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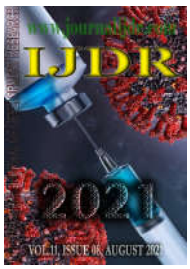

RESEARCH ARTICLE OPEN ACCESS

MULTICRITERIAL ANALYSIS OF RESEARCH ON BIOACTIVE EXTRACTS OF BURITI (MAURITIA FLEXUOSA L.) AGROINDUSTRIAL RESIDUES FOR THE VIABILITY OF INSERTION IN THE COSMETIC PRODUCTION SECTOR

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ABSTRACT

The present work evaluated scientific researches to obtain bioactive extracts of agro-industrial residues of buriti (Mauritia flexuosa L.), aiming to verify their adherence and commercial feasibility for the cosmetic sector and thus helping to prioritize alternatives for the allocation of buriti and therefore reducing investment risks. The SIMI-Biotech tool evaluated a set of environmental, economic, and social criteria, and adopted as a benchmark a company installed in the Amazon with expertise in the development and production of cosmetics from local fruits. The evaluation result reached a score of 57.2%, showing good potential to access the market. The most relevant criteria in the analysis were Technology, Culture, Consumption and Production, and Logistics. However, adjustments are still needed to be competitive in the market, such as marketing promotion based on the functional properties of food and cosmetics; participation of communities, cooperatives or small local producers as beneficiaries of buriti agro-industrial waste; and creation of stamps of origin of research linked to the university.

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INTRODUCTION

Buriti (Mauritia flexuosa) has occurrences in Brazil in the Cerrado, western Caatinga, Pantanal and Amazon biomes, as well as in neighboring countries such as Bolivia, Peru, Ecuador, Colombia, Venezuela, Trinidad and Tobago, Guyana, Suriname, and French Guiana. In the South American continent, the southern limit of distribution occurs in Mato Grosso do Sul and the Andes Mountains to the west (SAMPAIO, 2012). The fruit of buriti has antioxidants, which are beneficial compounds to health, and used in cooking in many ways, can be a good source of these substances and also other nutrients, such as carotenoids, since it has a high content of vitamin A (SOUSA *et al*., 2010). The production of buriti oils and juices generates various residues such as pulp, seeds, fibers, and pulp by-products. Buriti's beneficiary companies and communities view this waste as an environmental liability that should be appropriately allocated to avoid potential environmental and economic sanctions by the relevant agencies, as well as an operational cost to be included in the price of the products.

The main products derived from the buriti palm come from the fruit whose pulp is consumed mainly in the fresh and juice-like North and Northeast regions or can be used to make a kind of wine. Besides, the pulp still serves to obtain an edible oil used in the food and cosmetic industry. There are also records of the use of seed in animal feed, as well as the trunk and leaves used for housing construction and the manufacture of handicrafts (MELO, 2008). Buriti has high economic, social and environmental insertion and diversity of uses in the Amazon Region, as described by Lopes *et al.*(2016), Rufino *et al.* (2017), Saraiva (2009), Pinto *et al.* (2012), MAPA (2012), Vieira *et al.*(2011), and Sousa (2016). Most authors indicate that the potential for value addition and use of buriti requires the insertion of innovation in products and processes. The concept and applicability of innovation permeates various sectors of society, as presented and discussed by Schumpeter (1934), Tigre (2006), Hoff *et al*. (2010), Stefanovitz (2011), Dutta and Gurry (2012), Paixão*et al*. (2012), and Russo *et al*. (2012).

Innovation requires a connection with the principles of sustainability, especially concerning the use of Amazon resources. Sustainability aims at economic efficiency, respecting the support capacity of the environment, is an instrument of social justice, promoting social inclusion, the protection of minorities and vulnerable groups, and gender balance. Baumgarten (2008), Hansen *et al.* (2009), Barbieri *et al.* (2010), Kneipp*et al.* (2011), Kummer (2013), and Boons and Lüdeke-Freund (2013) defend one or more of the dimensions presented in sustainability. As scientific research is the primary source of knowledge for the development of products and services, as pointed out by Judice and Baêta (2005), it becomes strategic for companies to permanently monitor scientific discoveries, aiming at the development of process and product innovations (DA SILVEIRA *et al*., 2002). Nevertheless, this task is complicated, given the multiplicity of variables in the innovation process. Ipiranga and Almeida (2012) point out that just a good research result is not enough to start the technological development process; it is necessary to demonstrate the viability of turning research into innovation. The difficulty of proving the innovative potential of research is even more significant in areas such as biotechnology, where innovation is the determining factor for companies' competitiveness. This fact happens due to the instability in the market shares of industries, generated by the rapid technological evolution experienced by this type of sector (DA SILVEIRA *et al*., 2002). Thus, in order to establish a method that would enable the joint evaluation of environmental, economic and social research variables to consolidate them as a market business, Medeiros (2017) developed the Sustainable Innovation Multicriteria Index tool. Index for Assessment of Biotechnology Research - SIMI-Biotech).

