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Treatment and analysis of açai berry production waste: a study by the optics of eco-efficiency

Tratamiento y análisis de la producción de residuos de açai: un estudio desde la perspectiva de la ecoeficiencia

Tratamento e análise de resíduos da produção de açai: um estudo sob a ótica da ecoeficiencia

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Abstract

Purpose: The main objective of this research was to find out with the açai berry sales establishments of the Belém Metropolitan Region – Pa. (RMB), which treatment has been assigned to wastes (açai berry pits) by the açai beaters, having as analysis parameters the accounting and socio-environmental standpoint, under the optics of PNRS, within a context of eco-efficiency.

Methodology: An exploratory, cross-sectional research was conducted by gathering data of 80 RMB açai production establishments.

Results: The results indicated that the respondents, in part, have knowledge about social and environmental management and about what the social and environmental impacts mean.

However, they do not have a solid waste management plan, and, in the perception of the most of them, the obligation to make the proper disposal of açai berry wastes is the responsibility of the city hall, which demonstrates lack of knowledge about the PNRS guidelines. Regarding the treatment of açai berry pits, the majority of them responded that the wastes are destined to landfills, in spite of the possibilities of reuse. When analyzing the treatment of wastes by the accounting-Financial standpoint, it was observed as non-existent, which may be associated to the type of formalization (or its lack) and the fact that they do not have professional support to business management.

Contributions of the Study: This study concluded that it is necessary to establish incentive plans and/or guidances for the reuse of wastes, so that the açai berry beaters can enjoy the financial benefits and contribute in a better way to the reduction of the environmental impacts, performing an eco-efficiency management.

Keywords: environmental accounting; social and environmental management; eco-efficiency; açai berry wastes.

Resumen

Objetivo: El objetivo principal de esta investigación fue encuestar junto a los establecimientos de venta de açai de la Región Metropolitana de Belém - Pa. (RMB), qué tratamiento se está asignando a los residuos, teniendo como parámetros de análisis tanto el punto de vista contable y el punto de vista social y ambiental, desde la óptica de PNRS, dentro de un contexto de ecoeficiencia.

Metodología: Se realizó un estudio exploratorio de corte transversal a través de una encuesta de 80 establecimientos de producción de açai de RMB.

Resultados: Los resultados mostraron que los encuestados, en parte, tienen conocimiento sobre la gestión social y ambiental y lo que es el impacto social y ambiental, sin embargo, no tienen un plan de gestión de residuos sólidos. En la percepción de la mayoría de ellos, la obligación de hacer la eliminación correcta de los residuos de açai es responsabilidad del Prefectura Municipal, que muestra falta de conocimiento sobre las pautas de PNRS. Con respecto al tratamiento de los residuos de açai, la mayoría respondió que los residuos están destinados a vertederos, a pesar de las posibilidades de reutilización. Al analizar el tratamiento de los desechos desde la perspectiva contable-financiera, se descubrió que no existía, lo que puede estar asociado con el tipo de formalización (o falta de ella) y el hecho de que no cuentan con el apoyo profesional en la gestión empresarial.

Contribuciones del Estudio: Este estudio tiene como objetivo contribuir a la discusión sobre la importancia de establecer planes de incentivos y / u orientación para la reutilización, de modo que los empresarios açai puedan disfrutar de los beneficios financieros y contribuir mejor a la reducción de los impactos ambientales, realizando una gestión ecoeficiente.

Palabras clave: contabilidad ambiental; gestión social y ambiental; ecoeficiencia; residuos de açai.

Resumo

Objetivo: Esta pesquisa teve como principal objetivo levantar junto aos estabelecimentos de venda de açai da Região Metropolitana de Belém – PA (RMB), qual tratamento está sendo designado aos resíduos (caroços de açai), tendo como parâmetros de análise o ponto de vista

contábil e o socioambiental, sob a ótica da Política Nacional de Resíduos Sólidos (PNRS), dentro de um contexto de ecoeficiência.

Metodologia: Foi realizada pesquisa exploratória, transversal, por meio de levantamento, junto à 80 estabelecimentos de produção de açaí da RMB.

Resultados: Os resultados apontaram que os respondentes, em parte, possuem conhecimento acerca da gestão socioambiental e do que é impacto socioambiental, entretanto, não possuem plano de gerenciamento de resíduos sólidos, e, na percepção da maioria deles, a obrigatoriedade de realizar a correta destinação dos caroços de açaí é da prefeitura, o que demonstra desconhecimento acerca das diretrizes da PNRS. Quanto ao tratamento dos resíduos do açaí, a maioria respondeu que os caroços são destinados a aterros, a despeito das possibilidades de reaproveitamento. Quando analisado o tratamento dos resíduos pela ótica contábil-financeira, observou-se como inexistente, o que pode estar associado com o tipo de formalização (ou a sua falta) e o fato de não terem apoio profissional para realizar a gestão do negócio.

Contribuições do Estudo: O presente trabalho visa contribuir para a discussão acerca da importância de estabelecer planos de incentivo e/ou orientação para o reaproveitamento, para que os empreendedores de açaí possam desfrutar dos benefícios financeiros e melhor contribuir para a redução dos impactos ambientais, realizando uma gestão ecoeficiente.

Palavras-chave: contabilidade ambiental; gestão socioambiental; ecoeficiência; resíduos de açaí.

