of organizing actions for the management and promotion of sustainable management in forests used by family farmers settled by the agrarian reform and by traditional peoples and communities. And the National Plan for the Promotion of Socio-Biodiversity Product Chains (PNPSB) to strengthen chains and consolidate sustainable markets for non-timber forest products. This policy consolidated the phrase "socio-biodiversity products", which was defined as:

> *"Goods and services (finished products, raw materials or benefits) generated from biodiversity resources, aimed at the development of productive chains of interest to traditional peoples and communities and family farmers, which promote the maintenance and enhancement of their practices and knowledge, ensuring their rights, generating income, promoting their quality of life, and improving the environment in which they live." (BRAZIL, 2009).*

It is interesting to analyze the scope of these policies by establishing parallels with the analysis by Grisa and Schneider (2015) of the design trajectory of family farming public policies in Brazil, emphasizing how some benchmarks were strengthened at certain moments in the country's recent history and how they were, in a way, both the cause and consequence of the relations between the State and civil society.

During the 1990s, according to the authors, an agricultural (credit, infrastructure, pricing policy, etc.) and agrarian (land regularization and land reform) bias gained strength, while the "family farmer" category would have been institutionalized mainly through the National Program for the Strengthening of Family Farming (PRONAF) launched in 1995, triggering other rural development policies focused on this category (family farming). The second benchmark was based on the design of social and welfare policies. The third benchmark is related to the call for greater federal government attention to vulnerable groups of family farmers, as well as to indigenous and traditional peoples and communities, in order to improve their well-being and allow them to interact in better conditions in the agricultural and labor markets (GRISA and SCHNEIDER, 2015).

The creation of programs such as PRONAF B (aimed at the most vulnerable farmers), the Harvest Guarantee Program, the Brazil Without Extreme Poverty Program (PBSM), the National School Feeding Program (PNAE), the Food Acquisition Program (PAA), and the Program for The Promotion of Productive Activities illustrate the application of these benchmarks to public policies. The actions that comprised the PBSM search for rural productive inclusion considered strategies to improve basic infrastructure (water and electricity) and measures to support the structuring of production and the expansion of marketing channels through the private and institutional market, notably the PAA and the PNAE. With regard to the Program for the Promotion of Productive Activities, which was widely implemented in Pará, there was coordination between the technical assistance provided by rural extension experts, and the transfer of non-reimbursable funds to foster the productive structuring of farmers living in extreme poverty (MESQUITA et al, 2020).

In this set of policies there is strong orientation towards the construction of (private and institutional) markets and the challenge of sustainability, with a focus on agroecology and food and nutritional security, as well as on "socio-biodiversity" products, as we saw before in this section. Later on, they would be joined by differentiated credit lines from PRONAF with the aim of promoting sustainable forest exploitation activities. Examples of these credit lines include PRONAF Forest and PRONAF ECO, which were created specifically to finance sustainable forest management activities or for the implementation of agroforestry systems, but that in practice were of difficult access for EcoSocioBio-PA players.

The National Plan for the Strengthening of Extractive and Riverside Communities (PLANAFE) was established in 2015, followed, two years later, by the National Plan for the Recovery of Native Vegetation (PLANAVEG) established by Decree No. 8,972 of January 23, 2017. These policies represent opportunities for the management of NTFPs in forests and agroforestry systems.

2.2 State public policies to strengthen the socio-biodiversity of traditional populations in the state of Pará

The timeline of environmental management in Pará is divided into two phases. The first, which lasted until the end of the 1980s was linked to large federal government projects for the occupation of the Amazon through the Development Plans promoted by SUDAM - Superintendence of Development of the Amazon. The second started in the 1990s, when a global consensus was reached on the need to reconcile economic development with environmental sustainability.

In the first phase, mineral, hydroelectric, road, timber, and agricultural exploration projects were developed during the military government, which resulted in predatory occupation, with major environmental and social impacts. At that time, environmental control was focused on health and poorly implemented by SESPA - Public Health Secretariat of the State of Pará.

With the creation of the National Environmental Policy in 1981 and the structuring of environmental management at the national level, in 1987 the State Health Council was transformed into the State Health, Sanitation and Environment Council. In 1988, the State Secretariat of Science Technology and Environment (SECTAM) was created, but was never actually implemented, staying under the management of the Department of Environment of SESPA, which is in charge of planning and implementing environmental inspection and education actions, still focused on health (TOZI, 2007).

The second phase of environmental management in the state of Pará started in 1990, with the creation of the State Council for the Environment (COEMA) motivated by the promulgation of the Constitution of the State of Pará in 1989, which, like the Federal Constitution of Brazil, dedicated an entire chapter to the environmental issue. In the wake of this new environmental awareness, SECTAM was finally implemented in 1991, bringing with it the entire Department of Environment of SESPA. However, it was only in 1993 that the new secretariat gained an organization chart of its own, with specific positions and salaries (FREITAS, 2013).

Back then, the government of Pará began to structure the state's environmental management focused on the social, economic, and ecological problems of human intervention in nature, with the creation of the State Environment Policy by State Law No. 5,887 of 05/09/1995, which defines environmental control as an instrument to effect citizenship, enhance the quality of life and improve the balance between socioeconomic development and environmental preservation.

On the other hand, influenced by the National Water Resources Policy created in 1997, SECTAM identified the protection of water resources and fishery control as priorities. Thus, these issues began to be included in environmental management actions, involving agencies and institutions of the State Environment System of Pará (SISEMA) late in the 1990s.

With so many changes in the vision and practices of environmental control, it became necessary to reorganize the environmental management structure in the state of Pará by separating it from Science and Technology. So on July 30, 2007, the then State Secretariat of Science, Technology and Environment was renamed State Secretariat of Environment and Sustainability (SEMAS) by Law No. 7026.

In the same year, the State Forest Institute (IDEFLOR) was created by State Law No. 6,963 of 04/16/2007, for the purpose of managing public forests for sustainable production and the state policy for the production and development of

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the forest chain in the State. With the exception of SEMAS' competencies in the creation and protection of public forests, as well as in the licensing, control, and inspection of forest activities, IDEFLOR is responsible for coordinating, planning, and implementing state plans and programs for the production and development of the forest chain.

A cycle of valorization of forest resources in environmental management thus began, with the creation of public forests for forest exploitation through forestry concessions, whereby concessionaires have the right to exploit native wood species through sustainable forest management. This means that companies can harvest timber and non-timber products and provide tourism services in public areas without having to purchase them, according to the Public Forest Management Law (Federal Law No. 11,284, of 03/02/2006).

The first Annual Forest Grant Plan of Pará (PAOF/PA 2008/2009), which was designed with the aim of gathering technical information about the areas under state management available for sustainable forest exploitation, proposed making 1,312,244 hectares of State Forests available to lumber companies through public bidding processes (IDEFLOR, 2008). In 2021, the forest area granted by the State of Pará for logging activities totaled 544,061.11 hectares. However, three forest concession contracts were terminated at the end of 2016 due to breach of contractual obligations. Thus, the current area granted by the State of Pará totals 483,435.49 ha, with all concessions located in the Baixo Amazonas Integration Region, in the municipalities of Almeirim, Aveiro, Juruti, Monte Alegre, and Santarém (IDEFLOR-BIO, 2021).

In the timeline of the evolution of PAOFs, it is worth mentioning that non-timber forest products and community forest management played second fiddle to logging in the first Forest Grant Plans in Pará. PAOF/PA/2009 provides for studies of the potential of non-timber products in areas surrounding the concessions, as well as for the allocation of resources for community management and value addition to extractive products, totaling BRL 5.6 million, which accounts for 12.5 percent of the total available budget (IDEFLOR, 2008).

In PAOF/PA/2011, in turn, 21 percent of the budget was allocated to the "Live Extractivism Program", for the development of use plans in agro-extractivism projects and quilombola territories; the structuring of undertakings of extractive populations; the institutional strengthening of extractive organizations; and market studies for NTFPs (IDEFLOR, 2011). In PAOF/PA/2012, 30 percent of the available budget was allocated to the Socio-biodiversity Enhancement Program, in support of community forest management; to the implementation of local development plans in areas of traditional peoples and communities; and to the promotion of value chains of forest and environmental products and services of socio-biodiversity (IDEFLOR, 2012).

Back then, in the governments in which those first PAOFs were implemented, actions aimed at the valorization of socio-biodiversity, of NTFPs and of traditional peoples and communities were encouraged by state decree No. 1,001 of 05/29/2008, which established the State Policy for the Development of Extractivism in Pará, following the guidelines of the National Policy for the Sustainable Development of Traditional Peoples and Communities established by National Decree No. 6,040 of February 7, 2007.

The main goal of the State Extractivism Policy is "to promote in an integrated manner the sustainable development of the extractive economy in the State of Pará, with emphasis on the recognition, strengthening and guarantee of territorial, social, environmental, economic, and cultural rights of extractive communities, with respect for and recognition of their identity, forms of organization and institutions" (PARÁ, 2008).

One of the most important legacies for environmental management in Pará in the second half of the 2000s was a significant intensification of land regularization in areas occupied by traditional populations. This process was implemented by the Land Institute of Pará (ITERPA), following the new modalities of land regularization created at the national level and based on the customary rights of traditional populations.

Among these new settlement modalities that INCRA refers to as "environmentally differentiated", special mention should be made of the Agro-Extractive Settlement Projects (PAE), the Sustainable Development Projects (PDS), the Forest Settlement Projects (PAF), and the Decentralized Sustainable Settlement Projects (PDAS). INCRA also recognizes new modalities created by other institutions for access to public policies under the National Program for Agrarian Reform (PNRA), such as Extractive Reserves (RESEX) - for which land is not acquired by INCRA but rather by federal or state environmental agencies when the RESEX is created - and Remaining Quilombola Territories – which receive land acquisition funds from the federal government through integrated actions with the Palmares Foundation and other institutions including state agencies.

In the case of the State of Pará, ITERPA gained notoriety in the second half of the 2000s for the large number of recognized Quilombola Territories, which, according to data available on the agency's website totaled 56 titled territories in an area of 499,204 hectares, in addition to State Agro-Extractive Settlement Projects (PEAEX) and Settlement Projects (PEAS), all of them land regularization modalities recognized by INCRA for access to public policies under the National Program for Agrarian Reform (PNRA).

Together, the areas recognized by INCRA and ITERPA account for 85 recognized Quilombola Territories in the state of Pará spanning 1 million hectares, and 1,023 rural settlements spread over 12 million hectares, figures that are unprecedented among Brazilian states. Covering an area of 5 million hectares, 333 of these settlements are "environmentally differentiated" settlements, according to the shapefiles available in the land registry posted on the INCRA website.

It is important to highlight that the new settlement modalities are aimed at traditional populations that are already developing or are willing to develop low environmental impact activities. The idea of new forms of land regularization goes beyond the legal frameworks of access to land, as its foundations are based on meeting both ecological and social interests and on valuing social and labor organization and community management. Thus, land titling occurs in the form of a use concession contract with an association, subject both to environmental criteria for common exploitation - with respect for the aptitude of the area combined with the vocation of families of rural producers - and to the ecological interest in the recovery of the original potential of the area (BRASIL, 2000).

This new form of land regularization that strengthens traditional populations, facilitates the maintenance of socio--biodiversity and the development of non-timber forest product chains seems to have been incorporated into the development process of the State of Pará in the first half of the 2010s.

In the second half of that decade these trends seem to have been consolidated in the "Program for 2030", a strategic development plan of the State of Pará designed to foster an economy anchored in sustainable and innovative practices through the creation of family farming, grains, fishery and aquaculture, açai, livestock, cocoa, palm oil, oil, mineral exploitation, tourism and gastronomy, forest enhancement, and biodiversity productive chains. Land regularization was included in this plan as a cross-cutting action.

However, since 2016, when President Dilma Rousseff stepped down from her post as a result of the impeachment process, there have been radical changes in federal government priorities that have weakened public policies designed to strengthen traditional populations and value non-timber forest products in the Amazon. In the State of Pará there was a certain resistance to these changes, including through the launch of the "Pará 2030" Program in 2016.

However, because development actions at the state level depend on federal public policies, the priority assigned to traditional populations in the most favorable period began to gradually lose steam from the late 2010s up to the release of most recent Forest Grant Plan of Pará (PAOF/PA/2021), where terms such as "extractivism", "socio-biodiversity", "traditional populations" or "non-timber forest products" are no longer found. This Plan appears to be concerned mainly with the identification of new logging areas, totally ignoring principles and guidelines of the State Extractivism Policy.

In turn, the state government's most recent development program – the "Amazon Now State Plan" – seems to stray from the goal of valuing socio-biodiversity in traditional populations. Despite the intention to make Pará an example of Low Carbon Economy, the priority areas for the Plan's actions were defined in economic frontier zones in the territory of Pará, where the presence of traditional populations is low.

As the text states, among the twelve Integration Regions that make up the current regionalization of the State of Pará, the integration regions of Araguaia, Xingu and Tapajós were selected for the priority actions of the Sustainable Territories Policy (PARÁ, 2000).

However, the areas of greatest value in the production chains of NTFPs are located in the Integration Regions of Tocantins and Marajó, while the richest region in terms of diversified forests is located in the Integration Region of Baixo Amazonas. These regions are shown in black on the map, indicating that they have been excluded from territorial development actions.

It should also be noted that it is precisely in these last areas, which were neglected under the Amazon Now State Plan, that most of the traditional populations of the State of Pará live and work - more precisely along the Amazon River and in the areas closest to Belém in the mesoregion of northeastern Pará, which was the first region to be occupied in the state. Likewise, the Baixo Amazonas region is one of the oldest state-directed colonization areas in Pará, with an emphasis on the National Agricultural Colony of Pará (CAN) in the municipality of Monte Alegre as the oldest colonization area in the Amazon, where the concession of public land for colonization purposes began in 1927 (MOURA, 2011).

Understanding that the three selected regions form a very large space for coordinated and efficient action for achieving the expected results, a second selection of priority areas was carried out in the three regions selected for action under the Sustainable Territories Program. Thus, a territorial approach that allows to achieve the objectives of the program was proposed, considering as definition criteria: 1. Similarity in productive vocations. 2. Logistical similarity. 3. Dynamics of deforestation. 4. Existence of public and private initiatives linked to sustainability. 5. Level of state governance (PARÁ, 2000).

Based on these criteria, eight areas large enough to allow for result scale but at the same time small enough to allow for focused and efficient state action were defined.

A careful look at the definition of the strategic areas for the Sustainable Territories Program, based on full knowledge of the demographics of the three Integration Regions and on some field knowledge shows clearly that the areas defined are agricultural frontier areas, with a strong presence of pioneer populations and less visibility of traditional populations. As the text of the Plan itself states, the selected integration regions account for 70 percent of deforestation in Pará, 48 percent of conflicts and 68 percent of cases of work analogous to slavery (PARÁ, 2000).

This characterization clearly indicates that the areas chosen as priorities for territorial development actions are located on the agricultural frontier, in areas of great interest for occupation and economic exploitation. Investment actions in these regions can attract floating populations and increase deforestation and other forms of socio-environmental conflicts until such time as the frontier is exhausted.

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Finally, with regard to the content of the Amazon Now State Plan relating to the goals of valuing socio-biodiversity, it is worth mentioning the high level of knowledge of production problems for the inclusion of the population in the benefits of development. This level of knowledge makes it easier to solve the problems and overcome the obstacles to a low-carbon economy. Undoubtedly, this represents an opportunity for the discussion of actions required to strengthen socio-biodiversity in traditional populations.

Notwithstanding advances in federal and state policies that actually represent an institutional arrangement potentially favorable to NTFP-based economies, strengthening the specificities of EcoSocioBio-PA requires recognizing the diversity of players, structures and technological trajectories that make up the agrarian base in the Amazon, so that the instruments can reach specific players in the sectors, trajectories, and territories one intends to benefit (COSTA, 2020; 2013, 2012).

3. Public policy recommendations for the development of the value chains of EcoSocioBio-PA products

The recommendations proposed to strengthen and emancipate the value chains of EcoSocioBio-PA products permeate different strategies that make up a structured basis both to fill the existing institutional gaps that weaken the organization of these chains' players and to emancipate the potential of bioeconomy based on socio-biodiversity principles. Figure 1 shows the six strategic areas described in this section.

Figure 1: Strategic areas of recommendation for the development of public policies to strengthen the value chains of EcoSocioBio-PA products

Construction of EcoSocioBio-PA Product Database System

3.1 Axis 1: Rural development policies: knowledge, credit and technical assistance

Science, Technology and Innovation (ST&I) policies designed to stimulate or meet T2 demands should be aimed not only at isolated production systems but also at broader ecological processes, even if it takes longer for results to be achieved. Such initiatives should focus on the biological processes of the biome's soils and forest ecosystems, thus shifting the dominant focus on agronomic research guided by the mechanical-chemical paradigm that necessarily seeks the homogenization of production systems in order to more easily control them (COSTA, 2015).

ST&I policies should be linked to public policies or private technical assistance initiatives so that T2 technological, market and industrial needs are met. In the neoclassical tradition, the attempt to induce efficiency gains in the use of natural capital usually influences the design of high-tech technological development policies that are detached from the daily practices and needs of various sectors of the NTFP production chain, from peasants and small and medium merchants to industries. This does not mean that "cutting-edge" technologies are not important and desirable; they are and should rightly guide ST&I efforts. What we mean is that there are technological demands for innovations in products and processes that are not robust but are simple, creative and accessible to the different links of the EcoSocioBio-PA chain.

Knowledge and innovation policies must be linked to credit policies and technical assistance policies to address T2 technical and technological problems. Some aspects of institutionalization are deeply rooted in credit policies that decisively stimulate the economic and spatial growth of homogeneous production systems based on annual crops and dairy or beef cattle (T4 and T7). The impacts of this large wave of credit incentives to these technological trajectories that continuously incorporate T2 lands are well known, in addition to clearing extensive areas of primary and secondary forests and releasing large amounts of CO_2 into the atmosphere. Without a satisfactory level of employment and income generation in rural and urban areas, this scenario further exacerbates the structural relationship between poverty and deforestation.

The National Policy for Technical Assistance and Rural Extension for Family Agriculture and Agrarian Reform (PNATER) and the National Program for Technical Assistance and Rural Extension in Family Agriculture and Agrarian Reform (PRONATER) were established by Law No. 12,188 of January 11, 2010. The gratuitous nature, as well as the quality and accessibility of Technical Assistance and Rural Extension services, environmental conservation and agroecology are important tenets of PNATER. Applying the instruments of these policies is essential for the growth of T2, but some considerations must be kept in mind.

The provision of ATER services has a troubled history, with different directions throughout its development process. The public debates that supported its design sought to include in PNATER policy principles and instruments for a more dialogical, humanist and agroecological ATER, more concerned with getting rid of "extensionist diffusionism", an extensionist practice of authoritarian propagation of the mechanical-chemical paradigm that still governed ATER (CAPORAL, 2006).

Law 12,897 of December 18, 2013 established the National Agency for Technical Assistance and Rural Extension (ANATER), and in May 2014, Decree 8,252 defined the role of ANATER as one of "promoting, stimulating, coordinating, and implementing technical assistance and rural extension programs, with a focus on technological innovation and the appropriation of scientific knowledge of a technical, economic, environmental and social nature." These precepts should be put into practice through coordination among state secretariats, federal government ministries and civil society.

There is a commendable example of institutional innovation in the field of ATER that has the potential to be replicated. We are referring to the obligation to link credit policies to technical assistance policies, an initiative launched in Brazil under the Program for The Promotion of Productive Activities. This public policy experience was based on the conclusion of covenants or technical cooperation agreements between federal government ministries, state secretaries and public technical assistance companies (e.g. EMATER), in which the states had the executing and budgetary responsibility of organizing the provision of ATER services, and the central government was in charge of the credits intended for peasant families. Another option provided for in the policy was the contracting, through public bidding processes, of

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services from NGOs, OSCIPs and cooperatives that usually have in their staff specialists in forest management and agroecology that participated in T2 peasant socio-technical and family networks.

The university education of generations of agronomists and forestry engineers circumscribed to the mechanical-chemical paradigm is still a major hindrance to the type of technical assistance capable of addressing the technical and technological challenges of the agroecological paradigm that guides the solution of T2 technological problems. A movement that should be encouraged by policies is the training at the technical and university level of professionals qualified to deal with biological and ecological processes related to the management of soils, plants and forests, so that they are equally able to support technological innovation initiatives that should be potentialized in peasants' socio-technical networks.

An initiative capable of making a difference in the training of T2 extensionists would be the multiplication of extension or training courses at the technical level in models similar to the existing Rural Family Homes. These are experiences which, if multiplied under good budgetary and infrastructure conditions and supported by humanist pedagogical practices, would tend to strengthen knowledge and knowledge exchange networks between families and T2 peasant organizations, with the potential to generate a high impact on the possibilities of spillover of agroecological practices to T1 and T3 peasants.

In the case of a coordinated ST&I, credit and technical assistance policy, some guidelines should be defined as essential to ensure the success of the action with T2 players:

Recommendations:

1. ST&I policies must be guided by the agroecological paradigm and coordinate with public policies or private technical assistance initiatives so as to meet the technological, commercial and industrial needs of T2.

2. Creation of specific incentives and credit lines for sociobiodiversity product chains conditional on sustainability criteria in the extraction and production processes that do not generate risks of loss of biodiversity, for example, associated with overexploitation or monoculture of certain species such as açaí cultivated in dry land. Additionally, it is important that the existing credit lines facilities are facilitated and adjusted to the reality of the sociobiodiversity value chains.

3. Credit and technical assistance policies must be necessarily coordinated in order to occur together. Family follow-up by ATER for a period of not less than two years should be planned, with the implementation of technical visits to family production areas and broader activities to favor integration channels within the communities. During ATER activities, credits should be released so that families are able to implement the recommendations.

4. Release of requests for proposals under ATER + Credit specific to each Integration Region and focused on the regional specificities of T2.

5. Requests for proposals and/or public bidding processes should support productive projects that can

be both agro-extractive and directed to production processing activities (açai beaters, for example). Therefore, they can be rural or urban and should consider profitability, food sovereignty and both the experience and technical demand of the families assisted;

6. ATER should be provided by multidisciplinary teams, with gender and knowledge equity and technical staff from the region assisted, so that local knowledge and experiences in the management of forest ecosystems or SAFs can be shared.

7. Include fund-raising among the actions of the Eastern Amazon Fund for the development of NTFP chains.

8. Include fund-raising among the actions of the Eastern Amazon Fund for the training of young extractivists, with the aim of valuing NTFPs.

9. Resume support for extractivism, for the organization of production and for the valorization of NTFPs in Forest Grant Plans;

10. Ensure the feasibility of forest concession processes and financing for community forest management in Forest Grant Plans, with a focus of NFTPs.

3.2 Axis 2: Creation of a continuous database system of the value chains of the EcoSocioBio-PA products and adjustment of state policy instruments to priority integration regions

Article 9 of Decree No. 941/2020 presents the instruments for implementing the Amazon Now State Plan. Among the five instruments are the Policy for the Integrated Action of Sustainable Territories (PTS - item III) and the Land and Environmental Regularization Program of Pará (Regulariza Pará - item IV). The article also provides that other programs, projects, actions, and funds of either a governmental or non-governmental nature may also be considered implementation instruments, provided that they are compatible with the purposes, guidelines and objectives of this Plan and of State Law No. 9,048 of April 29, 2020 – State Policy on Climate Change.

With regard to the PTS, the PEAA (Pará, 2020) establishes three Sustainable Territories, namely: IR Xingu, IR Tapajós and IR Araguaia. The choice of these regions was justified by the fact that they make up a large deforestation area in the state, have important cases of land conflicts and slave-like labor, and show similarities in terms of productive vocation, logistics and deforestation dynamics.

Considering that important social groups, especially for the production of socio-biodiversity products are located in other regions, this recommendation seeks to propose that the construction of the Sustainable Territories strategy be expanded to other priority regions from the perspective of production of EcoSocioBio-PA products. As justified in the selection of case studies, the predominant regions in the production of EcoSocioBio-PA products and in the delimitation of socio-environmental protection areas, such as indigenous lands, settlements, quilombola territories and CUs are located in IR Xingu, IR Tocantins, IR Marajó, and IR Baixo Amazonas. Therefore, it is essential that the implementation of PTS actions be extended to and occur in these areas. Expanding the territorial focus enables benefitting the largest number possible of socio-environmental protection areas, such as indigenous lands, settlements, quilombos, and conservation units, which contribute not only to biodiversity conservation and carbon stock, but also to the production of EcoSocioBio-PA products.

The PEAA presents some bottlenecks associated with PTS planning and suggests some actions to overcome them. These bottlenecks include “deficient structure in agencies that handle the problem” and “absence of international coordination with the global climate agenda regarding private sector and consumer market demands”. However, it should be stressed that these bottlenecks can only be overcome in the long term if the State of Pará has an efficient system for generating statistics on such territories, especially regarding the usually “invisible” production of local populations that contribute to the provision of EcoSocioBio-PA products and the generation of ecosystem services.

In this sense, one of the foundations proposed by the PEAA provides for the construction of an “Information Ecosystem” as an information platform integrated with the various municipal, state, and federal spheres, with data shared with the State System of Environment and Water Resources (SISEMA). Some important examples are:

i) Establishment of an Information Technology Master Plan (PDTI), in line with the strategic objectives of the AMAZON NOW STATE PLAN and especially the C&C component;

ii) Improvement, harmonization, creation, and integration of Information Systems for Environmental Management, in the degrees and modes suitable for the best use and control of data by the Public Administration;

iii) Increased public transparency of the Systems' data, with the provision of specific access levels for control agencies and formal partners;

iv) Support and maintenance of bases in regional centers (NUREs) with the provision of internet services, security, and ongoing assistance;

v) Documentation of services and support for the implementation of technologies by all sectors.

vi) Management of developments in the systems: CAR, Inspection, Dams, SISFAP (fauna, aquaculture, and fishery), PRA, Environmental adaptation, SISFLORA and SIMLAM among others.

Therefore, in the context of the creation of an "Information Ecosystem" by the PEAA, the development of a Continuous System of EcoSocioBio-PA's Product Database is recommended.

Recommendations:

1. Expansion of the areas considered as sustainable territories for IR Tocantins, IR Baixo Amazonas and IR Marajó.

2. Identification and registration of EcoSocioBio-PA inducing agents in IR Xingu, IR Baixo Amazonas, IR Tocantins and IR Marajó, including: Survey of productive socio-environmental areas, namely, Indigenous Lands, Settlements, Quilombos, Conservation Units – defined as Sustainable Territories – in each integration region, and identification of the major producers of EcoSocioBio-PA's alpha sector inserted in the Sustainable Territories and types of socio-biodiversity products covered by these territories.

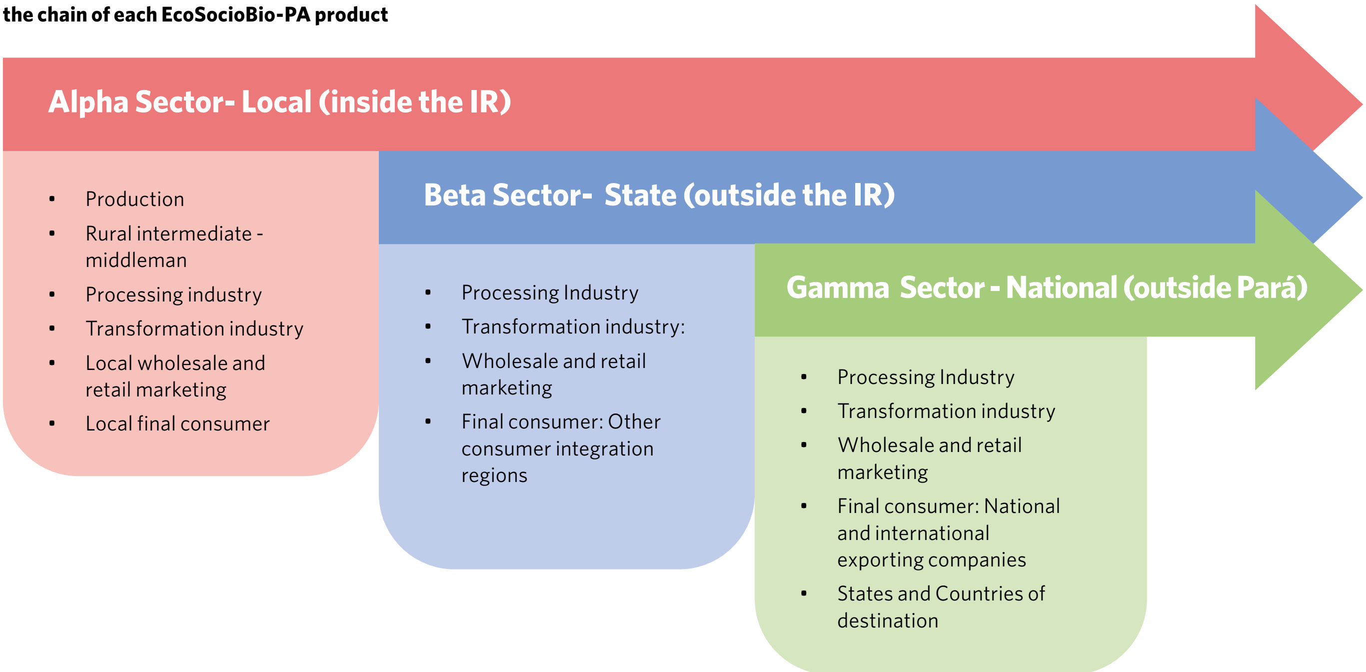
3. Have a prior information base for the construction of a systematic data collection system with EcoSocioBio-PA inducing agents, especially those described in Figure 2.

4. Construction of an efficient Continuous System of EcoSocioBio-PA's Product Database with collection and updating of data on different players in the value chain in IR Xingu, IR Baixo Amazonas, IR Tocantins and IR Marajó, including: Systematic collection of local production data fed by local production-inducing agents (lower chain) from the processing, transformation and marketing sectors at local, state and national level: production (quantity and sales value); product collection area (hectare); characterization of the production scale (extraction in native forest, SAF, permanent crops, machinery, others); stock; purchase and sale agent; purchase and resale by intermediaries; logistic production for distribution; retail and wholesale agents; export agents with national and international flags; issuance of invoice.

5. Creation of a counting system for exported products that do not have a code in the Mercosur Common Nomenclature System (NCM); survey of the quantity and value of exported socio-biodiversity products; exporting companies; destination country.

6. CNM codes 20079921 Açai Purees (Euterpe oleracea) and NCM 20079926 Cupuaçu Purees (Theobroma grandiflorum) do not yet provide information compatible with the export transactions carried out, as trade is usually recorded under other codes associated with the sale of generic products. Therefore, it is recommended to create a system for recording interstate transactions and exports of açai pulp, cupuaçu pulp and other products specific to the Amazon biome.

Figure 2: Survey of the inducing agents of the chain of each EcoSocioBio-PA product



3.3 Axis 3: Land policies for regularization of common use territories (PEAEX, PAE, PEAS, PDS, Quilombos, TI, others)

Identity and ethnic movements, alongside the 'environmentalism' of the agrarian issue, contributed for positive law in countries in the southern hemisphere to recognize, protect and title common land (COLIN; MEUR LE; LÉONARD, 2009). The Amazon version of this global movement led to policies for the recognition and valorization of indigenous peoples and of the historical or caboclo peasantry (COSTA, 2019), the so-called traditional peoples and communities, giving rise to policies for the recognition of territorial rights that resulted in the delimitation of many indigenous lands (TI), quilombola territories, extractive reserves (RESEX), national forests, and special categories of agrarian reform settlements such as the Agro-extractive Settlement Projects (PAE), as well as their related state versions.

However, this scenario began to change in 2009. Since then, in the framework of state and federal land policies the prioritization of public action has been directed towards the regularization of individual properties, such as through the Legal Land Program, often based on procedures that entail ownership disputes and environmental liabilities of many types. Without discrediting the importance of initiatives such as those of the aforementioned Program to the land regularization liability that exists in the Amazon, it should be emphasized that there is yet another significant liability for the recognition of land rights that directly concern the agents that drive the T2 economy.

This liability has two forms. First, the urgent demand for land regularization of state and federal territorial units that have already been delimited but have not yet been regularized through ratifications of declaration and homologation of indigenous lands; the granting of the real right of use (CDRU) in the case of RESEX, FLONA, FLOTA, PAE and PEAEX; and the issuance of definitive titles for the consolidation of quilombola territories. The lack of CDRU for the PAE of the RIs Marajó, Tocantins and Baixo Amazonas illustrates this problem that limits the binding of public policies in these territories, as discussed below.

Between 2004 and 2006, INCRA created more than 100 PAEs in these three RIs of Pará, with the aim to acknowledge the land rights of groups recognized by the State as traditional populations. Considering only IR Baixo Amazonas, in the transition regions between the wetland and dry land ecosystems, 49 PAEs were created between the municipalities of Faro and Prainha alone. Only one PAE received the CDRU (Henrique Lima, 2012). In the case of PAEs, there is an important geographical element. The layout of the perimeters of most PAEs is unsuitable for the combined use of the two ecosystems, which is a fundamental practice for the economic life of these peasants. However, 45 PAEs were either restricted to wetlands or entirely contained on dry land. Only four PAEs had land in both ecosystems, and only one PAE received the CDRU (FOLHES, 2018). The consolidation of T2 territories should take into account the search for the complementarity of resources in the two ecosystems.

Secondly, much still remains to be done as regards recognizing the territorial rights of T2 peasants and indigenous people, as expressed in the requests for studies on the delimitation of indigenous land, conservation units of sustainable use and agro-extractive settlement projects. Such claims, even if partially met, could ensure the integrity of territories of great productive potential within the scope of T2, generating positive spillovers in local economies and sustainability in the state agrarian base.

Recommendations:

1. Based on the new selection of priority areas for territorial development, prioritize traditional peoples and communities as well as areas with potential for the development of products and processes in NTPF chains. To this end, prioritize land regularization plans through the recognition of rights over common territories, which are essential to EcoSocioBio-PA.

2. To facilitate the regularization of public and private land, it is important to continue to support the Geographic Land Information System (Land SIFG), a software developed by the Federal University of Pará in partnership with the State Public Prosecutor's Office, which associates information from real estate public registries with cartographic data from the processes of origin in land agencies, thus allowing for the georeferenced location of the properties and the crossing of information for the purpose of reestablishing the chain of title. The same system can facilitate the validation of the Rural Environmental Registry (CAR), land regularization processes in public agencies, and judicial analysis for the resolution of land conflicts.

3.4 Axis 4: Development of financial mechanisms such as payments for Environmental services by product-producer of EcoSocioBio-PA

The ecosystem services provided by the forest are diverse and include, for example, fruits and material goods extracted from the forest, climate regulation through carbon stock and storage, regulation of the hydrological cycle through evapotranspiration and conservation of springs, conservation of ecological interactions, and ecosystem functioning, soil regulation, and cultural services associated with productive practices and the way of life.

For the implementation of economic instruments such as Payments for Ecosystem Services (PES), there must be service providers - for example, areas preserved by traditional and indigenous populations - and beneficiaries of such services.

The climate regulation service is the most feasible in terms of application, not only because of scientific advances in the estimation of carbon flow and stock per hectare of a certain type of forest phytophysiognomy, but also because carbon is a product with a market and a social price that is usually defined internationally. The service associated with the regulation of the hydrological cycle maintained by the Amazon Forest is of great importance to several regions of Brazil, especially for the agricultural and hydroelectric sectors that are the great beneficiaries of and rely on the conservation of the Amazon. The great reliance of these two sectors on water resources points to the need to step up efforts to quantify the contribution of a given forest area to rainfall and increased water flow in the other regions, followed by the implementation of a system of payments for environmental water services related to Amazon conservation to the major beneficiary sectors involved.

One of the objectives of the PEAA defined in Article 5, item IV, is to boost the Incentive for Ecosystem Services (IES), Payments for Ecosystem Services (PES) and results-based payments through the REDD+ mechanism.

Regarding the climate regulation service, in General Recommendation 5 Brandão et al. (2021) suggest the development of a Jurisdictional REDD+ strategy for the Amazon Now State Plan, so as to allow for the transfer of financial resources in return for reduced emissions in the forestry

sector, guaranteed by activities to combat deforestation and degradation and to promote stock conservation, sustainable management, and increased carbon stocks. The authors also describe the importance of the socio-environmental safeguards defined in the Cancun Agreements and established in COP16, which are closely related to the survey of the socio-productive structure of socio-biodiversity product chains, such as respect for the rights and knowledge of indigenous peoples and local communities, full and effective participation of all parties, in particular indigenous peoples and local communities, consistency with forest conservation, and biological diversity.

The results of the trend scenario with a carbon pricing policy (section 4) present an important redistribution of value added among the chain agents and an increase in the gross income of producers. Such income redistributions show the importance of including a product-producer financial mechanism to compensate for the carbon stock contained in the production areas of EcoSocioBio-PA products.

Therefore, the specific recommendations proposed by Brandão et al. (2021) associated with General Recommendation 5 are ratified by this study. Emphasis is given to those activities that may be closely related to the value chains of EcoSocioBio-PA products.

Recommendations:

1. Implementation of instruments of Payments for Ecosystem Services such as REDD+, linked to forest conservation guaranteed by agents in the value chain of EcoSocioBio-PA products in IR Xingu, IR Baixo Amazonas, IR Tocantins and IR Marajó.

2. Quantification of the carbon stock embodied in products and linked to EcoSocioBio-PA production agents.

3. Initiation of a process for the negotiation of socio-environmental safeguards at the state level with relevant players and inclusion of their negotiation and supervision structures in the design of the Amazon Now State Plan. This process should take into account the adaptation of the Cancun safeguards to the Brazilian context carried out within the scope of the National Commission for REDD+ (CONAREDD) and the experiences of Acre and Mato Grosso for the specific subnational context (Specific Recommendation 5.1 proposed in Brandão et al. (2021)).

4. Alignment of the benefit-sharing mechanisms of REDD+ programs with the structure of Sustainable Territories sub-programs, in order to avoid overlaps and conflicts. Regionalization of sub-programs (and of the benefit-sharing mechanism) across the state's 12 Integration Regions as an intermediate way of stepping up implementation (Specific Recommendation 5.3 proposed in Brandão et al. (2021))

5. Alignment of the Monitoring, Reporting and Verification (MRV) system and safeguard progress indicators with the structure of the Amazon Now State Plan. This can be done by designating a public agency for this mission, e.g. CIMAM. This system should also include the technical analysis of stock and flow mechanisms for benefit sharing (specific Recommendation 5.4 proposed in Brandão et al. (2021)).

3.5 Axis 5: Traceability and certification of ecosystem services embodied in EcoSocioBio-PA products

In addition to the economic instrument of payment for ecosystem services through bilateral agreements, certification seals can also be created for quantifying the services provided. Certification can be a fundamental step towards adding value to EcoSocioBio-PA products with the incorporation of ecosystem services generated, since the seal enables informing consumers about the quantity and quality metrics of the product.

The PEAA (Pará, 2020) provides for the issuance of the "We Are Sustainable" certification, with the aim of attesting to the compliance of the entire production cycle with the environmental legislation in force, as well as with the best socio-environmental practices involved in the process. The Plan points out that in certification the benefits are directly associated with the guarantee of origin, socio-environmental responsibility, institutional image, and to access to markets. Regarding the guarantee of origin, producers certified with the "We Are Sustainable" seal commit to not contribute to deforestation, to use raw materials originating in forests under sustainable management and to meet the zoophytosanitary requirements provided for in the Sustainable Territories Policy.

The PEAA points out that traceability and certification systems can be implemented in other subgroups of the Policy such as Indigenous Lands, in accordance with the specific objective of the Brazilian Policy for Territorial and Environmental Management of Indigenous Lands (PNGATI) of "promoting the regulation of certification for products coming from indigenous peoples and communities, identifying their ethnic and territorial origin", in order to value their important participation in the state's economy. Thus, the traceability and certification systems proposed by the Sustainable Territories Policy will not be isolated actions, but rather ongoing processes that in addition to the benefits conceived seek to raise awareness of the need for quality in order to maintain the competitiveness and consequently the market presence of the products.

With regard to traceability, the plan highlights that some actions are underway, such as the development of a platform, together with Safe Trace, a company specialized in traceability systems, that will enable crossing information from the Animal Transportation Form (GTA) with data from the Rural Environmental Registry (CAR), for verification purposes. Funds for the development of this system are being raised by The Nature Conservancy (TNC) with the Partnership for Forests (P4F).

Recommendations:

1. Establish a program for traceability and certification of environmental services for products and producers in the EcoSocioBio-PA value chain in IR Xingu, IR Baixo Amazonas, IR Tocantins, and IR Marajó.

2. Technological development for the construction of traceability systems for the production of socio-biodiversity products from existing integrated state data systems, such as SISFLORA-PA.

3. Development of a certification system for environmental services embedded in EcoSocioBio-PA products associated with the Amazon biome with agents in the value chain and in partnership with certifying institutions.

3.6 Axis 6: Tax policy applied on EcoSocioBio-PA products for the redistribution into the Local economy of income generated outside the state of Pará

The fiscal regulation of the state of Pará is determined by Decree nº 4.676 of June 18, 2001, which approves the Regulation of Tax on Operations Related to the Circulation of Goods – ICMS and on Interstate and Intermunicipal Transport and Communication Services.