MATERIALS AND METHODS

SIMI-Biotech's central proposal aligns with the OCDE in (2001) for the development of the biotechnology sector globally, as it mentions that effective technology management by biotechnology companies requires the use of tools that evaluate both economic and environmental performance of a given innovation. Complementarily, Trigueiro (2002 apud CUNHA and MELO, 2006) emphasizes that in the assessment of a given technology, together with the economic risk, a social risk must be associated with the possible impacts of the reaction of society to the products launched. Barbieri (2007) summarizes this new reality: to innovate is necessary to observe the whole and to adopt several criteria. Following the proposed steps for the application of the ANP (FORMAN and SELLY, 2001; SAATY, 2006; LEE, 2007), the index clusters the dimensions presented in the Sustainable Innovation Cube of Hansen *et al.* (2009). The first cluster is called a Goal. In the framework proposed by Hansen *et al.* (2009), this dimension analyzes the effects of innovations concerning the impacts generated on sustainability objectives.

The second cluster is the Life Cycle. This cluster has the purpose of evaluating the effects of innovations in the Objective cluster over time and space, tracking the processes and operations along a product's supply chain, increasing the focus of analysis beyond the internal organizational processes. The third cluster is called Need. The purpose of this cluster is to assess how the impact of innovation affects consumption patterns and how these patterns affect the sustainable potential of innovations.

SIMI-Biotech adopts a fourth cluster in the decision problem, entitled Alternatives. This cluster receives and evaluates research alternatives. The operationalization of SIMI-Biotech needs six postulates, namely:

Postulate 1: The Alternatives cluster will receive two surveys per assessment.

Postulate 2: Alternative A is research under development that aims to assess the potential for sustainable innovation. Alternative B is the product or technology used as a reference for a given criterion. The selection of the reference product or technology should be made by the decision-maker, considering that this is the actor in the innovation process best able to analyze the performance of a technology in the market.

Postulate 3: In judgments between criteria x criteria, the same cluster or different clusters, decision-makers signal the relative importance between a pair of criteria for the performance of the criterion under judgment.

Postulate 4: In judgments between criteria vs. alternatives, decision-makers point out how much the potential of the research under evaluation (Alternative A) approximates the performance of the benchmark product/technology (Alternative B) in the judgment under consideration.

Postulate 5: In judgments between alternatives x criteria, decision-makers point out the relative importance between a pair of criteria for the performance of research in evaluation.

Postulate 6: In clusters x clusters judgments, decision-makers point out how important the influence of the other clusters has on the performance of the cluster under judgment."

RESULTS

The evaluated researches were the ones that aimed the development of bioactive extracts from the agro-industrial residues of buriti, specifically the seed and the seed shell (endocarp), aiming at the application in the food and cosmetics industries. Therefore, the research aims to add value to a waste material generated from the processing of buriti seed and can turn it into an essential input for several other industries, as well as increase the sustainability of the buriti and product processing chain generated with the application of the extracts. The research evaluation followed the expertise of the cosmetic company, located in Manaus. It currently produces 15 different products, the main ones being: bar and liquid soaps, bushings, moisturizers, exfoliates, colonies, bath salts and ironing, flavoring and diffusers of the environment. The primary aromas and raw materials are andiroba, copaíba, murumuru, mulateiro, lemongrass, and Amazonian fruits such as açaí, buriti, and cupuaçu.

Economic effects: The economic effects generated by the use of Amazonian inputs in cosmetic products depend more on the social performance of the product than its environmental performance because the production of cosmetics generally generates little waste and customers in this segment value the product socially responsible source of inputs. In the product life cycle analysis, the Economic Effects are most affected by the operational viability of manufacturing (Production and Logistics) due to the affirmative market acceptance of the products, and the bottleneck is mainly associated with regional logistics issues. The Consumption stage also has a strong influence on the financial result, as the positive customer experience is the leading way to ensure market share in a segment with several competitors.

