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Socio-economic and environmental performance in cooperatives in Southeastern Pará

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Abstract - Cooperatives are considered an alternative for dealing with socioeconomic and environmental problems and achieving a more sustainable society due to their forms of work based on cooperation. This research proposes to identify how cooperatives can contribute to local sustainability through indicators. By collecting information through field research and applying a questionnaire containing questions about the members and indicators in the social, economic and environmental dimensions, the level of sustainability of the cooperatives and the performance of indicators were determined. The study showed that the cooperatives are characterised by medium sustainability. In the social dimension, it was evident that the indicators of employment opportunity and family succession in the cooperative showed the lowest performance. In the economic dimension, cooperatives manage to ensure financial returns to their members, but they still present weaknesses in economic income, in alternative sources of income, in the efficiency of their production system (*Cooper* and *Mulheres de Barro* [*lit*. Women of Clay]) and in commercialisation (*Mulheres de Barro*). Regarding the environmental dimension, *Mulheres de Barro* performed better than *Cooper* and the research identified that both cooperatives carry out practices to conserve natural resources, and believe that their activities help preserve the environment.

Keywords: Cooperatives. Cooperation. Dimensions of sustainability. Sustainability indicators. Sustainability level.

Desempenho socioeconômico e ambiental em cooperativas no sudeste do Pará

Resumo - As cooperativas são consideradas uma alternativa para o enfrentar problemas socioeconômicos e ambientais, e alcançar uma sociedade mais sustentável devido as suas formas de trabalho baseado em cooperação. A pesquisa propõe identificar como as cooperativas auxiliam a sustentabilidade local por meio de indicadores. O levantamento de informações se deu através de pesquisa de campo e aplicação

de um formulário contendo questões sobre os cooperados e indicadores inseridos nas dimensões social, econômica e ambiental, onde obteve-se o nível de sustentabilidade das cooperativas e o desempenho dos indicadores. O estudo mostrou que as cooperativas se caracterizam com média sustentabilidade. Na dimensão social ficou evidente que os indicadores de oportunidade de emprego e sucessão familiar na cooperativa apresentaram os menores desempenhos. Na dimensão econômica as cooperativas conseguem assegurar o retorno financeiro aos cooperados, mas ainda possuem fragilidades em renda econômica, fontes de renda alternativas, eficiência no sistema produtivo (Cooper e "Mulheres de Barro") e comercialização ("Mulheres de Barro"). Na dimensão ambiental, a "Mulheres de Barro" apresentou desempenho melhor que a Cooper e identificou-se que as duas cooperativas realizam práticas de conservação dos recursos naturais, e acreditam que suas atividades auxiliam na preservação do meio ambiente.

Palavras-chave: Cooperativismo. Cooperação. Dimensões da sustentabilidade. Indicadores de sustentabilidade. Nível de sustentabilidade.

Desempeño socioeconómico y ambiental en cooperativas del sureste de Pará

Resumen - Las cooperativas se consideran una alternativa para hacer frente a los problemas socioeconómicos y ambientales, y para lograr una sociedad **más** sostenible debido a sus formas de trabajo basadas en la cooperación. La investigación propone identificar cómo las cooperativas ayudan a la sostenibilidad local a través de indicadores. La recolección de información se realizó a través de investigación de campo y aplicación de un formulario que contenía preguntas sobre los cooperativistas e indicadores insertos en las dimensiones social, económica y ambiental, donde se obtuvo el nivel de sostenibilidad de las cooperativas y el desempeño de los indicadores. El estudio mostró que las cooperativas se caracterizan por una sostenibilidad media. En la dimensión social, se evidenció que los indicadores de oportunidad de empleo y sucesión familiar en la cooperativa presentaron los desempeños más bajos. En la dimensión económica, las cooperativas logran asegurar el retorno financiero a los socios, pero aún presentan debilidades en los ingresos económicos, fuentes alternativas de ingresos, eficiencia en el sistema productivo (Cooper y "*Mulheres de Barro*") y comercialización ("*Mulheres de Barro*"). En la dimensión ambiental, "*Mulheres de Barro*" se desempeñó mejor que Cooper y se identificó que ambas cooperativas realizan prácticas de conservación de los recursos naturales, y creen que sus actividades ayudan en la preservación del medio ambiente.

Palabras clave: Cooperativismo. Cooperación. Dimensiones de la sostenibilidad. Indicadores de sostenibilidad. Nivel de sostenibilidad.

Introduction

Sustainable development is founded on social and environmental values based on the responsible use of natural resources and seeks to meet the needs of the present generation, without compromising the satisfaction of the needs of future generations. Sustainability, in turn, is the balanced integration of economic,

social and environmental performance, in order to support and operationalize the implementation of sustainable development (Geissdoerfer et al., 2016; Santos et al. 2019; Ranjbari et al. 2021). From this perspective, Johnson (2017) points out that forms of cooperation provide the foundations for generating and transferring knowledge and experience on sustainable development and sustainability.

According to Baia et al. (2019) "the cooperativism is an association of people or groups that have the same interests, with the aim of obtaining common advantages". As cooperatives are viable ways to construct stronger and more sustainable local economies since they are considered a way for small communities to overcome economic problems (Czternasty 2014; Morais 2021). In the Amazon, cooperativism is an initiative for traditional communities to overcome socioeconomic obstacles, which make it more difficult to achieve better living conditions, thus it is a mechanism for the struggle to survive (Ramos and Barros 2020), before the processes of occupation and use of the territory's resources marked by intense disputes between different models of development, which lead to land, environmental and social conflicts (Rodrigues and Piraux 2021).

According to Moraes and Gonçalves (2020) a cooperative proposes the integration of three elements: the social, the economic and the environmental, where care for the environment and the valuation of human beings are associated. It is an option for a way of life that is different from capitalist priorities, which contributes to fundamental changes: the construction of relationships of participation in decisions, in production and in the common ownership of the goods produced (Moraes and Gonçalves 2020).

However, Silva et al. (2003) state that the development of cooperativism in Brazil poses challenges to achieving sustainability, since production models are based on the prodigal use of non-renewable resources that threaten the well-being of future generations and 'qualified cooperation'. There are also different types of cooperatives, those that work as capital companies focused on profitability in the market and, at the opposite end of the spectrum, small cooperatives based on socioeconomic insertion and the basic needs of poor populations (Nunes 2001; Anjos 2009).

For Sato et al. (2021) in Amazon communities there are also high levels of social inequality, productive structures with low levels of technological resources and human training and precarious logistical infrastructure, which hampers the permanence of local cooperatives. Analysing the cooperative environment assumes taking into account the changes and characteristics of the environment in which they are inserted, the process of adapting their activities to new market realities, the technological interface and forms of management, relationships with people and institutions and, above all, the sphere of sustainability (Wbatuba and Wittmann 2015).

In this context, sustainable development based on indicators socioeconomic and environmental, plays an important role in improving the population's living conditions, and aims for economic equity, social progress, the rational use of natural resources and conservation of the environment (Erazo et al. 2020). The indicators aim to construct sustainable responses that reduce the conflict between society and the environment, making it possible to quantify sustainability (Reis et al. 2017).