1 Introduction

Over the years the need to adopt a right environmental stance has been essential, people and organizations need to commit to the sustainability of the planet in the medium to long term. In this sense, Longo, Ribeiro, Carvalho and Bertolini(2017) emphasize that the sight about the environmental awareness as way to achieve a sustainable future hasn't been a recent discussion, with regard to human behavior related to the environment, it can be said that individuals who have a higher environmental awareness level can make their decisions according to the impacts that they cause to the environment (Afonso, Zanon, Locatelli, & Dias Afonso, 2016).

The need for the companies fit in this new concept is undeniable, in other words, acting in implantation of activities related to the environmental preservation and conservation, aimnig to mitigate the damage caused to the environment, notably those ones brought by wastes from economic activity (Reis, 2016). In this context, the National Solid Waste Policy (PNRS) institutes an integrated management and an environmentally proper solid waste management (Brasil, 2010). Among many principles of PNRS, the eco-efficiency stands out, which can be defined as a systemic view between economy e ecology, whose objective is the reach of sustainability (Pereira, Santa, & Andrade, 2012).

It's important to mention that the practice of eco-efficiency, in the business environment, is not just considered environmentally correct, but it also has the potential to generate more profitable results. For Portugal (2013), this strategy can generate good dividends, image and reputation, contributing significantly to the development of these businesses, in this sense, it's possible to transform the use of these wastes as a source of extra income. Padilha e Asta (2014) highlights the importance of accounting in relation to minimizing environmental impacts

through the effective accounting treatment of solid waste, which is able to show, among other aspects, the eco-efficient financial gains due to an environmentally proper economic activity.

In the scope of the eco-efficiency, the concerns with the reuse of wastes from production of açai in the state of Pará. The consumption of açai berry fruit participates significantly in paraense cuisine. According to the estimate of the Association of Artisanal Açai Sellers of Belém and Metropolitan Region (AVABEL, 2019), two hundred eighty kilos of açai berry pits are produced, on average, every day, at each point of sale. Also according to Avabel, the concern with the environment and the produced wastes also affect the açai berry beaters because they're responsible for selling the food that goes to the final customer.

The açazeiro tree is a Brazilian Amazon Native Specie from state of Pará, which is an important food for the local population. From the açazeiros trees is extracted pulp, commonly known as açai berry which is consumed on a large scale for the local population added to other foods such as: manioc flour, fish, shrimp, among others. Thus, statistical data about the use of açai berry fruit show that the pit is equivalent to 85% of its weight, while the pulp is equivalent to 15%. Therefore, it arises the responsibility for properly destination of the pits from the açai berry production, since que the accumulation of these wastes promotes several impacts on the environment (Nogueira, Figueiredo, & Muller, 2005). It shows the problem as it can be seen in the Picture 1, authored by Octávio Cardoso, published in the Diário do Pará newspaper.



Picture 1 Waste accumulation from açai production (pits), in Belém city.

Source: Octávio Cardoso, veiculado no Jornal Diário do Pará (2018)¹.

Thus, the amount of waste accumulation in Belém city has worried the paraense population due to the environmental impact brought by these wastes, mainly in peripheral neighborhoods of the capital where the number of small açai berry beaters increases, daily throwing pits in walloons and open-air dumps, causing silting up and floodings, leading to serious environmental damage caused by these practices (ORM, 2014; DOL, 2018).

According to Vedoveto (2008), there are many ways of açai berry commercialization, among them, the producer sells directly the product (açai berry) to the “machinist”, commonly

¹Available on: <https://www.diarioonline.com.br/noticias/para/noticia-392850-sobra-de-açai-berry-nao-tem-coleta-adequada.html>.

known as “açai beater”, who is responsible for handling the açai production process through a industrial machine that transforms the açai berry pits to açai pulp, which is traditionally consumed by the paraense population.

Therefore, a concern arises about the treatment of açai berry production wastes, for the environmental point of view as well as for the economic financial point of view, where the question that will guide the research comes from: **How is the treatment of açai berry production wastes in metropolitan region of Belém - PA?**

Thus, the main research goal is to discover in açai berry production establishments, what treatment has been given to the wastes, based on the accounting point of view and the socio-environmental point of view, from the perspective of the National Solid Waste Policy, within a context of eco-efficiency.

It's important mentioning that according to Secretaria de Municipal de Saneamento data (2017), there are about 10,000 açai sales point in the Belém metropolitan region that produce a daily average of 200 kilos of wastes (pits) at each sale point. It has a daily waste volume of around 1,6 to 2 tons, causing a constant concern about their right destination, so motivating the research, which intends to contribute to the discussion about the need of actions that support the environmental impact reduction through the proper destination of açai production wastes, within the possibility to accomplish eco-efficient actions with wastes which opens ways for new studies in the area.

2 Theoretical aspects

2.1 Socio-environmental Responsibility and Eco-efficiency

The social and environmental responsibility can be understood, firstly, as a commitment, not just to companies and people, but also, to the environment (Eon, 2015). It's emphasized that the environmental issue started to be arised just after three centuries after the industrial revolution, specifically in the late 60's, what indicates that discussions about socio-environmental concern are still considered recent.(Pott & Estrela, 2017).

Inside the business scenario, studies by Daher, Mineiro, Damaso and Boas (2012) have discovered that there are still several obstacles for socio-environmental responsibility implementation in the companies. In this sense, it can be mentioned that a large portion of small entrepreneurs still don't know the benefits arised from a management based on social responsibility (Daher *et al.*, 2012).