In the market evaluation, the decision-maker pointed out as more relevant for the economic effects the factors Technology and Culture, due to the customers of the cosmetics sector to consume, mainly, due to the benefits promised by the products. In this context, the functional aspect is the differential for product acceptance and consumption, on the other hand, aromas of Amazonian raw materials are a significant factor for income generation due to the appreciation of the origin of the product.

Environmental Effects: In the cosmetics and perfumery sector, the decision-maker considers that the environmental performance of innovation is more dependent on social performance since the main environmental impacts caused by the manufacture of cosmetics happen in the supply chains of raw materials. In the cosmetics life cycle, the Disposal stage has a strong predominance under the

Table 1. Final evaluation supervisor of scientific research to obtain bioactive extracts of buriti agro-industrial residues

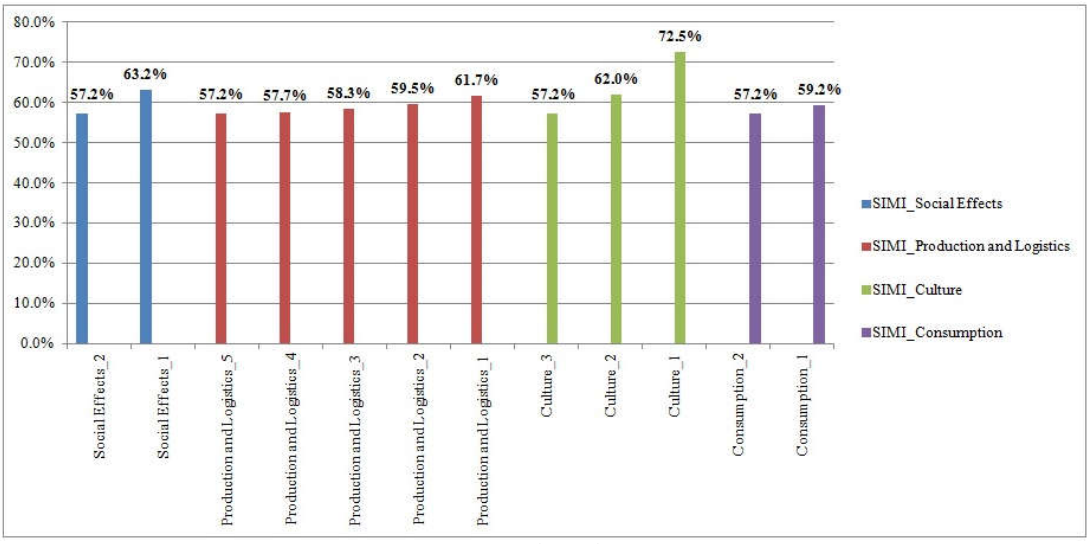
LIMIT MATRIX												
Clusters		Alternatives		Cluster Objective (Effects)			Life Cycle Cluster			Cluster Need		
		Alternative A	Alternative B	Economic	Environmental	Social	Production and Logistics	Consumption	Discard	Culture	Technology	System of use
Alternatives	Alternative A	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Alternative B	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Cluster Objective (Effects)	Economic	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
	Environmental	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Social	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Life Cycle Cluster	Environmental	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Social	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Production and Logistics	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Cluster Need	Consumption	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
	Discard	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
	Culture	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Source: The Authors

Table 2. Weight of importance by criterion x Evaluation by criterion

Criterion	Importance of Criterion	Evaluation by Criterion
Economic Effects	8.7%	2
Environmental Effects	8.8%	1
Social Effects	15.8%	2
Production and Logistics	12.9%	5
Consumption	12.7%	2
Discard	7.8%	1
Culture	12.8%	3
Technology	14.5%	1
System of use	6.1%	2

Source: The Authors



Source: The Authors

Figure 1. Simulation of the SIMI-Biotech index growth of the bioactive extract research of buriti agro-industrial residue by criterion

environmental impact, but there is active user participation in the correct disposal of product waste, especially packaging and the like. Regarding the need dimension related to the consumer market, the decision-maker emphasizes that the environmental impact depends mainly on the cultural factor, since consumers, when well educated, tend to buy products made with cleaner technologies. Next comes the System of use factor, as consumers prioritize financial products with low potential contaminants due to use.

Social effects: Social effects are more affected by environmental rather than economic effects, mainly because adverse environmental effects can impair the quality of life of the community as a result of product consumption. In the life cycle, the decision-maker cites as the most critical stage for social performance the Disposal, due to the potential negative impacts generated to the community by pollution from the improper disposal of possible waste. For market acceptance, we highlight the cultural importance that consumers of this segment

attribute to the social impact of products. However, social impacts need to be explained to the end consumer, as this can be a competitive differentiator that can even affect the final price and customer loyalty.