The planning and management process of a cooperative must take place based on the interaction of the internal environment with the external environment and, regarding the Amazon region, a vision of sustainability must consider the peculiarities of the traditional and cultural ways of life of the communities involved. From this perspective, the indicators emerge as parameters in the measurement of sustainable development in its qualitative and quantitative aspects within the dimensions of sustainability (social, economic, environmental) (Arruda et al. 2018; Macêdo and Torres 2019; Silva et al. 2020). Given the above, the research sought knowledge about: "what role do cooperatives play in

building a sustainable environment?", aiming to understand how much a cooperative can be sustainable in the social, economic and environmental scope and what factors influence, through a study with members of two cooperatives located in Parauapebas-PA.

Material and Methods

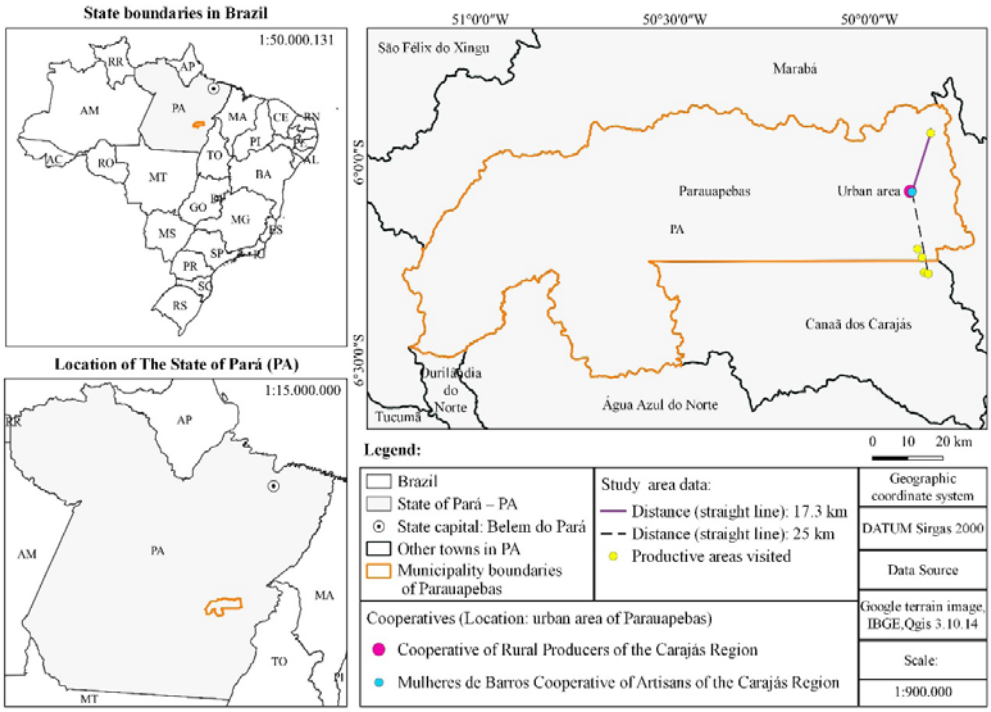
Study area

The survey was conducted in the municipality of Parauapebas, which has an estimated population of 213,576 people (IBGE 2020) and is located in the Integration Region of Carajás, in south-eastern Pará, Brazil. It occupies an area of 6,885,794 km^2 (IBGE 2020), which includes the mineralogical reserve Serra dos Carajás, and its main economic activities are agriculture, mining and logging (Kzam 2021).

The study was conducted in two cooperatives located in the municipality of Parauapebas (Figure 1). The *Cooperativa dos Produtores Rurais da Região de Carajás* (*Cooper*) [Cooperative of Rural Producers of the Carajás Region] was founded in 1997 and consists of 141 cooperative members, family farmers and 26 formal employees. Its main activity is the production and sale of fruit pulp and chocolates in Parauapebas and in the towns of Curionópolis, Canaã dos Carajás and Xinguara. The *Cooperativa dos Artesãos da Região de Carajás Mulheres de Barro* [Mulheres de Barro Cooperative of Artisans of the Carajás Region] was created in 2013 and consists of 10 artisans who produce and sell ceramic pieces inspired by archaeological remains and offer craft workshops for the community.

These cooperatives were chosen based on the social, economic and environmental dynamics of the place in which they are located, due to mining activities that cause changes in the migratory flow, in land use and in social mobilisations, which drives the communities to seek alternatives to maintain the reproduction of social and environmental life in this region.

Figure 1. Location of the cooperatives and farmers' properties.



Source: IBGE (2021). Prepared by Silva (2022).

Cooperatives involved in the study

The research was conducted with 21 members of the *Cooper* and *Mulheres de Barro* [*lit.* Women of Clay] cooperatives. Contact was established with the participants through prior indication of the presidents of these cooperatives and through intentional non-probabilistic sampling in which the researcher uses their judgment to select the members of the population, according to the following criteria (Oliveira 2001): time as a member over 2 years; logistics, because some members reside in places some distance from the urban perimeter; and the productive characteristics of the farmers and artisans.

Data collection and analysis

This exploratory and descriptive research was conducted following a qualitative-quantitative approach to investigate the characteristics of the cooperatives studied (Aleixo et al. 2020). To analyse the link between the theory and practice of sustainability in cooperatives, we made visits to the two cooperatives and to five farmers' properties between March and October 2020. A questionnaire was used, containing open and closed questions about the cooperative members with reference to sustainability indicators (Table 1) included in the sustainability dimensions (social, economic, environmental) applied to the 21 cooperative members to determine the comprehension qualitative and quantitative of cooperative members concerning the factors that involve sustainability.

Which made it possible to obtain a qualitative and quantitative understanding of the cooperative members about the factors that involve sustainability. The indicators were defined based on a review of the literature, which for Prodanov and Freitas (2013) consists of the analysis of publicly available texts, and the characteristics of the object of study, since according to Azapagic (2003), the sustainability indicators need to reflect the characteristics of the organisation.

Table 1. Sustainability indicators.

Dimension	Indicator	Authors
Social	Quality of Life assessment	Streimikiene (2015); Gallo et al. (2016); Hutchins et. al. (2019); Santos et al. (2020)
	Satisfaction in being a cooperative member	Ibáñez-Forés et al. (2019); Santos et al. (2020)
	Work opportunity	Welford et al. (1998); Keeble et al. (2003); Seuring et al. (2003); Halme et al. (2004); Jones et al. (2005); Choi and Sirakaya (2006); Halme et al. (2006); Erol et al. (2009); Karji et al. (2019); Ibáñez-Forés et al. (2019)
	Family succession in the cooperative	Targanski et al. (2017); Santos et al. (2020)
	Participation in the cooperative	Briquel et al. (2001); Gallo et al. (2016); Targanski et al. (2017); Ibáñez-Forés et al. (2019)
	Involvement in and support for the local community	Choi and Sirakaya (2006); Nordheim and Barrasso (2007); Labuschagne et al. (2005); Kinderytė (2010); Martins et al. (2017); Karji et al. (2019)