Complementing the reasoning of Daher *et al.* (2012), Martins, Escrivão and Nagano (2015) have verified through studies with small and medium-sized companies, that these organizations are still in a initial stage in relation to their environmental practices. Besides this issue, while they analyzed the strategies of the companies, they discovered lack of environmental aspects in management, and while they searched for reasons of this fact, they found that this fact happens because the concern about environmental issue will only begin when it becomes a requirement of the intern market or when it causes a concrete perception of economic benefits for the company.

The perception about financial economic gains which the eco-efficient management can bring, it seems to be the issue focus, since small business owner-managers are relatively stimulated only by the profitability of their companies (Williamson, Lynch-Wood & Ramsay, 2006). The literature shows that environmental practices accomplishment by small companies seems to make sense a little bit, in the financial economic scenario which the companies are in (Cassells & Lewis, 2011).

In Brazil, there's a similar scenario, Pereira and Moreira (2018) emphasize that the discussion for socio-environmental practices awareness and development by small companies needs to gain space in the business management, and within this context, also discuss eco-efficient practices in the small companies ambit.

Added to that, reinforcing the initial discussion, the idea about eco-efficiency can be seen as a link between goods and services production and environmental responsibility. In this sense, companies that accept the eco-efficient system can reduce progressively the goods and services environmental impacts as well as through reuse of wastes to reduce economic costs of the companies, therefore, promoting sustainable development in the business sector (CEBDS, 2015).

As quoted by Ilomaki e Melanen (2001), the most used environmental practices by small and medium-sized companies are those ones able to generate costs reduction. On the other side, it's considered the idea that if there were relevant benefits, such as costs reduction or income generation, the stimulation of change in environmental practice would not be enough within the business scenario (Cassells & Lewis, 2011). In this sense, it can be emphasized as product of eco-efficient practice that the organizations can account properly its effects through wastes accounting treatment.

2.2 Eco-efficient Actions in Açai Berry Waste Reuse

In the eco-efficiency ambit, there are several types of açai berry processing waste reuse (pits). It's clear that there's a great viability related to these wastes reuse, being possible to minimize environmental damage caused by excessive accumulation of açai berry pits which are thrown in inappropriate places. In the economic perspective, entrepreneurs can benefit from the sale or the reuse for own consumption, therefore, through these practices, eco-efficient actions are accomplished.

In reference to the reuse types, several process stand out, which are developed by researchers, as well as by industries and civil society individuals, worried people about the impact of açai berry wastes, if properly treated, can cause to the environment. In this scenario, several actions of wastes treatment stand out.

Composting actions, which consists of decomposition of solid wastes, açai berry wastes composting techniques acts on economic problems solutions, income generation by sale, and ecological, it avoids the atmospheric pollution caused by burning because it's a totally natural process (Nogueira, Figueiredo & Muller, 2005).

In the handicraft area, wastes from açai berry production (pits) have a great relevance in confection of biojewels, such as necklaces, earrings, rings and bracelets (Aygadoux, 2016). This technique of waste reuse using açai berry as raw material is done by handicrafters and it stands out because of the simplicity how it's marketed, social involvement and strengthening of the culture and amazonian identity.

It's also emphasized the use of açai berry pits in thermal energy production in potteries. Among several practices of environmental commitment, the sale of solid wastes from production as alternative energy source for potteries, what reduces the waste storage physical space in agro industries and promotes income for the company, aligned with a correct environmental posture contributing to the environmental impacts reduction (Farias Filho, Silva, & Silva, 2013; Cordeiro, Paula, Sousa, & Amorim, 2017). In this sense, studies verified that açai berry pit has generated economic, social and environmental benefits for açai producers as well as for potteries owners.

Considering the same need of açai berry production waste treatment (pits) for the environmental impact minimization, studies are considered about using wastes in energetic briquettes production. This way of treatment allows organic wastes reuse for energy generation. Furthermore, it was considered as a more viable alternative to product energy by the economic viewpoint and also by the environmental viewpoint, considering that this practice has a low gas emission, minimizing the environmental impact (Reis, Silva, Silva, & Rocha, 2002).

Bufalino *et al.* (2018) has verified a high base density, an advantageous characteristic of açai berry wastes in bioenergy formation, in other words, the energy efficiency through burning, considering the high daily consumption of açai berry in Amazonia, it is always expected high quantities of biomass for bioenergy production.

The authors emphasize the importance for the environmental and social ambience, because these wastes will be properly destined, contributing to material damage minimization and improving the quality of life of the local population, as well as helping these wastes makers who can benefit through the consumption and/or sale of açai berry wastes for energy production (Bufalino *et al.*, 2018).

It's also emphasized the reuse of wastes from açai berry production in the technological area. In this tense, Braga (2019) has sought to change chemically mesocarp fibers of the açai berry, for the production of cellulose nanofibers and chitosan-based nanocomposites (substance more abundant in the nature after cellulose), being accomplished processes such as whitening, humidity measurement, drying in the oven until it is able to obtain cellulose nanofibers which are achieved through white açai berry fibers, that are able to be used in production of packages for food and products which are, in general, humidity intolerant. Also Souza e Bufalino (2017) have sought to develop mixed papers from short and long fibers recycled papers that come from wastes of açai processing.