With regard to sociobiodiversity products, Decree no. 4,676/2001 defines specific rules for certain products, namely: Brazil Nuts, Açai Pulp, Cupuaçu Pulp, Cocoa, Honey, and Heart of Palm. The tax benefits of regulation apply to the three spheres, that is – within the state of Pará (local), interstate and international - in three main forms:

i) Tax exemption applicable to specific transactions and sectors;

ii) Deferral of ICMS so that the tax burden can be applied to transactions subsequent to the first one;

iii) Granting of presumed credit, which consists of a tax benefit used only at the time of the ICMS tax assessment, in the ICMS Tax Assessment Book, with prohibition of any other tax credit.The criterion for applying such benefits can be determined by the classification of the producer and extractor, that is, whether or not he is equivalent to a trader and industrialist constituted by a legal entity that promotes the exit of interstate goods and/or for export purposes.

It is worth noting that the tax regulation applicable to transactions involving EcoSocioBio-PA products for foreign trade, as well as revenues collected from international trade requires an in-depth analysis. One of the reasons for the importance of a specific analysis is the lack of official data on the quantity and value of products sold to the rest of the world. There is a serious statistical gap regarding the sale of a big variety of NTFPs. Since the Mercosur Common Nomenclature (NCM) and the Harmonized System (HS) do not include the variety of products from the Amazon biome that are harvested and processed, sales to the rest of the world by international or domestic companies are not factored in, hence impairing access to data on the share of international trade in the sale of these products as well as on related revenues.

Recommendations:

1. Due to the lack of incentive to processing and transformation in the local economy, for example, Cocoa Beans, Brazil Nuts, Cupuaçu, and other products, and considering the high value added in the processing and marketing sector outside the state of Pará (domestic economy), it is recommended the creation of tax incentives for products sold within the State of Pará as well as the application of a specific tax rate for export operations (to other states and to the rest of the world) involving products from the Amazon region, as they are differentiated products from the Amazon biome.

2. Application of tax exemption on the processing and transformation of cocoa beans, heart of palm and Brazil nuts.

3. Application of a specific tax rate on exported cocoa, exported açai, exported heart of palm, whether fresh or processed, to other states or to the rest of the world, with a view to establishing a fund for redistribution into the local economy of the value added generated in the domestic economy.

4. Scenarios for assessing the potential value of the EcoSocioBio-PA products chain

4.1 Methodology and databases for the development of economic scenarios and projections

4.1.1 Trend scenario

The trend scenario was developed with a view to projecting the market based on the behavior of previous years. Considering that the behavior of the quantity and price of EcoSocioBio-PA products varies over time, the projections aim to consider the different trends of changes in production and price.

To this end, the methodology consists of four steps:

i) Calculation of price and quantity indices by EcoSocioBio-PA product;

ii) Regression of the trend curve of price and quantity indices (logarithmic, exponential, linear, polynomial or power) with better behavior representation;

iii) Calculation of the quantity and price Projection Indices by 2040, from the equation of the quantity and price trend curve;

iv) Application of the quantity and price projection indices and calculation of the value added projected for each link in the CSα Input-Output Matrix chain to obtain the trend projection from 2019 to 2040.

The Price and Quantity Indices are calculated according to the calculation of the indexers through the Alpha Accounts, that is, based on quantity and average price data of the annual situational statistics of the Plant Extraction and Forestry Production (PEVS), the Municipal Agricultural Production (PAM) and the Municipal Livestock Survey (PPM).

In all cases, the quantity indexers are the index numbers of the total quantities of *product v* for the group of municipalities in the Integration Regions considered, with 2019 as the final reference year and 2006 as the base year. Thus, the index numbers are:

$$I^{Q}_{\text{sva}} = \frac{q_{\text{sva}}}{q_{\text{svBaseYear}}} \quad (1)$$

and

$$I^{P}_{\text{sva}} = \frac{\bar{p}_{\text{sva}}}{\bar{p}_{\text{svBaseYear}}} \quad (2)$$

After calculating the respective indices, the next step is to calculate the regression curve representing the trend that best applies to price and quantity changes. The selection of the trend curve of price and quantity behavior is determined for the one with the highest coefficient of determination (R-square - R^2), that is, the one that when drawn minimizes the distance between the line and all points distributed on the two axes. Technically, the R-squared is calculated from the regression by ordinary least squares (OLS) that minimizes the sum of squared residuals. By selecting the trend curve, the price and quantity projection indices are estimated from the application of the trend curve equation.

The premise used is that the distribution of the value chain structure remains even over time, and once the projection indices have been calculated, the quantity projection index is applied on the quantity produced in the physical Input-Output Matrix, and the price projection index is applied on the value added per unit produced. This value added, in turn, is calculated from the Input-Output Matrix estimated for 2019 for each product. The Value Added generated in each link of the chain projected until 2040 is obtained according to the following equation:

$$VA_{s,c,yrt} = Q_{s,c,yr2019} \cdot I^{Qprojection}_{s,yrt} \cdot VA^{q}_{s,cyr2019} \cdot I^{Pprojection}_{s,yrt} \quad (3)$$

Where: $VA_{s,c,yrt}$: value added of product *s* generated by link *c* of the value chain, in year *t* of the projection.

$Q_{s,c,yr2019}$: quantity produced of product *s* generated by link *c* of the value chain, in base year 2019.

$VA^{q}_{s,cyr2019}$: projection index of the quantity of product *s* produced in year *t* of the projection.

$I_{s,yrt}^{Qprojection}$: value added per unit produced of product *s* generated by link *c* of the value chain in base year 2019.

$I_{s,yrt}^{Pprojection}$: projection index of the average price of product *s* in year *t* of the projection.

4.1.2 Trend scenario with cost reduction policy and redistribution of the value added generated in the local and domestic economy

The objective of developing this projection is to integrate the links of the processing and transformation sectors, thus allowing for greater verticalization in the local economy and reducing price distortions found in the sectors of the local and domestic chain, which, for some products, lead to strong value-added generation at the national level, to the detriment of a low increase in the product's value at the local level.

Considering the objective of strengthening the local economy, the choice was to suggest a policy to reduce the intermediate costs of the local processing and transformation sectors, both in the interior and in urban centers, especially those that occur between the rural intermediate sector (middlemen) and the industrial sectors, and the redistribution of a portion of the value added generated in the domestic market, based on the application of a tax rate on the product sold in the local economy, which in turn will contribute to the generation of revenue to finance cost-reducing investments. The application of this scenario is based on the following assumptions:

i) The difference between the average price paid by the processing and transformation sectors and the average price paid by the rural intermediate sector integrates a portion of the costs of intermediate inputs and industrial sectors' margin.

ii) It is considered that because it is closer to the production sector, the rural intermediate sector indicates a minimum product distribution cost. For this reason, the proposed cost reduction portion consists of a percentage applied on the difference between the average prices paid for the product by the processing and transformation industries and the average prices paid for the product by the rural intermediate sector. The equations below present the calculations performed for the sectors. In the projection exercise, the value of 50 percent was adopted for g1 and the value of 20 percent for g2, as the intention is to encourage greater verticalization between the chain links in the local rural sector.

The following equations are used:

$$Mincost_{sectors\alpha 2,3} = g_1 \cdot (\overline{P_{alpha2,3,}} - \overline{P_{alpha1}}), \text{ when } \overline{P_{alpha2,3}} > \overline{P_{alpha1}} \quad (4)$$

$$Mincost_{Sectors\ \beta 1,2} = g_2 \cdot (\overline{P_{beta\ 1,2}} - \overline{P_{alpha\ 1}}), \text{ when } (\overline{P_{beta\ 1,2}} > \overline{P_{alpha\ 1}}) \quad (5)$$

Where:

$Mincost$: minimization of the transaction cost between the alpha and beta sectors.

g_1: percentage of cost reduction policy applied on the difference in the price practiced for rural industrial sectors and the rural intermediate sector.

g_2: percentage of cost reduction policy applied on the difference in the price for the industrial sectors of urban centers and the rural intermediate sector.

$(\overline{P_{alpha2,3,}}$: average price per unit of the product consumed by the rural processing and transformation sector.

$\overline{P_{beta\ 1,2}}$: average price per unit of the product consumed by the processing and transformation sector in urban centers.

$\overline{P_{alfa1}}$): average product purchase price paid by the rural intermediate sector.

It should be noted that the average prices per unit consumed by each link in the chain were estimated from the physical and monetary IOMs.

iii) In relation to the rate applied for the redistribution of the value added that occurred in the domestic economy, the following equation was applied. In the projection exercise, the 8 percent rate was applied on intermediate consumption by the marketing sector of the domestic economy.

$$RateSector\gamma4\ (T) = \overline{P_{gamma4}} \cdot (1 + t_4) \quad (6)$$

Where:

$\overline{P_{gamma}}$: average price per unit of the product consumed by the retail sector in the domestic economy.

t_4: rate applied on the sale price to the domestic retail sectors.

As explained, the objective of this scenario is to identify the effects of an integration (or verticalization) policy between the links of the local production chain and the local processing and transformation industry, based on an intermediate cost reduction policy and on the application of the rate for redistribution into the local level of the value added generated at the domestic level.

4.1.3 Trend scenario with policy of carbon stock pricing

The objective of this scenario is to visualize the impact of the incorporation into the producers' income of the value of ecological benefits generated with the carbon stored as a result of forest conservation in areas used for the extraction of EcoSocioBio-PA products, based on a policy of the shared value of these benefits for the products' price.

Forests play an important role in the mitigation of and adaption to climate change. Among the benefits are carbon sequestration and storage, which prevents it from being released into the atmosphere. Hence, they participate in climate regulation in order to avoid extreme weather events. This carbon storage or retention has an economic value known as "Social Cost of Carbon" (SCC), which represents the economic cost associated with the climate harm (or benefits) caused by emitting one an additional ton of CO_2 (Ricke et al., 2018). The social cost of carbon is often used as an estimate of the carbon price. Since the intention is to internalize the benefits of forest cover in the areas of extraction of EcoSocioBio-PA products, the benefits of stored (or stocked) carbon, the SCC, will hereinafter be referred to as the Social Benefit of Stocked Carbon (SBC)

The total carbon stored in forests is divided into five groups by the Intergovernmental Panel on Climate Change (IPCC), Good Practice Guidance (GPG) for Land Use, Land-Use Change and Forestry (IPCC, 2003). The living portion of the biomass carbon is classified as "aboveground biomass", "belowground biomass", "soil organic carbon" and "litter carbon".

Considering that the extraction of biodiversity products by producers consists of an activity that maintains the carbon stock and sequestration services, the identification of the potential for incorporating the economic value of carbon in the pricing of biodiversity products in the state of Pará is a necessary exercise for a future vision of the value of this production and the associated remuneration potential of the agents involved. Therefore, in addition to the direct economic income absorbed by chain agents, the ecological benefits associated with the conservation of the biome and its ecosystem must also be identified. The carbon stock associated with forest conservation is one of the most important of these benefits, hence the need for it to be measured in physical terms and estimated in monetary terms, with a view to its inclusion in the prices of EcoSocioBio-PA products and effective future internalization by the market.

It is suggested that the incorporation of the carbon value be internalized by the Alpha 0 sector, that is, the producer that carries out the direct extraction activity and maintains the conservation of the forest cover. In order for the method of measuring such benefits to be implemented in an accessible way, seven databases were used.

i) The first of such methods is the Alpha Accounts, which allows to obtain the geographic coordinates of data collection by value chain agents.

ii) The second is the Vegetation Map (IBGE), which provides the vegetation classes by phytophysiognomy type throughout the national territory.

iii) The third is Land Cover and Use Monitoring (IBGE), which measures by satellite the forest cover and grassland vegetation areas throughout the national territory.

iv) The fourth is the use of the limits of Integral Protection Conservation Units and Sustainable Use Units (MMA)[2] and the 2010 Indigenous Land database (MMA, 2010)[1].

v) The fifth is the use of the limits of state settlements in Pará, that is, State Sustainable Settlement Projects (PEAS) and Agro-Extractive Settlement Project (PEAEX), Quilombola State Territory (ITERPA)[3].

vi) The sixth are the belowground, aboveground, litter, and soil carbon stock factors (tons/hectare) by vegetation class, as established in Brazil's Global Forest Resources Assessment Report 2020 - FRA 2020 (FAO, 2020).

vii) The seventh is the use of the social cost of carbon estimated for Brazil (Ricke et al., 2018) for assessing the $SBC_{stocked}$, which consists of the forest's contribution to carbon stock and mitigation of greenhouse gas emissions.

From these databases, the selection for the state of Pará was made by municipality by applying the factors, estimating, in physical and monetary terms, the carbon stock contained in the vegetation existing in the municipalities producing EcoSocioBio-PA products, both inside and outside Conservation Units, Settlements, Quilombola Territories, and Indigenous Lands, hereinafter referred to as Socio-Environmental Protection Areas ($AREA_{socioenv}$).

Considering that these socio-environmental areas are protected by legal instruments and comprised of villages and populations that contribute to preventing deforestation, the interest in selecting them in the territory is justified by the importance of measuring their contribution to the carbon stock ecosystem service. The estimation of the carbon stock contained in the $AREA_{socioenv}$ will allow the implementation policies meant to assess avoided emissions in these areas. To avoid double counting in cases of overlapping of more than one category of socio-environmental protection in the same area, the carbon stock was assigned to the most restrictive category, in the following order: Indigenous Land, Federal Integral Protection CU, Municipal Integral Protection CU, Municipal Integral Protection CU, Federal Sustainable Use CU, State Sustainable Use CU, Municipal Sustainable Use CU. The equations for each step are presented below:

$$COEF_{FRA\ phyto\ i}\ (ton/ha) = \Sigma\ COEF_{FRAphyto\ i} \quad (7)$$

$$CS\ (MtC) = [(AREA_{env,\ phyto\ i}\ X \cdot 100) \cdot COEF_{FRA\ phyto\ i}] \quad (8)$$

$$GHG_{stocked,\ AREAenv}\ (MtCO_2\ equivalent) = EC \cdot 3.67 \quad (9)$$

$$SBC_{stocked,AREAenv}\ (BRL\ _{2018})^3 = GHG_{stocked,AREAenv} \cdot P_{carbon} \cdot 1{,}000{,}000 \quad (10)$$

$$SBC_{stocked\ ,AREAenv,\ year\ t} = SBC_{stocked,\ AREAenv} \cdot (1+r)^t \quad (11)$$

Where:

$COEF_{FRA\ phyto}$: Sum of belowground, aboveground, soil and litter carbon stock coefficients, for phytophysiognomy i, in ton per hectare.

$AREA_{phyto\ i}$: Area with native vegetation in the following classes: "Forest Vegetation", "Grassland Vegetation", "Wet Area" and "Uncovered Area", by phytophysiognomy i, in km^2.

$AREA_{env,\ phyto\ i}$: Selection of areas with defined forest cover such as conservation units, indigenous lands, sustainable and agro-extractive settlements, and quilombola territories, by phytophysionomy i.

CS: Carbon stock in million tons.

$GHG_{stocked,\ AREAenv}$: Stocked CO_2 equivalent, in million tons, in a socio-environmental protection area, namely, Integral Protection Conservation Unit, Sustainable Use Conservation Unit, Indigenous Land, State Sustainable Settlement Projects

2 Available at: http://mapas.mma.gov.br/i3geo/datadownload.htm

3 Available at: State Settlements | ITERPA - PARÁ LAND INSTITUTE and Maroons | ITERPA - PARÁ LAND INSTITUTE.

(PEAS), Agro-Extractive Settlement Project (PEAEX), Quilombola State Territory.

$SBC_{stocked,AREAenv}$: Social Benefit of Carbon stocked by a given socio-environmental area.

P_{carbon} : Social price of carbon based on Social Cost of Carbon, as estimated for Brazil by Ricke *et al.* (2018), in reais, considering the Central Bank's exchange rate in 2018.

r (t): Discount rate[4] of 3 percent p.a. applied in year *t*.

The estimate of carbon stock in socio-environmental protection areas must be followed by the selection of the potential radius where the extractive production of biodiversity products occurs. Therefore, the suggestion is to adopt accessibility criteria for product extraction from a spatial selection that considers a radius of 20 kilometers from the surroundings of villages and the extension of 5 kilometers on both sides of access routes, namely roads, highways and navigable rivers crossing this radius. In these analyses, the following databases were used to define the accessible areas:

a) Coordinates of locations (villages, cities, rural clusters),, from the Continuous Cartographic Base 1:250,000 (IBGE, 2019);

b) Roads (road sections and commuting routes) from the Continuous Cartographic Base 1:250,000 (IBGE, 2019);

(c) Rivers potentially navigable by small vessels (Schielein 2017);[5]

d) Water bodies connected to potentially navigable rivers, from the Continuous Cartographic Base 1:250,000 (IBGE, 2019).

The criteria used were defined with a view of delimiting the forest area located in the points that are most accessible to extractivists, considering the data available on an appropriate scale and with continuous coverage for the entire State of Pará. These assumptions are adopted due to the lack of data on traditional extractive practices and on the vegetation area traveled for the extraction of fruits and products, by traditional community and indigenous land. Considering that traditional extraction practices, as well as the total area traveled in the forest is specific to each community and fruit harvesting, accessibility criteria homogenize the harvesting conditions, imposing limitations on the estimation of the area actually used for this purpose. In this sense, it is understood that in the design of a political strategy for the implementation of carbon value, knowledge of the area used for extraction would provide more accurate calculations of carbon stock in the production location of each product.

Assuming that the Social Benefit of Stocked Carbon will be transferred as a portion of the income to the alpha 0 sector (producer that extracts the product), an apportionment percentage for the analyzed products must be considered. Based on the assumption that the implementation of a carbon pricing policy will cover the 30 products for which there is an Alpha Accounts survey, the next step is to prepare an apportionment of the share of the value added of each product in the total value of the income generated in the value chain of EcoSocioBio-PA products.

4.2. Scenarios and projection of the value added generated in the value chain of selected EcoSocioBio-PA products

4.2.1 Scenarios of income generated in the açai value chain

Açai *(Euterpe oleracea)* is the fruit of a palm tree originally from the state of Pará, but also found in the Pan Amazon region. Açai wine, also known as the "black gold from Pará", is the most popular form of açai consumption in the region and beyond, although the fruit yields products that vary in terms of form and purpose, such as powdered açai and açai jam, for example. Because of its high nutritional value, açai is recognized as a superfood and its use extends beyond culturally Amazonian cuisine to the food menus of sports supplements, combined with the idea of improving sports performance (Shanley & Medina, 2005).

4 Adopted in Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017).

Available at: https://www.nap.edu/read/24651/chapter/9

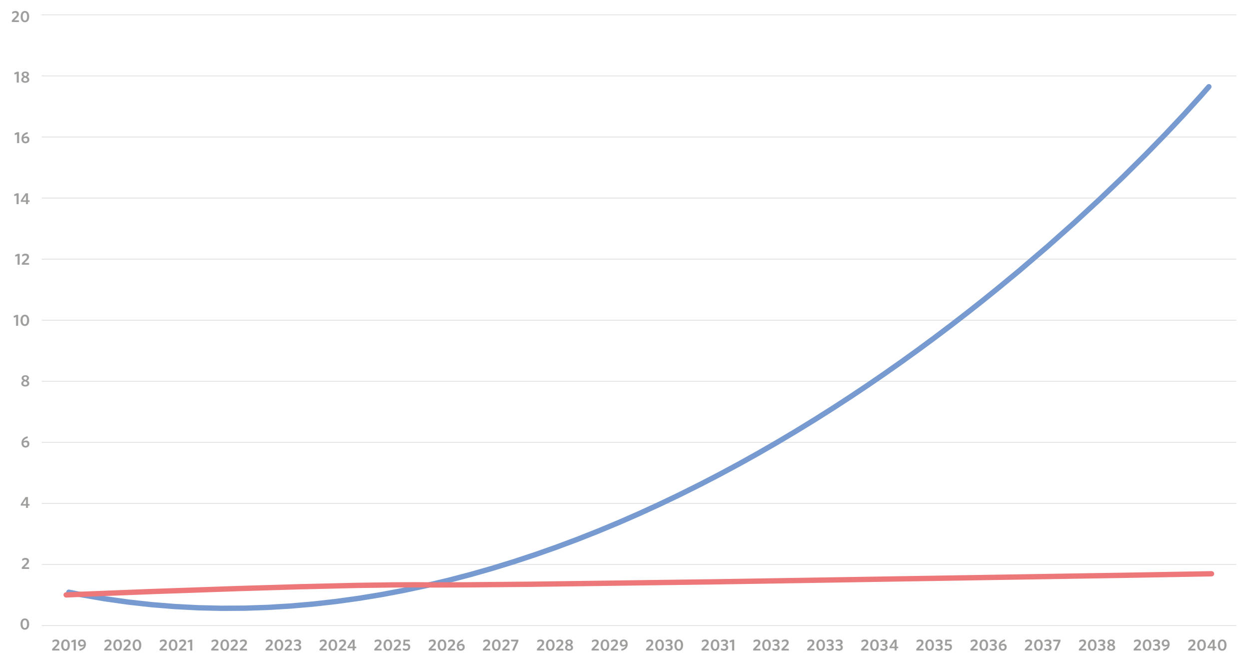
5 Available at: https://dataverse.harvard.edu/dataset.xhtml?persistentId=-doi:10.7910/DVN/1G8PZI

The Alpha Accounts show that the complete value of the açai chain - from harvesting and transformation and processing to marketing - contributes to an increase of 2.8 times the income generated by the extractive sector alone, reaching the Value Added BRL3.7 billion in 2019. The steady increase in the fruit price, as well as the expansion of cultivation areas, provide a perspective of an important growth in the production of açai. The analysis below shows the results of the projected income generation along the açai value chain by 2040.

4.2.1.1 Trend scenario

The analysis of the increase in the average price and quantity of açai from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for price and a power curve to represent the increase in quantity. Chart 1 shows the quantity and price projection curves. Although the production in tons does not present important expected growths, with an average growth of only 3 percent p.a., an important positive price change is expected, leading to an average growth of the value added generated of 19 percent p.a. in the analyzed period.

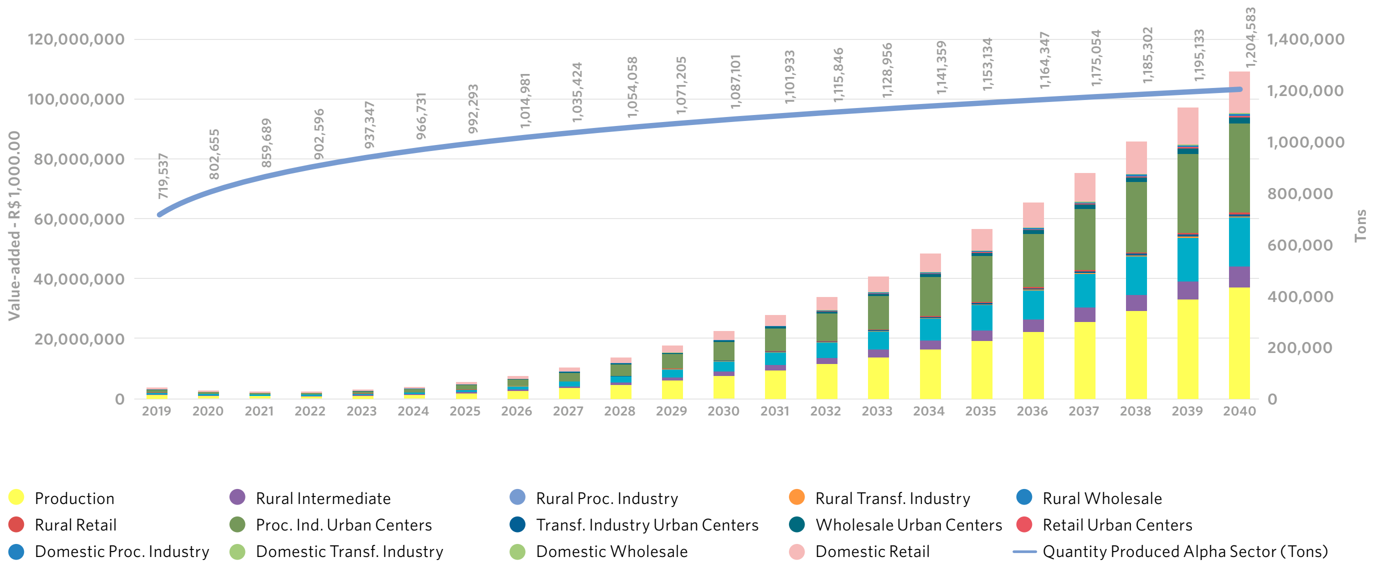
Chart 1 - Curves of the quantity projection index and price projection index to calculate the future value of açai



Source: Prepared by the authors.

Chart 2 shows the Value Added (VA) projections (Table 1 of Annex 1). It also shows projections for each link in EcoSocioBio-PA's açai value chain, as well for as the quantity produced by 2040. It is observed that the VA absorbed in the chain, which totaled BRL3.7 billion in 2019, is expected to reach BRL109.3 billion in 2040. As noted, the VA increase in each sector occurs evenly along the chain. In 2040, of the total projected income, the production sector absorbs the largest share of the total income generated, with BRL37.2 billion (34 percent), followed by processing industries in rural areas and urban centers, with BRL16.3 billion (15 percent) and BRL29.6 billion (27 percent), respectively; domestic retail, with BRL13.7 billion (13 percent); and rural intermediate agents with around BRL7 billion (6 percent). In relation to the quantity projected for 2040, production is expected to reach 1.2 million tons, with an average annual growth of 3 percent.

Chart 2 - Projection of the Value Added (BRL) and Quantity produced in the açai value chain of EcoSocioBio-PA by 2040



Source: Prepared by the authors.

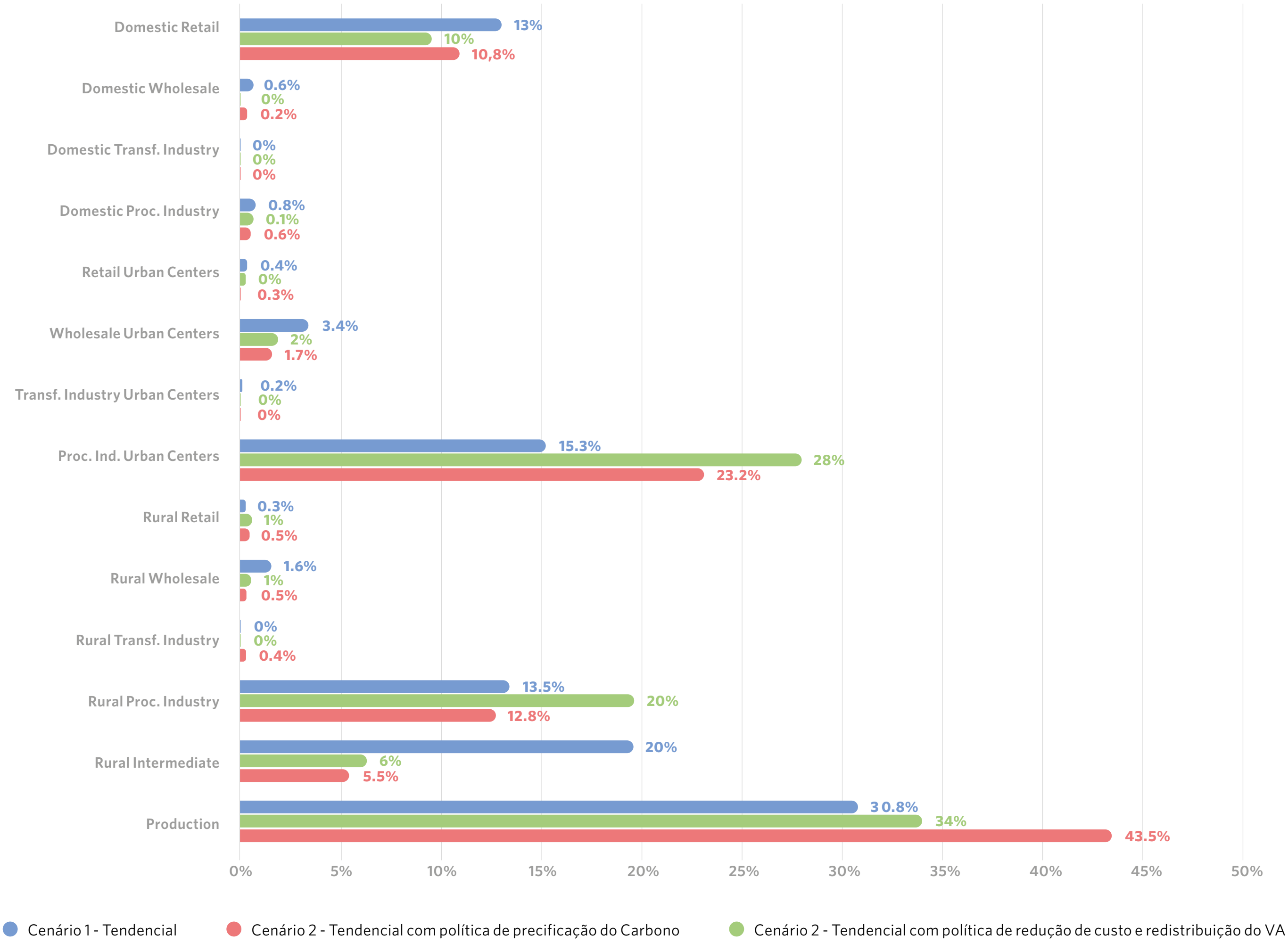
4.2.1.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the açai value chain with the projected policies, Chart 3 shows the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing.

It is observed that in scenario 2, with the income redistribution policy (intermediate cost reduction of 50 percent and 20 percent between the alpha and beta sectors, and application of an 8 percent tax on the price of açai sold to the domestic retail sector), the share of the VA generated in domestic retail falls from 13 percent to 9.5 percent, while the rural processing sectors and the industrial sector of urban centers experience an increase from 13.5 percent to 19.7 percent and from 15.3 percent to 28.1 percent, respectively. A drop in the share of income generation by the rural intermediate sector is also observed, mainly due to the greater price integration between this sector and the processing sectors in urban areas and urban centers.

The changes in these VA distributions imply greater integration between the links of the rural local sphere, thus reducing the differences between agents horizontally and vertically expanding the production chain and payments for the processing and transformation of açai production in rural areas and urban centers.

Chart 3: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value added redistribution scenario in the açai value chain



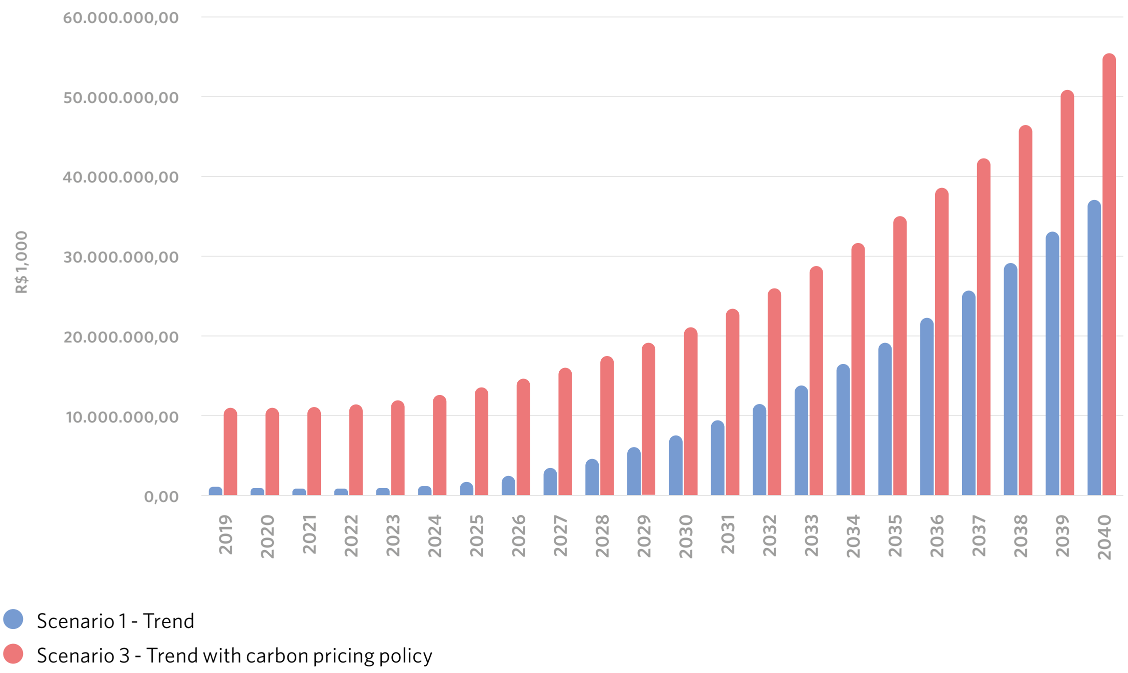
Source: Prepared by the authors.

The inclusion of the social benefit of stocked carbon in the producer's income aims to ensure the remuneration associated with the conservation of the standing forest that contributes to climate change mitigation. In this sense, the incorporation of the benefit of stocked carbon will imply the redistribution of the value added generated. It is observed that in scenario 3, with the policy on pricing of the social benefit of stocked carbon, the share of the VA generated increases from 30.8 percent to 43.5 percent in the production sector (alpha 0), falls from 20 percent to 5.5 percent in the rural intermediate sector, increases from 15.3 percent to 23.2 percent in the processing industry in urban centers, and decreases from 13 percent to 10.8 percent in domestic retail.

These readjustments contribute to increase the producer's remuneration since in addition to the extracted product, they also produce the positive externalities associated with the conservation of native vegetation that implies important amounts of stocked carbon.

Chart 4 shows the remuneration of the production sector with and without the incorporation of carbon pricing in the açai value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing considerably increases the producer's income, which should reach about BRL55.5 billion, while without the pricing policy the value added estimated for 2040 should total BRL37.2 billion.

Chart 4: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the açai chain



Source: Prepared by the authors.

4.2.2 Scenarios of the income generated in the Brazil nut value chain

The extraction of Brazil Nut *(Bertholletia excelsa)* is a fundamental economic activity that began in the mid-1910s. The fruit can be consumed fresh or as oil, flour and even bran. It is used in areas other than pastry and cooking, as well as in the pharmaceutical and cosmetics industry (Gonzales, 2010; Shanley & Medina, 2005).

Bertholletia excelsa is an endangered species, according to version 2012.2 of the Red List of the Brazilian flora (CNCFlora, 2012) and the Red List of the Flora of Pará (COEMA-PA, 2007). Although protected by law, *B. excelsa* is under a strong extractive pressure due to the use of its seeds for industrial and food purposes - which is already restricting the recruitment of new individuals in some subpopulations - as well as to the significant continuous decline in the size and quality of its habitat in much of its distribution, as a result of the expansion of agricultural activities. It is suspected that, notwithstanding legal protection, *B. excelsa* is being subject to logging due to its large size and columnar trunk, which re typical of *Lecythidaceae* species. Thus, considering the current and potential threats to which it is exposed, and estimating the generation time of the species in at least 50 years, it is possible to believe that *B. excelsa* will experience a population decline of at least 30 percent in the next 100 years (CNCFlora,2012).[6]

According to Mori et al. (1990), between 1978 and 1983 there was a sharp decrease in the production of Brazil Nuts (*Bertholletia excelsa*) due to logging. Researchers from EMBRAPA in Eastern Amazon, in turn, are conducting an analysis of the decrease in Brazil nut production. Homma et al. (2000) point out that the logging of Brazil nut trees, although legally prohibited since the 1960s, is also related to the loss of competitiveness vis-à-vis other economic alternatives. Even if Brazil nut trees could bear fruit indefinitely, without its verticalization by pickers, at the current price of the standing tree maintaining them will hardly be an attractive endeavor. Because of the appreciation of the cupuaçu market, maintaining native cupuaçu plantations has become more profitable than maintaining

6 Accessed at: CNCFlora. Bertholletia excelsa in Red List of Brazilian flora, version 2012.2 National Center for Flora Conservation. Available at <http://cncflora.jbrj.gov.br/portal/pt-br/profile/Bertholletia excelsa>. Access on 21 March 2021.

Brazil nut plantations. On the other hand, this is promoting the domestication of the species. In Castanhal Araras, for example, the percentages are 70 percent for domesticated plantations and 30 percent for extractive plantations, whereas the opposite holds true for the Agro-Extractive Project of Praialta and Piranheira, in Nova Ipixuna. The extractive activity, by itself, cannot guarantee economic sustainability, requiring the implementation of subsistence agriculture; hence the clear risk for ecological and economic sustainability in the medium and long term (Homma et al., 2000).

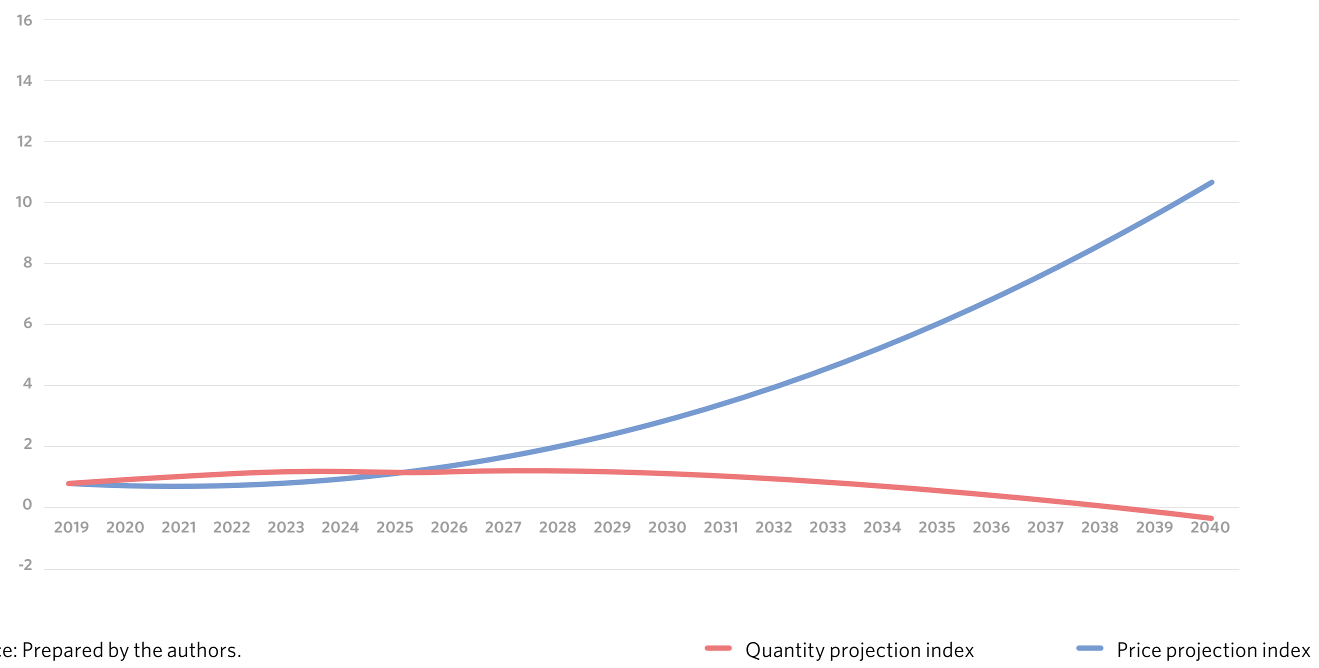
The Alpha Accounts show that the complete value of the Brazil nut chain - from harvesting and industrial transformation and processing to sales - contributes to increasing income generation by some 1,280 percent (compared to the income generated by the harvesting sector), with a Value Added of BRL220.9 million in 2019.

4.2.2.1 Trend scenario

As shown in the aforementioned studies, the trend analysis of Brazil nut indices presents production and price fluctuations, with price increasing at a steady rate. The analysis of the increase in the average price and amount of Brazil nuts from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for both price and quantity. Chart 5 shows the quantity and price projection curves. It is observed that the quantity produced grows slightly until 2026 and begins to fall continuously in 2027. On the other hand, price boasts a steady growth. Despite the forecast fall in production, the price growth above the negative variation in production will ensure a value-added increase, thus hiding the production fall in terms of quantity. Therefore, it is essential to analyze the factors underlying the decrease in Brazil nut productions in order to propose public policies aimed at ensuring the conservation of the species and maintaining product provision.

In order to identify the municipalities that influence the downward behavior of the quantity curve, table 1 shows the municipalities with the highest production share in the State of Pará in 2006 and 2019, and the quantity variation in the period by municipality.

Chart 5 - Curves of the quantity projection index and price projection index to calculate the future value of Brazil nuts



Source: Prepared by the authors.

It is observed that, in 2006, Oriximiná and Alenquer were the municipalities with the highest production share in Pará, with 23 percent and 15 percent, respectively. However, a 36 percent drop in production was found in Alenquer, while Oriximiná boasted a 65 percent increase in the analyzed period. In addition to Alenquer, other municipalities show a drop in production, such as Altamira (-40 percent) and Faro (-36 percent). Although these municipalities have a lower share of the state's production, these and other municipalities influence the state's aggregate production curve. On the other hand, some municipalities show positive results in production, such as Óbidos and Portel, with an increase of 265 percent and 41 percent, respectively, in the analyzed period.