Dimension	Indicator	Authors
Social	Training and development of cooperative members	Briquel et al. (2001); Azapagic (2003); Kinderytė (2010); Targanski et al. (2017)
	Safety of cooperative members	Azapagic (2003); Kinderytė (2010); Guimarães et al. (2015); Gallo et al. (2016); Cappuyns (2016); Karji et al., (2019); Ibáñez-Forés et al. (2019)
	Health perception of cooperative members	Azapagic (2003); Santos et al. (2020)
Economic	Economic income	Azapagic and Perdan (2000); Targanski et al. (2017); Campos et al. (2018); Ibáñez-Forés et al. (2019)
	Alternative sources of income	Zhen and Routray (2003); Belcher et al. (2004); Gallo et al. (2016); López-Ridaura et al. (2005)
	Returns for cooperative members	Halme et al. (2006); Martins et al. (2017)
	Commercialisation of products	Omar et al. (2000); Gallo et al. (2016); Martins et al. (2017); Campos et al. (2018); Santos et al. (2020)
	Efficiency of the productive system	Martins et al. (2017)
Environmental	Use of renewable energy	Veleva et al. (2001); Marchettini et al. (2003); Belcher et al. (2004); Waage et al. (2005); Nordheim and Barrasso (2007); Walter and Stützel (2009); Erol et. al. (2009); Kinderytė (2010)
	Conservation of natural resources	Foxon et al. (2002); Krajnc and Glavič (2003); Miranda and Teixeira (2004); Labuschagne et al. (2005); Tanzil and Beloff (2006); Erol et al. (2009); Linton and Budds, (2014); Guimarães et al. (2015); Martins et al. (2017); Campos et al. (2018); Haeffner et al. (2018); Merino-Saum et al. (2018); Santos et al. (2020)
	Waste management	Welford et al. (1998); Callens and Tyteca (1999); Veleva et al. (2001); Kolk and Mauser (2001); Halme et al. (2004); Székely and Knirsch (2005); Kjaerheim (2005); Waage et al. (2005); Diakaki et al. (2006); Tanzil and Beloff (2006); Halme et al. (2006); Bos et al. (2007); Kinderytė (2010); Guimarães et al. (2015)
	Use of reusable/recycled materials	Krajnc and Glavič (2003); Kinderytė (2010)
	Participation in events or projects on sustainability actions	Santiago and Dias (2012)
	Environmental awareness of cooperative members	Virgem et al. (2013); Ibáñez-Forés et al. (2019)

Source: Authors (2020).

Based on the information collected using the questionnaire containing the sustainability questions, the level of sustainability (LS) of the cooperatives was calculated. For each question related to the indicators, the cooperative member assessed the issue according to performance scores ranging from 1 to 10, reflecting their opinion on each indicator (Kampen 2019), where 1 represents the least desirable situation and 10 represents the most desirable situation (Ibáñez-Forés et al. 2019). The LS was calculated according to Equation 1, adapted from Santiago and Dias (2012):

$$LS = \frac{\sum t\,he\ scores\ attributed\ in\ the\ assessment}{\sum the\ maximum\ score\ for\ each\ dimension} \times 10$$

Thus, the LS of the cooperatives was analysed according to the ranges described in Table 2:

Table 2. Level of sustainability (LS).

Sustainability range	Level of sustainability
LS < 10	Unsustainable
10.0 ≤ LS < 40.0	Low sustainability
40.0 ≤ LS < 80.0	Medium sustainability
80 ≤ LS < 100	High sustainability

Source: Authors (2020). Adapted from Santiago and Dias (2012).

The performance values of each indicator were obtained by calculating the mean scores achieved for each question. For better understanding and interpretation of the level of sustainability and indicators, scatter plots and radial formats were constructed in Microsoft Excel.

Ethical considerations

The research was submitted to *Plataforma Brasil* under registration CAAE 37127720.3.0000.8607 and approved by the Research Ethics Council of the State University of Pará, according to specialist assessment no. 4.331.065. The interviews were conducted after the participants read and signed a term of free, informed consent.

Results and Discussion

Twelve farmers from *Cooper* and nine artisans from *Mulheres de Barro* were interviewed. The profile of the interviewees is outlined in Table 3.

Table 3. Characteristics of the cooperative members interviewed.

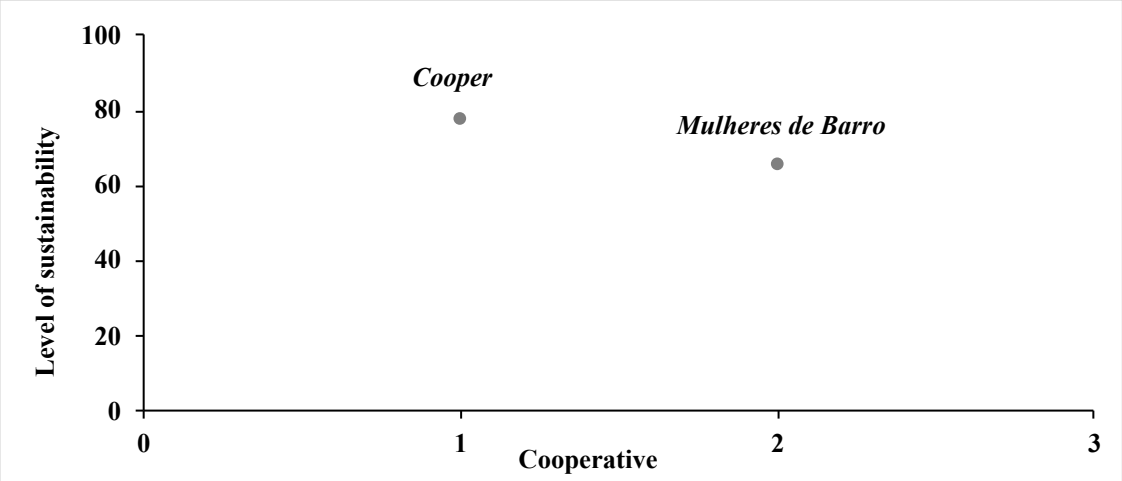
Category	Item	Cooperative	
		Cooper	*Mulheres de Barro*
Sex	Male	75%	11%
	Female	25%	89%
Age group (years old)	20 - 40 y/o	42%	22%
	40 - 60 y/o	33%	45%
	Over 60 y/o	25%	33%
Time as a cooperative member	0 - 5 yrs	33%	33%
	5 - 10 yrs	17%	67%
	10 - 20 yrs	50%	

Source: Cooperative members (2020).

Level of sustainability

Based on the results achieved, the cooperatives were characterised as having medium sustainability (Figure 2), which implies that the cooperatives' operating formats have a positive impact on farmers and artisans as they are close to the assumptions and values of sustainability (Santos and Trez 2020).

Figure 2. Level of sustainability of the cooperatives.