Production and Logistics: According to the decision-maker, the Production and Logistics criterion of innovation is equally affected by the economic and environmental effects. So the decision to manufacture and distribute a new product must be financially viable and have a minimal environmental impact. Therefore, failure to comply with these restrictions makes the implementation of innovation unwise. In the life cycle, Production and Logistics are much more affected by the characteristics desired by the customer in the Consumption phase than by the Disposal phase because the cosmetics sector traditionally has a low environmental impact. About meeting market needs, production is most affected by the system of use, followed by the technological aspect (benefits), according to the decision-maker; this is due to customer requirements and preferences that are the main factors for modifying, improving or creating new production processes.

Consumption: Regarding the goal dimension (sustainability), Consumption is most affected by social performance due to the importance of generating a sense of well-being and hygiene after the use of cosmetics. Then comes the Environmental Effects due to consumer concern about the potential environmental damage generated by using the product. Regarding the other stages of the product life cycle, Consumption is extremely more affected by Production and Logistics than by Disposal; this judgment stems from the perception that changes in the production process have a more significant potential to positively or negatively impact the experience consumption than improvements made to the disposal. In the cosmetics market, Consumption is significantly affected by the technological factor since one of the determining factors for product acceptance, and consumption is the promised benefits. Another critical factor is the System of use because the cosmetics sector invests heavily in packaging, labels, design, and usability of products.

Discard: In the cosmetics sector, the decision-maker attaches greater importance to social and environmental effects in assessing the efficiency of the Disposal phase when it comes to sustainability. The adverse social effects should be as small as possible for the direct and indirect consumers of the product when it generates waste at the end of its useful life. Usually, the Disposal phase connects to the potentially harmful environmental effects generated by the product; however, cosmetics mainly generate plastic waste that can be reused or recycled. Regarding the life cycle, the judgment pointed out the significant importance of the Consumption on the Production and Logistics stage, regarding the efficiency of disposal, since due to legal issues the disposal of waste from the production process must be adequate. While at the end of the consumption phase, the disposal is made by the consumer himself, who, in many cases, has no guidance on the correct destination of specific waste. Regarding the consumer market, the proper disposal or not depends mainly on the cultural aspect, since the decision of the correct destination is with the user of the product. The second most relevant factor is closer to the control of the manufacturing company; it is the technological factor. Selecting technologies that benefit the environment and reduce the social impact of improper disposal increases product acceptance in an increasingly environmentally conscious market.

Culture: Regarding sustainability goals, the cultural factor in the cosmetics sector is more associated with social and economic issues. Social Effects are the main facilitating arguments for product acceptance, as customers value job and income generation for local chains. The price factor of the product also significantly affects the acceptance of the product, as it is more challenging to practice higher prices in the local market, unlike what happens in other squares around the country or internationally. The Criterion Culture is most affected by the Production and Logistics and Consumption stages, which are part of the life cycle. The Production and Logistics criterion affects Culture because, in order to create a positive brand image in the market, the quality of the production process must guarantee the promised benefits. Consumption positive experience is one of the foundations for the product to acquire a significant market share and a loyal consumer audience. With the other market factors, Culture is mostly more affected by Technology compared to the System of use; this is basically because the positive image of the product and acceptance depend on the benefit that the cosmetic can generate.

Technology: Regarding sustainability, Technology's performance depends mainly on economic viability; that is, embedding an innovative benefit requires price adjustment to make the product accessible to its intended niche. Another essential aspect of Technology acceptance is the possible associated social impacts that may reduce or increase the demand for the developed cosmetic. The most important life cycle stage for Technology acceptance is Consumption because, at this stage, the consumer evaluates the positive and negative effects that determine the success or failure of an innovative cosmetic. The second most crucial step is the Production and Logistics that contribute to ensuring the quality and effectiveness of the promised benefits. Regarding other market variables, Technology is hugely influenced more by the Culture factor than by the System of Use. The benefit generated by Technology can be better accepted if the local culture is more likely to validate this information. For example, making a cosmetic with a raw material that traditional knowledge already uses facilitates product acceptance.