Table 1: Main Brazil nut producing municipalities in 2006 and 2019 and variation in the quantity produced in the period

Municipalities	Integration Region	Share in the production of the State of Pará (%)		Quantity variation 2019/2006 (%)
		2006	2019	
Acará (PA)	Tocantins	8%	3%	-45
Alenquer (PA)	Baixo Amazonas	15%	7%	-36
Almeirim (PA)	Baixo Amazonas	3%	3%	18%
Altamira (PA)	Xingu	6%	3%	-40%
Faro (PA)	Baixo Amazonas	2%	1%	-36%
Óbidos (PA)	Baixo Amazonas	9%	25%	265%
Oriximiná (PA)	Baixo Amazonas	23%	29%	65%
Portel (PA)	Marajó	3%	3%	41%
Other municipalities		31%	26%	

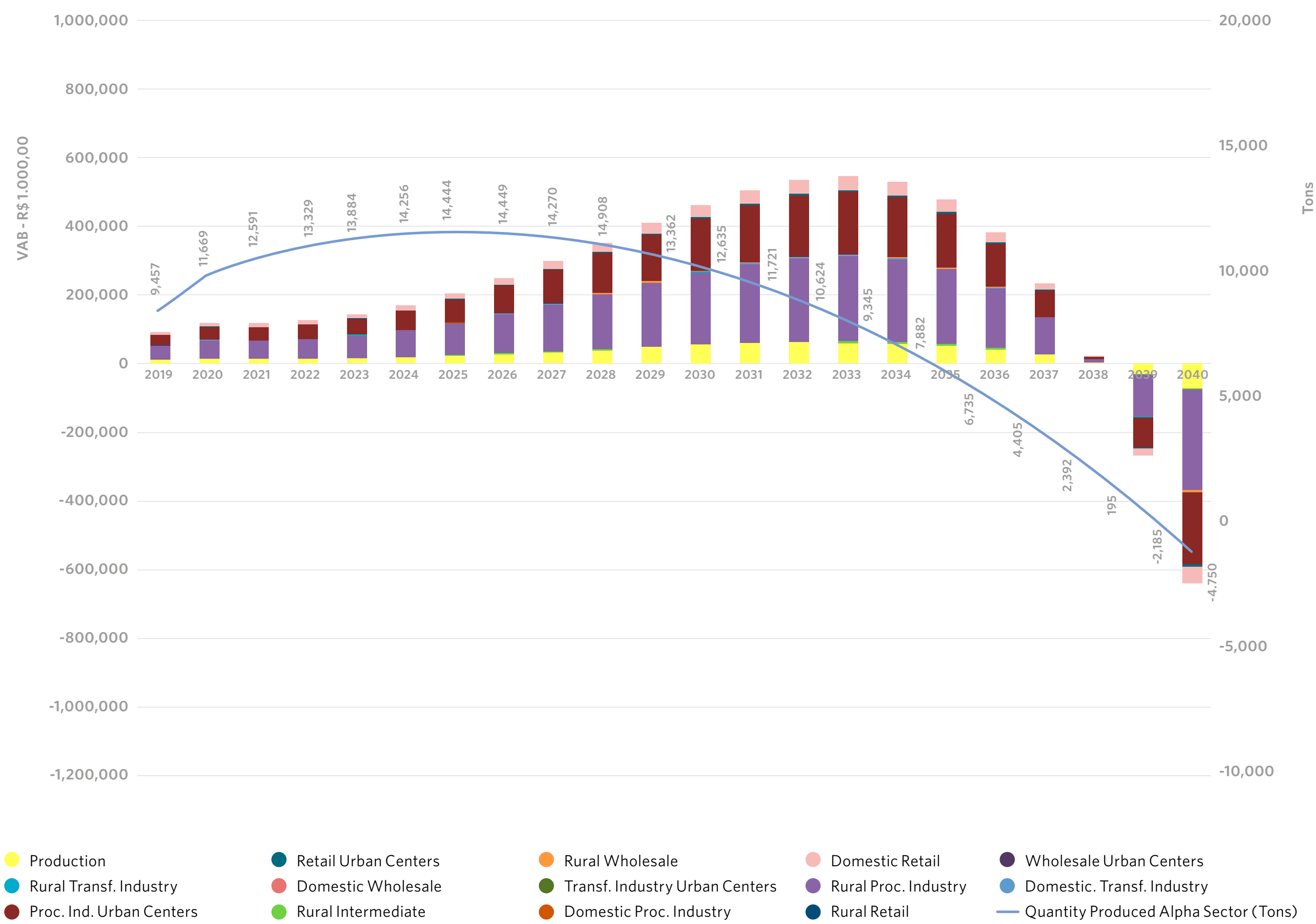
Source: Prepared from PEVS (IBGE)

Given the downward behavior of production in some municipalities, the aggregate quantity projection curve for the state tends to increase in the short term and decrease in the medium and long term. These observations point to the importance of strengthening the production chain of Brazil nuts.

Chart 6 shows the Value Added (VA) projections for each link in EcoSocioBio-PA's Brazil nut chain, as well as the quantity produced by 2040, represented in table 15. In 2019, the total VA absorbed in the chain was BRL247.4 million. The quantity projection analysis shows that production reaches a peak in 2026, with 14,449 tons (average growth of 6 percent p.a.), begins to fall in 2027 to 195 tons in 2038 (average drop of 20 percent p.a.), and stabilizes in 2039.

In relation to the expected price change, projected growth is expected to exceed the drop in quantity by the year 2033. From 2033 onwards, price increases stop outweighing quantity decreases and begin to contribute to the value-added decrease along the Brazil nut chain. Between 2020 and 2033, the VA grows around 14 percent p.a., with a peak in income generation estimated at BRL1.5 billion. The lowest level of value added generated of BRL56.9 million (a 32 percent drop p.a.) is reached between 2033 and 2038, when production would be halted. The income generated is expected to start a downward spiral in 2039, as the positive price variation will no longer outweigh the fall in physical production.

Chart 6 - Projection of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's Brazil nut chain by 2040



Source: Prepared by the authors.

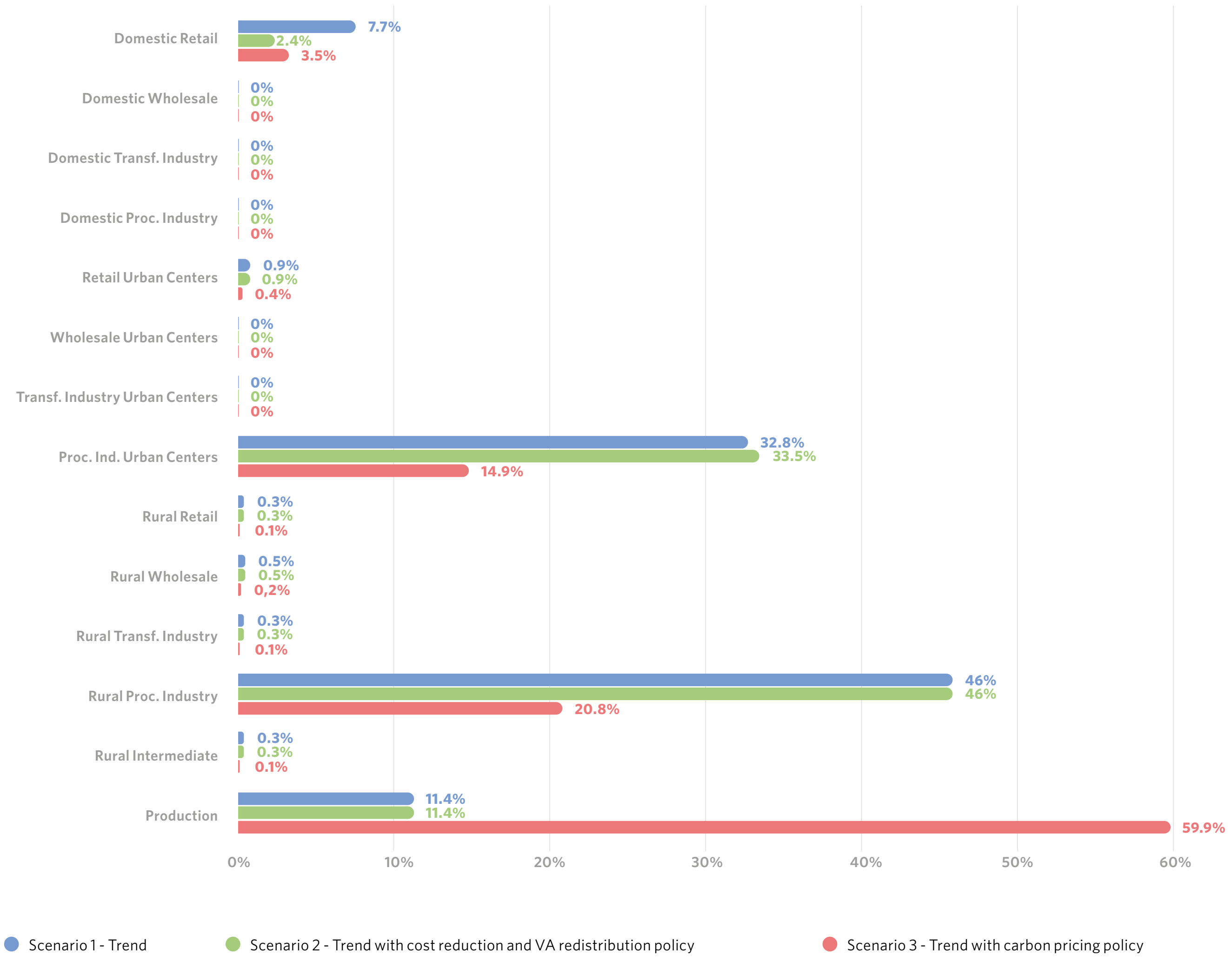
4.2.2.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the Brazil nut value chain with the projected policies, Chart 7 shows the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction on industrial sectors and a domestic retail tax, and in scenario 3 with carbon pricing.

In the trend scenario, 11 percent of the VA is absorbed by the production sector, 46 percent by the rural processing industry, 33 percent by the processing industry in urban centers, and 8 percent by the domestic wholesale industry. Therefore, it is observed that domestic retail is the one with the highest absorption of the VA generated, showing a strong distortion in the distribution of income generated from the production of Brazil nuts.

In scenario 2, with the income redistribution policy (cost reduction between the alpha and beta sectors and rate

Chart 7: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the Brazil nut value chaint



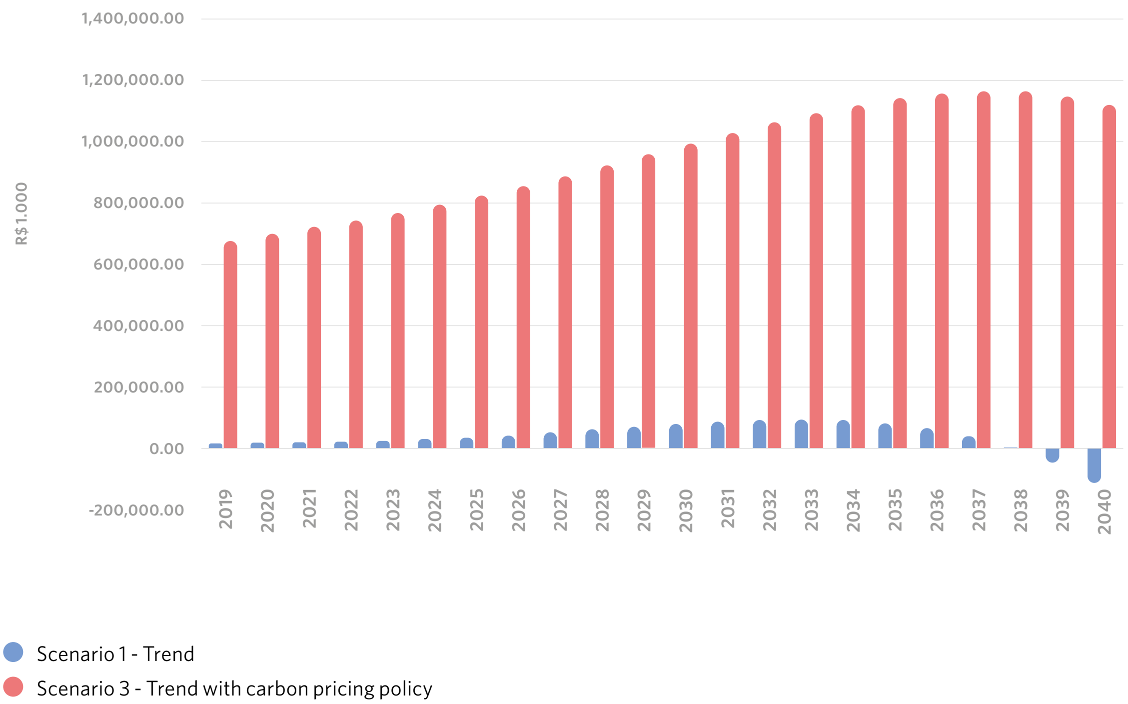
Source: Prepared by the authors.

application in the gamma sectors), the participation of the VA generated in domestic retail falls from 8 percent to 2 percent (5 p.p.) and increases from 32.8 percent to 33.5 percent in the processing sectors in urban centers. These instruments are of low magnitude for the redistribution of VA, requiring larger amounts to reduce redistribution costs and taxation.

In scenario 3, with the policy on pricing of the social benefit of stocked carbon, the share of the VA generated in the production sector (alpha 0) jumps from 11 percent to 60. Although the policy favors producers, processing industries in rural areas and urban centers are also impacted by a reduction in their shares, which may indicate the importance of income distribution to the other chain agents through carbon pricing.

Chart 8 shows the remuneration of the production sector with and without the incorporation of carbon pricing in the Brazil nut value chain. As foreseen by the trend scenario, production remains positive only until 2038. It is observed that, in 2038, the Value Added of producers (Alpha 0 sector) projected with carbon pricing is around BRL1.2 billion, while without the pricing policy the value added for 2040 is estimated at BRL3.7 million.

Chart 8: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the Brazil nut chain



Source: Prepared by the authors.

4.2.3 Scenarios of the income generated in the cocoa beans value chain

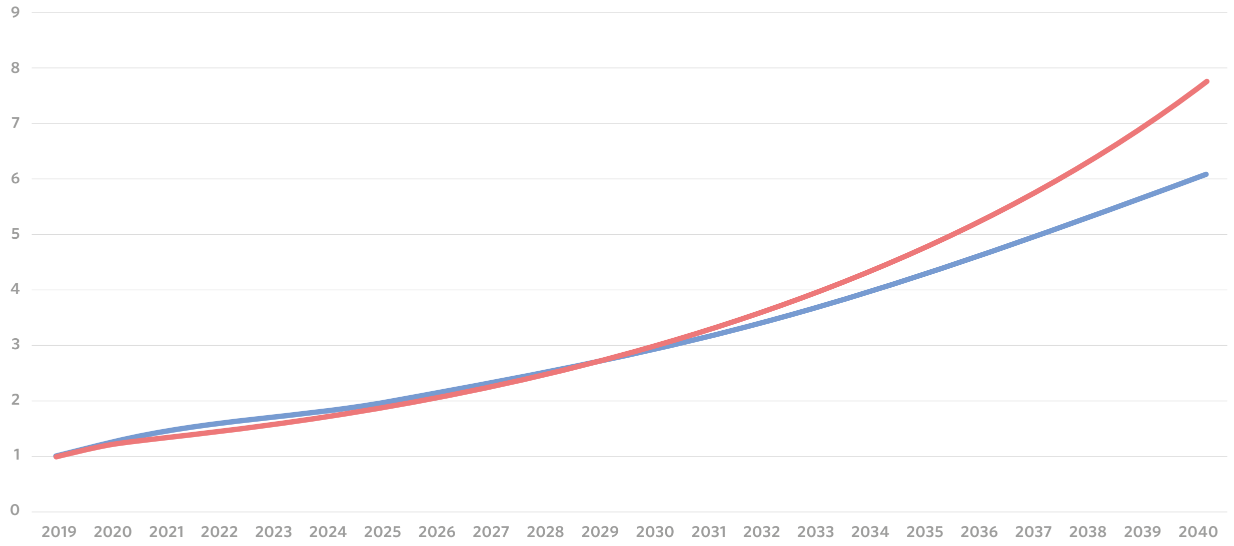
Cocoa (cacao) bean (*Theobroma cacao*) is, in short, the most natural form of chocolate; small pieces of beans are roasted and then crushed. It is appreciated mainly in gastronomic niches that favor natural products with a high nutritional value, especially because of its antioxidant property that contributes to blood pressure control (Shanley & Medina, 2005).

The Alpha Accounts show that the complete value chain of cocoa beans - from harvesting and industrial transformation and processing to marketing - contributes to an increase in income generation of some 132 percent compared to the income generated by the extractive sector, having reached the total Value Added of BRL1.3 billion in 2019.

4.2.3.1 Trend scenario

The analysis of the increase in the average price and the quantity of cocoa from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for the price and an exponential curve to represent quantity increases. Chart 9 shows the quantity and price projection curves with very similar slopes. It is only in 2030 that the slope is higher for the quantity produced than for the projected price.

Chart 9 - Curves of the quantity projection index and price projection index to calculate the future value of cocoa beans

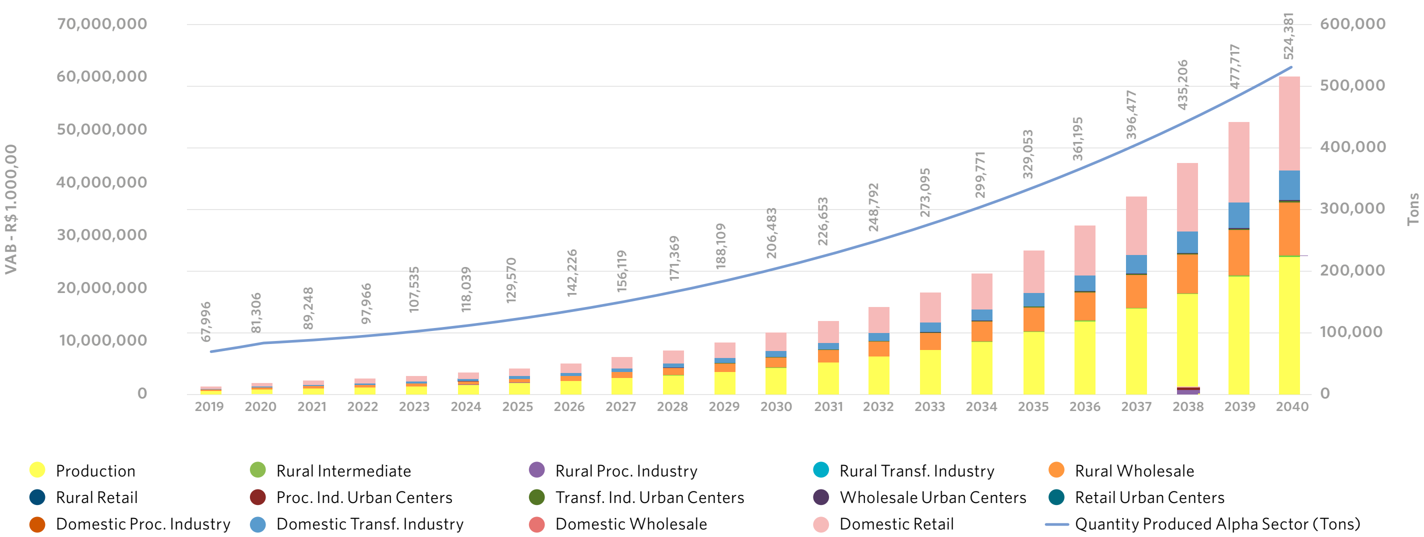


Source: Prepared by the authors.

Chart 10 shows the Value Added (VA) projections for each link in EcoSocioBio-PA's cocoa bean chain, as well as the quantity produced by 2040, represented in table 18. It is observed that the VA absorbed in the chain, which totaled around BRL1.3 billion in 2019, is expected to reach BRL59.8 billion in 2040 - an average increase in income generation of 20 percent p.a.. As noted, the increase in the VA absorbed by each sector occurs evenly along the chain. That is, in 2040, of the total projected income, the production sector is expected to absorb BRL25.7 billion (43 percent), local rural wholesale BRL10 billion (16.8 percent), the domestic processing industry BRL5.6 billion (9.4 percent), and domestic retail around BRL17.7 billion (29.6 percent).

As for quantity, the production projected for 2040 should reach 524,381 tons, representing an average growth of 10 percent p.a. in annual production over the projected period.

Chart 10 - Projection of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA' cocoa bean chain by 2040



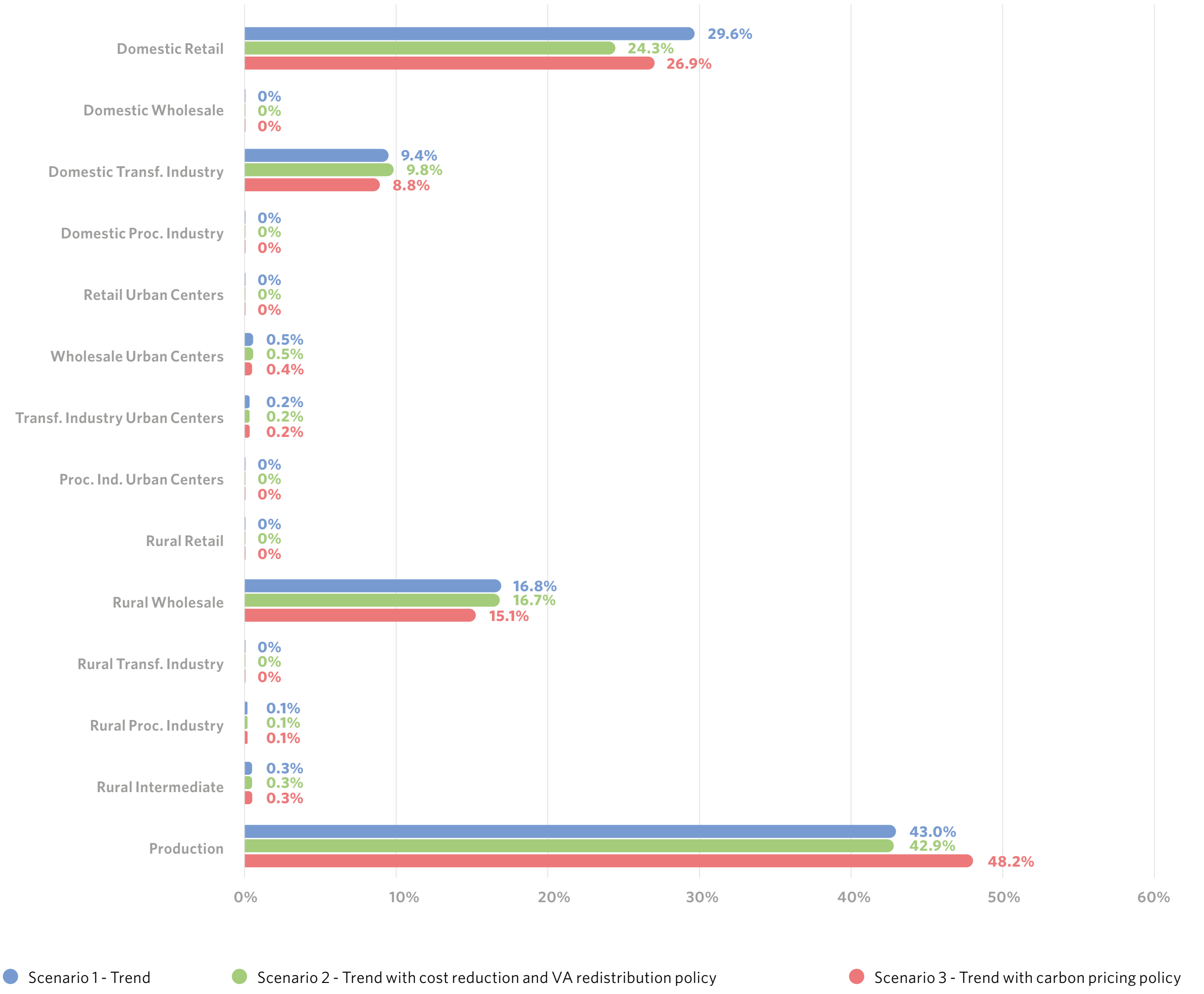
Source: Prepared by the authors.

4.2.3.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the cocoa bean value chain with the projected policies, Chart 11 shows the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and in scenario 3 with carbon pricing. In the trend scenario, it is observed that the production sector (alpha 0) absorbs 43 percent of the value generated, followed by the domestic retail sector with 29.6 percent, rural wholesale with 16.8 percent and the domestic processing industry with 9.4 percent. The industrial sectors of the local economy absorb only 0.3 percent.

In scenario 2, with the implementation of an intermediate cost reduction policy in the industrial sectors and a domestic retail tax, it is observed that the share of the VA generated in domestic retail falls from 29.6 percent to 24.3 percent, while the processing sectors show a small increase of only 0.4 percent. Such measures, when adopted in this proportion, prove to be of low magnitude for VA redistribution, requiring higher percentages to further minimize costs and increase the collection of domestic economy revenues.

Chart 11: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the cocoa bean chain

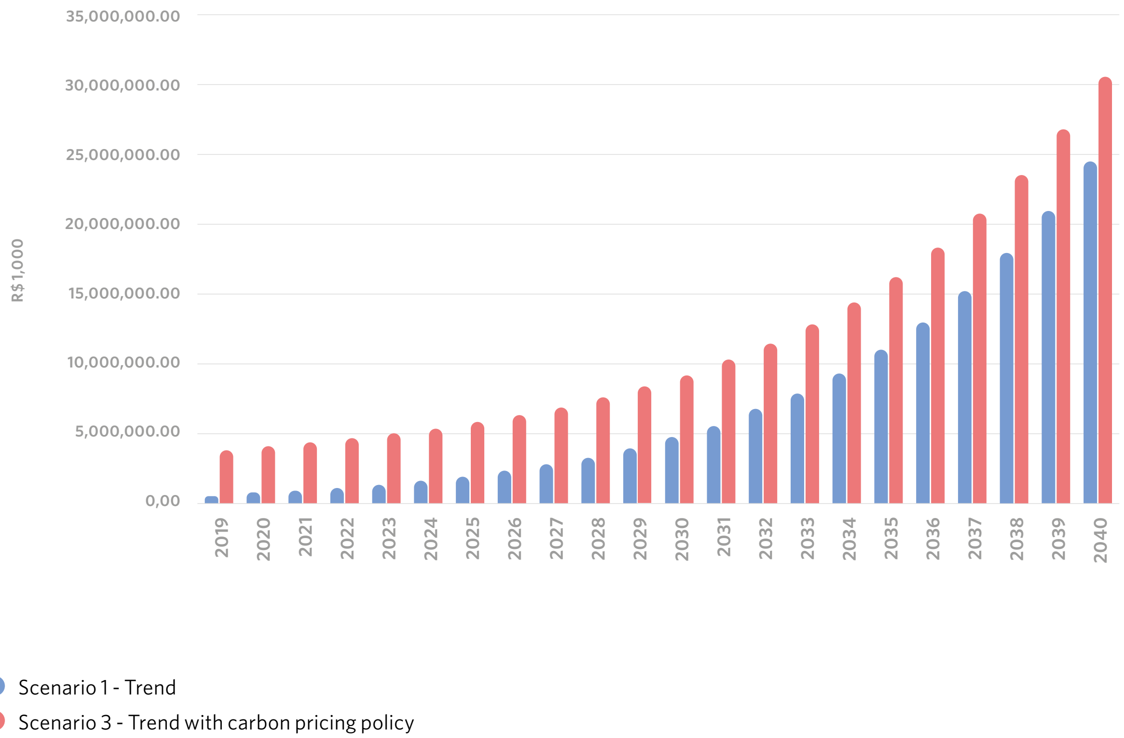


Source: Prepared by the authors.

In scenario 3, with the carbon pricing policy, the participation of the VA generated in the production sector (alpha 0) increases from 43 percent to 48.2 percent, the share of domestic retail falls from 29.6 percent to 26.9 percent and the domestic industrial processing sector also experiences a decrease from 9.4 percent to 8.8 percent.

Chart 12 shows the remuneration of the production sector with and without the incorporation of carbon pricing into the cocoa value chain. It is observed that the VA generated with carbon pricing increases the income of the product, which is projected to reach BRL32 billion in 2040.

Chart 12: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the cocoa bean chain



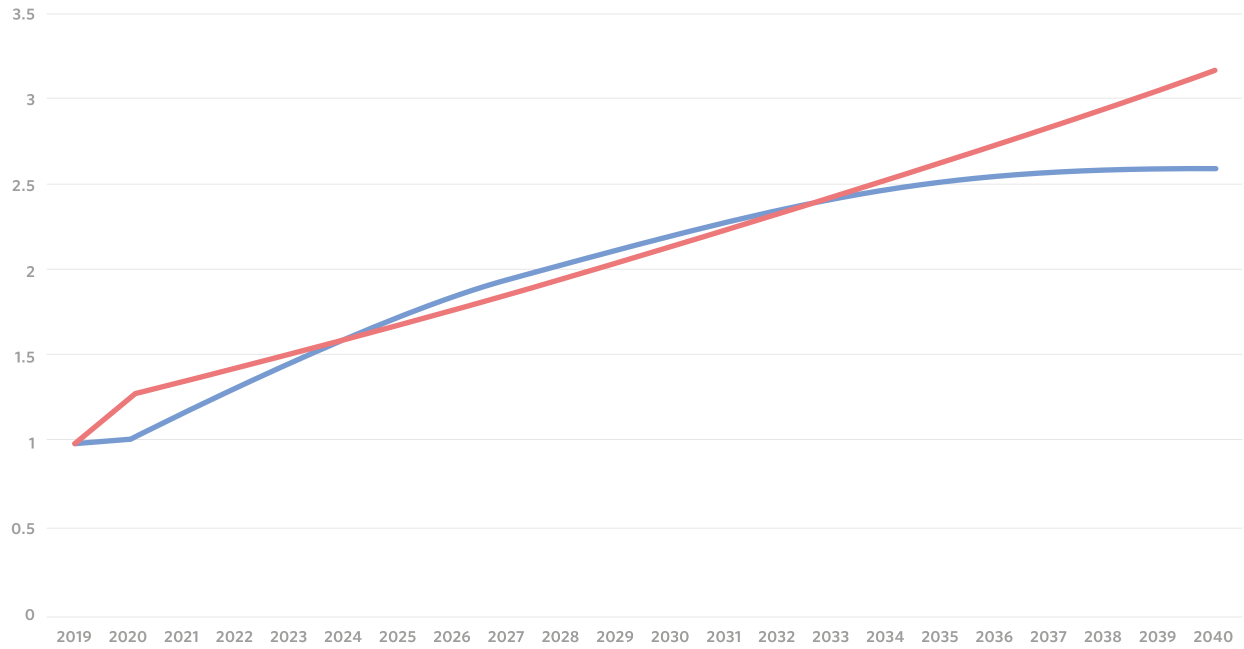
Source: Prepared by the authors.

4.2.4 Scenarios of the income generated in the honey value chain

4.2.4.1 Trend scenario

The analysis of the increase in the average price and quantity of honey from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for price and for the representation of the increase in quantity. Chart 13 shows the quantity and price projection curves. It is observed that regarding the quantity produced, the growth variation is lower than the positive power slope of the projected price.

Chart 13 - Curves of the quantity projection index and price projection index to calculate the future value of honey

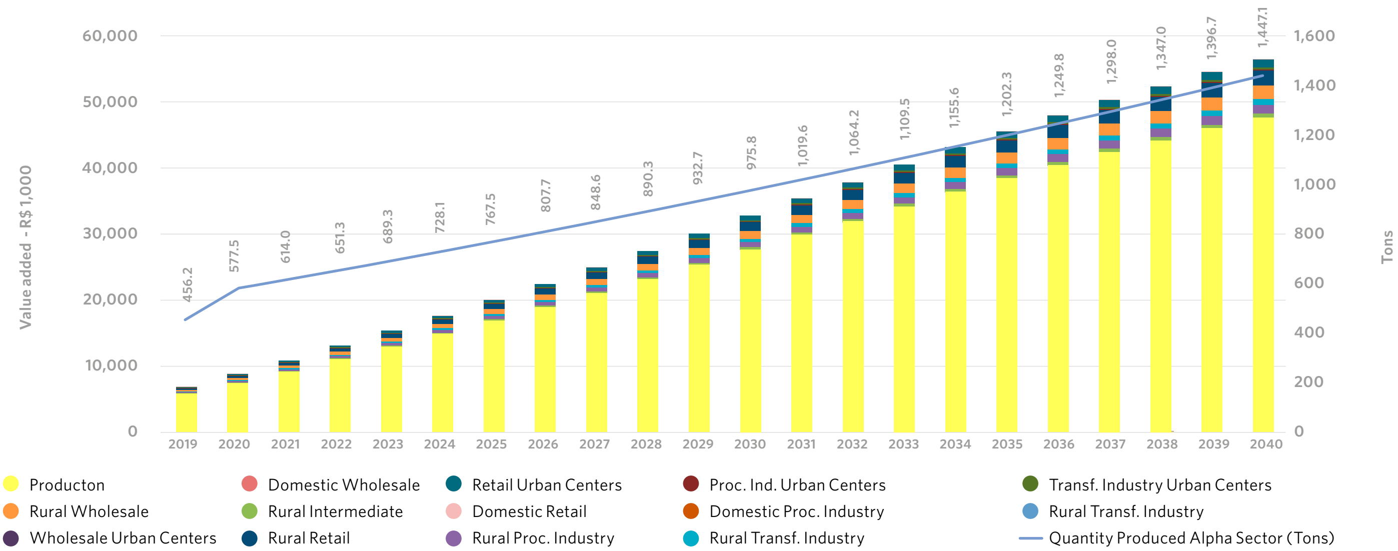


Source: Prepared by the authors.

Chart 14 shows the Value Added (VA) projections for each link in EcoSocioBio-PA's honey chain, as well as the quantity produced by 2040. It is observed that the total VA absorbed in the chain, which in 2019 stood at around BRL6.9 million, is expected to reach BRL56.6 million by 240 - an average growth of 11 percent p.a. in the income generated. As noted, the increase in the VA absorbed by each sector occurs evenly along the chain. That is, in 2040, of the total projected income, the production sector is expected to absorb BRL47.6 million (84 percent), and rural wholesale and retail BRL2 million (4 percent) and BRL2.4 million (4 percent), respectively.

In relation to the projected quantity for 2040, production is expected to total 1,446 liters, with an average growth of 6 percent p.a. in annual production.

Chart 14 - Projection of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's Honey value chain by 2040



Source: Prepared by the authors.

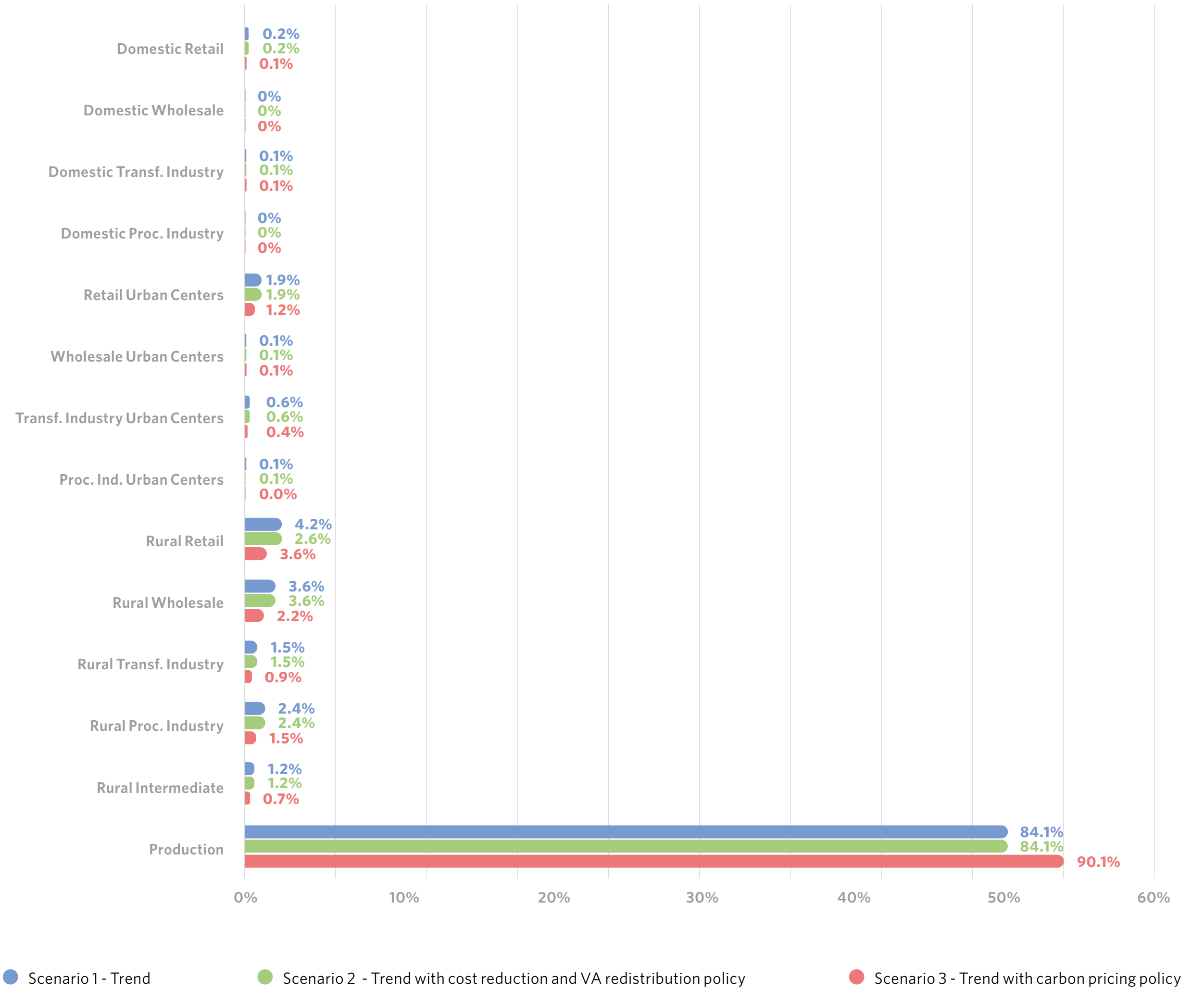
4.2.4.2 Carbon pricing policy scenario and cost reduction scenario and value-added redistribution scenario

As for the distribution of the value added generated in the honey value chain with the projected policies, Chart 15 shows the redistribution of the value added projected for scenario 3 with carbon pricing.

As observed in the trend scenario, the value generated in the honey chain is highly concentrated in the producer, who absorbs 84 percent of the total value added generated, followed by rural retail and rural wholesale, with 4.2 percent and 3.6 percent, respectively. Considering the absence of industrialization for honey marketing and distortions in income generation between the domestic and local economy, scenario 2 does not apply to the honey chain.

The inclusion of the social benefit of stocked carbon in the producer's income aims to ensure the remuneration associated with the conservation of the standing forest that contributes to climate change mitigation. In this sense, the incorporation of the benefit of stocked carbon will imply the redistribution of the value added generated. In scenario 3, with the policy on pricing of the social benefit of stocked carbon, the share of the VA generated in the production sector (alpha 0) increases from 84 percent to 90 percent.

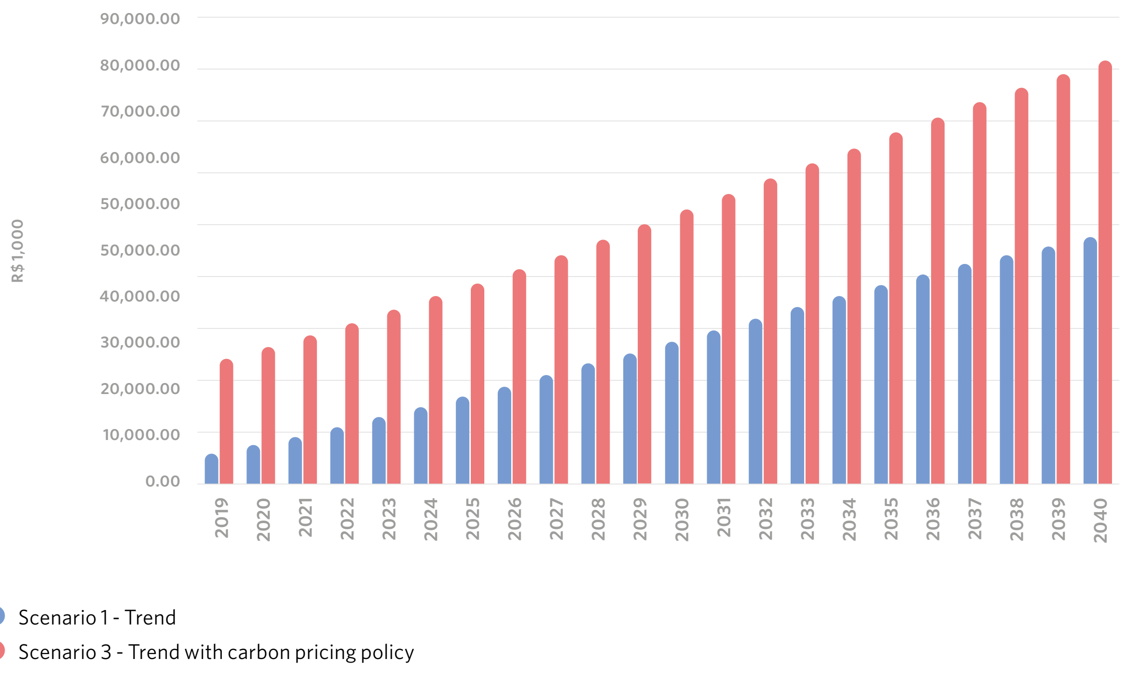
Chart 15: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the honey value chain



Source: Prepared by the authors.