Therefore, it can be realized a lot of actions and studies quantities that suggest a possibility of eco-efficient açai berry wastes reuse, in which it is emphasized the importance of the correct recognition process, measurement and confirmation of these eco-efficient practices by accountancy.

2.3 Accounting Treatment of Açai Berry Wastes

Accountancy is an applied science which has as one of the main characteristics its constant evolution e adaptation, according to its users needs. In this sense, considering the large amount of waste that comes from business activity, the importance of correct accounting treatment accomplishment for these wastes through the environmental accounting and socio-environmental management.

Therefore, Colares e Moreira (2012) propose three ways of wastes behavior: a) when a waste is lost or it evaporates; b) when a waste is reused (as by-product or raw material); e c) when a waste isn't used and it must have a proper disposal (Table 1).

However, in a research conducted by Padilha e Asta (2014) in a company from the solid waste treatment area, which is based in Cascavel – PR, it was verified that there isn't a proper exposure of the environmental items in the financial statements, although the company has assets and environmental income. Referring to açai berry waste, there are several possibilities, according to the reuse way which is established.

Table 1
Accounting for ways of waste treatment

Types of wastes	How they must be accounted	Accounting examples
Waste loss caused by evaporation or shrinkage	The cost of loss will have to be incorporated into costs of the main product.	D – Production Costs C – Raw Material stock
Wastes reused as by-products	Accounting of by-products sales by net realisable value, reducing cost of the finished product (the main product).	D – Cash Flow/Banks C – Finished product stock
	Treatment of by-products sale as other revenues.	D – Cash Flow/Banks C – Revenue From By-products D – Production Cost (by-product) C – By-product Stock
Wastes reused as raw material	Wastes reused as raw material will have to be transferred from stock of processing products to raw material stock.	D – Raw Material Stock C – Production Cost
Wastes not reused and incurred in a final proper disposal	Normal losses are incorporated into production cost and not normal losses can be accounted as other results.	D – Costs of Final Disposal of wastes (production/loss cost) C – Cash Flow/Banks

Source: *An Adaptation by Colares and Moreira (2012).*

The wastes accounting process incites to an interesting reflexion: if there's a reuse of wastes as by-products or raw material, it happens cost reduction or revenue generation for the organization related to good results (eco-efficiency). In other side, if the organization doesn't accomplish the environmentally correct treatment of wastes, consequently, it will be necessary to pay for proper final destination accomplishment, which will increase its costs and will reduce results.

Thus, it's emphasized the importance of entrepreneurs (beaters) of açai berry worry about the wastes final destination, and about the possibility of costs generation for final destination (If the wastes are environmentally incorrect managed) and revenues (if the wastes are environmentally well managed), in eco-efficient actions.

It's also worth to emphasize the possibility of partnerships between açai berry beaters and other recycler organizations, in which the recycler organization takes over the responsibility of wastes removal, in order that, it doesn't cause revenue increasing and cost increasing neither for açai berry beaters. It's important to say about the choice of the type of treatment for wastes, this treatment is obligatory, according to the PNRS/2010.

2.4 National Solid Waste Policy – PNRS

The PNRS, decreed by Law 12,305/10, instituted the integrated solid waste management, aiming proper destination and its reuse, which has sustainable development practice as a goal. Referring to the Law, it's approached important principles that involve economy, in which it's emphasized the eco-efficiency that is related to meet the human needs, in other words, it means to consider the environmental concern added to natural resources consumption aiming to the environmental impact reduction; the shared responsibility; The

removal of the reused and recycled wastes as an economic good, which has social value, and it is a job and income generator as well as a promoter of citizenship (Brasil, 2010).

According to Pereira (2012), the PNRS has a relevant role in reference of eco-efficient solid waste treatment. Thus, it shows that eco-efficiency tends to reduce the environmental impact and increase the proper consumption of natural resources. Besides that, it can be affirmed that is possible to evolve within eco-efficient way through a shared responsibility, which means a set of individual actions that involve manufacturer, consumers, importers and others, aiming to reduce the amount of waste produced. (Brasil, 2010). Lavnitcki, Baum and Becegato (2018) corroborate when they affirm that a good level of a sustainable standard will be truly achieved just when goals to reduce, reuse, recycle, treat and allocate solid wastes are effectively being put into practice.

According to the PNRS, açai berry wastes are classified as commercial activity waste and its collection and destination is a responsibility for its generator – in this case beaters, included those ones related to inputs used in these activities; obligatory collection by its generator (over 50 kilos), the need for a simple management. In the economic scope, besides the traditional destination in landfills, the PNRS points to article 42 item V, the development of a simplified environmental management program aimed at the production process improvement and wastes reuse (Brasil, 2010).

In reference of waste reuse management, it can be said that solid waste is recognized as an economic good which is reuse and recyclable, and it's considered as a generator of work and income, as well as being a citizenship producer. Thus, all this issue is related to açai berry solid waste production.

3 Methodological aspects

The classification of this research follows the taxonomy proposed by Farias Filho and Arruda Filho (2013). This is about an applied and transversal study, which has predominantly an exploratory characteristic, because although there are many studies about açai berry solid waste treatment, under the accounting-financial and eco-efficiency optics, there's still an extensive space for researches. About knowledge area, it's considered multidisciplinary, an intrinsic characteristic of socio-environmental management, which involves several sciences for understanding it.

About problem approach, it is a quantitative research, accomplished through data survey, whose data were treated as descriptive statistics. For the research conclusion, a questionnaire, which was elaborated from the theoretical framework section, and a pre-test was accomplished with a master's student and two beaters of açai berry.