System of use: Concerning the sustainability objectives, the criterion of use system is more affected by the social issue, since the purpose of packaging and consumption mechanism is the figure of the customer. Environmental responsibility is also valued because products that minimize damage to the environment have a strategic advantage over their competitors. Regarding the life cycle, the Usage System is significantly more production-dependent as any change to improve usability depends on production capacity and design for manufacturing. Another critical factor is the Consumption because it is the demands and preferences of the customers that guide the modifications. To the other factors of the consumer market, the system of use depends mainly on the characteristics of the technology embedded in the innovation, being the secondary cultural factor in the technical aspect.

Innovations in the cosmetics sector: Innovation in the cosmetics sector should preferably outperform some of the criteria already analyzed. Regarding the sustainability criteria, the decision-maker attributed greater importance to the economic and social criteria, as these are more determinant for the acceptance of the product, that is, factors such as product price and raw material from local producers are differential for the success of the innovation. In life cycle analysis, a cosmetic innovation should prioritize the Consumer phase, as the product will only be commercially successful if the user experience is positive and meets customer expectations. We also highlight the significant and almost equivalent importance of the Production and Logistics and Disposal stages, which demonstrates the need for a feasibility analysis from the acquisition of raw materials to the correct disposal of possible residues. In market analysis, an innovation for the cosmetic sector needs to prioritize the technological impact, that is, the benefit that the product will bring to the consumer. The cultural factor is commercially relevant, that is, it is pertinent to develop strategies to increase consumer empathy with products with characteristics: natural, handcrafted, Amazonian raw materials, produced in the Amazon, among other facilitating aspects.

Performance of research evaluated on SIMI-Biotech criteria: Scientific research on the production of bioactive extracts of buriti agro-industrial residues had their potential performance evaluated considering each of the criteria present in the SIMI-Biotech index. In the criterion Economic effects, the research obtained a score 2, that is, very close to the ideal, since it has the potential to increase the added value of the product and consequently the monetary value of the product, as well as contributing to the increase in sales volume. However, due to the lack of sufficient information to estimate production costs more accurately, it is not possible to state that the financial results will be better than those obtained by-products already

marketed. In the criterion Environmental effects, the research obtained a score of 1 due to being an alternative to minimize environmental impacts generated by the agro-industrial residues of buriti. This score also contributes to the fact that cosmetic production has a high rate of utilization of raw materials and generates little waste. In the criterion Social effects, the surveys were evaluated with score 2, because they have the potential to generate employment and income for buriti producing communities in several municipalities of the states of the Amazon region. The first criterion of the life cycle is Production and Logistics, with a score of 5 for the researches evaluated. This evaluation is mainly due to the known production difficulties in the interior municipalities of the Amazon region, which include challenges of a reliable supply of energy, water. , communication services, access to production inputs, availability of skilled labor, and precarious public services. However, according to the decision-maker, the main bottlenecks are the deficiencies of Amazonian logistics that directly impact the operational cost for production flow.

Regarding the Consumption criterion, grade 2 is satisfactory and points to a significant impact on the end user's consumption experience by adding functional properties that contribute to product efficiency and consequent consumer satisfaction. However, tests, formulations, and prototypes are required to convert extracts produced into shelf products. In the Disposal phase, 1 was the evaluation of scientific research, that is, with optimal performance in the criterion. This assessment is due to the low generation of waste in the manufacturing process. The fact that the origin of the extracts is from agro-industrial waste does not increase the toxicity of the final product, and the waste generated at the end of consumption is the same as the products that are already part of the evaluating company's line, which is usually plastic, paper, and other packing materials. The Criterion Culture was rated with score three because there is still some resistance in the local market with cosmetic products made in the region. However, scientific research has several characteristics that can enhance the acceptance of products derived from the developed extracts, such as the raw material the buriti fruit is quite popular; the use of buriti agro-industrial waste has sustainable appeal; the possibility of manufacturing a product with less synthetic substances; craft production; the research produced by an educational and research institution in the region. The Technology criterion obtained the highest score since the proof of functional effects in cosmetic products is a tremendous competitive advantage against the numerous competitors in the sector. The benefits of extracts could range from the use of less synthetic substances to social technologies that would increase the added value of the product and its supply chain, which positively impacts its marketing performance. The criterion System of Use obtained a score of 2, very close to ideal since the adoption of buriti agro-industrial waste extracts would not impact significant changes in the physical characteristics of the derived products. However, as it would be a product with different properties than conventional products, it would be necessary to adapt components such as design, size, packaging, labels to value innovation. The company translated the judgments into a matrix of importance and performance weights. From the mass of data obtained, it was possible to use the ANP algorithm, the mathematical basis of the SIMI-Biotech method, to synthesize the innovative sustainable potential of research on bioactive extracts of buriti agro-industrial waste. The normalization of values in the line “research A” in the matrix supervisor of Table 1 generates the SIMI-Biotech index.