Chart 16 shows the remuneration of the production sector with and without the incorporation of carbon pricing in the honey value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing increases the producer's income, which is estimated at around BRL81.7 million, whereas without the pricing policy the estimated value added of BRL47.6 billion would be reached in 2040.

Chart 16: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the honey chain



Source: Prepared by the authors.

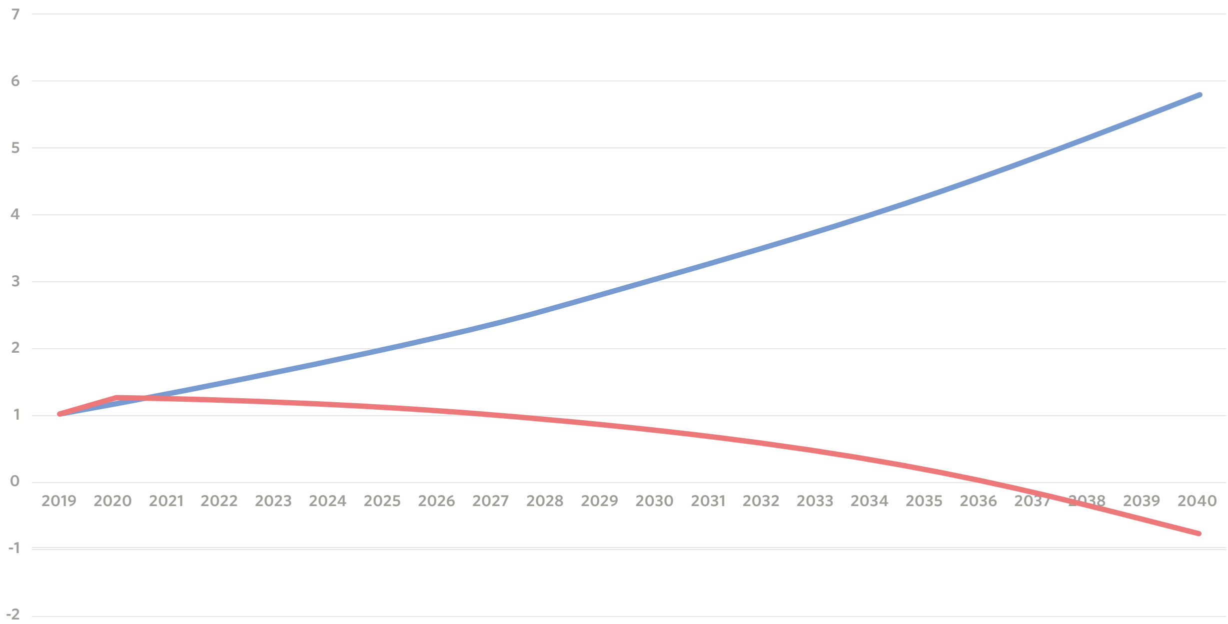
4.2.5 Scenarios of the income generated in the copaiba value chain

The oil extracted directly from the trunk of the copaiba tree *(Copaifera langsdorffii)*, which can reach the height of 40 meters, has high anti-inflammatory property and has been known for centuries by the peoples of the forest. In addition to being one of the most popular antibiotics in the region for its medicinal properties, copaiba oil is also used in the manufacture of varnish, paints, soaps, and shampoos (Gonzales, 2010; Shanley & Medina, 2005).

4.2.5.1 Trend scenario

The analysis of the increase in the average price and quantity of Copaiba from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for the price and for the representation of quantity increases. Chart 17 shows the quantity and price projection curves. It is observed that a slight growth in production is expected, followed by a fall. In relation to price, a positive slope of the projected price is observed, indicating a price increase.

Chart 17 - Curves of the quantity projection index and price projection index to calculate the future value of copaiba



Source: Prepared by the authors.

In order to identify the municipalities that influence the downward behavior of the projection curve of the quantity of copaiba oil produced, table 2 shows those with the highest production share in the state of Pará in 2006 and 2019, and the quantity variation in this period by municipality. It is observed that most of the municipalities with the highest production share in the State of Pará show a production decrease in the analyzed period. In 2006, Oriximiná and Medicilândia were the municipalities with the highest production share in Pará, the former with 32 percent and the latter with 16 percent; however, a production drop of 13 percent and 100 percent, respectively, was observed in the analyzed period. Despite the drop in production in Oriximiná, in 2019 the municipality was the main producer of copaiba in the State of Pará, with 41 percent, followed by Altamira, with 24 percent. The latter is the only municipality where production showed an upward trend in the analyzed period, with an increase of 100 percent.

Table 2: Main copaiba producing municipalities in 2006 and 2019 and variation in the quantity produced in the period.

Municipalities	Integration Region	Share in the production of the State of Pará (%)		Quantity Variation 2019/2006 (%)
		2006	2019	
Altamira (PA)	Xingu	8%	24%	100%
Faro (PA)	Baixo Amazonas	4%	0%	-100%
Medicilândia (PA)	Xingu	16%	0%	-100%
Óbidos (PA)	Baixo Amazonas	12%	6%	-67%
Oriximiná (PA)	Baixo Amazonas	32%	41%	-13%
Santarém (PA)	Baixo Amazonas	8%	0%	-100%
Uruará (PA)	Xingu	12%	0%	-100%
Other municipalities		8%	29%	

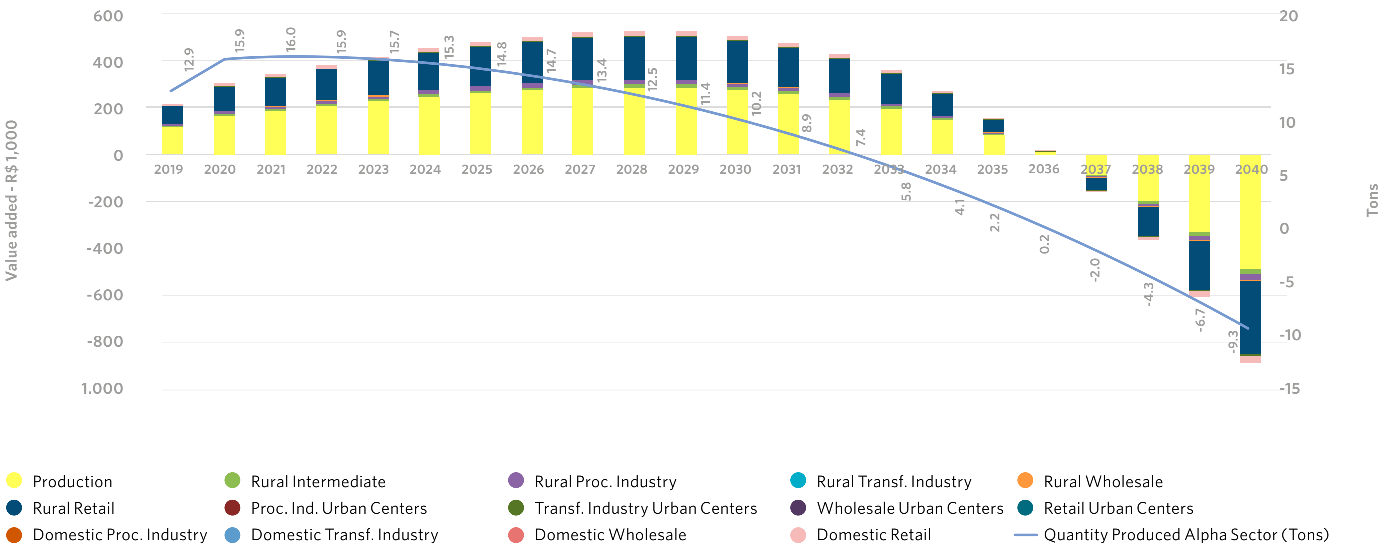
Source: Prepared from PEVS (IBGE)

Given the downward behavior of production in several municipalities, the projection curve of the aggregate quantity for the state tends to decrease, which points to the importance of designing strategies that strengthen the value chain of copaiba production.

Chart 18 shows the Value Added (VA) projections for each link in the EcoSocioBio-PA's copaiba chain, as well as the quantity produced by 2040. In 2019, the total VA absorbed in the chain was BRL212,000. In the analysis of the quantity projection, it is observed that production reaches a peak in 2021, totaling 13,900 tons (average growth of 8 percent p.a.), starts to fall in 2021 to 183 kg in 2036 (average fall of 17 percent p.a.), and stabilizes from 2037 onwards.

In relation to the expected price change, the projected growth should outweigh the fall in quantity by the year 2028. From 2028 onwards, price increases stop outweighing quantity decreases, and a fall in the value added occurs throughout the copaiba production chain. Between 2020 and 2028, the VA increases by around 11 percent p.a., with an income peak estimated at BRL524,000. The lowest level of value added generated is reached in 2036d, with BRL13,700 (down 24 percent p.a. from 2029 to 2036). Income is expected to start falling in 2037, as the positive price variation no longer outweighs the fall in physical production.

Chart 18 - Projection of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's copaiba value chain by 2040



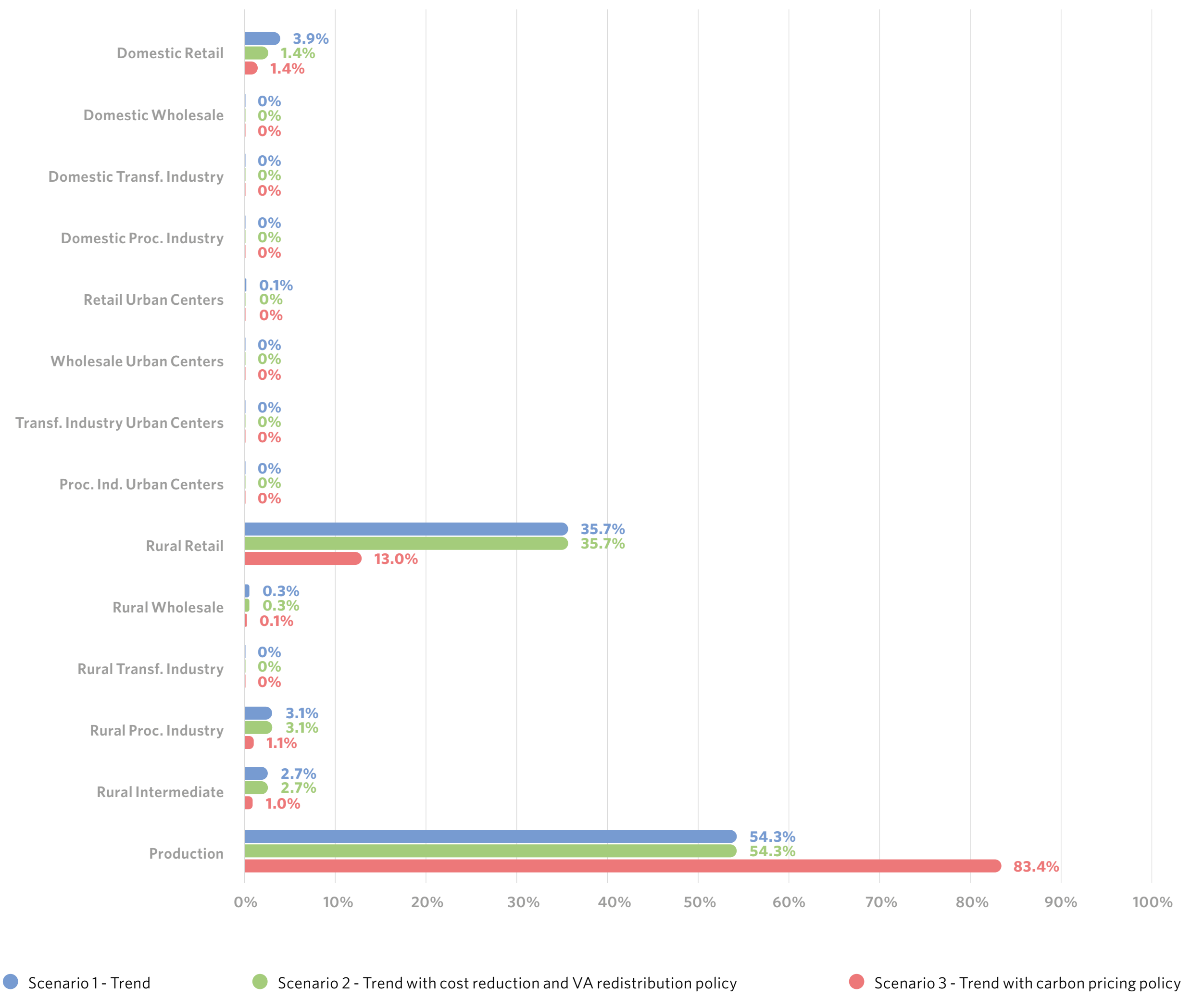
Source: Prepared by the authors.

4.2.5.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the copaiba value chain with the projected policies, Chart 19 presents the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing. In the trend scenario, it is observed that the production sector shows the highest income absorption with 54.3 percent, followed by rural retail with 35.7 percent and domestic retail with 3.9 percent. The rural processing industry absorbs only 3.1 percent.

Due to the almost non-existent income generation in the processing and transformation industries, such a policy would imply almost zero effects. It is observed that the only sector that would show a loss in its share is domestic retail, with a drop from 3.9 percent to 2.6 percent. However, in scenario 3 with the policy on pricing of the social benefit of stocked carbon, the share of the VA generated in the production sector (alpha 0) jumps from 54.3 percent to 83.4 percent, while the share of rural retail falls from 35.7 percent to 13 percent.

Chart 19: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the copaiba value chain



Source: Prepared by the authors.

Chart 20 shows the remuneration of the production sector with and without the incorporation of carbon pricing into the copaiba value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing, increases the producer's income. In 2036, when production is still positive, income is expected to reach BRL940,000, while without the pricing policy the projected income would be BRL7,000.

Chart 20: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the copaiba chain

Source: Prepared by the authors.

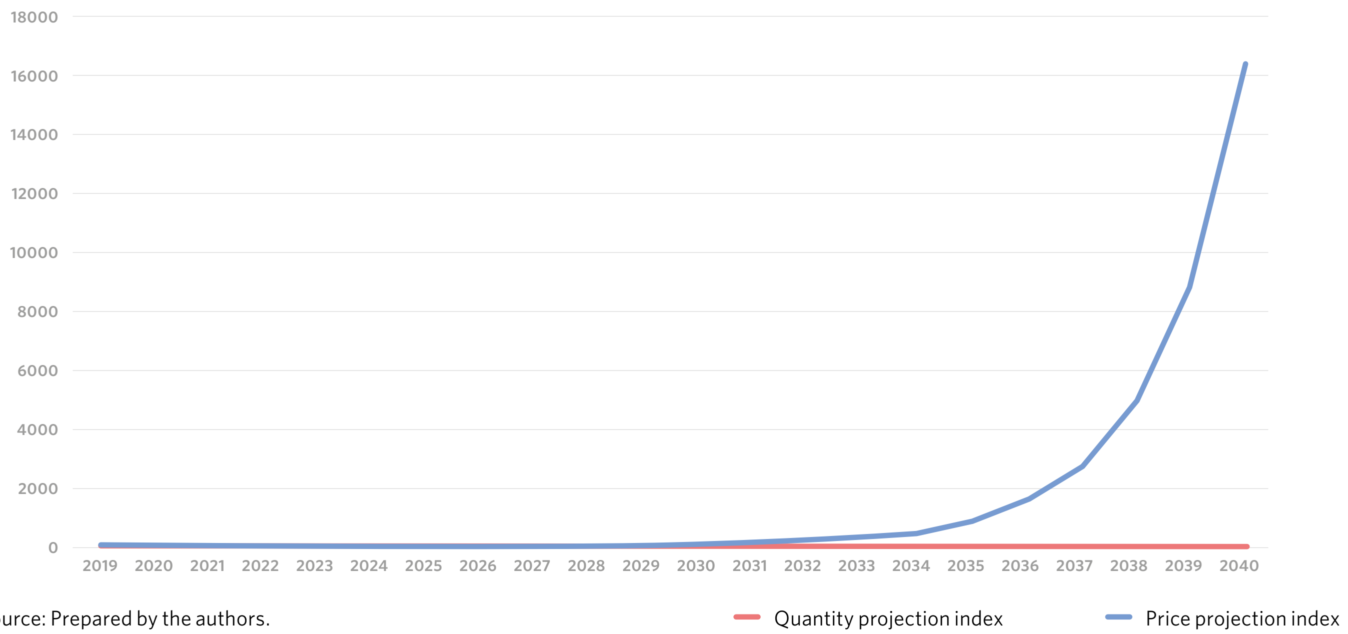
4.2.6 Scenarios of the income generated in the Cumaru value chain

The main economic use of Cumaru *(Dipteryx odorata)* lies in its wood and seeds, which have slightly sweet aromas. The cumaru tree produces broad beans that are responsible for its reproduction. In the Amazon region, cumaru is used to treat muscle pain and rheumatism (Shanley & Medina, 2005).

4.2.6.1 Trend scenario

The analysis of the increase in the average price and quantity of cumaru from EcoSocioBio-PA pointed to a better adaptation of the exponential trend curve for the price and a polynomial curve to represent quantity increases. Chart 21 shows the curves of the quantity and price projection indices. It is observed that the quantity projection curve indicates a very low growth of at most 5 percent, while the projected price follows an exponential curve.

Chart 21 - Curves of the quantity projection index and price projection index to calculate the future value of cumaru

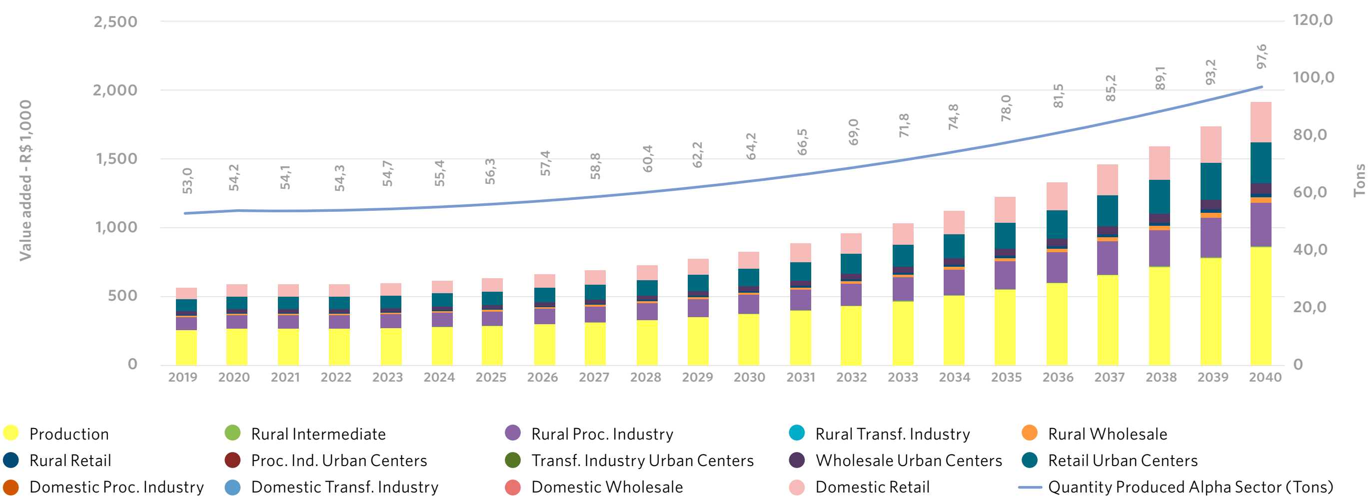


Source: Prepared by the authors.

Chart 22 shows the Value Added (VA) projections for each link in the EcoSocioBio-PA cumaru chain, as well as the quantity produced by 2040. It is observed that the total VA absorbed in the chain, which in 2019 was around BRL566.4 million, is expected to reach BRL1.9 million in 2040 - an average growth of the income generated of 6 percent p.a., reaching up to 10 percent at the end of the period. As noted, the VA growth absorbed by each sector occurs evenly throughout the chain. That is, in 2040, of the total projected income, the production sector absorbs BRL859,000 (45 percent), the rural processing industry BRL318,300d (17 percent), retail in urban centers BRL294,000 (15 percent), and domestic wholesale BRL296,000 (13 percent).

In relation to the quantity projected for 2040, a potential production of 98 tons is expected, with an average annual production growth of 3 percent p.a..

Chart 22 - Projection of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's cumaru value chain by 2040



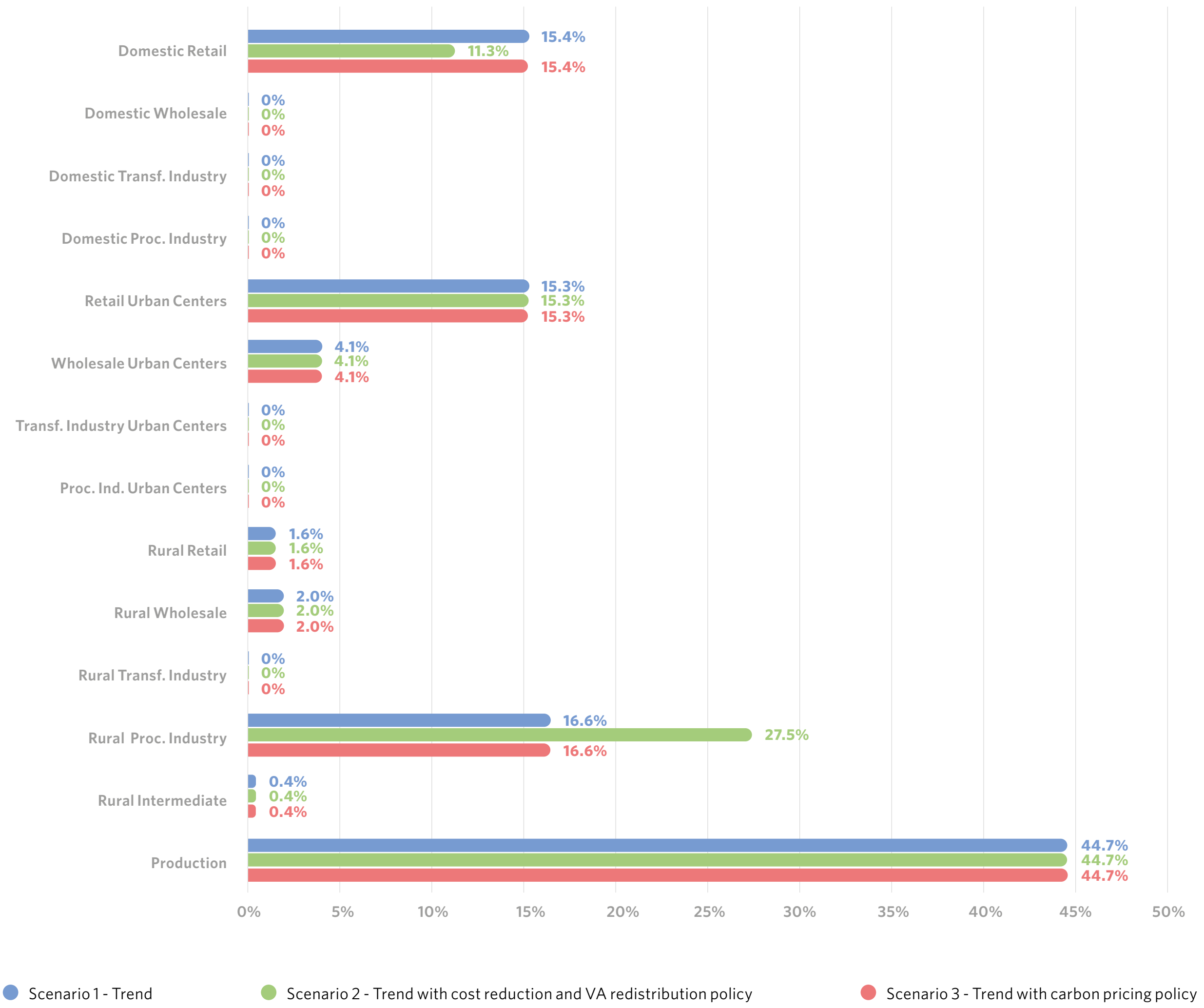
Source: Prepared by the authors.

4.2.6.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the Cumaru value chain with the projected policies, Chart 23 presents the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing.

In the trend scenario, the production sector absorbs 44.7 percent, followed by the rural processing industry with 16.6 percent, domestic retail with 15.4 percent and retail in urban centers with 15.3 percent. In scenario 2, with the implementation of an intermediate cost reduction policy in the industrial sectors and the domestic retail tax, the share of the VA generated in domestic retail falls from 15.4 percent to 13.3 percent, while the share of the rural processing sector increases from 16.6 percent to 27.5 percent.

Chart 23: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the Cumaru value chain



Source: Prepared by the authors.

On the other hand, the implementation of carbon pricing has a low impact due to the fact that the value added of cumaru represents only 0.009 percent of the total income generated by EcoSocioBio-PA. In scenario 3, the effects of income redistribution with the policy on pricing of the social benefit of stocked carbon are small and do not impact the value added distribution or the projected gross income.

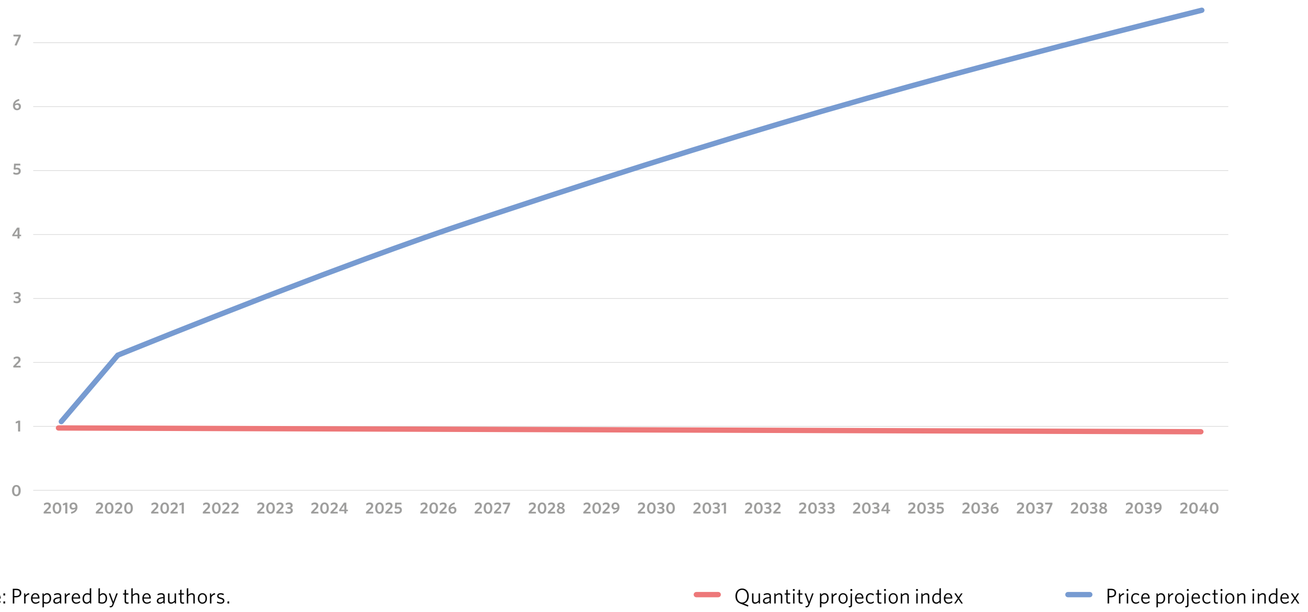
4.2.7 Scenarios of the income generated in the Buriti value chain

The fruit of Buriti *(Mauritia flexuosa)*, which is one tallest palm trees in the Amazon is used for various purposes in the economic scenario of the region and of those who live of its production, whether through the extraction of oil (important for domestic and culinary use but also for the production of cosmetics and cleaning products) or, in particular, through the production of "wine", pulp and sweets such as ice cream. The palm tree is also a key component in many Amazon socio-environmental contexts such as that of riverine populations in the Marajó Archipelago, which in addition to using the fruit also use the trunk to build bridges that connect their dwellings to the river. The palm tree fruit is also widely consumed by game species such as tapirs (Shanley & Medina, 2005).

4.2.7.1 Trend scenario

The analysis of the increase in the average price and quantity of buriti from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for the price and to represent quantity increases. Chart 24 shows the quantity and price projection curves. It is observed that the quantity projection curve shows a very low growth, while the projected price follows an average growth curve of 12 percent per year.

Chart 24 - Curves of the quantity projection index and price projection index to calculate the future value of buriti



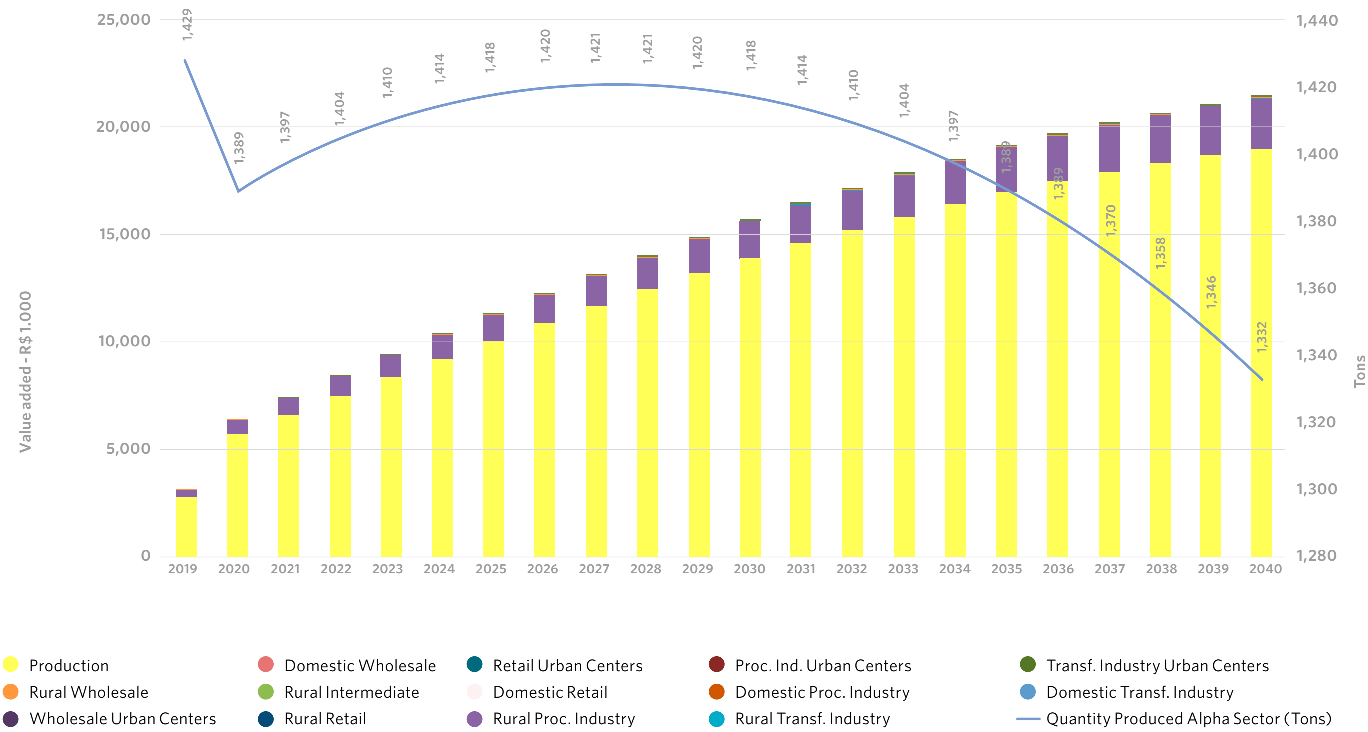
Source: Prepared by the authors.

Chart 25 shows the Value Added (VA) projections for each link in EcoSocioBio-PA's buriti chain, as well as the quantity produced by 2040. It is observed that the total VA absorbed in the chain, which was around BRL7.9 million in 2019, is expected to reach BRL55.4 million in 2040 - an average growth of the income generated of 11 percent p.a..

The growth of the VA absorbed by each sector occurs evenly along the chain. That is, in 2040, of the total projected income, the production sector absorbs BRL19 million (72 percent), the rural processing industry BRL2.3 million (23 percent), and the rural and urban transformation industry BRL13,000 and BRL90,000, respectively.

As observed in the Chart, unlike the projected income growth, there is a fall in physical production in the first year and from 2029 onwards. In relation to the projected quantity for 2040, a potential production of 1,332 tons is expected, with an average drop of 0.3 percent p.a..

Chart 25 - Projection of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's buriti value chain by 2040



Source: Prepared by the authors.

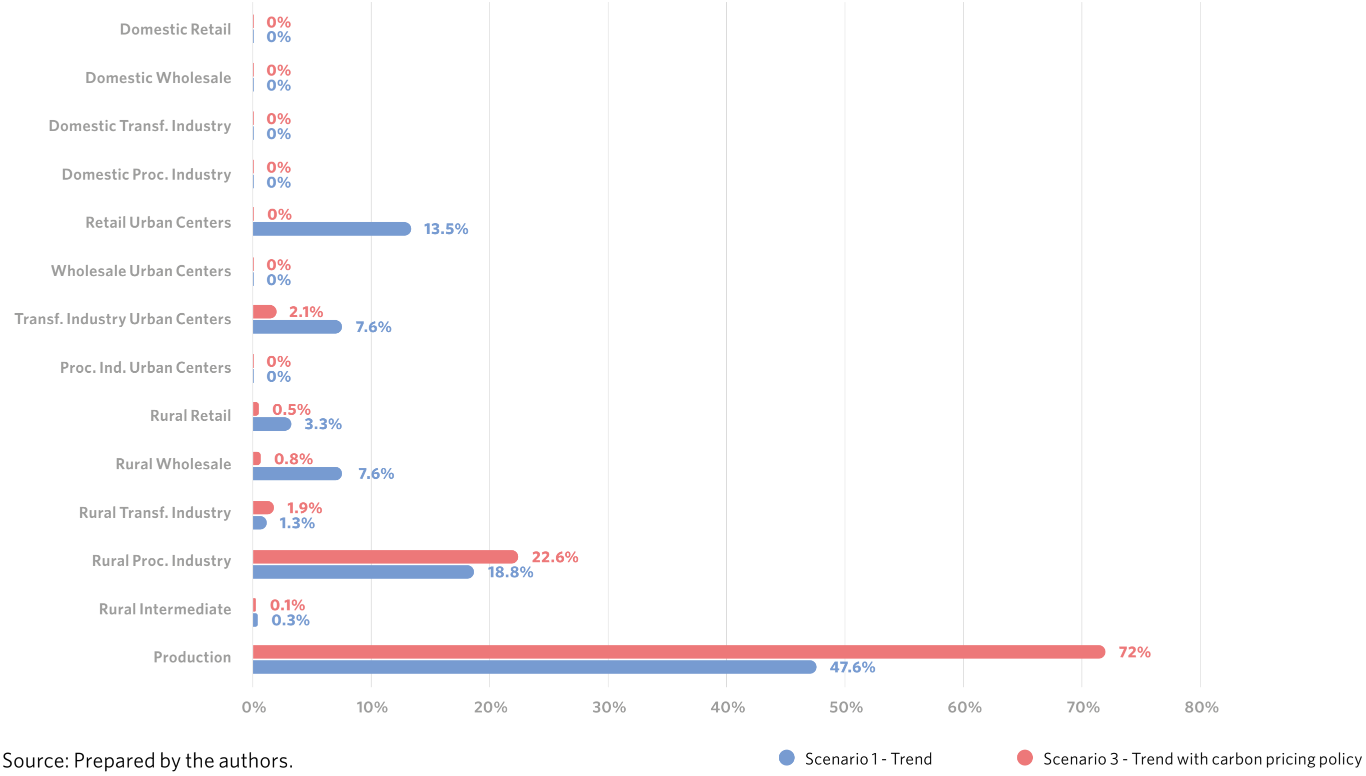
4.2.7.2 Carbon pricing policy scenario

As for the distribution of the value added generated in the Buriti value chain with the projected policies, Chart 26 presents the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing.

In the trend scenario, the value generated in the buriti chain is concentrated in the rural local sphere, which absorbs 79 percent, and the remainder is found in the local sphere of urban centers, which in turn absorb 21 percent. Considering the absence of distortions in income generation between the domestic and local economies, scenario 2 is not applied to the buriti chain.

In scenario 3, with the carbon pricing policy, the share of the VA generated in the production sector (alpha 0) increases from 47.6 percent to 72 percent; from 18.8 percent to 22.6 percent in the rural processing industry, and from 1.3 percent to 1.9 percent in the rural transformation industry. On the other hand, the other players in the chain would experience a reduction in the share of the total VA generated.

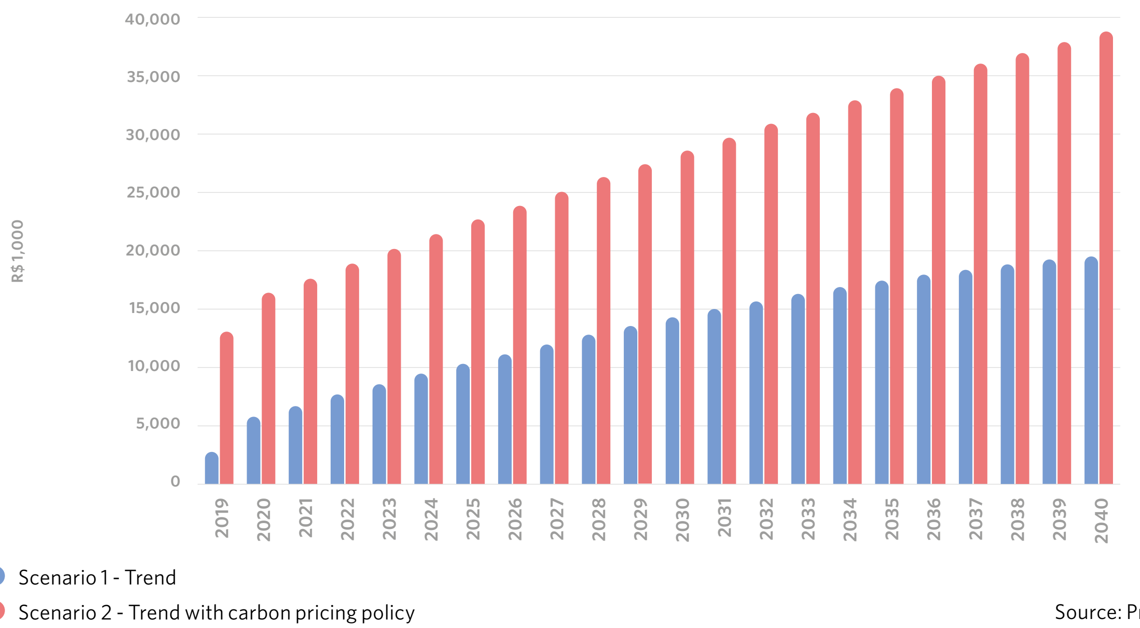
Chart 26: Percentage distribution of the value added projected in the trend scenario and in the trend scenario with a policy on shared value of stocked carbon in the buriti chain



Source: Prepared by the authors.

Chart 27 shows the remuneration of the production sector with and without the incorporation of carbon pricing in the copaiba value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing, increases the producer's income. In 2040, income is expected to reach BRL37.7 million, while without the pricing policy the projected income would be around BRL19 million.

Chart 27: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the buriti chain



Source: Prepared by the authors.

4.2.8 Scenarios of the income generated in the heart of palm value chain

Heart of Palm *(Bactris gasipaes),* which comes from palm trees such as açai and buriti, is an ally in the off-season periods of açai and has a high market value due to its metabolizing properties (helps promote weight loss). It is also rich in vitamin B6 and used as a sleep aid and to treat diseases such as depression. It can be consumed cooked or as oil (it has medicinal properties). Its wood, in some cases, is also used for making furniture (Youyama et al 1999).

4.2.8.1 Trend scenario

The analysis of the increase in the average price and quantity of heart of palm from EcoSocioBio-PA pointed to a better adaptation of the polynomial trend curve for the price and to represent quantity increases. Chart 28 shows the quantity and price projection curves. There are projections for both a fall in the quantity produced and an increase in the price of heart of palm. The fall in quantity can reach as low of -5 percent, with an average of -2 percent per year. On the other hand, price growth can reach a positive variation of 14 percent, with an average of 8 percent p.a..

Chart 28 - Curves of the quantity projection index and price projection index to calculate the future value of heart of palm

Source: Prepared by the authors.