In the end of this step of elaboration and accomplishment of pre-test, the questionnaire was finished, which was structured with 20 multiple choice questions that were divided in three blocks of questions, such as: block 1, questions about social reality of entrepreneurs; block 2, questions about socio-environmental management knowledge; block 3, questions about PNRS knowledge and the way of treatment of açai berry waste that comes from the commercial activity.

For definition of the sample of açai berry beaters to be interviewed, this research has taken as study population 141 establishments that are part of Belém Association of Artisanal Açai Sellers (Avel, 2019), whose registers (name of establishments and address) are available on the internet, on the link: www.avabel.com.br, according to a research which was elaborated on 01/30/2019.

The technical visits in establishments of açai berry sale for applying the research questionnaire to açai berry beaters were done personally by the researchers, in the period from 04/01/2019 e 06/15/2019, so getting a sample with 80 respondents. The results are presented in sequence.

4 Presentation and Analysis of the Research Results

4.1 The sample characterization

Based on the research data, a descriptive analysis was performed for the sample characterization. Among respondents, there were 78% male entrepreneurs and 22% female entrepreneurs, and 46% of respondents were over 35 years old; 35% were from 26 to 35 and 19% under 25 years old. In what it refers to education level, 90% have completed high school, according to what is shown in Table 2.

Table 2

Education level of the respondents

Education Level	Quantity	(%)
Complete Middle School	14	18%
Incomplete/ Studying in Middle School	4	5%
Complete High School	35	44%
Incomplete/ Studying in High School	9	11%
Complete Higher Studies	8	10%
Incomplete/ Doing Higher Studies	10	13%
Total	80	100%

Source: *The Research data (2019).*

Added to this, in what it refers to the role inside the establishments, 53% of respondents were owners-managers, 25% were employees, 20% members of families and 2% collaborators without a employment relationship. Next to this, it was questioned about how long they have been working in the field of açai berry activity. Therefore, 45% of respondents have been working in açai berry activity for over 10 years, whereas 30% have been working between 5 and 10 years now, 17,5% between 1 and 5 years and 7,5% under one year.

It's important to emphasize that among the respondents who have participated in the research, approximately 39% were not formalized workers, they are people that undertake their work informally without accounting, fiscal, financial and management assistance. Also it was emphasized the approximate percentage of 3% of Simples Nacional (just two as enterprises) and 59% as MEIs, which shows that a great part of them have already formalized, turned their enterprises legal to have benefits of MEI, such as retirement, maternity assistance, sickness assistance and other benefits (Portal do Empreendedor, 2019).

Therefore, in general, the profile of respondents denotes that they are mostly male, and are over 35 years old, high school completed, and they have been working over ten years in this market area with establishments efforting to become formalized. A market area mainly composed of older men and long experience in açai berry business area, with a long period of action in this area. On the other side, despite the effort to legalize enterprises, it's important to

emphasize that it's still necessary a greater engagement in order that everybody becomes formalized, at least, as individual entrepreneurs.

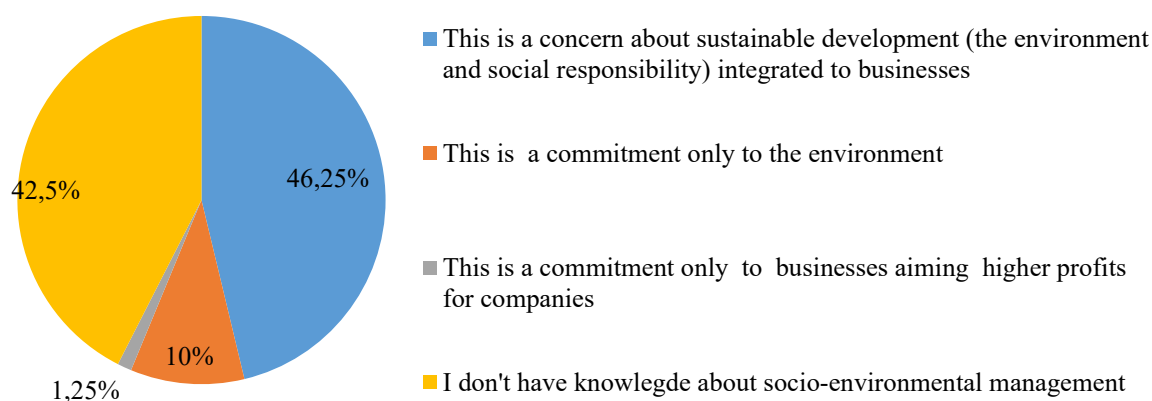
In the sequence, the second block of questions aimed to know the açai entrepreneurs comprehension about socio-environmental management elements.

4.2 Knowledge about socio-environmental business management

In this way, the first question aimed to know the açai beaters perception about socio-environmental management and among 80 respondents, 46,25% (37 respondents) chose the alternative in accordance with their theory:

- It's a concern with sustainable development (the environment and social responsibility) integrated to businesses.

Whereas 11,25% responded incorrectly and 42,5% claimed not to have knowledge about socio-environmental management, as shown in the picture 2.



Picture 2. Knowlegde about what socio-evironmental management is.