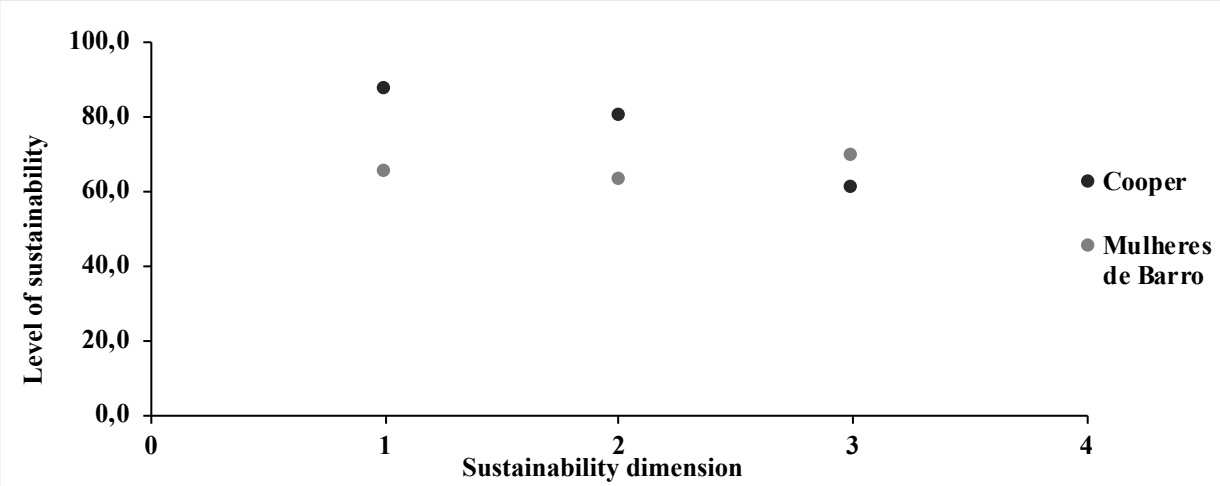


Source: Cooperative members (2020).

Analysis of the performance in each dimension (Figure 3) clearly shows that *Cooper* demonstrated better performance than *Mulheres de Barro* in the social and economic dimensions, characterised by high sustainability. In the environmental dimension, *Mulheres de Barro* presented better results than *Cooper*, since according to authors Zhan et al. (2017) and Zhan (2017), craft practices present

characteristics that relate to the principles of sustainability through the potential to reconnect people with nature (Abson et al. 2017). Regarding family farming, Ribeiro et al. (2021) indicate that such work is responsible for providing healthy food and favouring ecologically correct production practices; however, the intensive use of natural resources for agriculture can cause soil erosion, pollution and increased deforestation if it is not performed in line with environmental preservation (Aubin et al. 2019).

Figure 3. Level of sustainability in the social, economic and environmental dimensions.



Source: Cooperative members (2020).

Cooperatives have different views on cooperativism that translate the results in relation to the sustainability achieved by each one according to social, economic and environmental dimensions. At *Cooper*, there is a strong emphasis on market strategies through the commercialisation of products through the town hall and in places like supermarkets, small businesses and cafeterias, which enables them to achieve the main objective of the cooperative, that of obtaining returns for the cooperative farmers and those who are not members, in addition to stabilising the cooperative in the market:

> 'The most rewarding thing is to get a return for the rural producers (...) the idea at *Cooper* is to help the producers here, working precisely with the farmers (...) we could buy pulp from Bahia, cheaper, like the competition does. But we don't' (D de J da C. – male *Cooper* member, 37 y/o).

> 'Before *Cooper* was really constrained, because it only bought from members and depended a lot on school lunches, now we dominate the pulp market in Parauapebas (...) the secret is to sell (...) we have to go to the market, town halls are one more trading space (...)' (MM da S. - male *Cooper* member, 57 y/o).

At *Mulheres de Barro*, due to the problems faced in the management of the cooperative, opinions diverge regarding the decision to create a cooperative, since in the opinion of the artisans, the cooperative was created without sufficient resources or support from institutions that provided them with training to understand the administrative processes of a cooperative. This group of cooperative members resents the support of public policies that provide assistance and training so that local

artisans are able to establish themselves in an articulated manner as a cooperative and keep up with commercial companies:

> 'We challenged each other and created all this, a Parauapebas cultural heritage (...) we never had money, though we always had daring (...) we don't understand the cooperative's accounting, I always tell the small-scale producers to only open a cooperative when you understand' (S dos SS. - *Mulheres de Barro* member, 53 y/o).

Social dimension

In the social dimension, the data show that the cooperative members consider they have a good quality of life (76%), representing 75% in *Cooper* (Figure 4) and 78% in *Mulheres de Barro* (Figure 5). Although some scored quality of life as regular (24%) due to financial instability as a member, the cooperatives are able to guarantee resources that meet the demands of their members and there is clear progress in the lives of members from a more vulnerable socioeconomic condition to one that aggregates economic, social, cultural and environmental growth (Bakar et al. 2016).

Thus, the members are either satisfied (28.6%) or very satisfied (71.4%) to be part of their respective cooperatives, given that at *Cooper*, farmers feel rewarded for the work they perform and get aid for agricultural growth, while at *Mulheres de Barro* the discourses express feelings of freedom, recognition and pride in the work, which makes them more united: 'It was a great satisfaction to become a member of the cooperative (...) because when we need them, we're really helped' (AA da S. - female *Cooper* member, 45 y/o); 'They helped me not to lose more merchandise, when we see that it's getting ripe, they take it (...) there's a technician from the cooperative who checks the plantations' (GFP da S. - female *Cooper* member, 66 y/o); 'Because besides being recognised, I feel honoured for the work I do in Heritage Education classes, the result of the students' learning and recognition for the work done' (AMB de S. - *Mulheres de Barro* member, 67 y/o); 'Because we have autonomy and freedom to work at our own pace and it's good to be a member' (A das NO. - *Mulheres de Barro* member, 33 y/o).

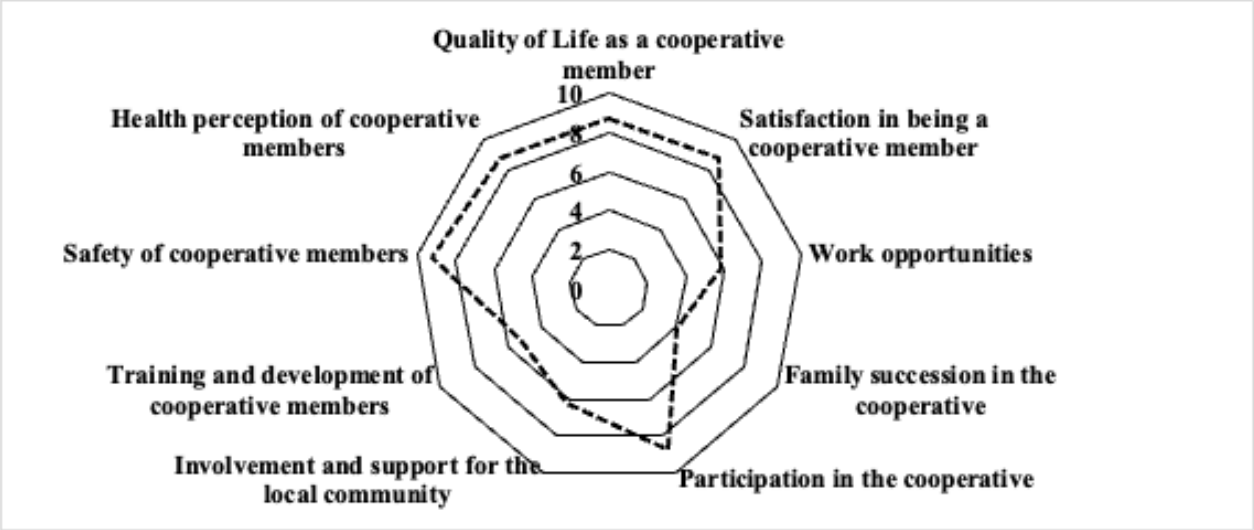
Regarding the safety of cooperative members, we verified that they use personal protective equipment (PPE) when necessary (mask, boots, gloves, safety googles, apron, overalls, uniform and damper) though 14% do not use them because they do not perceive the need to do so and not because they do not have access to PPE; this indicates that cooperatives guarantee a safe working environment. Regarding the cooperative members' perception of health, they consider it to be normal (29%) or good (71%), although some report tiredness due to advanced age, the effort required to execute the activities, and the lack of labour. In cooperatives, the use of PPE reduces work-related accidents and illnesses, ensuring a more capable, healthier workforce, which increases the levels of efficiency of activities and cooperation (Evangelakaki et al. 2020).