In order to identify the municipalities that influence the downward behavior of the heart of palm quantity projection curve, table 3 shows those with the highest production share in the state of Pará in 2006 and 2019, and the quantity variation in this period by municipality. It is observed that most of the municipalities with the highest production share in the State of Pará show a fall in production during the analyzed period. In 2006, Anajás and Cametá were the municipalities with the highest production share in Pará, the former with 33 percent and the latter with 15 percent. Production fell 80 percent in Anajás and an increased 66 percent in Cametá, with the latter concentrating 42 percent of production in the State of Pará. In addition to Anajás, other municipalities show a decrease in production: Breves (-97 percent), Igarapé-Miri (-43 percent), Muaná (-45 percent), and Oeiras do Pará (-86 percent). In addition to Cametá, a production increase of 68 percent is also observed in Limoeiro do Ajuru in the analyzed period.

Table 3: Main palm of heart producing municipalities in 2006 and 2019 and variation in the quantity produced in the period

Municipalities	Integration Region	Share in the production of State of Pará (%)		Quantity Variation 2019/2006 (%)
		2006	2019	
Anajás (PA)	Marajó	33%	11%	-80%
Breves (PA)	Marajó	10%	0%	-97%
Cametá (PA)	Tocantins	15%	42%	66%
Igarapé-Miri (PA)	Tocantins	9%	9%	-43%
Limoeiro do Ajuru (PA)	Tocantins	3%	9%	68%
Muaná (PA)	Marajó	11%	10%	-45%
Oeiras do Pará (PA)	Tocantins	6%	1%	-86%
Other municipalities		13%	17%	

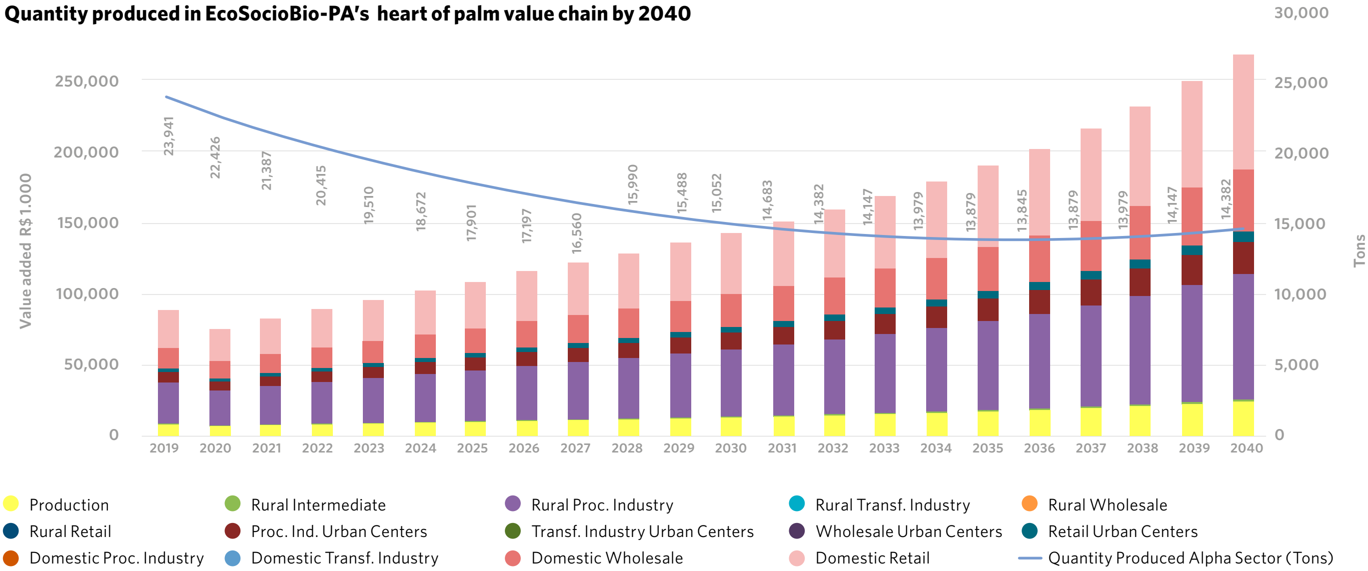
Source: Prepared from PEVS (IBGE)

Given the downward behavior of heart of palm production in several municipalities, the projection curve of the aggregate quantity for the state tends to fall, which points to the importance of designing strategies that strengthen the value chain of heart of palm production.

Chart 29 shows the Value Added (VA) projections for each link in EcoSocioBio-PA's heart of palm chain, as well as the quantity produced by 2040. It is observed that, the total VA absorbed in the chain, which was around BRL223.6 million in 2019, is expected to reach BRL674.5 million in 2040 - an average growth of the income generated of 6 percent p.a.. As noted, the VA growth absorbed by each sector occurs evenly along the chain. That is, in 2040, of the total projected income, the production sector absorbs BRL67.7 million (10 percent), the processing industry in rural areas and urban centers BRL268.8 million (40 percent) and BRL80.8 million (12 percent) respectively, domestic retail BRL222.9 million (33 percent), and local retail in urban centers BRL30.9 million (5 percent).

Unlike the projected income growth, physical production experiences a decrease, which indicates that the positive price variation outweighs the fall in production, as is the case in the forecasts for Brazil nuts and copaiba. In relation to the projected quantity for 2040, the potential production is estimated at 14,381 tons, i.e. an average drop of 2 percent p.a. in the period considered.

Chart 29 - Projection in the Trend Scenario of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's heart of palm value chain by 2040



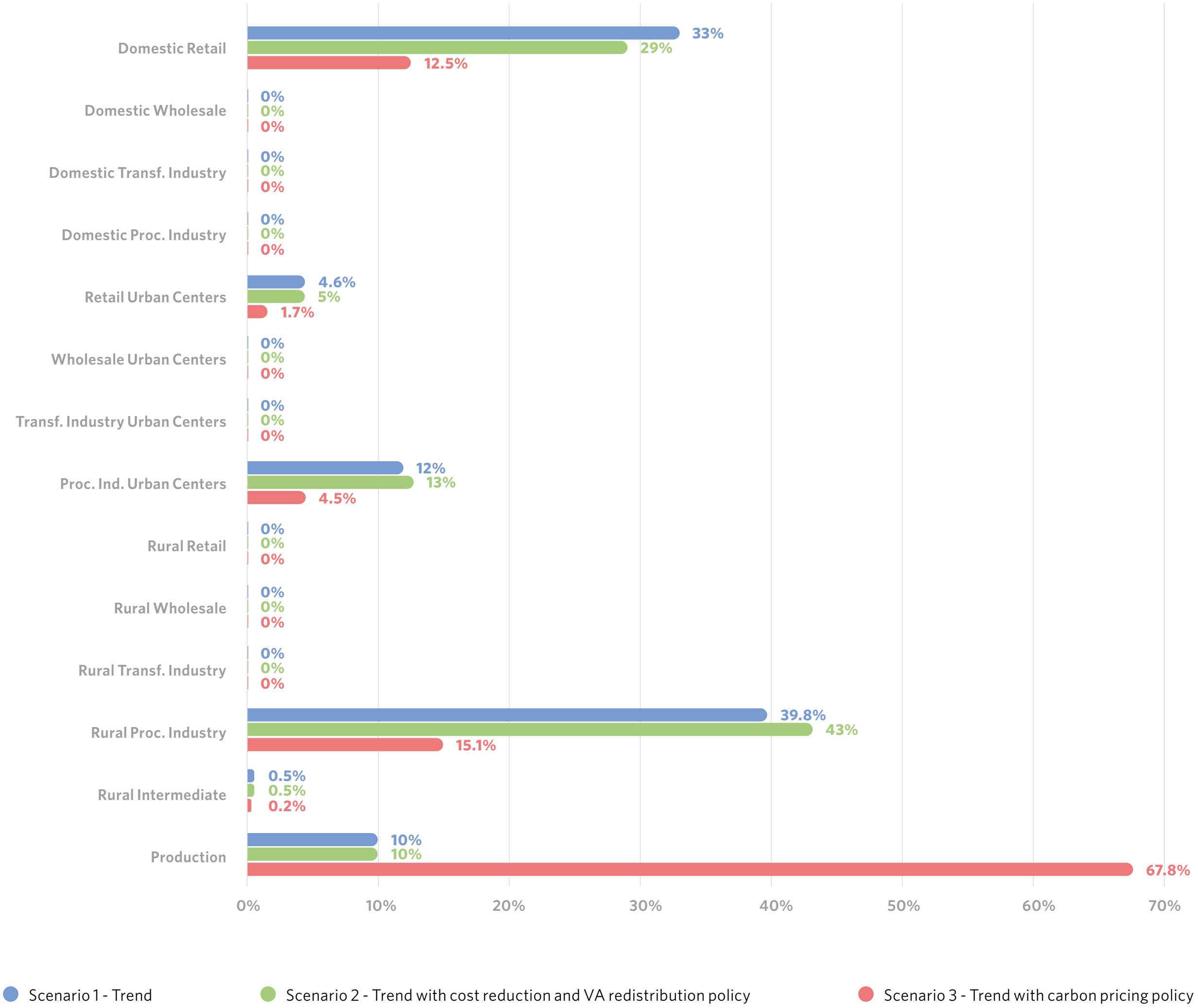
Source: Prepared by the authors.

4.2.8.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the heart of palm value chain with the projected policies, Chart 30 presents the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing. In the trend scenario, processing industries in rural areas and urban centers absorb 40 percent and 12 percent of the total value generated, respectively. Domestic retail, in turn, absorbs 33 percent and the production sector only 10 percent of the total value generated in the chain.

In scenario 2 with the income redistribution policy, the share of the VA generated in the national retail falls from 33 percent to 29.1 percent and increases from 39.8 percent to 43.3 percent in the rural processing sector and from 12 percent to 12.8 percent in the industrial sector in urban centers.

Chart 30: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the heart of palm value chain



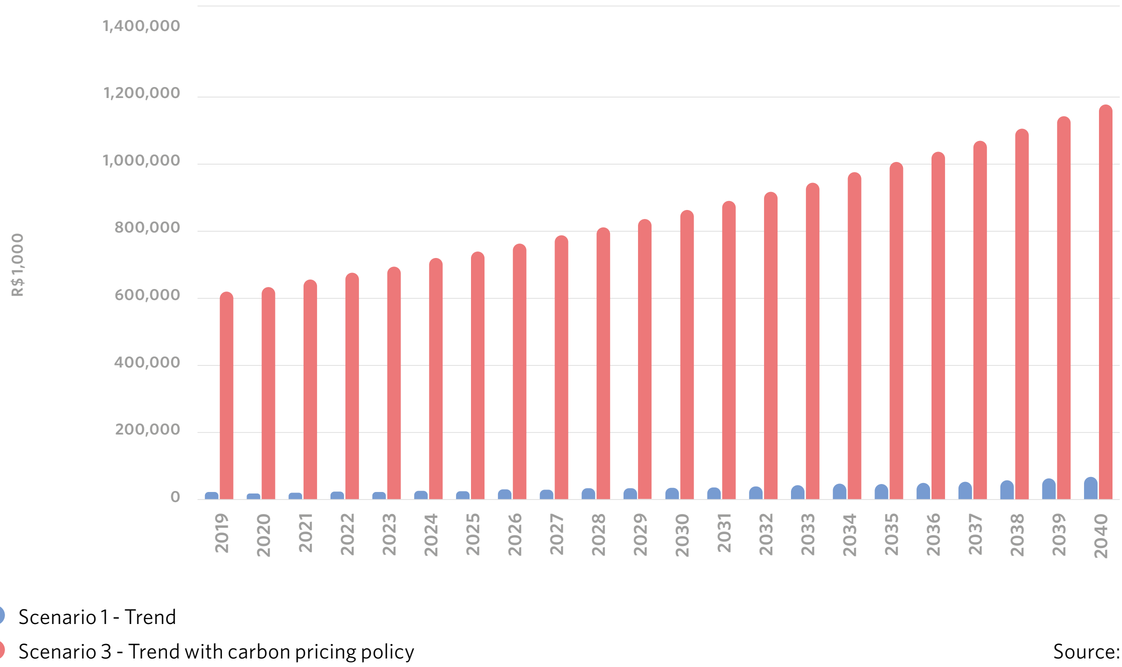
Source: Prepared by the authors.

In scenario 3, with the policy on pricing of the social benefit of stocked carbon the share of the VA generated in the production sector (alpha 0) jumps from 10 percent to 67.8 percent. Domestic retail falls from 33 percent to 12.5 percent. Considering the drop in the shares of the processing sectors in rural sectors and in urban centers from 39.8 percent to 15.1 percent and from 12 percent to 4.5 percent, the importance of distributing the revenue from the producer's carbon pricing to other local chain agents s once again observed.

These readjustments contribute to increase the producer's remuneration, as in addition to the extracted product they also produce the positive externalities associated with the conservation of native vegetation that implies important amounts of stored carbon.

Chart 31 shows the remuneration of the production sector with and without the incorporation of carbon pricing in the heart of palm value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing, considerably increases the producer's income, which is expected to be around BRL1.2 billion, whereas without the pricing policy the value added estimated for 2040 would be BRL67.7.

Chart 31: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the heart of palm chain



Source: Prepared by the authors.

4.2.9 Scenarios of the income generated in the cupuaçu value chain

The economic value of cupuaçu fruit (*Theobroma grandiflorum*), which is typical to the Amazon region, lies especially in its dense pulp that can be consumed in the form of juice, nectar, liqueur, jam, pie, and other sweets. It is present not only in popular cuisine but also in more refined dishes (Cohen *et al*,2005).

The fruit is extracted from native forests and also produced in permanent crop systems. The analysis of the projection considered the situational data available in the 2006 and 2017 Agricultural Census, given the absence of statistics with structural annual series on the fruit. The situational data for 2017 show a drop of 84 percent in the production of extracted cupuaçu and a 32 percent increase in the production of cultivated cupuaçu, compared to 2006. In relation to price, there is a 7 percent drop in cultivated cupuaçu in the period.

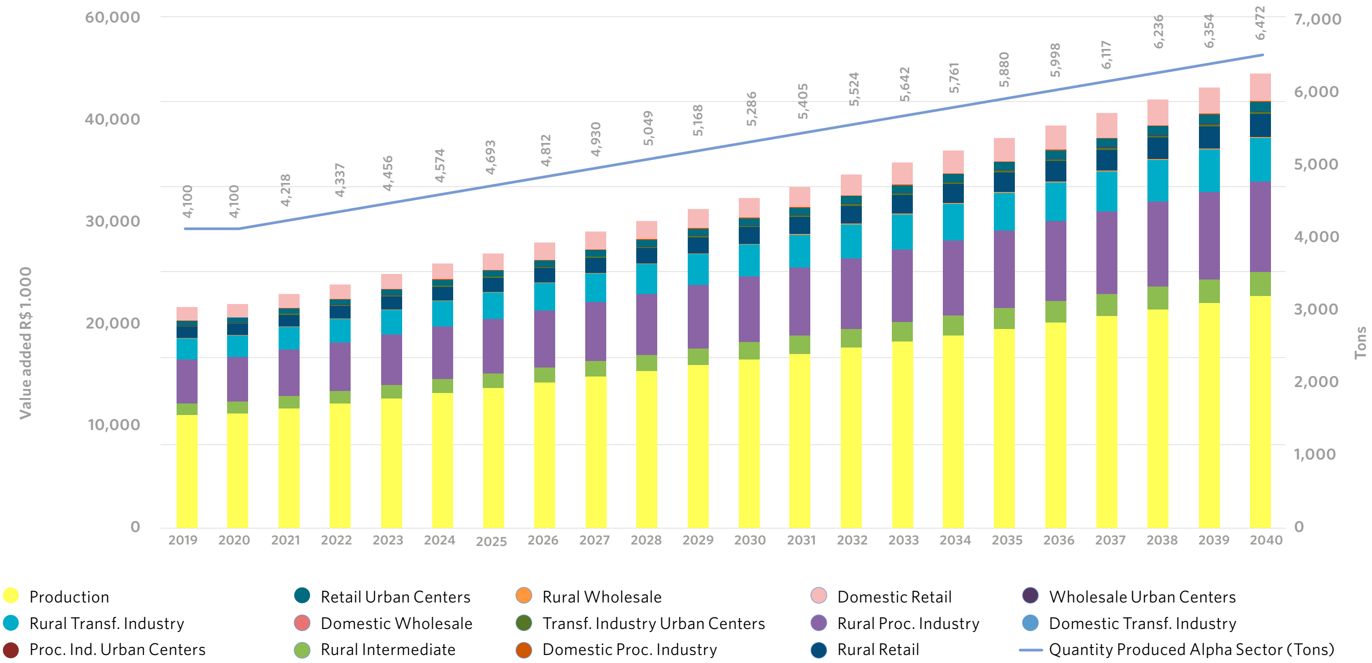
4.2.9.1 Trend Scenario

Based on the variation in the average production and price of cupuaçu, both extracted and cultivated, in the years 2006 and 2017 an average annual variation in the amount produced of 2.9 percent and a variation in the average price of 1.43 percent were used.

Chart 32 shows the Value Added (VA) projections represented in table 34 for each link in the cupuaçu chain, as well as for the quantity produced by 2040. It is observed that the VA absorbed in the chain, which totaled BRL25.9 million in 2019, is expected to reach BRL53.2 million in 2040.

As noted, the VA growth in each sector occurs evenly along the chain. In 2040, of the total projected income, the production sector has the largest share of the total income generated, with BRL21.1 million (51 percent), followed by the rural processing industry with BRL10.4 million (20 percent), the rural transformation industry with BRL5.2 million (10 percent), and domestic retail with BRL3.1 million (6 percent). The production quantity projected for 2040 is expected to reach 6,473 tons, with an average growth in annual production of 2 percent.

Chart 32 - Projection in the Trend Scenario of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's cupuaçu value chain by 2040



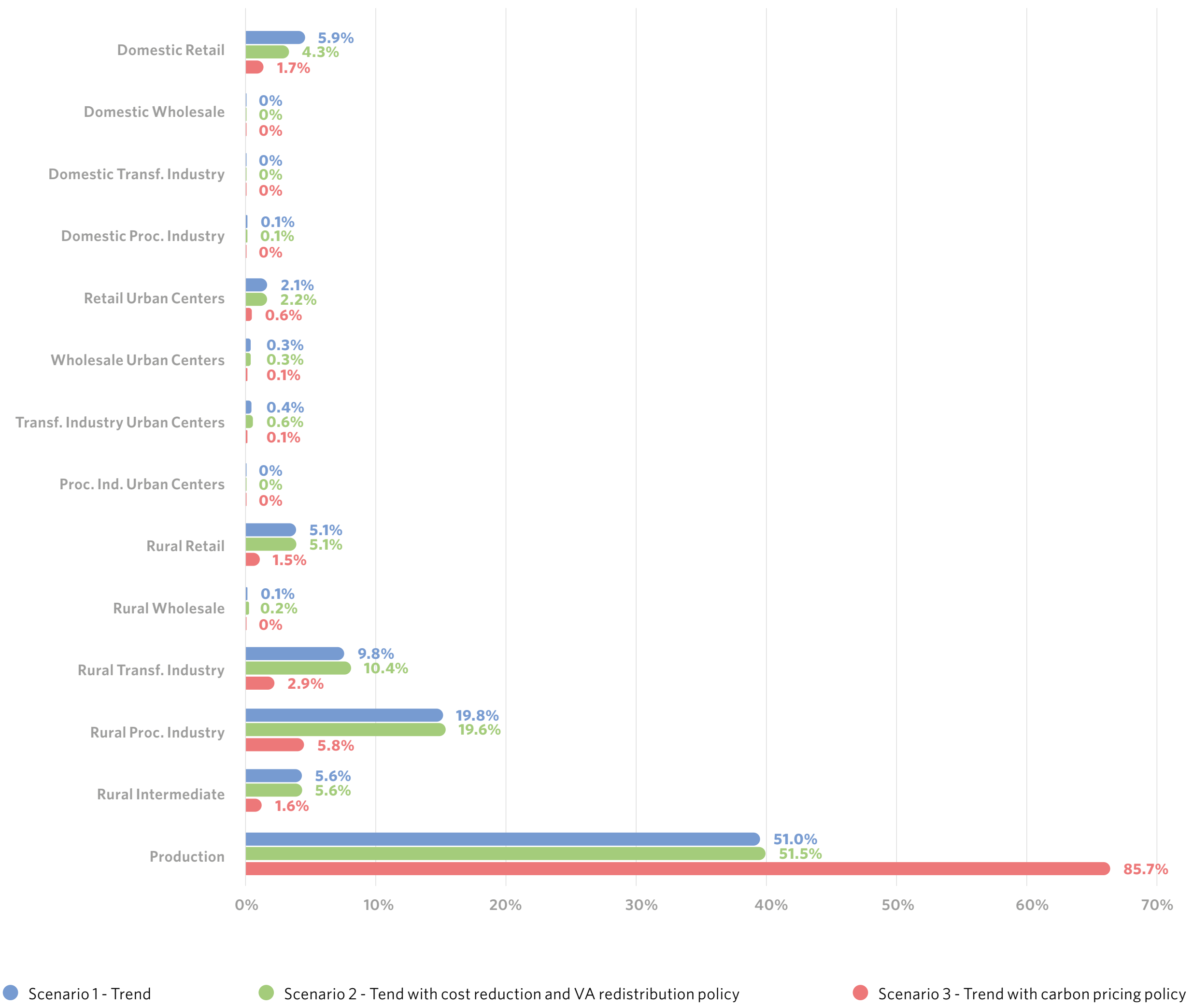
Source: Prepared by the authors.

4.2.9.2 Carbon pricing policy scenario and cost reduction and value-added redistribution scenario

As for the distribution of the value added generated in the cupuaçu value chain with the projected policies, Chart 33 presents the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing. In the trend scenario, it is observed that the production sector absorbs 51 percent, followed by the rural processing and transformation industries, which jointly absorb a total of 29.4 percent, rural retail with 5.1 percent, and domestic retail with 5.9 percent.

In scenario 2, with the implementation of an intermediate cost reduction policy on the industrial sectors and the domestic retail tax, it is observed that the share of the VA generated in domestic retail falls from 5.9 percent to 4 percent. The share of the rural processing sector and the rural transformation sector increases by a mere 0.2 percent and 0.6 percent, respectively.

Chart 33: Value Added distribution in the trend scenario, in the carbon pricing policy scenario and in the cost reduction and value-added redistribution scenario in the cupuaçu value chain

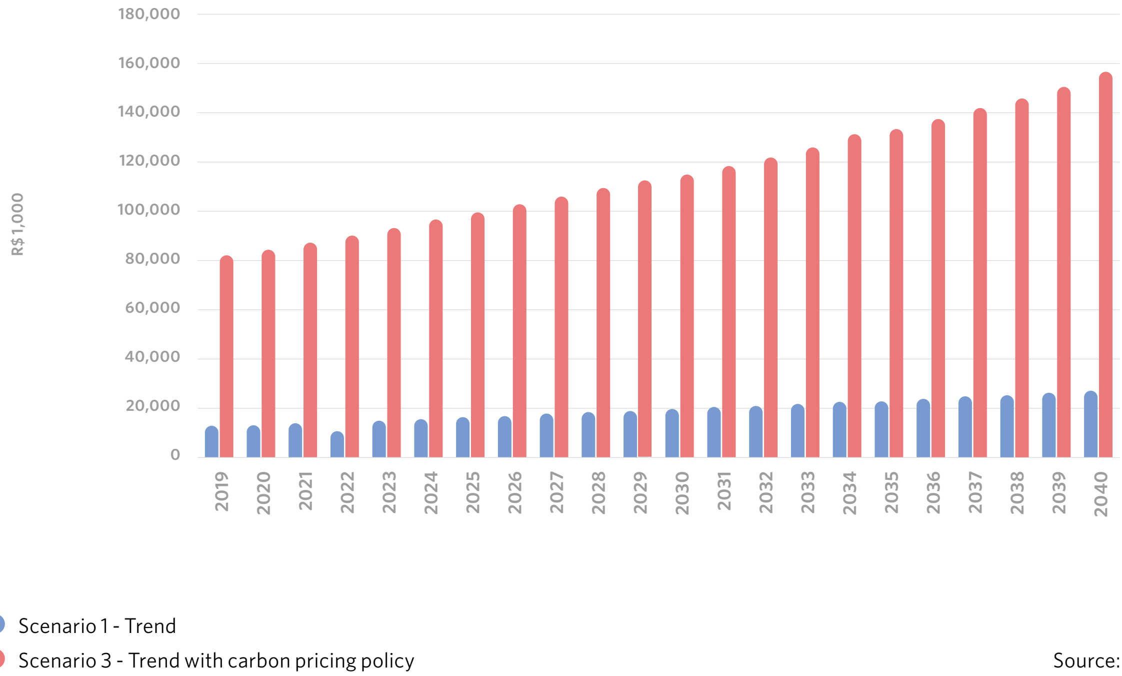


Source: Prepared by the authors.

In scenario 3, with the policy on pricing of the social benefit of stocked carbon, the share of the VA generated in the production sector (alpha 0) jumps from 51 percent to 85.7 percent and falls from 9.8 percent to 2.9 percent and from 19.6 percent to 5.8 percent, respectively, in the transformation and processing sectors. Once again, the importance of distributing the revenue from the producer's carbon pricing to the other local chain agents observed.

Chart 34 shows the remuneration of the production sector with and without the incorporation of carbon pricing into the cupuaçu value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing can reach BRL155.6 million, whereas without the pricing policy the value added estimated for 2040 would be BRL27.2 million.

Chart 34: Projection of Gross Income of the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stock carbon pricing included in the cupuaçu chain



Source: Prepared by the authors.

4.2.10 Scenarios of the income generated in the andiroba value chain

Andirobeira *(Carapa guianensis)* is of great importance for the Amazonian cultural, economic, and medicinal context. Although the wood of the species is highly demanded by sawmills, the richness of the tree lies in the oil extracted from its seeds, which has medicinal properties and is used to treat wounds and injuries from falls. The tea made from the bark is used to treat worm infections among other illnesses. Andiroba is also used in the cosmetics industry (Gonzales, 2010; Shanley & Medina, 2005).

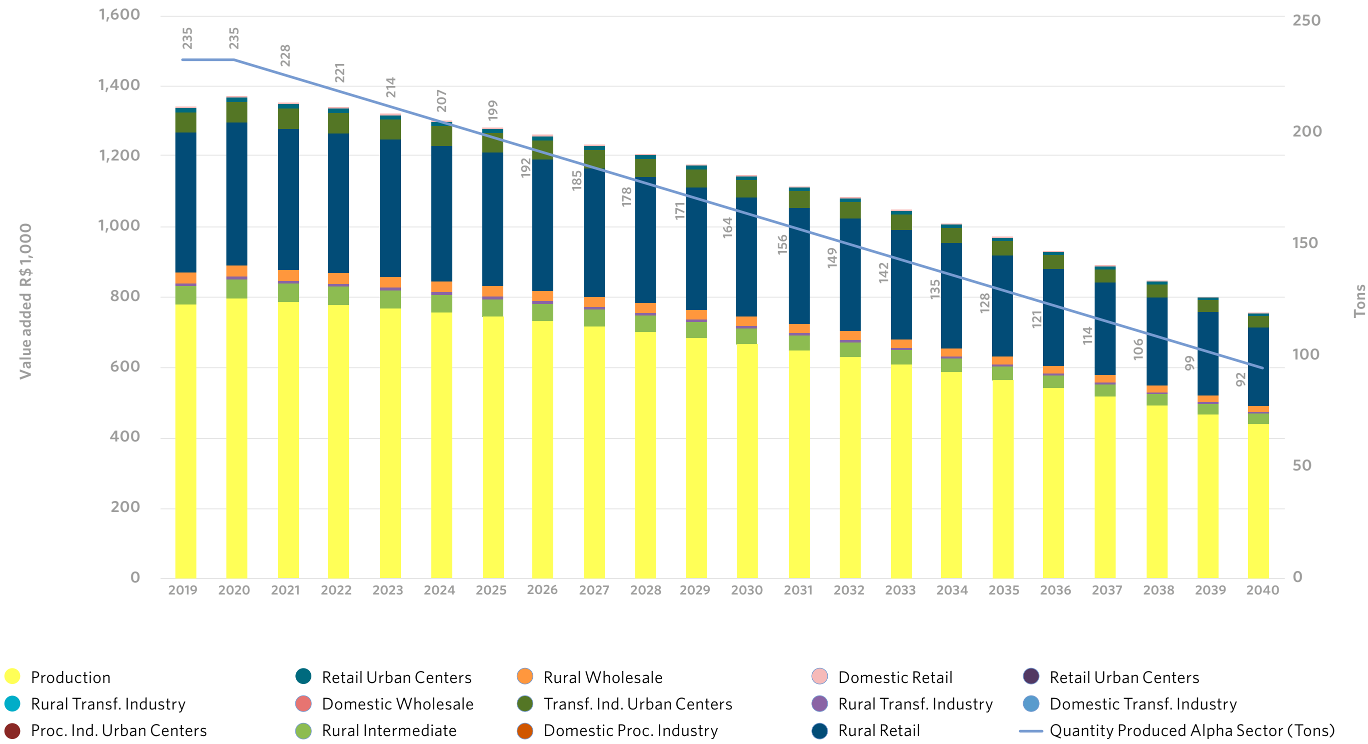
The analysis of the projection considered the contextual data available in the 2006 and 2017Agricultural Census due to the absence of statistics with structural annual series on the fruit. Situational data for 2017 show a 37 percent drop in andiroba production and a price increase of 25 percent compared to 2006.

4.2.10.1 Trend Scenario

Based on the average variation in the production and price of andiroba in 2006 and 2017, an average annual variation in the quantity produced of -3 percent and a variation in the average price of 2 percent were adopted.

Chart 35 shows the Value Added (VA) projections represented in table 35 for each link in the andiroba chain, as well as for the quantity produced by 2040. It is observed that while in 2019 the total VA absorbed in the chain was BRL2.2 million, the amount expected to be generated in 2040 is BRL1.2 million. As noted, the VA growth in each sector occurs evenly along the chain. In 2040, of the total projected income generation, the production sector has the highest share with BRL775,000, followed by rural retail with BRL340,000. The production quantity projected for 2040 is expected to reach 92 tons.

Chart 35 - Projection in the Trend Scenario of the Value Added (BRL) and Quantity produced in EcoSocioBio-PA's andiroba value chain by 2040



Source: Prepared by the authors.

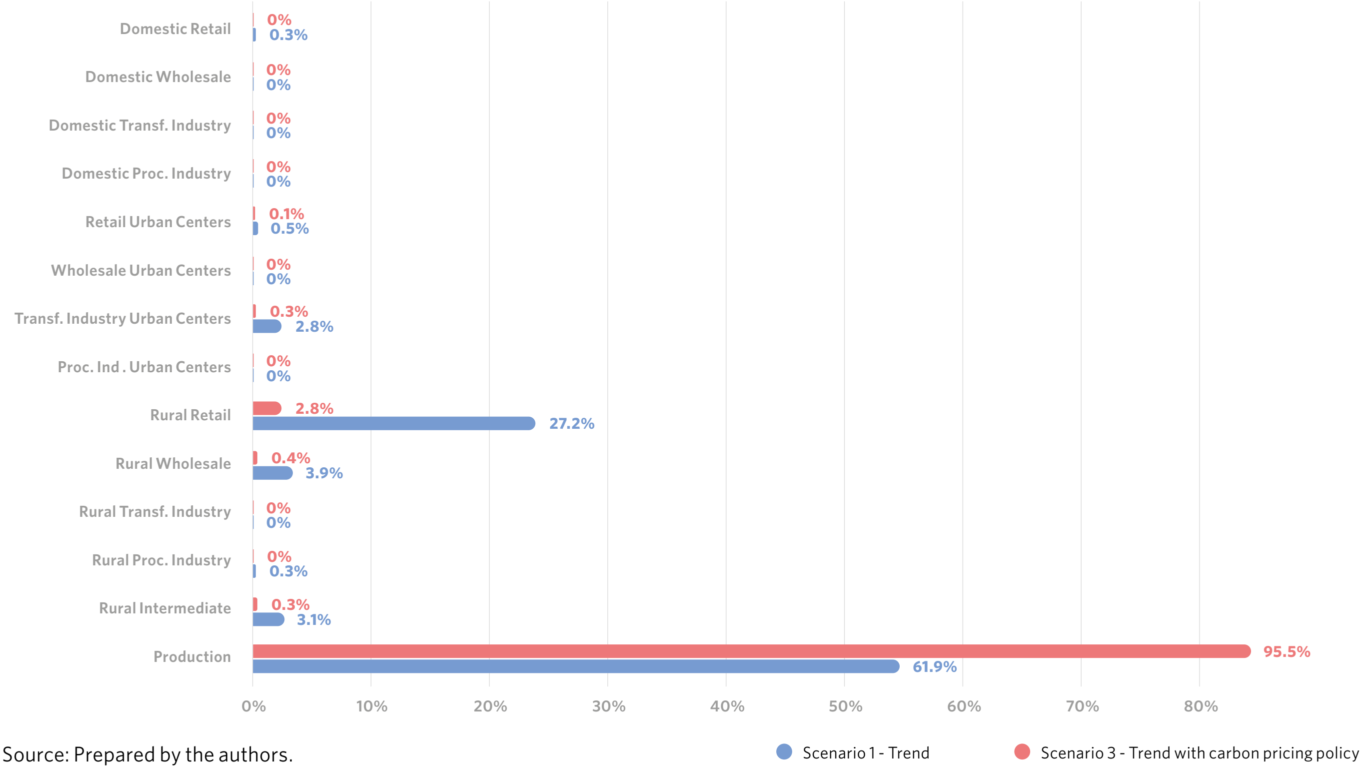
4.2.10.2 Carbon pricing policy scenario

As for the distribution of the value added generated in the andiroba value chain with the projected policies, Chart 36 presents the redistribution of the Value Added projected for scenario 2 with the implementation of intermediate cost reduction in the industrial sectors and a domestic retail tax, and for scenario 3 with carbon pricing.

In the trend scenario, the value generated in the andiroba chain is highly concentrated in the local sphere of rural production, which accounts for 62 percent, and the remainder is found in local retail trade, with 27 percent. Considering the absence of distortions in value added generation between the national and local spheres, the scenario of subsidy to the industrial sector does not apply.

In scenario 3, with the policy on pricing the social benefit of stocked carbon, the share of the VA generated in the production sector (alpha 0) jumps from 61.9 percent to 95.5 percent.

Chart 36: Value Added distribution in the trend scenario and in the carbon pricing policy scenario in the andiroba value chain



Source: Prepared by the authors.

Chart 37 shows the remuneration of the production sector with and without the incorporation of carbon pricing into the andiroba value chain. It is observed that the producer's VA (Alpha 0 sector) projected with carbon pricing, considerably increases the producer's income, which is expected to reach a value added of around BRL11.8 million, whereas without the pricing policy the estimated value added of BRL775,000 would be reached in 2040.

Chart 37: Projection of Gross Income in the Production Sector (Alpha 0) in the trend scenario and in the trend scenario with stocked carbon pricing included in the andiroba chain

Source: Prepared by the authors.

4.3. Aspects of production trends and limitations of projections

The projection of economic scenarios faces uncertainties related to endogenous and exogenous variables that are not considered in the the model. It is possible to identify some of these interferences with positive and negative socio-environmental and economic implications, which may occur in sociobiodiversity product production. Examples include:

i) Increased knowledge about distribution of species and investments in logistics to access new areas, could contribute to a productivity increase in product extraction.

ii) Technical-economic viability for cultivating certain species could lead to economies of scale and a drop in the price of products, which would then discourage traditional and indigenous people from extracting products to sell. An example is the economic cycle of rubber, which was affected by extensive cultivation of Hevea Brasiliensis, leading to a relevant drop in rubber prices on the international market.

iii) Deforestation due to land conversion for raising livestock could lead to a loss in area in which fruit trees thrive. An example of this is Bertholletia Excelsa, which produces Brazil nuts and is in a vulnerable to extinction due to deforestation and wood commercialization.

Some products trend towards growth while others have a tendency to decline, as their progression is related to different socio-environmental and economic factors that must be analyzed case by case.

4.4. Risks of economies of scale for cultivated products

Although many Amazon species that provide sociobiodiversity products are still not cultivated, there are others that can be cultivated in many different soils with technical-economic viability. This last production system, characterized by economies of scale, is implemented in cultures such as rubber trees, cocoa trees and, recently, *Euterpe Oleracea* - the species that provides açaí.

Unlike in culture crops, sociobiodiversity products that are managed by local communities and indigenous peoples have a production frontier with a scale defined by different factors, such as accessibility to the forest, technical knowledge of sustainable management and period of species fruiting. Therefore, the production of sociobiodiversity products in agroforestry systems, for example, is characterized by a productivity aligned and determined by ecological balance and sustainability criteria of species in its surroundings.

The production frontier of a cultivation system with increased land use and density of a single species, is determined by aspects such as increased productivity per area and capacity of cultivation development. According to the National Center for the Conservation of Flora (CNCFlora), the cultivation of *Hevea Brasiliensis*, for example, in which significant stretches of forest are destroyed, has led to the extinction threat of other species such as *Dichorisandra leucophthalmos Hook* (vulnerable) and *Picramnia coccinea W.W.Thomas* (endangered).

Therefore, due to the risk of ecological impact from large scale cultivation, we must differentiate cultivated species, such as cultivated açaí, and the fruit collected and managed in areas with a high diversity of species. This differentiation by market requires information, such as traceability systems and sociocultural origin certificates, as well as environmental services embodied in products.

Tables

Charts

Abbreviations and Acronyms

ANATER - National Agency for Technical Assistance and Agricultural Extension

COEMA - State Environment Council

CSα - Alpha Ascending Social Accounts

CT&I - Science, Technology and Innovation

EcoSocioBio-PA - Socio-biodiversity Bioeconomy of Pará

GCC - Global Commodity Chain

GPDADESANAEA - Research Group on Agrarian Dynamic and Sustainable Development in the Amazon

GVA - Gross Value Added

GVAP - Gross Value of Agricultural Production

IDEFLOR - Institute for Forestry Development

IDESP - Development Institute of Pará

IOM - Input-Output Matrix

IPEA - Institute for Applied Economic Research

ITERPA - Pará Land Institute

NAEA - Center for Higher Amazon Studies

NTFP - Non-Timber Forest Products

PAA - Food Acquisition Program

PAE - Agro-extractive Settlement Projects

PAF - Forestry Settlement Projects

PAOF/PA - Annual Forest Concession Plan of Pará

PBSM - Brazil Without Extreme Poverty Plan

PDAS - Decentralized Sustainable Settlement Projects

PEAA - Amazon Now State Plan

PEAEX - Agro-extractive Settlement Project

PEAS - State Sustainable Settlement Projects

PGPM-BIO - Minimum Price Guarantee Policy

PLANAFE - National Plan for the Strengthening of Extractive and Riverside Communities

PLANAVEG - National Plan for the Recovery of Native Vegetation

PMCF - National Community and Family Forest Management Program

PNAE - National School Feeding Program

PNATER - National Technical Assistance and Agricultural Extension Policy for Family Agriculture and Agrarian Reform

PPNPCT - National Policy for the Sustainable Development of Traditional Peoples and Communities

PNPSB - National Plan for The Promotion of Socio-Biodiversity Product Chains

PNRA - National Agrarian Reform Program

PPG7 - Pilot Program to Conserve the Brazilian Rainforest

PRONAF - National Program for the Strengthening Family Agriculture

PRONATER - National Program for Technical Assistance and Agricultural Extension in Family Agriculture and Agrarian Reform

PTS - Integrated Action Policy for Sustainable Territories

REDD+ - Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

IR - Integration Regions of Pará

SA - Agrarian System

SAF-A - Agriculture-type Agroforestry Systems

SAF-F - Forest-type Agroforestry Systems

SDI - Shannon's Diversity Index

SDP - Sustainable Development Projects

SDPE - Direct Subsidy to the Extractive Producer

SECTAM - Secretary of State for Science, Technology and Environment

SEMAS - Secretary of State for Environment and Sustainability

SISEMA - State Environmental System of Pará

SUDAM - Superintendence for the Development of the Amazon Region

T1 - Technological trajectory of peasant systems whose strategies are based on greater agricultural specialization

T2 - Technological trajectory of peasant systems that organize themselves as SAFs, following an "agroecological" paradigm

T3 - Technological trajectory of peasant systems whose strategies are based on greater cattle-ranching specialization

T4 - technological trajectory of commercial systems defined by the "mechanical-chemical paradigm" of agricultural production and focused on beef cattle

T5 - Technological trajectory of commercial systems defined by the "mechanical-chemical paradigm" of agricultural production and focused on permanent crops and forestry

T7 - Technological trajectory of commercial systems defined by the "mechanical-chemical paradigm" of agricultural production and focused on grains

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Annex 1 Methodological

A.1.1. Methodology of Alpha Social Accounting (CSa)

Representations of local economies require the generation of special input-output matrices with the aim of meeting three methodological principles. First, to address the actors and the structures of which they are part in their diversity. Second, to ensure the observation of the relations of these actors in nodes (organizations) and connections that make up the local productive systems and arrangements. Third, to verify the indications of the increasing productivity of these economies in the integrity of local-extra-local settings on the one side, and urban-rural settings on the other.

The *Ascending Alpha Social Accounting (CSα)* model is based on these principles, placing the descriptive and analytical potential of Leontief matrices at the service of a perspective that values structural diversity, thus allowing to define the situations of relevant actors and structures in the context of the systemic relations they establish with each other, in the LPAs in which they play a leading role and in the constitution of the local economy and its interactions with broader contexts (regional and national).