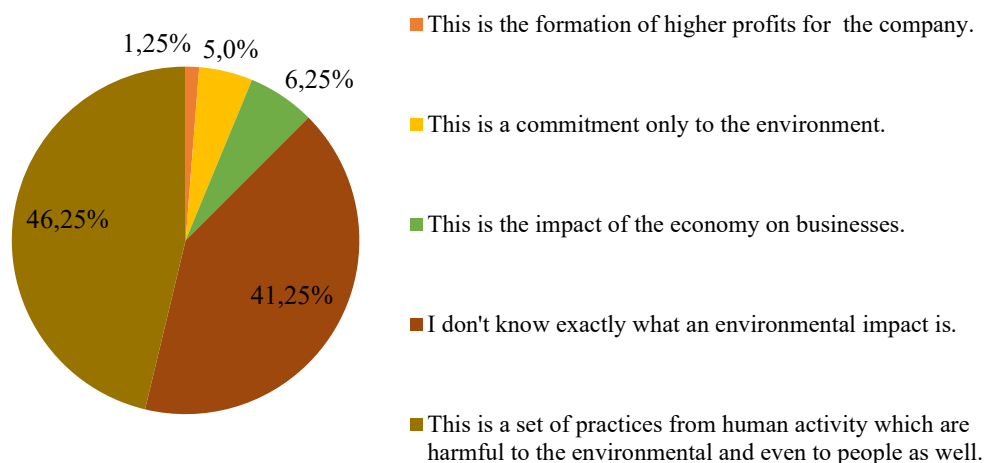
Source: *The Research Data (2019).*

After this, it was questioned about comprehension of what socio-environmental impact means. In this sense, the same people, representing 46,25%, responded according to the theory the issue below:

- This is a set of practices from human activity which are harmful to the environmental and even to people as well.

Whereas 41,25% claimed not to know about socio-environmental impact.

It must be emphasized that the people index who don't know about socio-environmental management and environmental impact is still relevant, which corroborates the research of Daheret *al.* (2012) about a great part of small entrepreneurs who don't know about a management based on social responsibility. The Picture 3 shows responses about environmental impact knowledge.



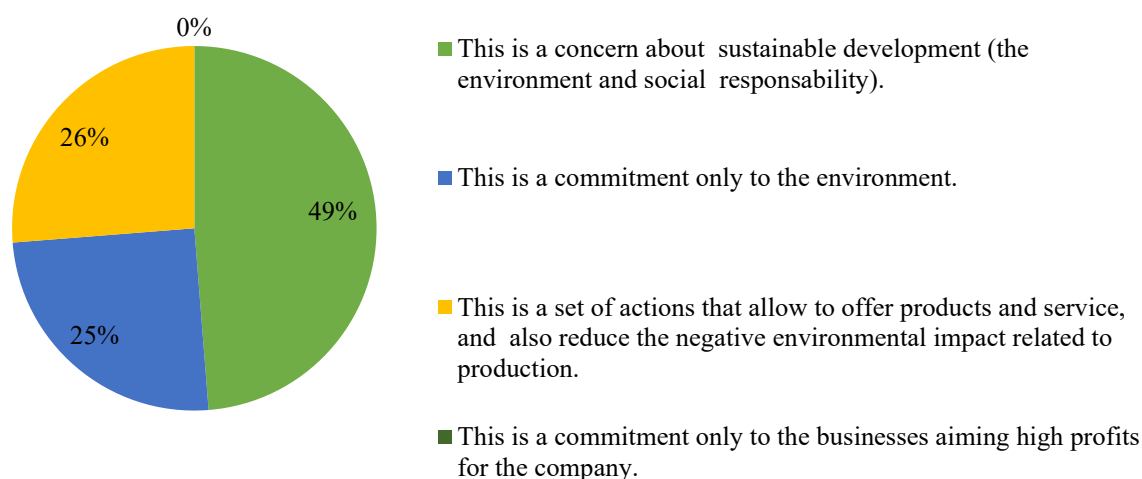
Picture 3. Knowledge about environmental impact.

Source: The Research Data (2019).

The third question that aimed to know about the açai entrepreneurs knowledge is about eco-efficiency. In this approach, it englobes the potencial of eco-efficiency in wastes reuse (Farias Filho, Silva, & Silva, 2013); (Aygadoux, 2016; Cordeiro *et al.*, 2017; Reis *et al.*, 2019; Bufalino *et al.*, 2018; Souza e Bufalino, 2017; Braga, 2019), only 26% responded this question according to the theory:

- This is a set of actions that allow to offer products and service, and also reduce the negative environmental impact related to production, generating economic benefits for companies while it reduces the environmental impact.

Whereas 74% of beaters didn't choose the right response, but it can be explained because this term is not often used among entrepreneurs. The Picture 4 shows the results.



Picture 4 Knowledge about eco-efficiency.

Source: The Research Data (2019).

It's worth to mention that in the result of the question about what eco-efficiency would be, it was inserted a question in the questionnaire related to understanding of cost minimization and profits increase through sale or reuse of açai berry pits. So, empirically, even without

knowing how to answer what eco-efficiency is about, 89% of respondents said that they believe it's possible to increase profits and/or reduce costs through açai berry waste sale, whereas only 11% of respondents don't believe that it's not possible. In practice, therefore, the results about an accomplishment possibility of eco-efficient waste management show that it's possible.