There is a consensus among 67% of cooperative members about the positive role in strengthening their activities as artisans and farmers when they form part of the cooperative, but there are other issues that need resolving in production and commercialisation (33%). At *Cooper*, the farmers do not have mechanised production that speeds up the work in planting and harvesting, which in the words of the member (RF de S. - female *Cooper* member, 37 y/o) would be 'a way to work less'. At *Mulheres de Barro*, difficulties occur in reference to production capacity, and commercialising the products in other locations, since the performance of cooperatives can be affected by the size of the membership

(Tadesse et al. 2018): 'There are pieces that people look for and we still haven't been able to deliver' (E dos SL. - *Mulheres de Barro* member, 66 y/o).

> 'The market needs to be expanded and I'm fighting for this, hotels could show our pieces, but it stays within Parauapebas (...) expanding to other cities (...) there are no strategic points to exhibit in other cities' (VC dos S. - male *Mulheres de Barro* member, 46 y/o).

Figure 4. Social dimension – *Cooper*.



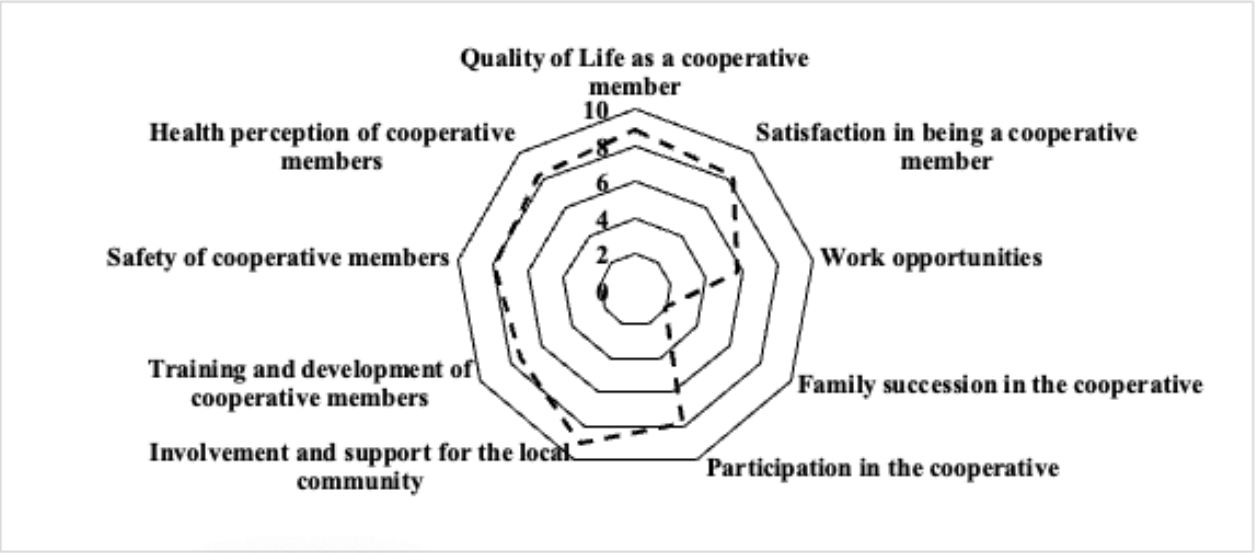
Source: Cooperative members (2020).

The indicators 'employment opportunity' and 'family succession in the cooperative' presented poor performance in the cooperatives. When analysing them as an employment opportunity, the members reported that they joined to supplement the family income (66,7%), given that they sought not only profit, but also improvements in their properties (*Cooper*), and to work on something that provided them well-being (*Mulheres de Barro*). Cooperatives are not seen merely as an opportunity for insertion in the market or profit, as scored by 33,3% of the members, but as an organisational strategy and the possibility of remaining an artisan or a farmer, which gives them the satisfaction of maintaining cultural customs and traditions: 'Many want to join for profit, but not me' (CA da S. - male *Cooper* member, 50 y/o); 'I wasn't looking for profit, but something to get out of the rut, a hobby, and today I like my work' (AMB de S. - Mulheres de Barro member, 67 y/o); 'Because we still don't earn enough here, we work for love' (VC dos S. - male *Mulheres de Barro* member, 46 y/o).

Regarding family succession, only a few family members also form part of the cooperative (52%), while at *Mulheres de Barro*, this corresponds to only 22%, which may be associated with the economic viability of the cooperative, the culture and personal goals of the young successors (Diniz et al. 2013). It worth highlighting that at *Cooper*, family succession refers to father (56%), mother (22%), brothers (44%) and wife (11%) family members, and low family succession in relation to the members' children (22%), because the children do not show an aptitude for agriculture and seek employment opportunities in the city, which generates a shortage of young people as members of the cooperatives and their lack of interest in continuing family work (Santos and Kieling 2020):

> 'Everywhere we go, one of the current problems is the aging of our farmers and the challenge is here's a region where you have a lot of employment opportunities, young people aren't staying on their parents' properties, they're coming to the city to work (...) (MZS - male *Cooper* member, 55 y/o).

Figure 5. Social dimension – *Mulheres de Barro*.



Source: Cooperative members (2020).

Regarding the development and training of cooperative members, we observed that the cooperatives provide training, such as fiscal council, cooperativism, production techniques, customer service, financial management, sales plan, but *Mulheres de Barro* performed better than *Cooper*, in that cooperative members attended trainings more frequently. It is worth noting that the principle of education, training and information is present in the culture of cooperatives, to develop their members, the community and promote social development (Cui et al. 2016; Figueiredo and Franco, 2018).

There is support for the local community that occurs from different perspectives in cooperatives and corroborates with one of the principles of cooperativism "interest in the community", since cooperatives have the social function of seeking to satisfy the interests of their members and generate work and good. -being for the community in which it operates (Socreppa and Silva, 2017). *Cooper* shows support by purchasing fruits from farmers who are not 'members', encouraging them to produce and facilitating the commercialisation of their products, which strengthens local agriculture. When cooperatives provide various services for their members, there is a positive externality in which numerous farmers who are not members of the cooperative also benefit (Xu and Wu 2010): 'We encourage producers to produce, then put it in the market (...) we've bought from members and non-members' (MM da S. - male *Cooper* member, 57 y/o).