SA is a methodology for the ascending (bottom-up) calculation of input-output matrices of computable balance. The set of its algorithms (see 5.3) make up the Netz program developed in the Agrarian Dynamic Research and Sustainable Development Group of the Center for Higher Amazon Studies (GPDadesaNAEA) of the Federal University of Pará (see Costa, 2002; Costa, 2006b; Costa and Inhetvin, 2006; Costa, 2008). It is an ascending methodology because it is based on the parameters and indicators of each product that composes the original and fundamental sectors, whose statistic figures are obtained at the lowest and most elementary level possible of a local economy. Such "original" sectors are designated as "alpha sectors": i.e. the initial point, the departure place of everything else. If, for example, one can establish in each information unit of the Agricultural Census what differentiates cases involving "peasant" (family labor) establishments from cases related to commercial ("*patronal*", i.e. employed labor) establishments, these two categories of establishments can make up "alpha sectors", should this be convenient for the analysis.

The method consists in identifying the production of each agent that can be included in the "alpha sectors" within a given geographical boundary and then following the flows of that production to its final destination. In this itinerary, the transactions in the several derived sectors (amounts transacted in each point and the corresponding markup) are calculated and the results become parameters of "beta sectors", which are adjusted at three different levels. In another exercise we use the local level (βa), the intermediate extra-local level (βb) and the national extra-local level (βc). In this exercise we use "periphery" (or "interior"), "center" and "extra-local" sectors, respectively. For each product, a computable balance of the conditions existing in the total of each sector β is established, so that supply and demand amounts are necessarily equalized, thus establishing the respective average prices.

Therefore, the CSα is a computation algorithm for obtaining the values of the input-output model in interregional flows. Empirically, based on the Leontief system, it would be possible to obtain all the social accounting of an economy of *k* products, whose flows are made up of *n* agents contained in *m+1* positions in the productive and distributive system, where the *m+1*th position is that of Final Demand (y), according to the following equation

$$\hat{X}_{ij} = \sum_{i=1}^{m}\sum_{j=1}^{m+1}\sum_{v=1}^{k} q_{ijv} \cdot p_{ijv} \qquad (11)$$

where *v is* the product, *j* is the purchase sector, *i* is the sale sector and $\hat{X}$ is the matrix whose elements are the total values purchased and sold among the producing sectors and, in column j=m+1, the values sold by each of them for the final consumption of households or government.

By establishing an amount *g* of topical, geographical or systemic attributes, and an amount *e* of structural attributes, the equation (11) would then be a result of the aggregation of an amount *g.e* of submatrices, each composed of

$$\hat{X}_{sr\ddot{y}} = \sum_{s=1}^{g}\sum_{r=1}^{e}\sum_{i=1}^{m}\sum_{j=1}^{m+1}\sum_{v=1}^{k} q_{sr\ddot{y}v} \cdot p_{sr\ddot{y}v} \qquad (12)$$

where *s* would be the topical attribute (e.g., local productive arrangements, as is the case of this exercise) and *r* would be the structural attribute (for example, rural technological trajectories, as is the case here).

The elements of the sum total matrices for the topical attributes (ASPIL, for example) would be

$$\hat{X}_{sij} = \sum_{s=1}^{g}\sum_{i=1}^{m}\sum_{j=1}^{m+1}\sum_{r=1}^{e} \hat{X}_{rij} \qquad (13)$$

For the structural attributes (Rural Technological Trajectories, for example), the elements of the sum total matrices would be

$$\hat{X}_{rij} = \sum_{r=1}^{e}\sum_{i=1}^{m}\sum_{j=1}^{m+1}\sum_{s=1}^{g} \hat{X}_{sij} \qquad (14).$$

The grand total matrix of the group (Local Economy) would be:

$$\hat{X}_{ij} = \sum_{i=1}^{m}\sum_{j=1}^{m+1}\sum_{r=1}^{g} \hat{X}_{rij} = \sum_{i=1}^{m}\sum_{j=1}^{m+1}\sum_{s=1}^{e} \hat{X}_{sij} \qquad (15).$$

In the matrices obtained in (13), (14) and (15) the x_i values of the equation (2) would be expressed, respectively, by:

$$\hat{X}_{si} = \sum_{i=1}^{m}\sum_{j=1}^{m+1} \hat{X}_{sij} ; \hat{X}_{ri} = \sum_{i=1}^{m}\sum_{j=1}^{m+1} \hat{X}_{rij} \text{ e } \hat{X}_{i} = \sum_{i=1}^{m}\sum_{j=1}^{m+1} \hat{X}_{ij} \qquad (16).$$

In matrix (16), column j=1 and row i=1 - which describe the *input-output* of the total production of the economy under analysis - can be "opened" by the values of columns *j*=1 and rows *i*=1 of the matrices (14), which will designate the alpha sectors of the model (see Costa and Inhetvin, 2006: 79; Costa, 2009; Costa, 2012).

The empirical operation of the system requires, first of all, compliance with the following requirements:

Obtaining the quantities and prices of products from the alpha sectors and their distribution by the beta sectors and for final consumption

The basic quantities and prices of alpha sectors' products are obtained using the data of two empirical matrices: one matrix comprises data on both production and price; the other contains the attributes of place, geographical (municipality, microregion, etc.) or systemic (local productive arrangement, etc.) and structural (form of production, technological trajectories, etc.). In the case of agriculture, both tables have their rows identified by the "area stratum"/"municipality" ratio. This identity is the key variable in the communication between the two. In relation to other sectors, key variables are established. Therefore, all possible structural indications based on census or primary research data are attributable or relatable to each row of the production matrix. However, the opposite is not true: attributes obtained from the production matrix are not attributable to the structural data matrix.

Distribution of quantities and price formation in the sectors' inputs-outputs relations

For the parametric description of the distribution of product quantities by the different sectors and the formation of the respective prices, coefficient matrices are produced for the relations between 14 sectors in intermediate transactions and between these sectors and the output of the products of the açai economy (see Figure 6).

In this exercise, the first two levels of the relations described in matrices , both the βa and βb sectors will be considered parts of the local economy (EcoL) - the first will be called *local-interior* and the second *local-urban centers.* The third will be called *extra-local economy* (EcoEL), in a methodological perspective that follows the recommendation of Considera *et alii* (1997:7): to treat a single region (the *Grão-Pará Region,* which is the territory of the Açai Economy, its periphery and epicenter), "... statistical information on the region should be considered, in such a way that its external transactions are limited to the rest of the world and to the group of other regions, that is, the rest of the country, without detailing the regions that are consumers and suppliers of goods and services".

Matrices used in this study resulted from seven primary research studies in the same number of Integration Regions (IR) in the state of Pará: Tocantins, 10 municipalities in 2008; Guamá, 18 municipalities in 2008 and 2009; Baixo Amazonas, 6 municipalities in 2009; Rio Caeté, 15 municipalities in 2009 and 2010; Marajó, 16 municipalities in 2010; Xingu, 10 municipalities in 2010; and Rio Capim, 16 municipalities in 2012. These research studies were conducted on the initiative of the Institute of Economic, Social and Environmental Development of Pará (IDESP) in cooperation with the Agrarian Dynamic Research and Sustainable Development Group (GPDadesa), Center for Higher Amazon Studies (NAEA), Feral University of Pará (UFPA). Therefore, they followed precisely the same methodology. The 2012 research also counted on the collaboration of the Institute for Applied Economic Research (IPEA).

For all products considered in this study, the model operates with matrices with parameters resulting from these research studies that describe the respective quantity () and price formation () flows.

Thus, for all cases, *q* and *p* values were obtained so that

$$Q_{srijv} = q_{srv}\hat{Q}_j^v \tag{17}$$

e

$$P_{srijv} = p_{srv}\hat{P}_j^v \tag{18}$$

where is the matrix of the intermediation coefficients and is the price formation matrix of the ratios between sectors *i* and *j* in relation to product *v*. The elements of the first matrix are the proportions of the quantity of *v* produced that goes through the *ij* position, that is, which is the object of transaction between *ij* agents or sectors. The elements of the second matrix are the factors that increase the average price paid to *v* producers in the *ij* position, that is, in transactions between *ij* agents or sectors.

The $\hat{Q}_{ij}^V$ mastrices have the following properties:

Each $\hat{Q}_{ij}^V = V_{ij}/\sum V_{1j}$, where $\sum V_{1j}$ is the output of product *v* distributed across the j sectors and V_{ij} is the volume transacted in each ij ratio.

The first $\hat{Q}_{ij}^V$ row describes the direct sectoral allocation of the alpha sector, so that $\sum\hat{Q}_{1j}^V = 1$.

Given that all values are proportions of a given total, every $\hat{Q}_{1j}^V < 1$ and

Considering that $\hat{Q}_j^V$ is the sum of the rows and $\hat{Q}_i^V$ is the sum of the columns, every $\hat{Q}_i^V = \hat{Q}_j^V$ when *i=j*, with *i* varying from 2 to *n*.

These conditions ensure that every product purchased is sold in each sector and in the economy as a whole, so that total sales and production are a perfect match. The average sectoral prices for the sectors are established.

Mass of profits, mass of wages and employment

CSα calculates the value added for each sector by aggregating the value added of each product, in both α and Beta Sectors. From there it produces a functional partition of the *value added* between wages and profits, using the following algorithm:

or every X_i, (according to the relation (2) the total revenue of sector i), λ_i being the applied worker's monetary productivity and ω_i the average wage of sector *i*, then:

$$E_i = \frac{X_i}{\lambda_i}; \tag{26}$$

$$S_i = E_i.w_i \tag{27}$$

e

$$L_i = V\!\!\!/ A_{j=i} \,\square\, S_i \tag{28}$$

For E_i being the employment volume, S_i the mass of wages, L_i the gross profit margin and VA_i, as defined in (3), the total value added of sector *i*.

Empirically, these figures are calculated in CSα as follows: in the case of CSα Sectors, based on the information related to the mass of wages provided by the Agricultural Census for rural production; in the case of derived (beta) sectors, based on the average wage parameters obtained from the statistics of the Ministry of Labor and Employment, aggregated in the databases of the *Annual Report on Social Information (RAIS),* which are available for all years of the research and for all the geographical attributes involved, in combination with the income parameters per worker obtained from the statistics of the *Annual Trade Survey (PAC)*, the *Annual Services Survey (PAS)*, the *Annual Industrial Survey (PIA)* and the *Construction Industry Survey (PICC)*, all of them conducted by IBGE.

A.1.2. Application of the network methodology to CS*a* results

Based on the Complex Network Analysis (ARC) methodology, charts were produced for the purpose of presenting the flows and interactions described in I-O matrices by the CS*a*, in the form of a network. The following text variables (string) were selected: type of selling actor, location of selling actor, sector of selling actor, type of purchasing actor, name of purchasing actor, sector of purchasing actor, product (NTFP) chosen and circuit number. As for numerical variables(interge) only the value field was used.

With the selected variables in hand , the new variables were created in the formatting phase: ID (identifiers), labels, weight, IR (Integration Region), latitude, longitude, polygon, source, target and type (refers to the arcs).

The ID (identifiers) variable aims to distinguish the actors from each other and consists basically of a combination of numbers and letters. The label variable consists of the names of the actors that were attributed based on information selected from the original database.

The weight variable was created based on value ranges (price times quantity) generated by each actor in their respective marketing circuit identified by the CS*a* methodology. The weights range from one (1) to eight (8) and vary according to the ranges shown in Table 1 below:

Table 1: Weights and value ranges created

Weight	Value range
1	<1.000
2	1.001-10.000
3	10.001-21.000
4	21.001-41.000
5	41.001-61.000
6	61.001-81.000
7	81.001-101.000
8	>101.000

Source: Prepared by the authors (2021).

The IR (Integration Region) variable was created based on the actor's location (municipality identified by the survey) and aims to aggregate the actors by integration region. The variables latitude and longitude were also created based on the location of the municipality identified by the survey and aim to distribute the actors based on the georeferenced point of each municipality.

The polygon variable seeks to differentiate the actors in the network by geometric shapes. The circles correspond to actors positioned in the alpha-local sector (rural and local-level environment), pentagons refer to actors positioned in the beta-state sector (urban centers-state level) and squares to actors self-generated by the survey and located in the national/ international gamma sector (national level and rest of the world).

The source variable consists of the actors of origin and the target variable of the actors of destination. These variables were created based on the analysis of each marketing circuit identified by the CSα. The type variable consists of a mandatory field for the production of networks since it classifies the rows as directed (arcs). In this study, the rows are directed and follow the path created by the Alpha Accounting methodology, that is, they necessarily come out of the producer and end up in the final consumer. It should be noted that depending on the chain, the number of intermediate actors may vary, thus producing chains with shorter or longer trajectories.

Representation, refinement, editing, and characterization of actors and flows

Once the data has been refined and the material edited, the following elements of the networks (production and marketing actors and transaction flows of the NTFP analyzed) were established, characterized as shown in Figure 3 below.

The analysis of the networks created through descriptive and statistical procedures is the last step of the methodological procedure. In this regard, it should be noted that the analysis was performed based on topological and structural dimensions.

Table A.1.2 Statistics used from networks

Wholesale in the center	Xingu			Tocantins			Marajó			Baixo Amazonas		
	N. Agents	Weights		N. Agents	Weights		N. Agents	Weights		N. Agents	Weights	
		Purchase	Sale		Purchase	Sale		Purchase	Sale		Purchase	Sale
Cocoa												
Rural Production	8	0	277	8	121	0						
Middlemen	9	57	59	28	103	96						
Wholesale in the interior	29	491	301	5	19	58						
Transf. Ind. in the center	1	20	16									
Wholesale in the center	2	37	16	16	77	105						
Domestic Transf. Industry	1	48	8	1	8	61						
Domestic retail	1	16	8	1	8	8						
Grand Total	51	669	685	59	336	328						
Brazil Nut												
Rural Production	5	0	28	3	34	0				6	0	78
Middlemen	6	11	14	1	8	8				3	5	5
Proc. Ind. in the interior				2	23	15				3	68	51
Transf. Ind. in the interior	1	1	2							3	7	13
Wholesale in the interior	5	12	12	4	22	20				8	34	50
Retail in the interior	6	7	8	2	4	4				2	2	8
Proc. Ind. in the interior	1	18	6	3	24	30				1	7	14
Wholesale in the center	1	2	2									
Retail in the center	4	7	8							1	3	8
Domestic retail	1	4	4	1	8	24				3	62	43
Grand Total	30	62	84	16	123	101				30	188	270
Açai berry												
Rural Production				10	1383	0	24	1	800			
Middlemen				84	517	406	95	465	511			
Proc. Ind. in the interior				198	1170	1014	146	700	753			
Wholesale in the interior				4	46	26	1	8	8			
Proc. Ind.in the interior				50	319	399	18	120	123			
Transf. Ind. in the center				2	13	13						
Wholesale in the center				11	56	45	11	66	68			
Retail in the center				1	8	8						
Domestic Proc. Industry				1	8	8	1	18	3			
Domestic Transf. Ind.				1	8	13						
Domestic wholesale				1	8	8	1	10	10			
Domestic retail				2	16	85	3	56	24			
Grand Total				363	3552	3552	321	2300	2300			
Açai palm												
Rural Production				6	0	82	10	0	76			
Middlemen				7	29	29	4	14	31			
Proc. Ind. in the interior				14	72	88	17	94	150			
Retail in the interior							1	1	1			
Proc. Ind. in the interior				8	29	39	8	54	58			
Retail in the center				2	5	5	9	48	54			
Domestic wholesale				1	8	8						
Domestic retail				1	106	8	1	104	1			
Grand Total				**39**	**249**	**259**	**50**	**315**	**371**			

A.1.3. Methodology for estimating area with vegetation and carbon stock in vegetation in public and private land

Carbon stocks in native vegetation in the four Integration Regions studied were estimated from the intersection of phytophysiognomies from the Mapping of Natural Resources of Brazil, Scale 1:250,000 (IBGE, 2018), in its version updated in 2019, with remaining areas of native vegetation in 2018 (IBGE, 2020),[7] to which the coefficients by phytophysiognomy established in Brazil's *Global Forest Resources Assessment 2020* - FRA 2020 (FAO, 2020) were applied, with the average amount of carbon per hectare. The distribution of the native vegetation area and associated carbon stock in the different territorial areas (public domain areas and private land) was estimated by municipality, based on the land network prepared from various sources. For public domain areas, spatial data from the National Register of Public Forests - 2019 Update (SFB, 2020) were complemented with:

i) Limits of quilombola territories (source: ITERPA – Land Institute of Para and INCRA - National Institute of Colonization and Agrarian Reform). The overlapping areas between this layer and the data from the National Register of Public Forests (CNFP) were attributed to the quilombola territories;

ii) Addition of state settlement areas and state and municipal Conservation Units (source: ITERPA) absent from the CNFP.

7 The cells of the "Forest Vegetation", "Rural Vegetation", "Wet Area" and "Discovery Area" classes were considered as natural cover. In the cells classified as "Mosaic of Occupations in Forest Vegetation" and "Mosaic of Occupations in Rural Vegetation" a 50 percent reduction was applied to all phytophysiognomies after the intersection, considering that part of the vegetation in these cells has already been converted and/or degraded.

The boundary maps of private areas was prepared based on shapefiles available at INCRA, ITERPA, Terra Legal Program, Land SIG of the Federal University of Pará (UFPA)[8] and CAR – Rural Environmental Registry of the Environment and Sustainability Secretariat of the State of Pará.

In order to avoid topological errors and overlaps in the articulation of boundary maps from various sources, the polygons of the Provisional CAR were excluded, due to excessive overlaps and the low level of reliability in the boundaries of the establishments with registration self-declared by the stakeholders. Establishments with the same ownership separated by roads and rivers less than 100 meters away were considered as a single property.

Following topological clean-up in each layer and the exclusion of overlaps with more than 1 hectare, the layers were joined two by two to avoid intersection, based on the following hierarchy: 1) plots georeferenced by the Terra Legal program; 2) property certified by SIGEF - Land Management System of INCRA; 3) plots registered in the Terra Legal program; 4) private lots certified in the old INCRA system; 5) polygons vectorized in the Property SIG of UFPA; 6º) private lots certified by ITERPA; 7) definitive CAR approved by SEMAS.

8 Land database developed by the Federal University of Pará in partnership with the Public Prosecutor's Office of the State of Pará, through the Laboratory for the Integration of Agrarian, Economic and Environmental Information for the Dynamic Analysis of the Amazon.

Table A.1-1 - Area with vegetation and carbon stock in designated and public land

Form of designation	Total Area (ha)	Vegetation area (ha)	Carbon (Mton)	Area with vegetation/ Total Area	Carbon/Total Area	Carbon/Area with Vegetation
Baixo Amazonas						
1. Other areas (private, urban, etc.)		3,003,026	509.27	0.59	99.60	169.59
2. OTHERS (reserves, military areas, etc.)	1,431,062	1,337,286	259.27	0.93	181.17	193.88
3. PAE	924,941	544,603	78.65	0.59	85.03	144.42
4. PDS	391,133	390,063	73.00	1.00	186.64	187.16
5. PEAEX	276,614	195,904	37.11	0.71	134.14	189.40
6. PEAS	8,034	8,034	1.46	1.00	181.72	181.72
7. PIC	415,796	318,371	38.35	0.77	92.22	120.45
8. QUIL	827,127	769,486	159.21	0.93	192.49	206.91
9. TI	9,888,806	9,837,957	1,991.59	0.99	201.40	202.44
10. UCPI	5,682,833	5,661,242	1,184.89	1.00	208.50	209.30
11. UCUS	6,841,062	6,735,736	1,387.87	0.98	202.87	206.05
Total	**31,800,659**	**28,801,709**	**5,720.67**	**0.91**	**179.89**	**198.62**
I. Settlements (2+...+8)	2,843,646	2,226,462	387.78	0.78	136.37	174.17
II. Indigenous Land (9)	9,888,806	9,837,957	1,991.59	0.99	201.40	202.44
III. Conservation Units (2+10+11)	13,954,957	13,734,263	2,832.03	0.98	202.94	206.20
IV. Other areas-municipality (1)	5,113,251	3,003,026	509.27	0.59	99.60	169.59
Marajó						
1. Other areas (private, urban, etc.)	2,349,460	1,282,434	259.34	0.55	110.38	202.22
2. OTHERS (reserves, military areas, etc.)	1,243,436	1,189,012	247.12	0.96	198.74	207.84
3. PAE	1,975,809	1,887,176	389.86	0.96	197.32	206.58
4. PDS	455,842	444,603	94.67	0.98	207.68	212.93
5. PEAEX	16,507	16,507	3.52	1.00	213.25	213.25
6. PEAS						
7. PIC						
8. QUIL	100,967	98,877	19.77	0.98	195.77	199.91
9. TI						
10. UCPI	109	109	0.02	1.00	182.94	183.65
11. UCUS	4,139,804	3,940,032	622.57	0.95	150.39	158.01
Total	**10,281,933**	**8,858,750**	**1.636.87**	**0.86**	**159.20**	**184.77**

I. Settlements (2+...+8)	2,549,124	2,447,163	507.82	0.96	199.21	207.51
II. Indigenous Land (9)	-	-	-			
III. Conservation Units (2+10+11)	5,383,350	5,129,153	869.71	0.95	161.56	169.56
IV. Other areas-municipality (1)	2,349,460	1,282,434	259.34	0.55	110.38	202.22
Tocantins						
1. Other areas (private, urban, etc.)	2,853,495	1,738,712	328.79	0.61	115.22	189.10
2. OTHERS (reserves, military areas, etc.)	314,756	231,159	47.14	0.73	149.77	203.93
3. PAE	207,579	187,291	39.89	0.90	192.16	212.98
4. PDS						
5. PEAEX	373	373	0.04	1.00	115.11	115.11
6. PEAS	12,494	7,827	1.66	0.63	132.73	211.87
7. PIC						
8. QUIL	109,682	105,143	17.71	0.96	161.50	168.47
9. TI	20,287	20,039	4.23	0.99	208.41	210.99
10. UCPI						
11. UCUS	154,042	136,944	28.90	0.89	187.58	211.01
Total	**3,672,707**	**2,427,488**	**468.36**	**0.66**	**127.52**	**192.94**
I. Settlements (2+...+8)	330,127	300,634	59.30	0.91	179.64	197.26
II. Indigenous Land (9)	20,287	20,039	4.23	0.99	208.41	210.99
III. Conservation Units (2+10+11)	468,798	368,103	76.04	0.79	162.19	206.56
IV. Other areas-municipality (1)	2,853,495	1,738,712	328.79	0.61	115.22	189.10
Xingu						
1. Other areas (private, urban, etc.)	4,088,315	1,336,215	275.10	0.33	67.29	205.88
2. OTHERS (reserves, military areas, etc.)	2,780,128	2,381,701	481.51	0.86	173.20	202.17
3. PAE						
4. PDS	1,049,229	935,939	193.60	0.89	184.52	206.85
5. PEAEX	37,397	37,067	7.49	0.99	200.23	202.02
6. PEAS						
7. PIC						
8. QUIL	570	570	0.12	1.00	216.93	216.94
9. TI	9,701,593	9,635,390	1.883.04	0.99	194.10	195.43
10. UCPI	3,647,338	3,603,562	686.38	0.99	188.19	190.47
11. UCUS	4,310,099	4,107,318	777.91	0.95	180.49	189.40
Total	**25,614,669**	**22,037,762**	**4.305.17**	**0.86**	**168.07**	**195.35**
I. Settlements (2+...+8)	1,087,195	973,576	201.21	0.90	185.08	206.68
II. Indigenous Land (9)	9,701,593	9,635,390	1.883.04	0.99	194.10	195.43
III. Conservation Units (2+10+11)	10,737,566	10,092,581	1.945.81	0.94	181.21	192.80
IV. Other areas-municipality (1)	4,088,315	1,336,215	275.10	0.33	67.29	205.88

The integration of the databases of different land layers was carried out by converting shapefiles to the geographic reference system SIRGAS-2000 and adjusted in the 1:100,000 scale with the IBGE's Continuous Digital Cartographic Base of the Legal Amazon.

All processing was performed in the R software, version 4 (R Core Team, 2021), using functions of the sf packages (Pebesma, 2018), tidyverse (Wickham *et al.* 2019), reshape2 (Wickham, 2007) and in QGIS software, version 3 (QGIS.org, 2021), where the maps were also created.

Table A.1-2 - Total area, area with vegetation and carbon stock in private land

	Lots smaller than 100 ha				Lots larger than 100 ha			
	Number of lots	Total lot area	Area with vegetation	CO_2 stock	Number of lots	Total lot area	Area with vegetation	CO_2 stock
B. Amazonas	4,886	191,741	99,389	14	1,359	1,229,199	948,213	180
Marajó	147	6,091	4,653	1	460	1,090,914	1,042,358	189
Tocantins	4,808	149,501	79,363	12	453	631,141	408,231	82
Xingu	6,041	387,073	176,016	36	3,714	1,237,136	724,803	149
Total	15,882	734,406	359,421	63	5,986	4,188,390	3,123,606	600
	Average lot size lot	**Vegetation Area/ Total Area**	**CO_2/Total Area**	**CO_2/ Vegetation area**	**Average lot size lot**	**Vegetation Area/ Total Area**	**CO_2/ Total Area**	**CO_2/ Vegetation area**
B. Amazonas	39	0.52	73.201	141.219	904	0,.77	146.698	190.169
Marajó	41	0.76	152.210	199.239	2,372	0.96	173.431	181.510
Tocantins	31	0.53	80.216	151.109	1,393	0.65	129.821	200.708
Xingu	64	0.45	93.304	205.183	333	0.59	120.191	205.149
Total	**46**	**0.49**	**85.880**	**175.478**	**700**	**0.75**	**143.288**	**192.133**

Annex 2 Input-Output Matrices

A.2.1. EcoSocioBio-PA's Aggregate Input-Output Matrix

Table A.2.1-1 EcoSocioBio-PA's Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	1,208,985	424,102	1,877	51,284	22,659	7,898	1,182	96,258	2,173	23,178	-	67	26	1,839,689	34,209	1,752	11	35,972	1,875,662
A1. Prim. Intermediate	-	309	377,995	663	545,758	5,317	351,535	471	95,882	2,448	6,929	324	44,106	4,129	1,435,864	17,470	707	-	18,177	1,454,041
A2 Processing Industry	-	-	3,974	1,291	695	4,415	8,202	699	5,446	2,607	-	6,555	2,693	279,756	316,334	1,175,572	459	-	1,176,031	1,492,365
A3 Transf. Industry	-	-	-	-	488	1,250	-	506	4	2,475	-	-	-	2,472	7,195	33,901	-	-	33,901	41,096
A4 Wholesale	-	349	6,827	32	136	466	61,902	11,618	18,488	380	-	733,467	-	242	833,908	1,681	29	-	1,710	835,618
A5 Retail&Service	-	-	22,553	1,924	-	69	15,281	-	-	-	-	-	-	56	39,884	25,833	71	-	25,904	65,788
B1 Processing Industry	-	-	-	-	-	1,531	-	10	-	51,610	-	-	-	1,250,748	1,303,899	-	397,443	49,871	447,314	1,751,213
B2 Transf. Industry	-	-	-	-	-	-	-	78	-	74	-	342	-	6,024	6,517	-	764	11,944	12,708	19,226
B3 Wholesale	-	-	-	-	-	-	251,640	43	563	275	-	34,596	-	33	287,149	6,065	1,963	-	8,028	295,177
B4 Retail&Service	-	-	-	3	-	1	594	83	-	19	-	-	-	-	699	-	80,159	-	80,159	80,858
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	220	220	-	-	76,079	76,079	76,299
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	893,928	893,928	-	-	3,052	3,052	896,979
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	21,149	29	-	50,541	71,719	0	-	-	0	71,719
C4 Retail&Service	-	0	-	-	-	-	-	-	-	0	-	-	-	-	0	-	0	3,484,143	3,484,143	3,484,143
Interm.Production	0	1,209,642	835,450	5,789	598,361	35,709	697,053	14,689	216,640	62,061	51,255	775,313	46,866	2,488,163	7,037,004	1,294,731	483,347	3,625,101	5,403,179	12,440,182
Total GVA	1,875,662	244,399	656,915	35,306	237,257	30,079	1,054,160	4,537	78,537	18,796	25,044	121,666	24,852	995,980	5,403,190	-	-	-	-	-
Total Wages	156,145	115,695	99,896	2,751	66,488	5,235	117,223	1,287	23,487	6,434	6,242	73,379	9,775	302,287	986,324	-	-	-	-	-
Profits+Other Inputs	1,719,516	128,704	557,019	32,556	170,769	24,844	936,937	3,250	55,050	12,363	18,802	48,287	15,077	693,693	4,416,867	-	-	-	-	-
Total Gross Income	1,875,662	1,454,041	1,492,365	41,096	835,618	65,788	1,751,213	19,226	295,177	80,858	76,299	896,979	71,719	3,484,143	12,440,182	-	-	-	-	-
Total Occupied Population	184,128	6,003	4,818	133	3,452	272	5,653	62	1,219	334	204	2,394	322	15,644	224,640	-	-	-	-	-
Total Wage Earners	19,088	6,003	4,818	133	3,452	272	5,653	62	1,219	334	204	2,394	322	15,644	59,599	-	-	-	-	-

Source: IBGE survey data (PAM and PEVS), 2017 Agricultural Census, Field survey and processing in the Netz System.

A0- Production, rural and surrounding areas; A1- Primary intermediation (rural retail), rural and surrounding areas; A2- Processing industry, rural and surrounding areas; A3- Transformation industry, rural and surrounding areas; A4- Wholesale, rural and surrounding areas; A5- Retail, urban, rural and surrounding areas; B1 - Processing industry, urban centers; B2- Transformation industry, urban centers; B3- Wholesale, urban centers; B4- Retail, urban centers; C1 – Domestic processing Industry; C2- Domestic transformation industry; C3- Domestic wholesale; C4- Domestic urban retail.

A.2.2. EcoSocioBio-PA'S Input-Output Matrix

Table A.2.2-1 EcoSocioBio Pará's Açai Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production	Valor Bruto da Produção
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total		
	Rural and Surrounding Area						Urban Centers														
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers				
A0 Production	-	656,326	389,119	376	43,839	15,218	7,838	21	91,922	78	23,079	-	67	-	1,227,882	30,288	8	-	-	30,296	1,258,179
A1. Prim. Intermediate	-	309	375,674	79	6,770	2,524	348,548	-	87,474	-	6,852	-	43,853	4,032	876,114	16,602	-	-	-	16,602	892,716
A2 Processing Industry	-	-	-	731	423	2,004	107	601	1,185	5	-	2,036	-	171,453	178,546	1,166,939	145	-	-	1,167,084	1,345,630
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19,111	-	-	-	19,111	19,111
A4 Wholesale	-	349	5,736	-	-	-	60,391	4,811	355	349	-	-	-	-	71,990	423	-	-	-	423	72,413
A5 Retail&Service	-	-	22,553	28	-	-	15,281	-	-	-	-	-	-	-	37,862	6,713	-	-	-	6,713	44,575
B1 Processing Industry	-	-	-	-	-	1,521	-	-	-	39,528	-	-	-	1,168,561	1,238,434	-	396,436	49,871	28,823	446,306	1,684,741
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	6,014	6,014	-	27	601	-	628	6,642
B3 Wholesale	-	-	-	-	-	-	251,640	-	-	-	-	-	-	-	251,640	749	-	-	-	749	252,388
B4 Retail&Service	-	-	-	-	-	-	532	-	-	-	-	-	-	-	532	-	51,853	-	-	51,853	52,385
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76,079	-	76,079	76,079
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,513	-	2,513	2,513
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	21,149	-	-	32,929	54,078	-	-	-	-	-	54,078
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,847,858	-	1,847,858	1,847,858
Interm.Production	-	656,984	793,082	1,213	51,033	21,267	684,336	5,433	180,936	39,961	51,080	2,036	43,919	1,382,989	3,914,268	1,240,826	448,468	1,976,923	28,823	3,666,217	7,609,309
Total GVA	1,258,179	235,733	552,549	17,898	21,380	23,308	1,000,404	1,209	71,453	12,424	25,000	477	10,159	436,046	3,666,217	-	-	-	-	-	-
Total Wages	75,359	71,031	90,074	1,279	5,762	3,547	112,774	445	20,082	4,168	6,224	206	7,371	162,822	561,144	-	-	-	-	-	-
Profits+Other Inputs	1,182,819	164,701	462,475	16,619	15,619	19,761	887,631	764	51,371	8,256	18,776	271	2,788	273,224	3,105,074	-	-	-	-	-	-
Total Gross Income	1,258,179	892,716	1,345,630	19,111	72,413	44,575	1,684,741	6,642	252,388	52,385	76,079	2,513	54,078	1,847,858	7,609,309	-	-	-	-	-	-
Total Occupied Population	151,745	3,686	4,344	62	299	184	5,438	21	1,042	216	203	7	243	8,426	175,916	-	-	-		-	-
Total Wage Earners	16,968	3,686	4,344	62	299	184	5,438	21	1,042	216	203	7	243	8,426	41,139	-	-	-		-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-2- EcoSocioBio-PA's Cocoa bean Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand					
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	Gross Value of Produc-tion	Valor Bruto da Produção
	Rural and Surrounding Area						Urban Centers														
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Cen-ters				
A0 Production	-	542,809	2,875	-	3,727	-	-	129	46	-	-	-	-	-	549,585	-	-	-	-	-	549,585
A1. Prim. Intermediate	-	-	-	-	538,908	-	-	-	8,064	-	-	-	-	-	546,972	-	-	-	-	-	546,972
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	4,519	-	-	4,519	-	-	-	-	-	4,519
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	84	-	-	6,168	17,683	-	-	728,722	-	-	752,658	-	-	-	4,717	-	757,374
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,795	-	8,795	8,795
B3 Wholesale	-	-	-	-	-	-	-	-	563	-	-	31,746	-	-	32,308	-	-	-	-	-	32,308
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	885,292	890,008	-	-	-	-	-	890,008
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,268,138	-	1,268,138	1,268,138
Interm.Production	-	542,809	2,875	-	542,719	-	-	6,298	26,355	-	-	764,986	-	885,292	2,776,050	-	-	1,276,933	4,717	1,276,933	4,057,700
Total GVA	549,585	4,163	1,644	-	214,655	-	-	2,498	5,953	-	-	120,305	-	378,130	1,276,933	-	-	-	-	-	-
Total Wages	77,502	43,521	302	-	60,263	-	-	589	2,571	-	-	72,809	-	-	-	-	-	-	-	-	-
Profits+Other Inputs	472,083	(39,358)	1,342	-	154,393	-	-	1,909	3,382	-	-	47,497	-	267,696	908,943	-	-	-	-	-	-
Total Gross Income	549,585	546,972	4,519	-	757,374	-	-	8,795	32,308	-	-	890,008	-	1,268,138	4,057,700	-	-	-	-	-	-
Total Occupied Population	25,007	2,258	15	-	3,127	-	-	28	133	-	-	2,376	-	5,715	38,659	-	-	-	-	-	-
Total Wage Earners	1,534	2,258	15	-	3,127	-	-	28	133	-	-	2,376	-	5,715	15,186	-	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-3- EcoSocioBio-PA's Brazil Nuts Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production	Valor Bruto da Produção
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total		
	Rural and Surrounding Area						Urban Centers									Rural and surrounding areas	Urban Centers				
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4							
A0 Production		1,162	12,503	23	2,097	196	-	-	-	8	-	-	-	-	15,989	16	2	-	-	19	16,008
A1. Prim. Intermediate	-	-	-	-	74	159	1,237	-	19	8	-	-	-	-	1,498	18	-	-	-	18	1,515
A2 Processing Industry	-	-	-	209	-	-	5,391	-	-	6	-	-	-	72,399	78,005	-	-	-	-	-	78,005
A3 Transf. Industry	-	-	-	-	488	-	-	-	-	-	-	-	-	-	488	119	-	-	-	119	607
A4 Wholesale	-	-	1,064	-	-	156	1,512	-	-	-	-	-	-	156	2,887	488	-	-	-	488	3,375
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	862	-	-	-	862	862
B1 Processing Industry	-	-	-	-	-	-	-	-	-	6,919	-	-	-	20,651	27,570	-	-	-	26,578	26,578	54,148
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	24	-	-	-	-	24	-	-	-	-	-	24
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,166	-	-	8,166	8,166
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	103,961	-	103,961	103,961
Interm.Production	-	1,162	13,567	232	2,659	510	8,140	-	19	6,966	-	-	-	93,205	126,461	1,503	8,169	103,961	26,578	140,212	266,672
Total GVA	16.008	353	64,438	375	716	352	46,008	-	5	1,201	-	-	-	10,756	140,212	-	-	-	-	-	-
Total Wages	504	121	5,222	41	269	69	3,625	-	2	650	-	-	-	1,881	12,380	-	-	-	-	-	-
Profits+Other Inputs	15.504	232	59,216	335	448	283	42,384	-	3	551	-	-	-	8,875	127,831	-	-	-	-	-	-
Total Gross Income	16.008	1,515	78,005	607	3,375	862	54,148	-	24	8,166	-	-	-	103,961	266,672	-	-	-	-	-	-
Total Occupied Population	2.134	6	252	2	14	4	175	-	0	34	-	-	-	1,067	3,688	-	-	-		-	-
Total Wage Earners	207	6	252	2	14	4	175	-	0	34	-	-	-	1,067	1,760	-	-	-		-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-4 EcoSocioBio-PA's Urucum Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	1,293	1,843	576	33	147	-	2	-	3	-	-	-	-	3,898	175	-	-	175	4,073
A1. Prim. Intermediate	-	-	893	95	-	-	735	-	-	3	-	6	23	-	1,755	15	-	-	15	1,770
A2 Processing Industry	-	-	-	45	45	174	-	-	-	-	-	-	-	-	264	4,241	-	-	4,241	4,505
A3 Transf. Industry	-	-	-	-	-	1,240	-	-	4	2,408	-	-	-	2,420	6,072	1,700	-	-	1,700	7,772
A4 Wholesale	-	-	-	32	-	-	-	8	-	-	-	1	-	-	40	45	-	-	45	85
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,991	-	-	1,991	1,991
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	919	-	919	919
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	10	-	-	-	-	10	-	3	-	3	13
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	5	5
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,062	-	3,062	3,062
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	41	41	-	-	-	-	41
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	29	-	-	29	-	-	-	-	29
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,076	3,076	3,076
Interm.Production	-	1,293	2,736	748	78	1,561	735	10	4	2,425	-	36	23	2,461	12,109	8,166	3,988	3,076	15,230	27,339
Total GVA	4,073	477	1,769	7,024	7	430	184	3	1	637	-	5	6	615	15,230	-	-	-	-	-
Total Wages	134	141	302	520	7	158	62	1	0	244	-	3	4	267	1,842	-	-	-	-	-
Profits+Other Inputs	3,939	336	1,467	6,504	0	272	122	2	1	394	-	2	2	348	13,388	-	-	-	-	-
Total Gross Income	4,073	1,770	4,505	7,772	85	1,991	919	13	5	3,062	-	41	29	3,076	27,339	-	-	-	-	-
Total Occupied Population	235	7	15	25	0	8	3	0	0	13	-	0	0	14	321	-	-	-	-	-
Total Wage Earners	9	7	15	25	0	8	3	0	0	13	-	0	0	14	94	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-5- EcoSocioBio-PA's Honey Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	Gross Value of Production
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	136.92	212.72	94.96	896.97	378.05	-	127.55	2.329.78	70.64	-	-	-	-	4,247.59	1.147.10	395.91	7.08	1,550.08	5,797.67
A1. Prim. Intermediate	-	-	-	0.28	-	2.62	-	-	-	4.24	-	-	-	-	7.14	210.97	-	-	210.97	218.11
A2 Processing Industry	-	-	-	-	-	250.46	20.89	27.86	65.81	-	-	-	-	-	365.02	10.45	-	-	10.45	375.47
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	67.19	-	-	-	32.09	99.28	100.16	-	-	100.16	199.44
A4 Wholesale	-	-	-	-	1.54	297.34	-	20.34	323.86	1.42	-	15.25	-	-	659.75	454.98	29.40	-	484.38	1,144.14
A5 Retail&Service	-	-	-	-	-	3.64	-	-	-	-	-	-	-	-	3.64	1,151.59	69.20	-	1,220.79	1,224.44
B1 Processing Industry	-	-	-	-	-	-	-	-	-	26.10	-	-	-	-	26.10	-	-	-	-	26.10
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	63.84	-	-	-	-	63.84	-	155.67	-	155.67	219.51
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	985.31	1.743.54	-	2.728.86	2,728.86
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	367.07	-	367.07	367.07
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	21.15	21.15	-	-	-	-	21.15
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66.55	66.55	66.55
Interm.Production	-	136.92	212.72	95.24	898.51	932.11	20.89	175.75	2.719.45	233.44	-	15.25	-	53.24	5,493.52	4,060.56	2,760.80	73.62	6,894.98	12,388.50
Total GVA	5.797,67	81.19	162.75	104.19	245.62	292.33	5.21	43.76	9.41	133.64	-	5.90	-	13.31	6,894.98	-	-	-	-	-
Total Wages	174,28	17.35	25.13	13.35	91.04	97.43	1.75	14.69	217.13	29.21	-	1.73	-	5.77	688.86	-	-	-	-	-
Profits+Other Inputs	5.623,39	63.84	137.62	90.84	154.59	194.90	3.46	29.07	(207.72)	104.43	-	4.17	-	7.54	6,206.12	-	-	-	-	-
Total Gross Income	5.797,67	218.11	375.47	199.44	1.144.14	1.224.44	26.10	219.51	2.728.86	367.07	-	21.15	-	66.55	12,388.50	-	-	-	-	-
Total Occupied Population	482,11	0.90	1.21	0.64	4.72	5.06	0.08	0.71	11.27	1.52	-	0.06	-	0.30	508.57	-	-	-	-	-
Total Wage Earners	12,93	0.90	1.21	0.64	4.72	5.06	0.08	0.71	11.27	1.52	-	0.06	-	0.30	39.40	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-6- EcoSocioBio-PA's Pupunha Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	1,014.6	-	-	14.9	2,435.6	-	-	22.0	562.4	-	-	-	-	4,049.5	309.1	-	-	309.1	4,358.5
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	1,161.3	-	-	-	-	1,161.3	-	280.8	-	280.8	1,442.2
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	-	19.9	-	-	-	-	-	19.9	-	-	-	-	19.9
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,379.0	-	-	3,379.0	3,379.0
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41.9	-	-	41.,9	41.9
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,527.1	-	2,527.1	2,527.1
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	1,014.6	-	-	14.9	2,435.6	-	-	41.9	1,723.7	-	-	-	-	5,230.7	3,730.0	2,808.0	-	6,537.9	11,768.6
Total GVA	4,358.5	427.6	-	-	5.0	943.5	-	-	-	803.4	-	-	-	-	6,537.9	-	-	-	-	-
Total Wages	313.9	114.8	-	-	1.6	268.9	-	-	3.3	201.1	-	-	-	-	903.5	-	-	-	-	-
Profits+Other Inputs	4,044.6	312.8	-	-	3.4	674.6	-	-	(3.3)	602.3	-	-	-	-	5,634.4	-	-	-	-	-
Total Gross Income	4,358.5	1,442.2	-	-	19.9	3,379.0	-	-	41.9	2,527.1	-	-	-	-	11,768.6	-	-	-	-	-
Total Occupied Population	472.,6	6.0	-	-	0.1	14.0	-	-	0.2	10.4	-	-	-	-	503.2	-	-	-	-	-
Total Wage Earners	44.9	6.0	-	-	0.1	14.0	-	-	0.2	10.4	-	-	-	-	75.5	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-7- EcoSocioBio-PA's Bacuri Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surroun-ding areas	Urban Centers			
A0 Produção	-	1,329.78	9.68	1.22	0.04	1,642.49	5.62	-	12.45	9.52	-	-	-	-	3,010.80	142.31	102.20	-	244.52	3,255.32
A1 Intermed. Primária	-	-	-	389.26	-	856.08	-	8.88	107.31	654.03	-	-	-	-	2,015.56	83.01	0.74	-	83.75	2,099.31
A2 IndustBenef	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.24	-	-	11.24	11.24
A3 IndustTransf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,353.65	-	-	8,353.65	8,353.65
A4 Atacado	-	-	-	-	-	0.07	-	-	-	-	-	-	-	-	0.07	-	-	-	-	0.07
A5 Varejo&Serv.	-	-	-	1,841.78	-	-	-	-	-	-	-	-	-	-	1,841.78	1,712.56	-	-	1,712.56	3,554.34
B1 IndustBenef	-	-	-	-	-	7.49	-	-	-	-	-	-	-	-	7.49	-	-	-	-	7.49
B2 IndustTransf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.10	-	11.10	11.10
B3 Atacado	-	-	-	-	-	-	-	-	-	16.51	-	-	-	-	16.51	-	195.10	-	195.10	211.61
B4 Varejo&Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	932.54	-	932.54	932.54
C1 IndustBenef	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 IndustTransf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Atacado	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Varejo&Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Produção Intermediária	-	1,329.78	9.68	2,232.26	0.04	2,506.14	5.62	8.88	119.76	680.06	-	-	-	-	6,892.22	10,302.78	1,241.69	-	11,544.47	18,436.68
VAB-Total	3,255.32	769.53	1.56	6,121.39	0.03	1,048.20	1.87	2.22	91.86	252.49	-	-	-	-	11,544.47	-	-	-	-	-
Salários-Total	134.82	167.04	0.75	559.18	0.01	282.81	0.50	0.74	16.84	74.20	-	-	-	-	1,236.89	-	-	-	-	-
Lucros+Outros Insumos	3,120.50	602.49	0.81	5,562.21	0.02	765.39	1.37	1.48	75.02	178.29	-	-	-	-	10,307.58	-	-	-	-	-
Renda Bruta-Total	3,255.32	2,099.31	11.24	8,353.65	0.07	3,554.34	7.49	11.10	211.61	932.54	-	-	-	-	18,436.68	-	-	-	-	-
Pessoal ocupado total-Total	457.77	8.67	0.04	26.97	0.00	14.68	0.02	0.04	0.87	3.85	-	-	-	-	512.90	-	-	-	-	-
Assalariados-Total	8.01	8.67	0.04	26.97	0.00	14.68	0.02	0.04	0.87	3.85	-	-	-	-	63.14	-	-	-	-	-

Fonte: Dados básicos do IBGE (PAM e PEVS e Censo Agropecuário de 2017); pesquisa de campo Idesp-Dadesa/NAEA-IPEA. Processamento para as CSα no Sistema Netz.