In the last question of this block, it was questioned about understanding of negative impacts of açai berry pits on the environment and on the social scope. In this sense, 70% responded that they believe that açai berry pits cause negative impacts on the environment and on the social scope, whereas 30% responded that they don't believe that it can happen. This is a worrying fact, considering that, according to Nogueira, Figueiredo e Muller (2005) the accumulation of açai berry waste causes a lot of impacts on the environment. Pits which are thrown in landfills by carters or those ones which are thrown in drainage waterways of the capital cause silting up and floodings (ORM, 2014; DOL, 2018), affecting a great part of the population, mostly those people who live in vulnerable areas, where vehicles transit with difficulties and they're subject to floodings.

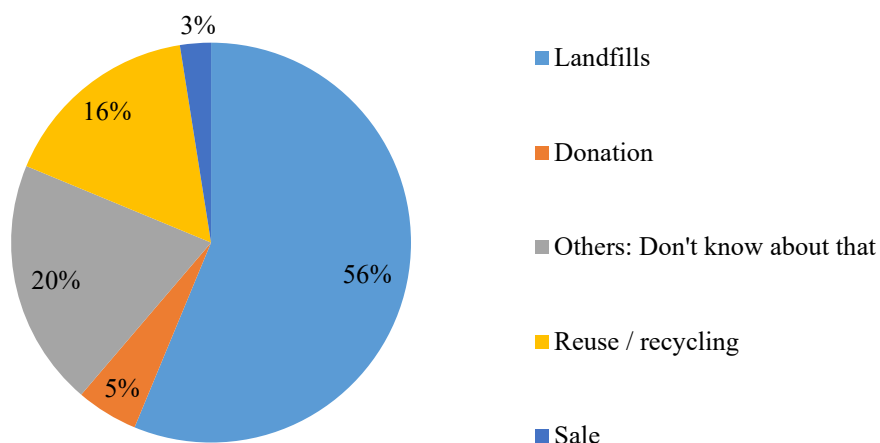
4.3 Knowledge about the National Solid Waste Policy (PNRS) and the way of wastes treatment

This block of questions aimed to analyze and know about destination that is given for wastes of açai berry production (pits), as well as verify compliance with PNRS rules and ensure a financial-accounting treatment for açai berry pits.

The first question aimed to verify the existence of a plan (simplified) for açai berry waste management according to prevision of PNRS (Brasil, 2010) for micro and small companies. So, 84% claimed not to have a management plan, whereas 16% claimed to have a plan, considering that, in the terms of article 20, item II and, in the article 42, item V of the National Solid Waste Policy (PNRS) is determined that companies are subject to elaboration of a solid waste management plan, even categorized as not dangerous, because of its nature, composition or volume (over 50 kilos per day), that they can't be equated to domestic waste by municipal government.

The questionnaire sequence aimed to analyze the understanding of the respondents about obligation for right destination of açai berry wastes (pits), which had the following alternatives: (a) the municipal city hall; (b) mine, for being the owner of açai berry sale point (generator) and (c) others. Thus, only 40% of respondents recognize that this type of responsibility belongs to the establishments. These informations are linked to the fact that açai berry entrepreneurs don't know about PNRS and they don't have a waste management plan.

Associated with waste destination, it was questioned about frequency of waste removal from points of sale. So, approximately 52% of respondents said that it's done weekly, whereas 26% said that it's done daily, and 18% responded three times a week and 4% biweekly (every fortnight), so that it had a wide variation among respondents. Added to this, the next question aimed to know about açai berry pits destination. In this issue, 56% responded that açai berry pits of their establishments are destined to landfills, whereas 16% responded that pits are reused or recycled, according to Picture 5 which shows the results. Other destinations involve donation 5%, sale 3% and others didn't know about that (20%).

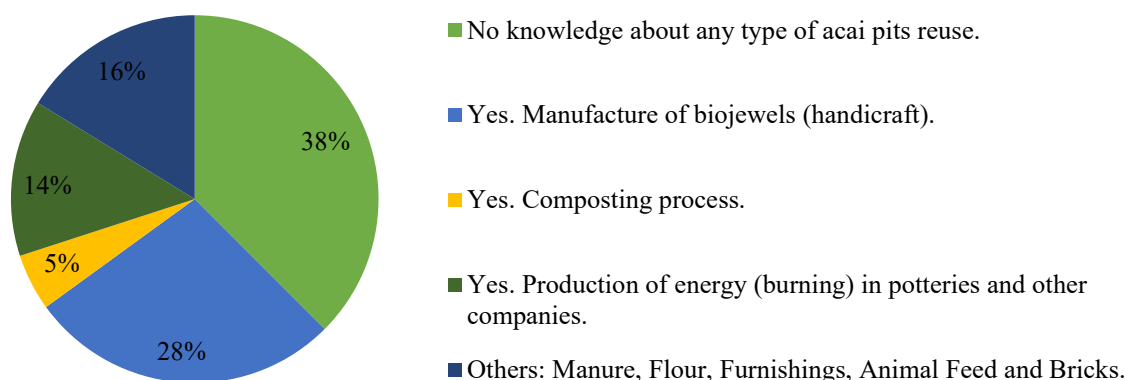


Picture 5 Ways of açai berry pits destination.

Source: The Research data (2019).

In this scenario where wastes are left in open-air areas, landfill destination seems an ecologically correct action, but certainly, among possibilities of reuse fixed in the PNRS, the landfill destination is the worst of them, considering the wastage of whole eco-efficient potential of this type of waste.