At *Mulheres de Barro* they offer free craft workshops for the local community on the themes of heritage education, arts, ceramics, weaving in natural fibres and seed jewellery. Thus, the community learns a way of earning income from handicrafts and the artisans feel motivated and develop forms of work based on cooperation and social responsibility: 'We're not just some vault installed here, and our

first public were our neighbours and the children of stall venders (...) the students provide numerous testimonies, they leave here happy, and this motivates us' (S dos SS. - *Mulheres de Barro* member, 53 y/o). Social indicators show that cooperatives are a way for farmers and artisans to articulate and achieve improvements in their activities, while maintaining their traditions, customs and ways of living, through the construction of collective work modes capable of ensuring their well-being and socio-environmental sustainability (Silva et al. 2019).

Economic dimension

In the economic dimension (Figures 6 and 7) most of the members obtain a financial return according to their participation in the cooperatives. At *Cooper* (100%), in the words of RPG (male member, 70 y/o): 'it's good the cooperative in our region (...) has money to return to us'. At *Mulheres de Barro* this corresponds to 89%, since one of the members mentioned that he receives a partial financial return, since not all cooperative members contribute to the work.

The commercialisation of members' products is achieved by direct sales for 92% of *Cooper*'s members (Figure 6), because one of the members highlighted that he still sells his products through 'intermediaries' who, according to the view of RPG (male member, 70 y/o), is 'the one who comes by with the truck buying from everyone'. At *Mulheres de Barro* (Figure 7), the products are only sold through direct sales, that is, directly to the consumer. The cooperatives also have commercialisation channels that are the cooperatives' own spaces, open markets and collective spaces, such as a store in the shopping mall for *Mulheres de Barro* and a point of sale at the farmer's market, in the case of *Cooper*.

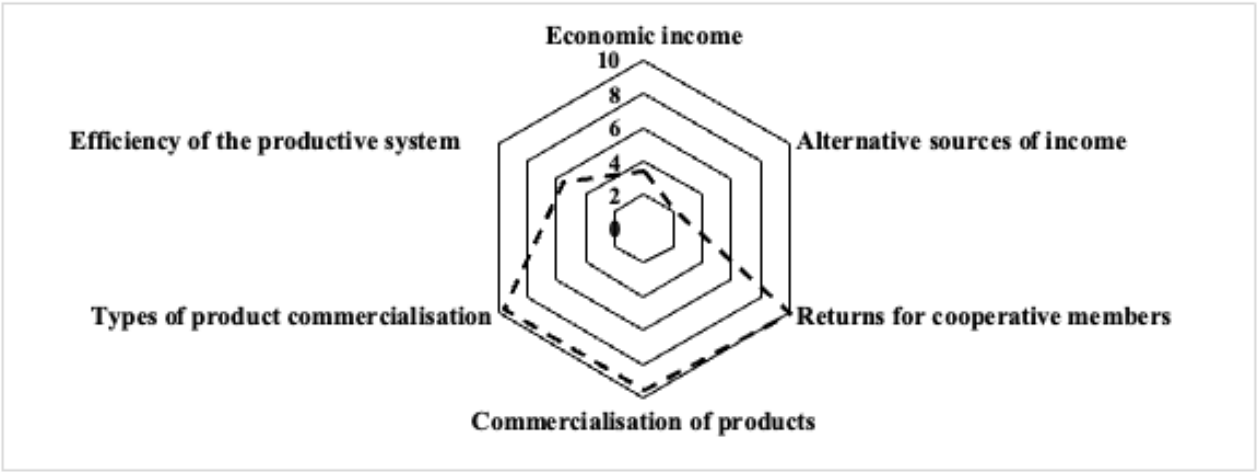
We verified that at *Cooper*, the commercialisation of products is done efficiently (92%), that is, the outflow of production to the market is achieved despite periods of seasonal sales due to the calendar of the fruit trees, since some species produce more fruit during the rainy season. In light of this, the cooperative stockpiles fruit pulp and buys fruit from other states and from farmers in the region who are not members: 'There's more acerola cherry during the rainy season' (RPG. - male Cooper member, 70 y/o); 'Pineapple for sale lasts three months, May, June and July' (JAR. - male Cooper member, 49 y/o); 'Guava hasn't produced in the last five months' (GFP da S. - female Cooper member, 66 y/o).

> 'In our case, there's been a lack of fruit, if the farmer can't supply the industry, we have to buy from someone who's not a member (...) we started to sell a lot, so we paused for a while, since sales began to exceed production, so we invested in machinery' (MM da S. - male *Cooper* member, 57 y/o).

Low fruit production is evident in the productive system efficiency indicator, because the cooperative is able to meet the market with quality and in sufficient quantity to support the cooperative (50%), but some farmers pointed out that they do not meet the market need (50%), since they are unable to produce the amount of fruit required to supply the cooperative, due to the lack of field labour and technologies: 'Sometimes it's not worth taking it to the cooperative, because it's a small amount of fruit, so we sell it direct (...) we deliver what we can' (RPG - male *Cooper* member, 70 y/o); 'There are no workers to help, it's just me and my husband' (GF da S. - female *Cooper* member, 66 y/o).

Given the above, we verified that the economic income of 50% of the members is around one minimum wage (R$ 1,100 or € 180), and 42% receive between 2 and 3 minimum wages (R$ 2,200-3,300 or € 360-540). This is due to the amount of fruit that the cooperative members manage to deliver to the cooperative, which means that they have alternative sources of income (92%), such as retirement benefits, permanent and temporary jobs, their own businesses, and trade in produce and animal products. Some members deliver only a portion of the production to the cooperative and sell the other portion produced to places like supermarkets, steakhouses, restaurants and fairs, where they earn more profit; 'I don't deliver much and I can't deliver every month' (CA da S. - male Cooper member, 50 y/o); 'The restaurant was an opportunity that came up' (RF de S. - female *Cooper* member, 37 y/o); '20% of the production goes to the cooperative and 80% goes to the town, the restaurant, steakhouse and supermarket, because the price is better' (JAR. - male *Cooper* member, 49 y/o).

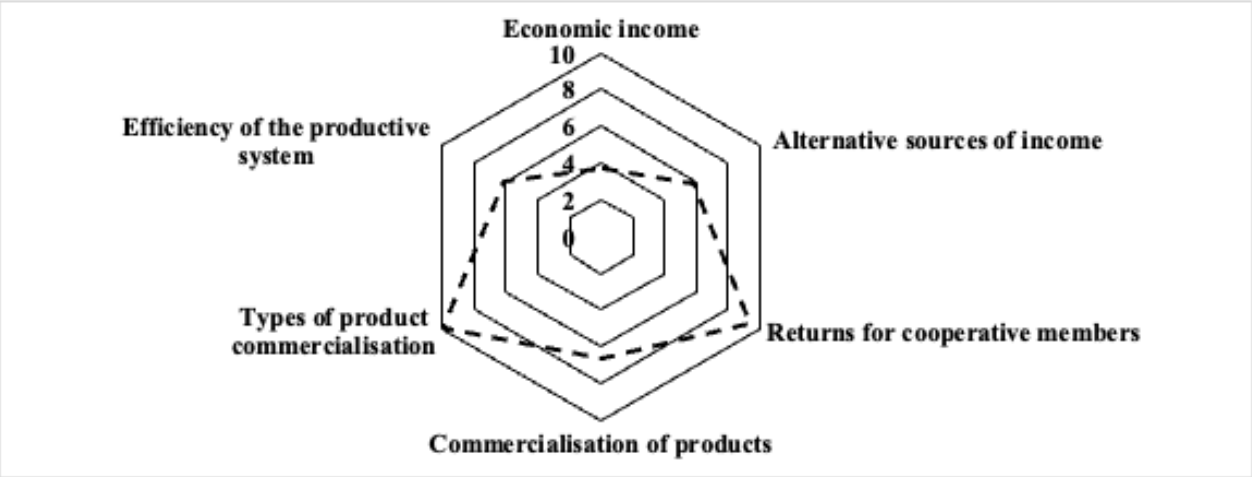
Figure 6. Economic dimension – *Cooper*.