Table A.2.2-8- EcoSocioBio-PA's Buriti Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Produção	-	5.48	1,442.34	151.57	294.57	50.59	-	-	-	683.11	-	-	-	-	2,627.66	91.92	-	-	91.92	2,719.58
A1 Intermed. Primária	-	-	-	-	-	10.39	-	-	-	-	-	-	-	-	10.39	-	-	-	-	10.39
A2 IndustBenef	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,294.25	-	-	2,294.25	2,294.25
A3 IndustTransf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	222.88	-	-	222.88	222.88
A4 Atacado	-	-	-	-	-	-	-	323.32	-	-	-	-	-	-	323.32	-	-	-	-	323.32
A5 Varejo&Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80.31	-	-	80.31	80.31
B1 IndustBenef	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 IndustTransf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	404.05	404.05	404.05
B3 Atacado	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Varejo&Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	683.11	-	683.11	683.11
C1 IndustBenef	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 IndustTransf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Atacado	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Varejo&Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Produção Intermediária	-	5.48	1,442.34	151.57	294.57	60.99	-	323.32	-	683.11	-	-	-	-	2,961.37	2,689.36	683.11	404.05	3,776.51	6,737.89
VAB-Total	2,719,58	4.91	851.92	71.31	28.75	19.32	-	80.73	-	-	-	-	-	-	3,776.51	-	-	-	-	-
Salários-Total	152,79	0.83	153.57	14.92	25.73	6.39	-	27.05	-	54.35	-	-	-	-	435.63	-	-	-	-	-
Lucros+Outros Insumos	2,566,78	4.09	698.34	56.39	3.02	12.93	-	53.68	-	(54.35)	-	-	-	-	3,340.88	-	-	-	-	-
Renda Bruta-Total	2,719,58	10.39	2,294.25	222.88	323.32	80.31	-	404.05	-	683.11	-	-	-	-	6,737.89	-	-	-	-	-
Pessoal ocupado total-Total	274,18	0.04	7.41	0.72	1.33	0.33	-	1.30	-	2.82	-	-	-	-	288.14	-	-	-	-	-
Assalariados-Total	5,14	0.04	7.41	0.72	1.33	0.33	-	1.30	-	2.82	-	-	-	-	19.10	-	-	-	-	-

Fonte: Dados básicos do IBGE (PAM e PEVS e Censo Agropecuário de 2017); pesquisa de campo Idesp-Dadesa/NAEA-IPEA. Processamento para as CSα no Sistema Netz.

Table A.2.2-9 EcoSocioBio-PA's Cupuaçu Berry Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surroun-ding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	2,035.33	7,483.37	424.08	72.67	975.36	32,73	-	193.15	162.55	98.65	-	-	19,79	11,497.66	667.71	1,067.95	-	1,735.66	13,233.32
A1. Prim. Intermediate	-	-	309.35	63.12	-	1,703.46	20,78	367,67	-	290.77	-	-	-	-	2,755.15	330.12	390.94	-	721.07	3,476.22
A2 Processing Industry	-	-	-	45.81	226.55	429.02	-	-	4,193.15	589.51	-	-	-	5,231.60	10,715.66	1,854.77	314.39	-	2,169.16	12,884.82
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,112.98	-	-	3,112.98	3,112.98
A4 Wholesale	-	-	-	-	50.38	12.06	-	-	38.43	-	-	-	-	19.48	120.35	267.91	-	-	267.91	388.26
A5 Retail&Service	-	-	-	47.86	-	63.63	-	-	-	-	-	-	-	-	111.49	4.386.05	1.78	-	4,387.83	4.499.32
B1 Processing Industry	-	-	-	-	-	2.55	-	-	-	-	-	-	-	35.44	38.00	-	23.63	-	23.63	61.62
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	543.87	-	543.87	543.87
B3 Wholesale	-	-	-	-	-	-	-	-	-	183.77	-	-	-	-	183.77	4.286.75	19.22	-	4,305.97	4,489.73
B4 Retail&Service	-	-	-	2.89	-	-	-	83.02	-	18.54	-	-	-	-	104.46	-	1.693.69	-	1,693.69	1,798.16
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	123.11	123.11	-	-	-	-	123.11
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,968.01	6,968.01	6,968.01
Interm.Production	-	2,035.33	7,792.72	583.76	349.60	3,186.08	53.51	450.70	4,424.74	1,245.14	98.65	-	-	5,429.42	25,649.64	14,906.29	4,055.47	6,968.01	25,929.78	51,579.42
Total GVA	13,233.32	1,440.89	5,092.10	2,529.22	38.66	1,313.23	8.11	93.17	64.99	553.02	24.46	-	-	1,538.59	25,929.78	-	-	-	-	-
Total Wages	1,193.47	276.60	862.49	208.38	30.89	358.00	4.12	36.41	357.24	143.08	10.07	-	-	604.55	4,085.29	-	-	-	-	-
Profits+Other Inputs	12,039.5	1,164.30	4,229.62	2,320.84	7.77	955,23	3.99	56.76	(292.24)	409.94	14.39	-	-	934.04	21,844.49	-	-	-	-	-
Total Gross Income	13,233.32	3,476.22	12,884.82	3,112.98	388.26	4,499.32	61.62	543.87	4,489.73	1,798.16	123.11	-	-	6,968.01	51,579.42	-	-	-	-	-
Total Occupied Population	1,066.07	14.35	41.59	10.05	1.60	18.58	0.20	1.76	18.54	7.42	0.33	-	-	31.28	1,211.78	-	-	-	-	-
Total Wage Earners	69.45	14.35	41.59	10.05	1.60	18.58	0.20	1.76	18.54	7.42	0.33	-	-	31.28	215.15	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-10 EcoSocioBio-PA's Açai Palm Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	1,721	6,597	0	-	1	23	0	-	26	-	-	-	-	8,368	2	-	-	2	8,370
A1. Prim. Intermediate	-	-	1,110	-	-	-	993	-	-	-	-	-	-	-	2,104	0	-	-	0	2,104
A2 Processing Industry	-	-	3,974	0	0	3	2,682	-	-	1,357	-	-	2,693	30,133	40,843	44	-	-	44	40,887
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	18	18
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0	0
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	6	6
B1 Processing Industry	-	-	-	-	-	-	-	-	-	5,137	-	-	-	6,098	11,235	-	9	-	9	11,245
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	0
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	28	-	-	-	-	-	-	-	28	-	8,760	-	8,760	8,788
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	17,318	17,318	-	-	-	-	17,318
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80,290	80,290	80,290
Interm.Production	-	1,721	11,681	1	0	5	3,727	0	-	6,520	-	-	2,693	53,549	79,897	69	8,769	80,290	89,129	169,026
Total GVA	8.370	382	29,206	17	-	1	7,518	0	-	2,269	-	-	14,625	26,741	89,129	-	-	-	-	-
Total Wages	217	167	2,737	1	0	0	753	0	-	699	-	-	2,360	6,966	13,902	-	-	-	-	-
Profits+Other Inputs	8.153	215	26,469	16	(0)	1	6,765	0	-	1,569	-	-	12,264	19,775	75,227	-	-	-	-	-
Total Gross Income	8.370	2,104	40,887	18	0	6	11,245	0	-	8,788	-	-	17,318	80,290	169,026	-	-	-	-	-
Total Occupied Population	909	9	132	0	0	0	36	0	-	36	-	-	78	360	1,561	-	-	-	-	-
Total Wage Earners	126	9	132	0	0	0	36	0	-	36	-	-	78	360	777	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-11 EcoSocioBio-PA's Rubber Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	Gross Value of Production
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	413.97	-	0.51	10.71	-	-	-	1,694.91	-	-	-	-	-	2,.120.10	-	-	-	-	2,120.10
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	217.64	-	-	292.76	-	-	510.39	-	-	-	-	510.39
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	5.47	-	-	-	-	-	-	-	19.36	24.84	0.73	-	-	0.73	25.56
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	12.99	-	-	12.99	-	-	-	-	12.99
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.53	-	-	5.53	5.53
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	2,850.55	-	-	2,850.55	-	-	-	-	2,850.55
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	3,470.67	3,470.67	-	-	538.76	538.76	4,009.43
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,352.70	4,352.70	4,352.70
Interm.Production	-	413.97	-	0.51	10.71	5.47	-	-	1,912.55	-	-	3,156.30	-	3,490.03	8,989.54	6.26	-	4,891.46	4,897.72	13,887.26
Total GVA	2,120.10	96.42	-	25.06	2.28	0.06	-	-	938.00	-	-	853.13	-	862.67	4,897.72	-	-	-	-	-
Total Wages	105.26	40.61	-	1.71	1.03	0.44	-	-	226.81	-	-	328.00	-	377.64	1,081.51	-	-	-	-	-
Profits+Other Inputs	2,014.84	55.81	-	23.35	1.25	(0.38)	-	-	711.19	-	-	525.13	-	485.03	3,816.21	-	-	-	-	-
Total Gross Income	2,120.10	510.39	-	25.56	12.99	5.53	-	-	2,850.55	-	-	4,009.43	-	4,352.70	13,887.26	-	-	-	-	-
Total Occupied Population	169.51	2.11	-	0.08	0.05	0.02	-	-	11.77	-	-	10.70	-	19.54	213.79	-	-	-	-	-
Total Wage Earners	6.55	2.11	-	0.08	0.05	0.02	-	-	11.77	-	-	10.70	-	19.54	50.83	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-12- EcoSocioBio-PA's Cumaru Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	20,72	60,69	0,08	98,76	3,38	-	-	69,52	-	-	-	-	-	253,17	-	-	-	-	253,17
A1. Prim. Intermediate	-	-	14,13	-	9,1	-	-	-	-	-	-	-	-	-	23,23	-	-	-	-	23,23
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	217,17	217,17	-	-	-	-	217,17
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,08	-	-	0,08	0,08
A4 Wholesale	-	-	48,55	-	-	-	-	-	60,69	-	-	-	-	9,93	119,18	-	-	-	-	119,18
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12,2	-	-	12,2	12,2
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	92,7	-	-	-	60,69	153,39	-	-	-	-	153,39
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	179,21	-	179,21	179,21
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	374,92	374,92	374,92
Interm.Production	-	20,72	123,37	0,08	107,87	3,38	-	-	130,22	92,7	-	-	-	287,8	766,13	12,28	179,21	374,92	566,41	1.332,55
Total GVA	253,17	2,51	93,8	-	11,31	8,81	-	-	23,17	86,52	-	-	-	87,12	566,41	-	-	-	-	-
Total Wages	7,3	1,85	14,54	0,01	9,48	0,97	-	-	12,2	14,26	-	-	-	32,53	93,14	-	-	-	-	-
Profits+Other Inputs	245,86	0,66	79,26	-0,01	1,83	7,84	-	-	10,97	72,26	-	-	-	54,59	473,27	-	-	-	-	-
Total Gross Income	253,17	23,23	217,17	0,08	119,18	12,2	-	-	153,39	179,21	-	-	-	374,92	1.332,55	-	-	-	-	-
Total Occupied Population	28,37	0,1	0,7	0	0,49	0,05	-	-	0,63	0,74	-	-	-	1,68	32,77	-	-	-	-	-
Total Wage Earners	1,03	0,1	0,7	0	0,49	0,05	-	-	0,63	0,74	-	-	-	1,68	5,42	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-13- EcoSocioBio-PA's Copaiba Input-Output Matrix in 2019, in BRL1,000.00

	Produção Intermediária															Demanda Final				Valor Bruto da Produção
	Economia Local										Economia Extralocal				Total Produção Inter-mediária	Local		Extralocal	Total	
	Interior						Centro													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Interior	Centro			
A0 Production	-	16.4	26.0	0.1	1.0	70.6	-	0.3	-	0.1	-	-	-	-	114.5	0.1	-	-	0.1	114.6
A1. Prim. Intermediate	-	-	-	-	-	21.3	-	-	-	-	-	-	-	-	21.3	0.8	-	-	0.8	22.0
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	32.6	32.6	-	-	-	-	32.6
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	0.1
A4 Wholesale	-	-	-	-	-	0.9	-	-	-	-	-	-	-	0.8	1.6	-	-	-	-	1.6
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168.3	-	-	168.3	168.3
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.3	-	-	-	-	0.3
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.1
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41.9	41.9	41.9
Interm.Production	-	16.4	26.0	0.1	1.0	92.9	-	0.3	-	0.1	-	-	-	33.7	170.5	169.2	-	41.9	211.0	381.5
Total GVA	114.6	5.6	6.5	0.0	0.6	75.4	-	0.1	-	0.0	-	-	-	8.2	211.0	-	-	-	-	-
Total Wages	7.2	1.8	2.2	0.0	0.1	13.4	-	0.0	-	0.0	-	-	-	3.6	28.4	-	-	-	-	-
Profits+Other Inputs	107.4	3.9	4.3	0.0	0.5	62.0	-	0.0	-	0.0	-	-	-	4.6	182.7	-	-	-	-	-
Total Gross Income	114.6	22.0	32.6	0.1	1.6	168.3	-	0.3	-	0.1	-	-	-	41.9	381.5	-	-	-	-	-
Total Occupied Population	15	0	0	0	0	1	-	0	-	0	-	-	-	0	16	15	0	0	0	0
Total Wage Earners	1	0	0	0	0	1	-	0	-	0	-	-	-	0	2	1	0	0	0	0

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-14- EcoSocioBio-PA's Andiroba Input-Output Matrix in 2019, in BRL1,000.00

	Produção Intermediária															Demanda Final				Valor Bruto da Produção
	Economia Local										Economia Extralocal				Total Produção Inter-mediária	Local		Extralocal	Total	
	Interior						Centro				C1	C2	C3	C4						
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4						Interior	Centro			
A0 Production	-	125.73	63.04	-	44.92	427.96	-	4.25	-	4.64	-	-	-	3.63	674.18	47.46	57.82	0.36	105.63	779.81
A1. Prim. Intermediate	-	-	-	-	-	2.07	-	60.78	-	-	-	-	-	-	62.85	118.12	-	-	118.12	180.98
A2 Processing Industry	-	-	-	-	-	-	-	69.76	-	-	-	-	-	-	69.76	-	-	-	-	69.76
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	12.12	-	30.20	-	-	-	28.24	70.56	-	-	-	-	70.56
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	832.53	-	-	832.53	832.53
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	76.64	-	-	-	-	-	5.31	81.95	-	-	203.02	203.02	284.97
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	0.63	-	-	-	-	-	-	-	-	0.63	-	42.96	-	42.96	43.59
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.02	40.02	40.02
Interm.Production	-	125.73	63.04	-	44.92	430.67	-	223.55	-	34.84	-	-	-	37.18	959.93	998.11	100.78	243.40	1,342.29	2,302.22
Total GVA	779.81	55.25	6.72	-	25.64	401.86	-	61.42	-	8.74	-	-	-	2.84	1,342.29	-	-	-	-	-
Total Wages	37.55	14.40	4.67	-	5.61	66.24	-	19.08	-	3.47	-	-	-	3.47	154.49	-	-	-	-	-
Profits+Other Inputs	742.26	40.85	2.05	-	20.03	335.62	-	42.34	-	5.27	-	-	-	(0.63)	1,187.80	-	-	-	-	-
Total Gross Income	779.81	180.98	69.76	-	70.56	832.53	-	284.97	-	43.59	-	-	-	40.02	2,302.22	-	-	-	-	-
Total Occupied Population	100.10	0.75	0.23	-	0.29	3.44	-	0.92	-	0.18	-	-	-	0.18	106.08					
Total Wage Earners	4.16	0.75	0.23	-	0.29	3.44	-	0.92	-	0.18	-	-	-	0.18	10.14					

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-15- EcoSocioBio-PA's Tapereba Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	90.84	315.20	32.19	-	116.93	0.04	-	0.07	1.98	-	-	-	2.40	559.66	28.41	55.54	-	83.95	643.61
A1. Prim. Intermediate	-	-	0.70	-	-	8.12	-	1.83	-	12.78	77.15	-	-	-	100.57	9.74	7.15	-	16.89	117.46
A2 Processing Industry	-	-	-	236.08	-	15.75	-	-	1.88	159.69	-	-	-	377.29	790.69	12.34	-	-	12.34	803.03
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	604.86	-	-	604.86	604.86
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	6.74	-	-	-	-	-	-	-	-	-	-	6.74	286.84	-	-	286.84	293.58
B1 Processing Industry	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	0.05	-	-	-	-	0.05
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.13	-	2.13	2.13
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.95	-	-	1.95	1.95
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	218.42	-	218.42	218.42
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	96.87	96.87	-	-	-	-	96.87
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	615.05	615.05	615.05
Interm.Production	-	90.84	315.91	275.02	-	140.84	0.04	1.83	1.95	174.45	77.15	-	-	476.56	1,554.57	944.13	283.24	615.05	1,842.42	3,396.99
Total GVA	643.61	26.61	487.12	329.84	-	152.74	0.01	0.30	-	43.97	19.72	-	-	138.49	1,842.42	-	-	-	-	-
Total Wages	34.91	9.35	53.75	40.49	-	23.36	0.00	0.14	0.16	17.38	7.92	-	-	53.36	240.82	-	-	-	-	-
Profits+Other Inputs	608.70	17.27	433.37	289.35	-	129.38	0.01	0.16	(0.16)	26.59	11.79	-	-	85.13	1,601.59	-	-	-	-	-
Total Gross Income	643.61	117.46	803.03	604.86	-	293.58	0.05	2.13	1.95	218.42	96.87	-	-	615.05	3396.99	-	-	-	-	-
Total Occupied Population	104.57	0.48	2.59	1.95	-	1.21	0.00	0.01	0.01	0.90	0.26	-	-	2.76	1.75	-	-	-	-	-
Total Wage Earners	17.98	0.48	2.59	1.95	-	1.21	0.00	0.01	0.01	0.90	0.26	-	-	2.76	28.15	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-16- EcoSocioBio-PA's Murici Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	-	194.59	1,362.40	10.91	1.16	142.51	-	-	-	1.02	-	-	-	-	1,712.58	42.45	-	-	42.45	1,755.03
A1. Prim. Intermediate	-	-	-	35.96	-	16.00	-	3.19	-	228.72	-	-	-	-	283.86	15.87	-	-	15.87	299.73
A2 Processing Industry	-	-	-	23.60	-	1,538.74	-	-	-	292.01	-	-	-	11.41	1,865.75	35.24	-	-	35.24	1,900.98
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	512.33	-	-	512.33	512.33
A4 Wholesale	-	-	-	-	-	-	-	-	0.35	-	-	-	-	-	0.35	0.90	-	-	0.90	1.24
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,678.65	-	-	2,678.65	2,678.65
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.99	-	3.99	3.99
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.35	-	-	0.35	0.35
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660.98	-	660.98	660.98
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.28	14.28	14.28
Interm.Production	-	194.59	1,362.40	70.46	1.16	1,697.25	-	3.19	0.35	521.74	-	-	-	-	3,862.54	3,.285.77	664.97	14.28	3,965.03	7,827.57
Total GVA	1,755.03	105.14	538.58	441.87	0.09	981.40	-	0.80	-	139.24	-	-	-	14.28	3,976.43	-	-	-	-	-
Total Wages	76.96	23.85	127.25	34.29	0.10	213.13	-	0.27	0.03	52.59	-	-	-	1.24	529.71	-	-	-	-	-
Profits+Other Inputs	1,678.08	81.29	411.33	407.58	(0.01)	768.26	-	0.53	(0.03)	86.65	-	-	-	13.04	3,446.73	-	-	-	-	-
Total Gross Income	1,755.03	299.73	1,900.98	512.33	1.24	2,678.65	-	3.99	0.35	660.98	-	-	-	14.28	7,827.57	-	-	-	-	-
Total Occupied Population	135.63	1.24	6.14	1.65	0.01	11.06	-	0.01	0.00	2.73	-	-	-	0.06	158.53	-	-	-	-	-
Total Wage Earners	6.50	1.24	6.14	1.65	0.01	11.06	-	0.01	0.00	2.73	-	-	-	0.06	29.40	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-17- EcoSocioBio-PA's Bacaba Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	-	87.83	-	1.56	16.07	-	-	-	20.41	-	-	-	-	125.87	10.63	-	-	10.63	136.50
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	129.48	-	-	129.48	129.48
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	4.00	-	-	-	-	-	-	4.00	-	-	-	-	4.00
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.95	-	-	22.95	22.95
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55.65	-	55.65	55.65
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.00	4.00	4.00
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	33.64	-	-	-	-	-	-	-	33.64	-	-	-	-	33.64
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	-	87.83	-	1.56	16.07	33.64	4.00	-	20.41	-	-	-	-	163.51	163.06	55.65	4.00	222.71	386.21
Total GVA	136.50	-	41.65	-	2.44	6.89	22.01	-	-	13.23	-	-	-	-	222.71	-	-	-	-	-
Total Wages	7.11	-	8.67	-	0.32	1.83	3.73	0.27	-	2.68	-	-	-	-	24.60	-	-	-	-	-
Profits+Other Inputs	129.38	-	32.98	-	2.12	5.06	18.28	(0.27)	-	10.55	-	-	-	-	198.11	-	-	-	-	-
Total Gross Income	136.50	-	129.48	-	4.00	22.95	55.65	4.00	-	33.64	-	-	-	-	386.21	-	-	-	-	-
Total Occupied Population	13.76	-	0.42	-	0.02	0.09	0.18	0.01	-	0.14	-	-	-	-	14.62	-	-	-	-	-
Total Wage Earners	0.77	-	0.42	-	0.02	0.09	0.18	0.01	-	0.14	-	-	-	-	1.63	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-18- EcoSocioBio-PA's Açai Seed Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	-	129.02	0.37	0.04	-	-	-	-	-	-	-	-	-	129.43	-	-	-	-	129.43
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2 Processing Industry	-	-	-	-	-	-	-	-	-	197.57	-	-	-	-	197.57	-	-	-	-	197.57
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.86	-	-	5.86	5.86
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.35	-	-	0.35	0.35
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	246.76	-	246.76	246.76
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	-	129.02	0.37	0.04	-	-	-	-	197.57	-	-	-	-	327.00	6.21	246.76	-	252.97	579.97
Total GVA	129.43	-	68.54	5.49	0.31	-	-	-	-	49.19	-	-	-	-	252.97	-	-	-	-	-
Total Wages	11.21	-	13.22	0.39	0.03	-	-	-	-	19.63	-	-	-	-	44.49	-	-	-	-	-
Profits+Other Inputs	118.22	-	55.32	5.10	0.28	-	-	-	-	29.56	-	-	-	-	208.48	-	-	-	-	-
Total Gross Income	129.43	-	197.57	5.86	0.35	-	-	-	-	246.76	-	-	-	-	579.97	-	-	-	-	-
Total Occupied Population	9.52	-	0.64	0.02	0.00	-	-	-	-	1.02	-	-	-	-	11.20	-	-	-	-	-
Total Wage Earners	1.41	-	0.64	0.02	0.00	-	-	-	-	1.02	-	-	-	-	3.08	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-19 EcoSocioBio-PA's Uxi Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	12.43	-	-	-	6.37	-	-	-	0.14	-	-	-	-	18.94	1.99	1.16	-	3.15	22.09
A1. Prim. Intermediate	-	-	-	-	-	0.84	-	4.84	-	16.44	-	-	-	-	22.12	0.84	0.73	-	1.57	23.69
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.90	-	-	14.90	14.90
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.98	-	5.98	5.98
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35.04	-	35.04	35.04
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	12.43	-	-	-	7.21	-	4.84	-	16.58	-	-	-	-	41.06	17.73	42.91	-	60.64	101.71
Total GVA	22.09	11.25	-	-	-	7.69	-	1.14	-	18.46	-	-	-	-	60.64	-	-	-	-	-
Total Wages	0.28	1.88	-	-	-	1.19	-	0.40	-	2.79	-	-	-	-	6.54	-	-	-	-	-
Profits+Other Inputs	21.82	9.37	-	-	-	6.51	-	0.74	-	15.67	-	-	-	-	54.11	-	-	-	-	-
Total Gross Income	22.09	23.69	-	-	-	14.90	-	5.98	-	35.04	-	-	-	-	101.71	-	-	-	-	-
Total Occupied Population	1.09	0.10	-	-	-	0.06	-	0.02	-	0.14	-	-	-	-	1.41	-	-	-	-	-
Total Wage Earners	0.04	0.10	-	-	-	0.06	-	0.02	-	0.14	-	-	-	-	0.36	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-20 EcoSocioBio-PA's Tucuman Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	104.98	-	0.90	-	-	-	882.54	-	-	-	-	0.49	-	988.91	298.89	-	-	298.89	1,287.80
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	230.56	17.53	248.08	-	-	-	-	248.08
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.78	-	-	10.78	10.78
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,094.35	1,094.35	1,094.35
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	294.03	294.03	-	-	-	-	294.03
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	495.97	495.97	495.97
Interm.Production	-	104.98	-	0.90	-	-	-	882.54	-	-	-	-	231.05	311.56	1,531.03	309.67	-	1,590.32	1,899.99	3,431.02
Total GVA	1,287.80	143.11	-	9.88	-	-	-	211.81	-	-	-	-	62.98	184.42	1,899.99	-	-	-	-	-
Total Wages	28.48	19.74	-	0.72	-	-	-	73.25	-	-	-	-	40.08	43.03	205.30	-	-	-	-	-
Profits+Other Inputs	1,259.32	123.37	-	9.16	-	-	-	138.56	-	-	-	-	22.90	141.38	1,694.69	-	-	-	-	-
Total Gross Income	1,287.80	248.08	-	10.78	-	-	-	1,094.35	-	-	-	-	294.03	495.97	3,431.02	-	-	-	-	-
Total Occupied Population	200.57	1.02	-	0.03	-	-	-	3.53	-	-	-	-	1.32	2.23	208.71	-	-	-	-	-
Total Wage Earners	1.88	1.02	-	0.03	-	-	-	3.53	-	-	-	-	1.32	2.23	10.02	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-21 EcoSocioBio-PA's Breu Branco Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	36.32	-	8.81	-	14.35	-	-	-	-	-	-	-	-	59.48	-	-	-	-	59.48
A1. Prim. Intermediate	-	-	-	-	-	0.18	-	-	-	20.00	-	25.00	-	4.00	49.18	8.64	-	-	8.64	57.82
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	4.80	-	-	-	-	-	-	-	-	4.80	9.00	-	-	9.00	13.80
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33.85	-	-	33.85	33.85
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.04	-	25.04	25.04
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	31.30	31.30	-	-	-	-	31.30
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43.10	43.10	43.10
Interm.Production	-	36.32	-	8.81	-	19.33	-	-	-	20.00	-	25.00	-	35.30	144.76	51.49	25.04	43.10	119.63	264.39
Total GVA	59.48	21.50	-	4.99	-	14.52	-	-	-	5.04	-	6.30	-	7.80	119.63	-	-	-	-	-
Total Wages	3.83	4.60	-	0.92	-	2.69	-	-	-	1.99	-	2.56	-	3.74	20.34	-	-	-	-	-
Profits+Other Inputs	55.65	16.90	-	4.06	-	11.82	-	-	-	3.05	-	3.74	-	4.06	99.28	-	-	-	-	-
Total Gross Income	59.48	57.82	-	13.80	-	33.85	-	-	-	25.04	-	31.30	-	43.10	264.39	-	-	-	-	-
Total Occupied Population	7.56	0.24	-	0.04	-	0.14	-	-	-	0.10	-	0.08	-	0.19	8.37	-	-	-	-	-
Total Wage Earners	0.26	0.24	-	0.04	-	0.14	-	-	-	0.10	-	0.08	-	0.19	1.06	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-22 EcoSocioBio-PA's Piquia Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	63.64	-	-	-	112.11	-	-	-	12.65	-	-	-	-	188.40	860.17	-	-	860.17	1,048.57
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	47.93	-	-	-	-	47.93	56.72	26.96	-	83.68	131.62
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	402.10	-	-	402.10	402.10
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125.16	-	125.16	125.16
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	63.64	-	-	-	112.11	-	-	-	60.58	-	-	-	-	236.34	1,319.00	152.12	-	1,471.12	1,707.45
Total GVA	1,048.57	67.97	-	-	-	289.99	-	-	-	64.58	-	-	-	-	1,.471.12	-	-	-	-	-
Total Wages	58.72	10.47	-	-	-	31.99	-	-	-	9.96	-	-	-	-	111.14	-	-	-	-	-
Profits+Other Inputs	989.86	57.50	-	-	-	258.00	-	-	-	54.62	-	-	-	-	1,359.98	-	-	-	-	-
Total Gross Income	1,048.57	131.62	-	-	-	402.10	-	-	-	125.16	-	-	-	-	1,707.45	-	-	-	-	-
Total Occupied Population	142.90	0.54	-	-	-	1.66	-	-	-	0.52	-	-	-	-	145.63	-	-	-	-	-
Total Wage Earners	5.74	0.54	-	-	-	1.66	-	-	-	0.52	-	-	-	-	8.46	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-23- EcoSocioBio-PA's Piquia Oil Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	-	-	-	-	3.10	-	-	-	-	-	-	-	-	3.10	-	-	-	-	3.10
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.10	-	-	17.10	17.10
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	-	-	-	-	3.10	-	-	-	-	-	-	-	-	3.10	17.10	-	-	17.10	20.20
Total GVA	3.10	-	-	-	-	14.00	-	-	-	-	-	-	-	-	17.10	-	-	-	-	-
Total Wages	0.08	-	-	-	-	1.36	-	-	-	-	-	-	-	-	1.44	-	-	-	-	-
Profits+Other Inputs	3.02	-	-	-	-	12.64	-	-	-	-	-	-	-	-	15.65	-	-	-	-	-
Total Gross Income	3.10	-	-	-	-	17.10	-	-	-	-	-	-	-	-	20.20	-	-	-	-	-
Total Occupied Population	0.28	-	-	-	-	0.07	-	-	-	-	-	-	-	-	0.35	-	-	-	-	-
Total Wage Earners	0.01	-	-	-	-	0.07	-	-	-	-	-	-	-	-	0.08	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-24 EcoSocioBio-PA's Plant-based Milks and Saps Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	0.11	-	11.94	-	17.38	-	-	-	-	-	-	-	-	29.43	5.12	-	-	5.12	34.55
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30	-	-	0.30	0.30
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.14	-	-	19.14	19.14
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.33	-	-	30.33	30.33
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	0.11	-	11.94	-	17.38	-	-	-	-	-	-	-	-	29.43	54.89	-	-	54.89	84.32
Total GVA	34.55	0.20	-	7.20	-	12.94	-	-	-	-	-	-	-	-	54.89	-	-	-	-	-
Total Wages	0.99	0.02	-	1.28	-	2.41	-	-	-	-	-	-	-	-	4.71	-	-	-	-	-
Profits+Other Inputs	33.56	0.17	-	5.92	-	10.53	-	-	-	-	-	-	-	-	50.18	-	-	-	-	-
Total Gross Income	34.55	0.30	-	19.14	-	30.33	-	-	-	-	-	-	-	-	84.32	-	-	-	-	-
Total Occupied Population	4.08	0.00	-	0.06	-	0.13	-	-	-	-	-	-	-	-	4.27	-	-	-	-	-
Total Wage Earners	0.16	0.00	-	0.06	-	0.13	-	-	-	-	-	-	-	-	0.35	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-25 EcoSocioBio-PA's Brazil Nut Oil Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	-	-	-	-	0.200	-	3.600	-	-	-	-	-	-	3.800	-	-	-	-	0.380
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.064	-	-	1.064	0.106
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	4.500	4.500	-	-	-	-	0.450
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.625	5.625	0.563
Interm.Production	-	-	-	-	-	0.200	-	3.600	-	-	-	-	-	4.500	8.300	1.064	-	5.625	6.689	1.499
Total GVA	3.800	-	-	-	-	0.864	-	0.900	-	-	-	-	-	1.125	6.689	-	-	-	-	-
Total Wages	0.091	-	-	-	-	0.085	-	0.301	-	-	-	-	-	0.488	0.965	-	-	-	-	-
Profits+Other Inputs	3.709	-	-	-	-	0.779	-	0.599	-	-	-	-	-	0.637	5.724	-	-	-	-	-
Total Gross Income	3.800	-	-	-	-	1.064	-	4.500	-	-	-	-	-	5.625	14.989	-	-	-	-	-
Total Occupied Population	0.36	-	-	-	-	0.00	-	0.01	-	-	-	-	-	0.03	0.41	-	-	-	-	-
Total Wage Earners	0.01	-	-	-	-	0.00	-	0.01	-	-	-	-	-	0.03	0.05	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-26- EcoSocioBio-PA's Handicraft Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	3.19	-	-	32.11	134.46	-	0.37	-	504.19	-	-	-	-	674.32	54.54	60.52	4.00	119.05	793.38
A1. Prim. Intermediate	-	-	-	-	-	4.28	-	-	-	-	-	-	-	-	4.28	-	-	-	-	4.28
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	32.11	32.11	-	-	-	-	32.11
A5 Retail&Service	-	-	-	-	-	1.32	-	-	-	-	-	-	-	56.31	57.63	124.71	-	-	124.71	182.34
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.93	-	9.93	9.93
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	631.22	-	631.22	631.22
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96.60	96.60	96.60
Interm.Production	-	3.19	-	-	32.11	140.07	-	0.37	-	504.19	-	-	-	88.42	768.35	179.25	701.67	100.60	981.52	1,749.87
Total GVA	793.38	1.09	-	-	-	42.27	-	9.56	-	127.03	-	-	-	8.18	981.52	-	-	-	-	-
Total Wages	23.91	0.34	-	-	2.56	14.51	-	0.66	-	50.23	-	-	-	8.38	100.58	-	-	-	-	-
Profits+Other Inputs	769.47	0.75	-	-	(2.56)	27.76	-	8.90	-	76.81	-	-	-	(0.20)	880.94	-	-	-	-	-
Total Gross Income	793.38	4.28	-	-	32.11	182.34	-	9.93	-	631.22	-	-	-	96.60	1,749.87	-	-	-	-	-
Total Occupied Population	261.77	0.02	-	-	0.13	0.75	-	0.03	-	2.61	-	-	-	0.43	265.75	-	-	-	-	-
Total Wage Earners	28.85	0.02	-	-	0.13	0.75	-	0.03	-	2.61	-	-	-	0.43	32.82	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-27- EcoSocioBio-PA's Medicinal Plants Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	-	-	0.15	-	171.91	-	-	-	-	-	-	-	-	172.06	3.33	-	-	3.33	175.39
A1. Prim. Intermediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.24	-	-	0.24	0.24
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	401.72	-	-	401.72	401.72
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	-	-	0.15	-	171.91	-	-	-	-	-	-	-	-	172.06	405.29	-	-	405.29	577.35
Total GVA	175.39	-	-	0.09	-	229.81	-	-	-	-	-	-	-	-	405.29	-	-	-	-	-
Total Wages	4.99	-	-	0.02	-	31.96	-	-	-	-	-	-	-	-	36.97	-	-	-	-	-
Profits+Other Inputs	170.40	-	-	0.07	-	197.85	-	-	-	-	-	-	-	-	368.32	-	-	-	-	-
Total Gross Income	175.39	-	-	0.24	-	401.72	-	-	-	-	-	-	-	-	577.35	-	-	-	-	-
Total Occupied Population	25.04	-	-	0.00	-	1.66	-	-	-	-	-	-	-	-	26.70	-	-	-	-	-
Total Wage Earners	4.48	-	-	0.00	-	1.66	-	-	-	-	-	-	-	-	6.14	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-28- EcoSocioBio-PA's Murumuru Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	5.82	-	-	27.46	-	-	10.50	-	-	-	-	-	-	43.78	-	-	-	-	43.78
A1. Prim. Intermediate	-	-	-	-	-	-	-	23.41	-	-	-	-	-	-	23.41	-	-	-	-	23.41
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4 Wholesale	-	-	-	-	-	-	-	40.03	-	-	-	-	-	-	40.03	-	-	-	-	40.03
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	1.15	-	-	-	-	-	-	1.15	-	1.88	94.52	96.39	97.55
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interm.Production	-	5.82	-	-	27.46	-	-	75.10	-	-	-	-	-	-	108.38	-	1.88	94.52	96.39	204.78
Total GVA	43.78	17.59	-	-	12.57	-	-	22.45	-	-	-	-	-	-	96.39	-	-	-	-	-
Total Wages	3.32	1.86	-	-	3.19	-	-	6.53	-	-	-	-	-	-	14.90	-	-	-	-	-
Profits+Other Inputs	40.47	15.73	-	-	9.39	-	-	15.92	-	-	-	-	-	-	81.50	-	-	-	-	-
Total Gross Income	43.78	23.41	-	-	40.03	-	-	97.55	-	-	-	-	-	-	204.78	-	-	-	-	-
Total Occupied Population	5.62	0.10	-	-	0.17	-	-	0.31	-	-	-	-	-	-	6.19	-	-	-	-	-
Total Wage Earners	0.45	0.10	-	-	0.17	-	-	0.31	-	-	-	-	-	-	1.03	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-29- EcoSocioBio-PA's Cupuaçu Almond Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers									Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4						
A0 Production	-	0.92	-	164.26	135.51	-	-	-	-	-	-	-	-	-	300.69	-	-	-	-	300.69
A1. Prim. Intermediate	-	-	-	-	-	-	1.15	-	-	-	-	-	-	-	1.15	-	-	-	-	1.15
A2 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3 Transf. Industry	-	-	-	-	-	-	-	505.61	-	-	-	-	-	-	505.61	-	-	-	-	505.61
A4 Wholesale	-	-	-	-	-	-	-	230.99	34.22	-	-	-	-	-	265.21	-	-	-	-	265.21
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B1 Processing Industry	-	-	-	-	-	-	-	9.93	-	-	-	-	-	-	9.93	-	-	-	-	9.93
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	341.87	-	-	341.87	-	-	746.53	746.53	1,088.40
B3 Wholesale	-	-	-	-	-	-	-	42.78	-	-	-	-	-	-	42.78	-	-	-	-	42.78
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	355.21	355.21	-	-	-	-	355.21
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	443.67	443.67	443.67
Interm.Production	-	0.92	-	164.26	135.51	-	1.15	789.31	34.22	-	-	341.87	-	355.21	1,822.45	-	-	1,190.21	1,190.21	3,012.66
Total GVA	300.69	0.23	-	341.35	129.70	-	8.78	299.09	8.56	-	-	13.35	-	88.46	1,190.21	-	-	-	-	-
Total Wages	32.28	0.09	-	33.84	21.10	-	0.66	72.86	3.40	-	-	29.06	-	38.49	231.80	-	-	-	-	-
Profits+Other Inputs	268.41	0.14	-	307.51	108.59	-	8.12	226.24	5.15	-	-	(15.71)	-	49.97	958.41	-	-	-	-	-
Total Gross Income	300.69	1.15	-	505.61	265.21	-	9.93	1,088.40	42.78	-	-	355.21	-	443.67	3,012.66	-	-	-	-	-
Total Occupied Population	19.92	0.00	-	1.63	1.10	-	0.03	3.51	0.18	-	-	0.95	-	1.99	29.32	-	-	-	-	-
Total Wage Earners	2.22	0.00	-	1.63	1.10	-	0.03	3.51	0.18	-	-	0.95	-	1.99	11.62	-	-	-	-	-

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

Table A.2.2-30- EcoSocioBio-PA's Cocoa Fruit Input-Output Matrix in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
A0 Production	-	6	198	6	50	124	-	5	-	22	-	-	-	-	411	4	-	-	4	415
A1. Prim. Intermediate	-	-	-	-	-	3	-	6	-	-	-	-	-	-	9	-	-	-	-	9
A2 Processing Industry	-	-	-	2	108	18	-	-	102	-	-	-	-	0	230	44	-	-	44	275
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	108	-	-	108	108
A4 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159	-	-	159	159
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	184	-	-	184	184
B1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	15	15
B3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	102	-	-	102	102
B4 Retail&Service	-	-	-	-	-	-	-	-	-	25	-	-	-	-	25	-	48	-	48	73
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
Interm.Production	-	6	198	8	159	145	-	12	102	47	-	-	-	0	675	602	62	0	665	1.340
Total GVA	415	3	76	101	-	40	-	3	-	26	-	-	-	0	665	-	-	-	-	-
Total Wages	46	1	18	7	13	15	-	1	8	6	-	-	-	0	115	-	-	-	-	-
Profits+Other Inputs	369	2	58	94	(13)	25	-	2	(8)	20	-	-	-	0	550	-	-	-	-	-
Total Gross Income	415	9	275	108	159	184	-	15	102	73	-	-	-	0	1,340	-	-	-	-	-
Total Occupied Population	-	6	198	6	50	124	-	5	-	22	-	-	-	-	411	4	-	-	4	415
Total Wage Earners	-	-	-	-	-	3	-	6	-	-	-	-	-	-	9	-	-	-	-	9

Source: IBGE basic data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey. CSα processing in the Netz System.