The respondents were questioned about their knowledge of reuse types of açai berry pits, in which 38% of respondents said that they don't know about açai berry pits reuse. The reuse in manufacture of biojewels (handicraft); the composting and fertilizing process of energy production (burning) in potteries were not much remembered by beaters. According to Picture 6.

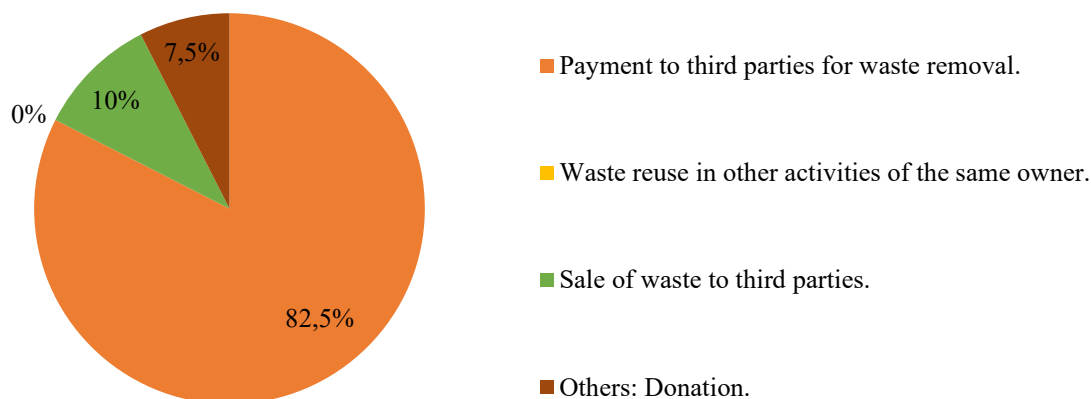


Picture 6 Knowledge about açai berry pits reuse.

Source: The Research data (2019).

At last, respondents were questioned about the financial-accounting treatment that their companies give for wastes. In this topic, 82,5% of interviewed establishments claimed that it is

made payment for waste removal, it becomes a spending. In other side, 10% of respondents said that they sell wastes, and it corresponds to an increase in revenue for enterprises. Lastly, six respondents (7,5%) claimed that they make waste donations to people interested in waste reuse. It's important to point out that none of 80 respondents has a regular writing about accounting statements. The Picture 7 shows the results of this question.



Picture 7 *Financial treatment for waste.*

Source: The Research data (2019).

So, in general, it can be said that açai entrepreneurs, traditionally called açai berry beaters, located in Metropolitan Area of Belém, in Pará, are lacking of knowledge about basic elements that are able to contribute for an eco-efficient socio-environmental management accomplishment, in which the elements of environmental protection and social respect could be associated to a financial return from açai berry waste sale, cost reduction, or at least, not to result in extra expenses for waste removal that, which are frequently thrown in landfills (while it could be much more useful if it's reused) or in public places, affecting quality of life of the population in Belém Metropolitan Region .

Açai berry beaters are still in an inferior level which could be considered satisfactory by the environmental point of view, social and accounting-financial, if they are analyzed by the view of Lavnitcki, Baum e Becegato (2018) who claim that a good level of sustainable patterns will just be really achieved when goals of solid waste reuse are effectively put into practice.

Little knowledge about environmental impacts of waste, as well as what it could be a eco-efficient management, lack of formalization, and for formalized entrepreneurs, lack of accounting advice which is able to guide them to accomplish an eco-efficient management, with their accounting-financial effects properly recognized, measured and evidenced, aspects which draw attention in this research.

5 Final Considerations

This research aimed to obtain, from establishments of açai berry sale in Metropolitan Region of Belém – Pa., what treatment has been given to açai berry wastes (açai berry pits), having as analysis parameters the accounting-financial point of view as well as the socio-environmental point of view, under optics of National Solid Waste Policy (PNRS), within an eco-efficiency context.

In this way, through responses obtained from açai enterprises Metropolitan Region of Belém – Pa., it was possible to evidence some important points: firstly the respondents have a little knowledge about socio-environmental management and socio-environmental impacts which show some awareness related to environmental practices that their enterprises need to adopt. Under a positive perspective, it is important to emphasize that many entrepreneurs recognize the negative impacts that açai berry pits cause on the environment and social environment and their reuse/recycling can bring benefits to enterprises, such as cost reduction and profit increase.

Specifically in relation to the treatment given for açai berry wastes, under physical optics of reuse, the majority of respondents said that açai berry pits from their establishments are destined to landfills, few respondents said that pits are donated or reused. When the waste treatment is analyzed under accounting-financial optics, it was verified as non-existent, which may be associated to the type of formalization (MEI) or the lack of formalization and the fact that they don't have support from experts to manage their enterprises. Therefore, if there were guidances about reuse ways, such as sale of waste or its reuse/recycling, entrepreneurs could enjoy the benefits that are come from these practices and also contribute for environmental impacts minimization, doing an eco-efficient management.

Thus, it's needed a greater engagement of açai establishments to seek for knowledge about a correct destination for açai berry pits, as well as, to have a plan of solid waste management in order to go into an eco-efficient system that will generate, not just economic benefits to enterprises, but also, the development of environmental practices in the business scope.

As suggestions for future researches, it is suggested the public policy analysis and incentives for açai berry beaters to develop actions of environmental protection within the eco-efficiency principles. New studies in socio-environmental and eco-efficiency management scope are relevant and important, due to the impact dimension that this activity imposes on society as a whole.

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