Source: Cooperative members (2020).

At *Mulheres de Barro*, the income of the members is basically between two and three minimum wages (R$ 2,200-3,300 or € 360-540) (67%), but this depends on how much they produce, according to member VC dos S. (46 y/o): 'because the cooperative is like this, if you produce, you earn'. This means that most artisans have alternative incomes, such as retirement benefits, selling products that are not related to crafts, providing decoration services, and their own craft store. It is clear that there is a difference in cooperative members' income between the two cooperatives, and the explanation for this is an agricultural family income often includes subsidies for food production and, above all, the fact that the cooperatives are in different areas; one actuates in the urban area and the other in the rural area. This reality makes farmers seek out sources of income that provide them with profit more quickly and easily, due to reduced production, inefficient logistics and the family structure (Morris and Bowen 2020).

Figure 7. Economic dimension – *Mulheres de Barro*.



Source: Cooperative members (2020).

Commercialisation for *Mulheres de Barro* shows periods with low sales, which impacts the efficiency indicator of the production system, where the cooperative serves the market, but the quantity sold is still not enough to sustain themselves. This makes it difficult to stabilise the cooperative and thus they seek contracts, partnerships and artistic services to maintain the cooperative: 'We still can't maintain the cooperative' (M do S de SC. - *Mulheres de Barro* member, 53 y/o). Even though the cooperatives have different levels of difficulties, they allow opportunities for stability even in times of unexpected crises, providing opportunities for a stable commercialisation channel that, to a certain extent, represents value not solely oriented towards the economy (Yu and Huang 2020).

Environmental dimension

In the environmental dimension (Figure 8), *Cooper* farmers conserve natural resources (water, soil, wood, plants and seeds) by protecting the soil (83%), rotating areas for planting and raising animals, promoting adequate soil recovery so it can be managed again: 'I remove my cattle for three months for the land to recover (...) throwing poison every day is harmful (...) (JAR - male *Cooper* member, 49 y/o). The biomass is naturally enriched through natural life cycles that enrich and protect the soil and thereby control the use of pesticides/chemicals (75%). They do not cut down the forest or they control deforestation (75%) on their properties, through the use of permanent planting and the preservation of native forest and areas close to the river. Fire is controlled (67%) and water is reused (17%).

It is important to highlight the changes in the comprehension of farmers in relation to deforestation and preservation of the forest on their properties, since even though some have already deforested certain areas when they initially settled on the land, they realised the importance of maintaining the surrounding forest. The changes expressed in the farmers' discourses are mainly related to the climate or the siltation of rivers: 'Today we're planting for sustenance' (RF de S. - female *Cooper* member, 37 y/o); 'We cut some down many years ago, today we don't do that anymore' (AA da S. - female *Cooper* member, 45 y/o); 'If it gets warmer like it is, we won't be able to produce (...) whether it's planting or cattle, same for everything' (JAR. - male *Cooper* member, 49 y/o). 'There's no more forest because I cut everything down when I arrived, today you can't even do that, and we're suffering (...) it's been 90

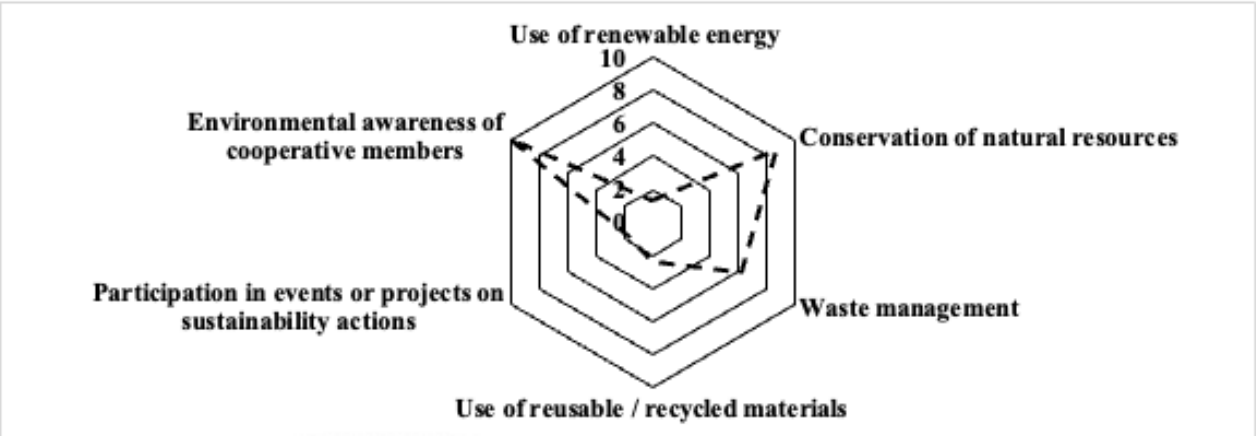
days since it rained' (CA da S. - male *Cooper* member, 50 y/o); 'In the hot period the pineapple won't grow, the sun burns' (RDC. - male *Cooper* member, 30 y/o).

> 'When we arrived on the property, 40% was already deforested and we deforested another 20% (...) there was no environmental awareness then and we started to see the river water drying up, so we started to let the area around the headwaters of the river and the pasture grow' (RDC - male *Cooper* member, 29 y/o).

At *Cooper*, most of the cooperative members do not use a renewable energy source in their activities (92%), even though the cooperative's agribusiness has solar panels installed. However, on one farmer's property there is a biodigester used to generate energy through animal and food wastes, which provides economic and environmental benefits. In the waste management indicator, we verified that 58% of *Cooper* members reuse waste in their activities, through the reuse of bags to place the pulp in, using organic residues from the processes of pulp production and harvesting as fertilizer, together with animal waste that is spread over planted crops. The remaining residues are disposed of in several ways: burning and incineration (58%), such as cardboard and plastics; regular rubbish collection (50%), plastics, glass, aluminium and paper; and selective collection (17%), in which cans and organic waste are separated, and plastics used during agribusiness activities are donated for reuse.

It was evident that some farmers dispose of rubbish inappropriately, since there is no rubbish collection where they live, as highlighted by RPG (male *Cooper* member, 70 y/o): 'Here, there's no rubbish collection, we have to sought out our own rubbish (...) dump it on the roads'. Others have a routine to collect rubbish on their properties and dispose of the containers of chemical products properly (collected by the city): 'you can't leave the containers lying around', says JAR (male *Cooper* member, 49 y/o). In contrast, only 33% use recycled/reused materials in some activities, such as newspaper to pack fruit, drums to carry water and put oil in the engine for irrigation, PET bottles to store products like milk, beans and açai and to control the entry of insects.