A.2.3. Input-Output Matrix of EcoSocioBio-PA's Integration Regions

Table A.2.3-1- Socio-biodiversity Bioeconomy of IR-Tocantins (EcoSocioBio-PA) in 2019, in BRL1,000.00

	Intermediate Production															Final Demand				Gross Value of Production
	Local Economy										Domestic Economy				Total Intermediate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	289,925	152,821	-	10,427	2,293	4,544	-	1,401	1,062	3,843	-	-	1	466,316	24,949	465	-	25,415	491,731
A1. Prim. Intermediate	-	309	73,811	-	5,332	1,189	241,855	164	21,319	118	-	145	17,460	31	361,733	14,060	-	-	14,060	375,792
A2 Processing Industry	-	-	26	209	-	-	6,691	601	3,788	590	-	2,036	2,693	9,345	25,979	341,907	8	-	341,914	367,893
A3 Transf. Industry	-	-	-	-	488	-	-	-	-	-	-	-	-	-	488	-	-	-	-	488
A4 Wholesale	-	-	-	-	-	-	13,093	4,831	3,805	30	-	298	-	124	22,182	556	-	5	561	22,742
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,777	71	-	4,848	4,848
B1 Processing Industry	-	-	-	-	-	-	-	3	-	39,561	-	-	-	795,639	835,202	-	85,953	49,871	135,823	971,026
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	6,014	6,014	-	182	633	815	6,829
B3 Wholesale	-	-	-	-	-	-	34,341	-	563	184	-	6,540	-	-	41,628	3,310	-	-	3,310	44,937
B4 Retail&Service	-	-	-	-	-	-	62	-	-	25	-	-	-	-	87	-	54,354	-	54,354	54,441
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28,518	28,518	28,518
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	13,549	13,549	-	-	2,513	2,513	16,062
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	20,923	-	-	17,318	38,241	0	-	-	0	38,241
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,109,981	1,109,981	1,109,981
Interm.Production	-	290,233	226,658	209	16,246	3,482	300,587	5,600	30,875	41,569	24,766	9,019	20,153	842,021	1,811,418	389,558	141,032	1,191,520	1,722,111	3,533,529
Total GVA	491.731	85,559	141,235	279	6,496	1,366	670,438	1,229	14,062	12,872	3,752	7,043	18,088	267,960	1,722,111	-	-	-	-	-
Total Wages	28.829	29,901	24,626	33	1,810	386	64,999	457	3,576	4,332	2,333	1,314	5,212	96,303	264,109	-	-	-	-	-
Profits+Other Inputs	462.902	55,658	116,609	246	4,687	981	605,439	772	10,487	8,540	1,419	5,729	12,876	171,657	1,458,002	-	-	-	-	-
Total Gross Income	491.731	375,792	367,893	488	22,742	4,848	971,026	6,829	44,937	54,441	28,518	16,062	38,241	1,109,981	3,533,529	-	-	-	-	-
Total Occupied Population	70.378	1,552	1,188	2	94	20	3,135	22	186	225	76	43	172	4,984	82,073,69	-	-	-	-	-
Total Wage Earners	5.481	1,552	1,188	2	94	20	3,135	22	186	225	76	43	172	4,984	17,176,39	-	-	-	-	-

Source: Basic IBGE data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey and processing in the Netz System. Production, rural and surrounding areas; A1- Primary intermediation (rural retail), rural and surrounding areas; A2- Processing industry, rural and surrounding areas; A3- Processing industry, rural and surrounding areas; A4- Wholesale, rural and surrounding areas; A5- Retail, rural, urban and surrounding areas; B1 - Processing industry, urban centers; B2- Transformation industry, urban centers; B3- Wholesale, urban centers; B4- Retail, urban centers; C1 - Domestic Processing Industry; C2- Domestic Transformation Industry; C3- Domestic wholesale; C4- Domestic urban retail

Table 2.3-2- Socio-biodiversity Bioeconomy of IR-Marajó (EcoSocioBio-PA) in 2019, at BRL 1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	302.883	131.311	72	31.675	431	967	-	60.279	256	19.236	-	67	5	547.181	2.531	48	-	2.579	549.760
A1. Prim. Intermediate	-	-	251.780	0	-	22	72.646	-	66.090	29	6.852	27	26.393	-	423.838	6	-	-	6	423.845
A2 Processing Industry	-	-	3.948	26	0	14	1.490	-	39	436	-	-	-	69.519	75.472	534.014	-	-	534.014	609.486
A3 Transf. Industry	-	-	-	-	-	5	-	198	-	-	-	-	-	-	203	578	-	-	578	781
A4 Wholesale	-	-	-	-	-	0	44.536	91	15	-	-	-	-	-	44.642	-	-	-	-	44.642
A5 Retail&Service	-	-	-	1	-	2	-	-	-	-	-	-	-	-	3	795	-	-	795	798
B1 Processing Industry	-	-	-	-	-	0	-	-	-	5.195	-	-	-	407.289	412.484	-	170.201	-	170.201	582.685
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	134	-	-	134	-	1	288	289	423
B3 Wholesale	-	-	-	-	-	-	158.071	17	-	0	-	166	-	-	158.254	42	-	-	42	158.296
B4 Retail&Service	-	-	-	0	-	-	-	-	-	0	-	-	-	-	0	-	8.000	-	8.000	8.000
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47.562	47.562	47.562
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	375	375	-	-	-	-	375
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	226	-	-	32.929	33.155	-	-	-	-	33.155
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	709.991	709.991	709.991
Interm.Production	-	302.883	387.038	100	31.675	474	277.709	306	126.423	5.916	26.314	327	26.460	510.117	1.695.741	537.967	178.250	757.841	1.474.058	3.169.799
Total GVA	549.760	120.962	222.448	681	12.967	324	304.976	117	31.873	2.084	21.248	48	6.696	199.874	1.474.058	-	-	-	-	-
Total Wages	29.908	33.724	40.798	52	3.552	63	39.004	28	12.595	637	3.891	31	4.519	61.599	230.402	-	-	-	-	-
Profits+Other Inputs	519.852	87.237	181.650	629	9.415	261	265.972	89	19.278	1.448	17.357	18	2.176	138.275	1.243.656	-	-	-	-	-
Total Gross Income	549.760	423.845	609.486	781	44.642	798	582.685	423	158.296	8.000	47.562	375	33.155	709.991	3.169.799	-	-	-	-	-
Total Occupied Population	70.092	1.750	1.967	3	184	3	1.881	1	654	33	127	1	149	3.188	80.033	-	-	-	-	-
Total Wage Earners	9.889	1.750	1.967	3	184	3	1.881	1	654	33	127	1	149	3.188	19.830	-	-	-	-	-

FSource: Basic IBGE data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey and processing in the Netz System. Production, rural and surrounding areas; A1- Primary intermediation (rural retail), rural and surrounding areas; A2- Processing industry, rural and surrounding areas; A3- Processing industry, Rural and surrounding areas; A4- Wholesale, rural and surrounding areas; A5- Retail, rural urban and surrounding areas; B1 - Processing industry, urban centers; B2- Transformation industry, urban centers; B3- Wholesale, urban centers; B4- Retail, urban centers; C1 - Domestic Processing Industry; C2- Domestic Transformation Industry; C3- Domestic wholesale; C4- Domestic urban retail

Table 2.3-3- Socio-biodiversity Bioeconomy of IR-Baixo Amazonas (EcoSocioBio-PA) in 2019, at BRL 1,000.00

	Intermediate Production															Final Demand				Gross Value of Produc-tion
	Local Economy										Domestic Economy				Total Interme-diate Production	Local		Domestic Economy and Rest of the World	Total	
	Rural and Surrounding Area						Urban Centers													
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4		Rural and surrou-nding areas	Urban Centers			
A0 Production	-	6,034	20,685	267	1,719	526	-	-	38	-	99		-	0	9	520	1	9	531	29,908
A1. Prim. Intermediate	-	-	6,891	6	7	604	0	4	25	0	77		6	253	35	1,014	-	-	1,014	8,923
A2 Processing Industry	-	-	-	-	-	143	-	-	-	6	-		-	-	72,550	30,360	145	-	30,504	103,204
A3 Transf. Industry	-	-	-	-	-	175	-	-	-	-	-		-	-	619	1,461	-	-	1,461	2,255
A4 Wholesale	-	-	1,091	31	135	132	346	16	33	-	-		102	-	174	208	-	-	208	2,269
A5 Retail&Service	-	-	602	-	-	1	-	-	-	-	-		-	-	28	1,890	-	-	1,890	2,521
B1 Processing Industry	-	-	-	-	-	-	-	2	-	-	-		-	-	4,017	-	-	-	-	4,019
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	27	27	27
B3 Wholesale	-	-	-	-	-	-	-	-	-	51	-		28	-	33	-	-	-	-	112
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	110	-	110	110
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-		-	-	220	-	-	-	-	220
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-		-	-	273	-	-	11	11	285
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-		29	-	294	0	-	-	0	323
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	184,553	184,553	184,553
Interm.Production	-	6,034	29,269	304	1,860	1,581	346	22	96	57	176		165	254	78,254	35,453	256	184,601	220,310	338,728
Total GVA	29,908	2,889	73,935	1,952	408	940	3,673	5	16	53	44		120	69	106,299	-	-	-	-	-
Total Wages	2,099	710	6,908	151	181	201	269	2	9	9	18		23	44	16,012	-	-	-	-	-
Profits+Other Inputs	27,809	2,179	67,027	1,801	228	739	3,404	3	7	44	26		97	25	90,287	-	-	-	-	-
Total Gross Income	29,908	8,923	103,204	2,255	2,269	2,521	4,019	27	112	110	220		285	323	184,553	-	-	-	-	-
Total Occupied Population	2,961.57	36.84	333.15	7.28	9.37	10.41	12.97	0.09	0.46	0.45	0.59		0.76	1.45	828.59	-	-	-	-	-
Total Wage Earners	483.64	36.84	333.15	7.28	9.37	10.41	12.97	0.09	0.46	0.45	0.59		0.76	1.45	828.59	-	-	-	-	-

Source: Basic IBGE data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey and processing in the Netz System. Production, rural and surrounding areas; A1- Primary intermediation (rural retail), rural and surrounding areas; A2- Processing industry, rural and surrounding areas; A3- Processing industry, Rural and surrounding areas; A4- Wholesale, rural and surrounding areas; A5- Retail, rural urban and surrounding areas; B1 - Processing industry, urban centers; B2- Transformation industry, urban centers; B3- Wholesale, urban centers; B4- Retail, urban centers; C1 - Domestic Processing Industry; C2- Domestic Transformation Industry; C3- Domestic wholesale; C4- Domestic urban retail

Table 2.3-4- Socio-biodiversity Bioeconomy of IR-Xingu (EcoSocioBio-PA) in 2019, at BRL 1,000.00

	Intermediate Production															Final Demand				
	Local Economy										Domestic Economy				Total Interme-diate Produc-tion	Local		Domestic Economy and Rest of the World	Total	Gross Value of Produc-tion
	Rural and Surrounding Area						Urban Centers				C1	C2	C3	C4		Rural and surrounding areas	Urban Centers			
	A0	A1	A2	A3	A4	A5	B1	B2	B3	B4										
A0 Production	-	553.392	19.661	852	593	1.658	-	166	-	28	-	-	-	-	576.349	1.747	-	-	1.747	578.096
A1. Prim. Intermediate	-	-	9.374	47	537.786	0	7.762	-	6.869	7	-	145	-	-	561.990	173	-	-	173	562.163
A2 Processing Industry	-	-	-	734	794	1.853	-	-	-	-	-	-	-	-	3.381	44.604	-	-	44.604	47.985
A3 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.041	-	-	20.041	20.041
A4 Wholesale	-	-	-	-	-	161	655	6.168	13.088	-	-	732.581	-	-	752.654	915	48	-	962	753.616
A5 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.032	-	-	5.032	5.032
B1 Processing Industry	-	-	-	-	-	-	-	-	-	6.829	-	-	-	245	7.074	-	9.647	-	9.647	16.721
B2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10	-	36	8.795	8.832	8.842
B3 Wholesale	-	-	-	-	-	-	-	-	-	24	-	23.939	-	-	23.963	-	-	-	-	23.963
B4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.065	-	8.065	8.065
C1 Processing Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2 Transf. Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	868.472	868.472	-	-	181	181	868.654
C3 Wholesale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4 Retail&Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.243.457	1.243.457	1.243.457
Interm.Production	-	553.392	29.035	1.632	539.173	3.673	8.417	6.334	19.958	6.887	-	756.665	-	868.728	2.793.893		17.796	1.252.434	1.342.742	4.136.635
Total GVA	578.096	8.771	18.950	18.409	214.443	1.359	8.305	2.508	4.005	1.178	-	111.988	-	374.730	1.342.742		-	-	-	-
Total Wages	79.343	44.730	3.212	1.342	59.964	400	1.119	592	1.907	642	-	71.062	-	107.883	372.195		-	-	-	-
Profits+Other Inputs	498.753	(35.959)	15.738	17.067	154.480	959	7.185	1.916	2.098	536	-	40.927	-	266.846	970.547		-	-	-	-
Total Gross Income	578.096	562.163	47.985	20.041	753.616	5.032	16.721	8.842	23.963	8.065	-	868.654	-	1.243.457	4.136.635		-	-	-	-
Total Occupied Population	25.947	2.321	155	65	3.112	21	54	29	99	33	-	2.319	-	5.583	39.736		-	-	-	-
Total Wage Earners	1.570	2.321	155	65	3.112	21	54	29	99	33	-	2.319	-	5.583	15.359		-	-	-	-

Source: Basic IBGE data (PAM and PEVS and 2017 Agricultural Census); IDESP-DADESA/NAEA-IPEA field survey and processing in the Netz System. Production, rural and surrounding areas; A1- Primary intermediation (rural retail), rural and surrounding areas; A2- Processing industry, rural and surrounding areas; A3- Processing industry, Rural and surrounding areas; A4- Wholesale, rural and surrounding areas; A5- Retail, rural urban and surrounding areas; B1 - Processing industry, urban centers; B2- Transformation industry, urban centers; B3- Wholesale, urban centers; B4- Retail, urban centers; C1 - Domestic Processing Industry; C2- Domestic Transformation Industry; C3- Domestic wholesale; C4- Domestic urban retail.

Annex 3

Maps - Territories of traditional communities, indigenous people and protected areas

Integration Region of Tocantins

Common use peasant land in settlements PAE/PDS/PIC/PEAS/PEAEX

4 PAE Ilha Tatuoca-Japim
10 PAE Ilha Jarimbu
12 Borba Gato
13 PAE Ilha das Onças
14 PAE Ilha Grande Cametá
15 PAE Ilha Trambioca
16 PAE Ilha Macaca
18 PAE Praia Grande
21 PAE Ilha Conceição
22 PAE Ilha Sumauma
23 PAE Ilha Damião
24 PAE Ilha Terê
25 PAE Ilha Panacauera-Miri
26 PAE Ilha Pindobal Grande
27 Pindorama
28 PAE Ilha Paruru
29 PAE Ilha Caripetuba
30 PAE Ilha Arapiranga
31 PAE Ilha Cuxipiari
32 PAE Ilha Sacajós Grande
33 PAE São João Batista II
34 PAE Ilha Arapari
35 PAE Ilha Santana de Cametá
37 PAE São Raimundo
38 PAE Ilha do Boi
39 PAE Ilha Mamangal
40 PAE Santo Afonso
41 PAE Ilha Umarituba Juacara
42 PAE Ilha Itaboca
43 PAE Ilha Japiim Seco
45 PAE Ilha Joroca
46 PAE Ilha Murujucá-Mirim
47 PAE Nossa Senhora da Paz
48 PAE Ilha Bacuri
49 PAE Ilha Tauare
50 PAE Ilha Machado
51 PAE Nossa Senhora das Graças
52 PAE Ilha Vitória
53 PAE Ilha Turuçu
54 PAE Ilha Cupijó Mirim
60 PAE Ilha São Mateus
61 PAE Ilha Mutirão
62 PAE Ilha Uruá I
64 PAE Ilha Conceição Mocajuba
65 PAE Ilha Paulista
67 PAE Ilha Grande de Viseu
69 PAE Ilha do Furo Grande
70 PAE Ilha Anajai
71 PAE Ilha Saracá
72 PAE Santo Antônio
73 PAE Ilha Jacareuá
76 PAE Santo Antônio II
77 PAE Ilha Manoel Raimundo
79 PAE Três Irmãs
81 PAE Nossa Senhora de Nazaré
82 PAE Ilha Itauna
84 PAE Ilha Jaituba
85 PAE Ilha Curupira
86 PAE Ilha Itanduba
88 PAE Ilha Angapijo
91 PAE Ilha Jacaré Xingu
92 PAE Ilha Mauba
93 PAE Ilha Acajui
95 PAE Ilha Pacuí
97 PAE Ilha Coroa Nova
99 PAE Ilha Araraim
100 PAE Complexo Maracujá
101 PAE Ilha Piquiarana
102 PAE Ilha Jaracuera
103 PAE Ilha Caí Grande
106 PAE Santa Maria
107 PAE Ilha Piquiarana Mirim
108 PAE Ilha Tabatinga do Carapajó
109 PAE Ilha Buçu
110 PAE São Francisco de Assis
111 PAE Ilha Guajará
112 PAE Ilha Aturiá Grande
113 PAE Ilha Marinteua
114 PAE Ilha Mucura
115 PAE Ilha Ajaraí
116 PAE Ilha Mapeuá
117 PAE São João Batista
118 PAE Ilha Aricura
119 Sindicato dos Trabalhadores Rurais de Abaetetuba - STRA
121 PAE Ilha Paquetá III
122 PAE Ilha Biribatuba

123 PAE Ilha Anuerá
125 PAE Ilha Moiraba
126 PAE Ilha Cacoal
128 PAE Nossa Senhora do Livramento
129 PAE Ilha Itapupana
130 PAE Ilha Quanguera
131 PAE Ilha Gama
132 PAE Ilha Capiteua
133 PAE Ilha Bituba
134 PAE Complexo Batuque
135 PAE Ilha do Carmo
136 PAE Ilha Arajapanema II
137 PAE Ilha Comprida
138 PAE Ilha Entre-Ilhas
139 PAE Ilha Grande Belém

Quilombola Communities

3 Igarapé Preto, Baixinha, Pampelonia, Teófilo
5 Porto Grande, Mangabeira, São Benedito de Viseu
6 Tomazia, Tachizal, Itapocu, Mola, Bonfim, Frade
8 Alto Itacuruca, Baixo Itacuruca, Bom Remédio
9 Bailique Beira, Bailinque Centro, Pocao
19 Centro Ouro, Nossa Senhora das Graças
36 Porto Alegre
44 Nossa Senhora da Conceição
55 Comunidade Remanescente de Quilombo da Ilha Grande de Cupijo
56 Tambai-Açu
57 Santa Maria do Mirindeua
58 São José de Icatu
59 Santo Cristo
63 Jacunday
66 Santana Axé do Baixo Jambuaçu
68 Matias
74 Ribeira do Jambu-Açu
75 São Manoel - PA
78 Laranjituba e África
80 Associação Remanescente de Quilombo Rei Zumbi da Comunidade Sítio Bosque
83 Guajará-Mirim
87 Itacuã-Mirim
89 Ramal do Piratuba
90 São Sebastião
94 Moju-Mirim
96 Santa Fé e Santo Antônio
98 Santa Maria de Tracuateua
104 Carananduba
105 Santa Quitéria e Itacoazinho
120 Santa Luzia do Tracuateua
124 Associação dos Moradores e Agricultores da Comunidade do Espírito Santo - AMECES
127 Samauba

Protected Areas of Sustainable Use

1 Área de Proteção Ambiental do Arquipélago do Marajó
2 Reserva Extrativista Ipau-Anilzinho
17 Pindorama
20 Borba Gato

Indigenous land

7 Terra Indígena Trocara
11 Terra Indígena Anambe

Integration Region of Marajó

Common use peasant land in settlements PAE/PDS/PIC/PEAS/PEAEX

2 PAE Ilha Santa Bárbara
4 PAE Ilha Grande de Gurupa
5 PAI Ilha Gurupai
6 Parque Estadual Charapucu/PAE Ilha Charapucu
8 PAE Ilha Grande do Laguna
10 PAE Ilha dos Macacos
11 PAE Baixo Anajás II
13 PAE Ilha Queimada
17 PAE Ilha Mututi
18 PAE Ilha Japichaua
19 PAE Ilha do Pará
20 PAE Ilha Limão
21 PDS Anapu
22 PAE Ilha Jurupari I
23 Majari I
24 PAE Ilha Grande-Pacajai
25 PAE Ilha Jacarezinho
26 PAE Comunidade Central
27 PAE Ilha Urutaí Parte
28 PAE Ilha Ituquara
29 PAE Ilha Salvador
30 PAE Ilha do Meio
32 PAE Ilha Maracujá I
33 PDS Horizonte Novo
34 PAE Ilha do Corre
35 PAE Ilha Buiussu
36 PAE Ilha Miritiapina

37 PAE Ilha Mutunquara
38 Camuta do Picuruí
39 PAE Baixo Anajás I
40 PAE Ilha Aranai
41 PAE Ilha Mujirum
42 PAE Ilha Purure
44 PAE Ilha Melgaço
45 PAE Ilha Aturiá
46 PAE Ilha dos Carás
47 PAE Ilha Guaribas
48 PAE Ilha Conceição I
49 PAE Ilha Pracaxi
50 PAE Ilha Macujubim
51 PAE Ilha de Nazaré
52 PAE Ilha Santo Amaro II
53 PAE Ilha Japatituba de Curralinho
55 PAE Ilha Ararama I
56 PAE Ilha Pereira
57 PAE Ilha Caldeirão
58 PAE Ilha Panema
59 PDS Castanheira II
60 PAE Ilha Cararuá-Grande
61 PAE Ilha São Raimundo II
62 PAE Ilha Taquari
64 PAE Ilha Bom Samaritano
65 PAE Ilha Itapera
66 PAE Ilha Murumuru I
67 PAE Ilha do Mutum
68 PAE Ilha Panacu
69 PAE Ilha Pracuuba
70 PAE Ilha Santana
71 PAE Ilha Santo Amaro
72 PAE Ilha Maritubinha
73 PAE Ilha Jurupari
74 PAE Ilha Jejuteua
75 PAE Ilha Santarém
76 PAE Ilha Cariá-Guajará
77 PAE Ilha São João I
78 PAE Ilha Baiano
80 PAE Ilha Pracuuba-Grande
81 PAE Ilha dos Teles
82 PAE Luz da Vida
83 PAE Ilha Camaleões
84 PAE Ilha Cajuuna
85 PAE Ilhas das Cinzas
86 PAE Ilha Urubuquara
87 PAE Santa Rosa do Maracati
88 PAE Ilha São Raimundo
89 PAE Tiririca
90 PAE Ilha Uruá II
91 PAE Ilha Rasa
92 PAE Ilha Jurara
93 PAE Ilha Chiqueiro
94 PAE Ilha Samanajós
95 PAE Ilha Calheira
96 PAE Ilha Furo Muaná
97 PAE Ilha Nossa Senhora do Livramento I
98 PAE Ilha Cajuubinha
99 PAE Ilha Atatazinho
100 PAE Ilha Santa Luzia
101 PAE Ilha Coroca
102 PAE Ilha do Tangarazinho
103 PAE Ilha Marajozinho
104 PAE Ilha Santa Apolônia
105 PAE Ilha Raquel
106 PAE Ilha Murumuru
107 PAE Ilha Laranja
108 PAE Ilha Canaticu
109 PAE Ilha Tucupi Grande
110 PAE Ilha Sorva
111 PAE Ilha Santo Antônio III
112 PAE Ilha Castanhal
114 PAE Ilha Xipaiá
115 PAE Ilha Santa Maria I
116 PAE Ilha Gaiobal
117 PAE Ilha Santa Maria
118 PAE Ilha Caeté
119 PAE Ilha do Teso
120 PAE Ilha Chaves
121 PAE Ilha Tracuateua
122 PAE Ilha Boa Vista
123 PAE Ilha Santa Maria II
124 PAE Ilha São Pedro e Barbosa
125 PAE Ilha das Pracuubinhas
126 PAE Ilha São João
127 PAE Ilha Paquetá II
128 PAE Ilha Buiussu do Atata
129 PAE Ilha Umarituba
130 PAE Ilha Bom Sucesso
131 PAE Ilha Mossoró
132 PAE Ilha União
133 PAE Ilha Uruá
134 PAE Ilha Piraruaia
136 PAE Ilha do Cabo Dico
138 PAE Ilha Providência
139 PAE Ilha Quati

140 PAE Ilha Palheta
141 PAE Ilha Bela Pátria
142 PAE Ilha Itaboca II
143 PAE Ilha Santa Catarina
144 PAE Ilha do Paulo
145 PAE Ilha Mariana
146 PAE Ilha Soberana
147 PAE Ilha Sapateiro
148 PAE Ilha Crajuru
149 PAE Ilha Setubal
150 PAE Ilha Cipoteua
151 PAE Ilha Campumpema
152 PAE Ilha Santa Cruz
153 PAE Ilha Periquitão
154 PAE Ilha Joiás
156 PAE Ilha Santa Maria III
157 PAE Ilha Azeite
158 PAE Ilha Araras
159 PAE Ilha Japatituba

Quilombola Communities

14 Gurupa Mirim, Jocojo, Flexinha, Carrazedo
31 Igarapé Preto, Baixinha, Pampelonia, Teófilo
54 Gurupa
79 Rosário
135 Santa Luzia
137 Bacabal

Protected Areas of Integral Protection

155 Parque Estadual Charapucu

Protected Areas of Sustainable Use

1 Área de Proteção Ambiental do Arquipélago do Marajó
3 Floresta Nacional de Caxiuana
7 Reserva Extrativista Terra Grande-Pracuuba
9 Reserva Extrativista Gurupa-Melgaço
12 Reserva Extrativista Mapua
15 Reserva Extrativista Arioca Pruana
16 Reserva de Desenvolvimento Sustentável de Itatupa-Baquia
43 Reserva Extrativista Marinha de Soure

Integration Region of Baixo Amazonas

Common use peasant land in settlements PAE/PDS/PIC/PEAS/PEAEX

13 PIC Monte Alegre
15 PAE Largo Grande
16 PDS Paraíso
23 Curumucuri
26 PIC Monte Alegre/Floresta Estadual do Paru
28 PAE Juruti Velho
31 PDS Serra Azul
32 Sapucuá-Trombetas
35 PAE Curuá II
38 PAE Cachoery
39 PDS Renascer II
40 PAE Urucurituba
41 PAE Atumã
42 PAE Região do Cuçari
43 PAE Salé
44 PAE Aritapera
46 PAE Paraná Dona Rosa
48 Aruã
49 Vila Nova
50 PAE Salvação
51 PAE Vale do Salgado
52 PAE Ituqui
53 PAE Balaio
55 PAE Costa Fronteira
56 PAE Santa Rita
57 PAE Madalena
58 PDS Maloca
59 PAE Três Ilhas
62 PAE Tapará
63 PAE São Pedro
65 PAE Eixo Forte
66 PAE Cacoal Grande
68 Mariazinha-Aracati
70 PAE Paraná de Baixo
72 PAE Paru
73 PAE Nhamunda
74 Repartimento
75 PAE Chicantã
77 PAE Eixo Forte/Área de Proteção Ambiental de Alter do Chão
80 PAE Nossa Senhora do Perpétuo Socorro
81 PAE Pindobal
82 Prudente - Monte Sinai
83 Vista Alegre
84 PAE Nazaré
85 PAE Aldeia
87 PDS Vila Nova I e II
89 PAE Aramanaí
90 PAE Valha-me Deus
91 PAE Anema
92 PAE Missionário Rufino
93 PAE Ilhas Reunidas
96 PAE Pacoval/Pracobal
98 PAE Araca-Açu
101 PAE Jaquará
102 PAE Paituna
104 PAE Maria Tereza
105 PAE Costa do Amazonas
106 PAE Jacarecapá
107 PIC Monte Alegre/Parque Estadual de Monte Alegre
108 PAE Região dos Lagos
109 PAE Curralinho
115 PAE São Diogo

118 PAE Igarapé do Cuçari
123 PAE Piapó
124 PAE Cuieiras
138 Mariazinha-Aracati

Quilombola Communities

20 Associação das Comunidades Remanescentes de Quilombos Bacabal/Aracuan de Cima/Aracuan do Meio/Aracuan de Baixo/Serrinha/Terra PretaII/ Jarauaca
22 Associação das Comunidades Remanescentes de Quilombos Pancada/Araca/Espírito Santo/Jauari/Boa Vista do Cumina/Varre Vento/Jarauaca e Acapu
25 Alto Trombetas - Área II
27 Alto Trombetas II - Área I
29 Alto Trombetas II - Área II
30 Abui, Paraná do Abui, Tapagem, Sagrado Coração
33 Alto Trombetas - Área I
54 Remanescentes das Comunidade de São José, Silêncio, Matar, Cueca, Apui e Castanhaduba, Quilombo Cabeceiras
61 Ariramba
64 Maria Valentina
67 Associação da Comunidade Remanescentes de Quilombo de Ariramba - ACRQA
76 Associação da Comunidade Remanescente de Quilombo Pacoval de Alenquer - ACONQUIPAL/PA
86 Tiningu
88 Arapema
94 Saracura
95 Bom Jardim
100 Peruana
103 Murumuru
112 Boa Vista
117 Arapucu
119 Nossa Senhora da Graça
120 Água Fria

Protected Areas of Integral Protection

1 Unidade Ecológica do Grão Pará
8 Reserva Biológica de Maicuru
19 Reserva Biológica do Rio Trombetas
21 Estação Ecológica do Jari
97 Parque Estadual de Monte Alegre
110 Parque Estadual de Monte Alegre/PAE Cucaru
111 Reserva Biológica de Maicuru/Floresta Estadual do Paru
113 E. E. Grão Pará
116 Parque Estadual de Monte Alegre/PAE Paituna
139 Estação Ecológica do Jari

Protected Areas of Sustainable Use

2 Floresta Estadual do Paru
6 Floresta Estadual do Trombetas
11 Reserva Extrativista Tapajós-Arapiuns
17 Floresta Nacional do Tapajós
18 Floresta Estadual de Faro
24 Floresta Nacional de Mulata
34 F. E. Faro
36 Área de Proteção Ambiental Paytuna
47 F. E. Trombetas
69 APA Praia de Aramanaí
71 Área de Proteção Ambiental de Alter do Chão
78 Arua
125 Floresta Estadual de Faro
126 Repartimento
130 Área de Proteção Ambiental da Serra do Saubal
132 Reserva de Desenvolvimento Sustentável do Rio Iratapuru
134 Área de Proteção Ambiental do Juá
137 Área de Proteção Ambiental Nhamundá
140 F. E. Faro
141 Floresta Estadual do Paru
142 Reserva de Desenvolvimento Sustentável do Rio Iratapuru

Indigenous land

3 Terra Indígena Parque do Tumucumaque
4 Terra Indígena Trombetas/Mapuera
5 Terra Indígena Kaxuyana-Tunayana/Floresta Estadual do Trombetas
7 Terra Indígena Rio Paru Deste
9 Terra Indígena Nhamunda/Mapuera
10 Terra Indígena Zoe
12 Terra Indígena Kaxuyana-Tunayama/Floresta Estadual de Faro
37 Terra Indígena Maro
45 Terra Indígena Munduruku-Taquara/Floresta Nacional do Tapajós
60 Terra Indígena Bragança-Marituba/Floresta Nacional do Tapajós
79 Terra Indígena Cobra Grande
99 Terra Indígena Cobra Grande/PAE Lago Grande
114 Terra Indígena Nhamunda/Mapuera
121 Terra Indígena Trombetas/Mapuera
122 Terra Indígena Bragança-Marituba
127 Terra Indígena Kaxuyana-Tunayana
128 Terra Indígena Maro/Reserva Extrativista Tapajós-Arapiuns
129 Terra Indígena Mundukuru-Taquara
131 Terra Indígena Cobra Grande/Curumucuri
133 Terra Indígena Andira-Marau
135 Terra Indígena Parque do Tumucumaque
136 Terra Indígena Kaxuyana-Tunayana/F. E. Faro

Integration Region of Xingu

Common use peasant land in settlements PAE/PDS/PIC/PEAS/PEAEX

11 PDS Liberdade I
22 PDS Liberdade

23 PDS Ademir Fredericce
29 PDS Terra Nossa
31 PDS Itatá
33 PDS Ouro Branco
34 PDS Anapu
35 PDS Renascer II
36 Irmã Dorothy
37 PDS Anapu I
38 PDS Castanheira
40 PDS Água Preta
41 PDS Santa Clara
43 PDS Arthur Faleiro
44 PDS Avelino Ribeiro
4 PDS Mãe Menininha
47 PDS Esperança
48 PDS Brasília
49 PDS Castanheira II

Quilombola Communities

32 Gurupá-Mirim, Jocojo, Flexinha, Carrazedc

Protected Areas of Integral Protection

2 Estação Ecológica da Terra do Meio
18 Reserva Biológica Nascentes da Serra do Cachimbo
21 Estação Ecológica da Terra do Meio/Gleba Mossoró
25 Parque Nacional da Serra do Pardo
52 Refúgio de Vida Silvestre Tabuleiro do Embaubal
70 Parque Nacional do Jamanxim

Protected Areas of Sustainable Use

5 Reserva Extrativista Verde para Sempre
7 Reserva Extrativista Riozinho do Anfrísio
9 Área de Proteção Ambiental Triunfo do Xingu
10 Floresta Nacional de Altamira/PF Cachimbo - Gleba Limão
12 Floresta Estadual de Iriri
13 Reserva Extrativista Rio Iriri
17 Floresta Nacional de Caxiuana
19 Reserva Extrativista Rio Xingu
24 Floresta Nacional do Tapajós
26 Reserva Extrativista Renascer
42 Reserva de Desenvolvimento Sustentável Vitória de Souzel
50 Floresta Nacional de Altamira
60 F. E. Iriri
63 Reserva Extrativista Rio Xingu/Gleba Mossoró
65 Reserva Extrativista Riozinho do Anfrísio/PF Cachimbo - Gleba Limão
66 Floresta Nacional do Trairão
73 Reserva Extrativista Rio Iriri/Gleba Mossoró

Indigenous land

1 Terra Indígena Menkragnoti
3 Terra Indígena Baú
4 Terra Indígena Trincheira Bacaja
6 Terra Indígena Arawete Igarapé Ipixuna
8 Terra Indígena Cachoeira Seca
14 Terra Indígena Koatinemo
15 Terra Indígena Paraná
16 Terra Indígena Kararaô
20 Terra Indígena Arara
27 Terra Indígena Xipaya
28 Terra Indígena Kuruaya
30 Terra Indígena Ituna/Itata (restrição de uso)
39 Terra Indígena Arara da Volta Grande do Xingu
45 Terra Indígena Paquicamba
51 Terra Indígena Ituna/Itata (restrição de uso)
53 Terra Indígena Cachoeira Seca/Reserva Extrativista Rio Iriri
54 Juruna do Km 17
55 Terra Indígena Xipaya/Reserva Extrativista Rio Iriri
56 Terra Indígena Arawete Igarapé Ipixuna/Reserva Extrativista Rio Xingu
57 Terra Indígena Baú/Estação Ecológica da Terra do Meio
58 Terra Indígena Kuruaya/Estação Ecológica da Terra do Meio
59 Terra Indígena Kararaô/Gleba Mossoró
61 Terra Indígena Menkragnoti/Estação Ecológica da Terra do Meio
62 Terra Indígena Kararaô/Estação Ecológica da Terra do Meio/Gleba Mossoró
64 Terra Indígena Baú/PF Cachimbo - Gleba Limão
67 Terra Indígena Xipaya/Floresta Nacional de Altamira
68 Terra Indígena Xipaya/Reserva Extrativista Riozinho do Anfrísio
69 Terra Indígena Panará/Reserva Biológica Nascentes da Serra do Cachimbo
71 Terra Indígena Menkragnoti/Reserva Biológica Nascentes da Serra do Cachimbo
72 Terra Indígena Baú/Floresta Nacional de Altamira/PF Cachimbo - Gleba Limão
74 Terra Indígena Kararaô/Estação Ecológica da Terra do Meio
75 Terra Indígena Kuruaya/Reserva Extrativista Rio Iriri
76 Terra Indígena Menkragnoti
77 Terra Indígena Cachoeira Seca/Reserva Extrativista Riozinho do Anfrísio
78 Terra Indígena Panará

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