SIMI-Biotech Index: Scientific research for the production of bioactive extracts of buriti agro-industrial waste obtained a rating of 57.2% concerning the benchmarking used by the decision-maker, which can be considered high value, considering that in only three criteria the research obtained the maximum score.

DISCUSSION

Table 2 indicates that two of the four most important criteria - Production and Logistics and Culture - obtained the lowest ratings, 5 and 3, respectively. In the criteria, Economic Effects, Environmental Effects, Social Effects, Consumption, Disposal, Technology and System of use, which concentrates 74.4% of the importance for innovative sustainable performance, the research obtained a positive score, i.e., 1 or 2. Thus, the value of the SIMI-Biotech index shows that the bottlenecks for applying research in the cosmetics segment center on the areas of Production and Logistics and Culture (Marketing). These areas concentrate 25.6% of the global importance and have a significant margin of improvement in the opinion of the evaluating company. The main factors for selecting Technologies for application in cosmetic products connect to the needs and desires of consumers (Consumption criterion), which justifies the grouping of criteria. The Consumption phase is still influenced by cultural and marketing issues, especially about products originating from Amazonian raw materials, such as buriti. Moreover, finally, Consumption is significantly affected by the final quality of the product, obtained through the efficiency of the production processes.
Figure 1 would show a simulation of SIMI-Biotech index growth if performance on critical criteria were individually improved. Note that the Culture criterion has the highest growth margin (57.2% to 72.5%), followed by the Social Effects criterion (57.2% to 63.2%). Figure 1 shows that although the Production and Logistics criterion is the most outdated (score 5) and has significant importance (12.9%), the criteria that most individually impact on the innovative sustainable potential of the evaluated researches are those focused on human aspects such as Social Effects, Culture, and Consumption. The Environmental Effects, Disposal, and Technology criteria presented performance equal or superior to benchmarking; this fact is due to the low volume of waste generated in the production of cosmetics, especially in the evaluating company. The Technology criterion is affected by the institutional origin of the research. The fact that the researches evaluated in a federal university positively recognized in the local market are a competitive differential, in marketing terms, such advantage the current products do not have, nor the competitors.

The simulation shows the response sensitivity of the SIMI-Biotech index when there is variation in the scores obtained in the adopted criteria. It is essential to highlight the growth of the index with the improvement of the Social Effects criterion, which, in this case, contemplates both the development of cosmetic products well accepted by end consumers and the promotion of marketing based on the improvement of the quality of life of people involved in the production chain from buriti. Finally, the consistent growth of the innovative sustainable potential of the evaluated research depends on technical studies focused on productive technologies that allow the production of buriti agro-industrial waste extracts in producing locations, considering the resource constraints, the demand for quality of the cosmetic industry and the logistical difficulties inherent in the Amazon region. In summary, the suggested actions for further research to obtain bioactive extracts of buriti agro-industrial residues based on the data obtained for both sector actors and researchers can be summarized as follows:

- Commercial exploitation of the institutional origin (UFAM) of scientific research as a strategy to increase cultural acceptance;
- Commercial exploitation of social benefits generated with conscious consumption;
- Preparation of tests and prototypes of cosmetic products from the application of the obtained extracts. This strategy can be carried out in partnership with companies in the segment;
- Construction of a model unit for the processing of agro-industrial waste from Buriti, aiming at the development of productive technologies and the attraction of public and private investments;

CONCLUSION

Thus, the use of SIMI-Biotech in the evaluation of bioactive extracts of buriti (Mauritia flexuosa) agro-industrial residues for the production of cosmetics such as soaps and moisturizers, replacing the

extracts currently used, proved to be a powerful tool to support the aggregation process of value to the product that has a strong relationship with the extractive communities. Scientific research to obtain bioactive extracts of buriti agro-industrial waste obtained a score of 57.2%, representing hopeful applicability for the generation of industrializing products and insertion in the consumer market. The most relevant criteria were Technology, Culture, Consumption and Production, and Logistics. The results showed that scientific research has significant innovative sustainable potential, but still needs to be adjusted to achieve appropriate production scale and market responsiveness. The first suggestions for enhancing the innovative potential for buriti agro-industrial waste utilization research are marketing promotion based on the functional properties of food and cosmetics; participation of communities, cooperatives or small local producers as beneficiaries of buriti agro-industrial waste; and creation of stamp of origin linked to the university of research execution.

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