Figure 8. Environmental dimension – *Cooper*.

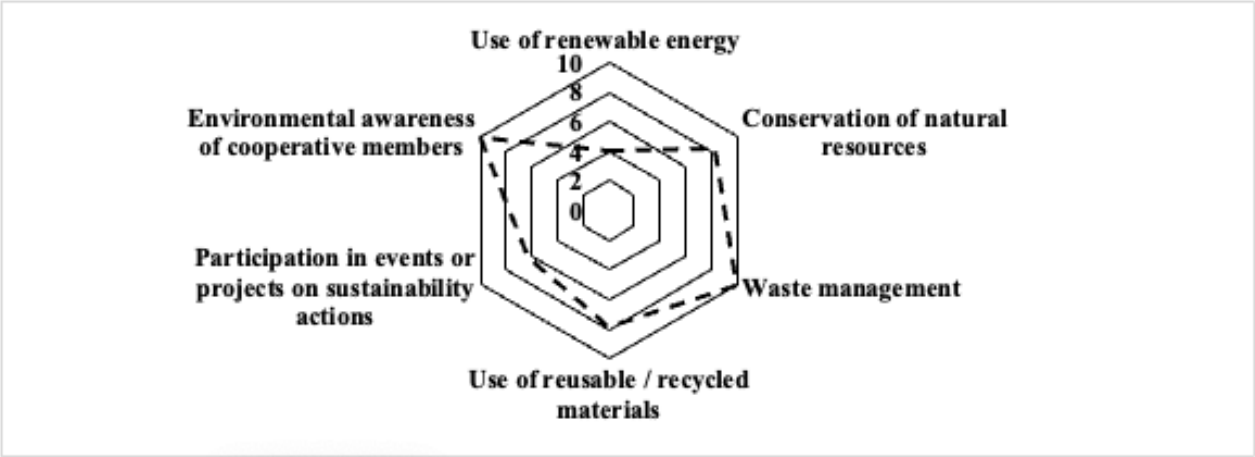


Source: Cooperative members (2020).

At *Mulheres de Barro* (Figure 9), the sun is the renewable energy source for drying clay, which is washed and then placed in a '*cama*' [*lit*. bed] made of wire, brick and canvas. Natural resources (soil,

water, ore, wood, plants and seeds) are conserved through the extraction of clay from constructions, excavations of town hall services and ponds for raising fish, the use of a gas kiln as a way to control the use of fire, the reuse of pieces of wood that are discarded by companies, and through the storage of ore left over after painting ceramic pieces in PET bottles, so it is not thrown directly on the ground, because according to the opinion of M do SAT (*Mulheres de Barro* member, 59 y/o): 'after a while, this ore could harm the soil'.

Figure 9. Environmental dimension – *Mulheres de Barro*.



Source: Cooperative members (2020).

Residues from the ceramics are reused in the cooperative, in the restoration of broken pieces, through the transformation of pieces into powder, or pieces that are not fired are mixed with other clays and transformed again. There is also the reuse of decorations (plastic, rope, wood, fabric and iron) on account of the space decoration services provided by the cooperative. Materials that are not reused are destined for normal and selective rubbish collection. As a result, some artisans recycle unused objects that were disposed of or from other activities in the construction of work tools: 'Before firing, it softens and forms another piece and after firing, sometimes it's restored, but there are those we grind up and create other art (...) tools, we invent them' (NMPK - *Mulheres de Barro* member, 76 y/o); 'PET bottles, cardboard, fabric scraps, old toothbrushes, deodorants bottles, pens without ink (...) we reuse everything' (M do S de SC - *Mulheres de Barro* member, 53 y/o); 'Our tools are all recycled (...) cardboard is reused for packaging and plastic to pack the pieces, or even to conserve the decoration (M do SAT. - *Mulheres de Barro* member, 59 y/o).

Ultimately, most *Cooper* members have never participated in events or talks on environmental issues by the cooperative, which reflects on the low performance in the environmental dimension brought about by the lack of disclosure of information on social and environmental responsibility, in contrast to *Mulheres de Barro*, where 56% have participated in events and 33% participate in actions in support of sustainability every year. It is important to emphasise that *Cooper* and *Mulheres de Barros* continue to search for improvements in their conservation practices: 'Like you don't throw away rubbish, which accumulates in the river or on the roads, and preserve the forest' (AA da S. - female *Cooper* member, 45 y/o); 'I don't use anything that causes harm (...) I preserve the forest surrounding the river' (JAR. - male *Cooper* member, 49 y/o); 'I only use one area, I don't deforest, I don't set fires'

(RDC. - male *Cooper* member, 30 y/o);'Using ore tailings and reusing materials is already a great contribution to the environment' (M do S de SC. - *Mulheres de Barro* member, 53 y/o); 'If we artisans, who need the clay, the earth, don't preserve where it's being extracted from, we're not thinking about tomorrow' (NMPK. - *Mulheres de Barro* member, 76 y/o).

In this context, it is evident that care for the environment in cooperatives is carried out in different processes, which are impacted by the unique characteristics of the activities performed by each of them and the impasses that permeate agriculture and handicrafts, but to some extent we observed a search in balancing their work with environmental preservation, albeit a gradual step.

Conclusions

Through the study conducted at *Cooper* and *Mulheres de Barro*, it was possible to analyse how much cooperatives drive the local market and provide visibility to the agricultural producers and artisans. Social indicators showed that cooperatives enabled improvements in the quality of life of members and satisfaction in performing their activities in a safe and coordinated manner, despite certain obstacles identified in cooperatives, such as low family succession, difficulties in increasing production, and also in the expansion of commercialisation in the case of *Mulheres de Barro*, which imply low sales periods and slow growth in the market.

In the economic dimension, cooperatives provide financial returns to members and channels to commercialise their products, but we found that artisans and farmers seek alternative sources of income to maintain themselves and these are seen as a way of organising and strengthening production that is not focused solely on profit. In the environmental dimension, we noted that the members of both cooperatives seek to conserve the natural resources they use in their activities, but at *Mulheres de Barro* waste management is better, since it involves the processes of restoring pieces, reuse of materials from the activities of artistic decoration, and the use of recycled materials.

Finally, attitudes are perceived that show the performance of cooperatives in working in line with the social, economic and environmental dimensions, given the relevance they have in the region in providing that farmers and artisans are a more autonomous and sustainable community, contributing to sustainability place. The study made it possible to understand that cooperatives play a role in addition to facilitating the organization of members and obtaining financial gains, but also a way to strengthen the maintenance of the livelihoods of farmers and artisans according to their traditions. In this way, the characterization of sustainability in cooperatives can be seen as a way of growth for communities and also preservation of customs.

Regarding the limitations of the study, research has been expanded in the pandemic period with respect to biosafety standards, as well as the recent nature of the academic literature on cooperativism in the studied region. As a proposal for future studies, there is an analysis and incorporation of the cultural and political dimensions of sustainability, in view of the sociocultural dynamics in which cooperatives are inserted, with the purpose of investigating their importance in these dimensions and in view of the proposed development plans for the region.

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Authors' contribution: JCKS - conceived the project, data collection and analysis, writing; GPM - conceived the project, Supervising, writing; FCAL - fieldwork, database curation, writing; HWAP – sample design.

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Data availability statement: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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