RELISE

ECODESIGN PRACTICES IN COASTAL RESTAURANTS: A CASE STUDY ON SUSTAINABILITY AND ENVIRONMENTAL IMPACTS[1]

PRÁTICAS DE ECODESIGN EM RESTAURANTES LITORÂNEOS: UM ESTUDO DE CASO SOBRE SUSTENTABILIDADE E IMPACTOS AMBIENTAIS

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ABSTRACT

This study proposes the implementation of EcoDesign practices in a coastal restaurant in Maracajaú, Rio Grande do Norte, an environmental protection area, to promote sustainability and reduce operational environmental impacts. A literature review provided the theoretical foundation, followed by a case study using a qualitative approach with semi-structured interviews and structured observations to assess existing sustainable practices. Identified areas for improvement were addressed through the PDCA cycle, structuring an action plan with specific enhancements and a continuous monitoring process. The results indicate that, despite financial and structural challenges, adopting EcoDesign practices is feasible and beneficial through measures such as rainwater harvesting, composting, green marketing strategies, and organic garden cultivation. The study adapts EcoDesign principles to the restaurant sector in protected areas, highlighting the importance of nature conservation for business sustainability and expanding the understanding of sustainable practices in structurally limited regions. This research contributes to local appreciation, cost reduction, sustainable tourism, and regional preservation, offering a replicable planning and implementation model for businesses seeking to align sustainability, economic viability, and competitiveness.

Keywords: ecodesign, sustainability, sustainable practices, sustainable development, circular economy, restaurants.

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RESUMO

O presente trabalho objetiva propor a implementação de práticas de EcoDesign em um restaurante litorâneo, visando promover a sustentabilidade e reduzir os impactos ambientais de suas operações, uma vez que está localizado em Maracajau no litoral do Rio Grande do Norte, uma área de proteção ambiental. Inicialmente, realizou-se um levantamento bibliográfico para fundamentar teoricamente a pesquisa. Em seguida, através da metodologia de estudo de caso, foi utilizada uma abordagem qualitativa, com entrevista semiestruturada e observação estruturada, que permitiram avaliar as práticas sustentáveis já existentes. Posteriormente, foram identificadas as áreas que necessitavam de melhorias e, com base nas informações coletadas, foi aplicado o ciclo PDCA para estruturar um plano de ação, propondo melhorias específicas e um processo contínuo de monitoramento dessas práticas. Os resultados indicam que, apesar dos desafios financeiros e estruturais enfrentados pelo Restaurante, a adoção de práticas de EcoDesign é viável e benéfica, mediante medidas como: captação de água da chuva, implementação de práticas de compostagem, estratégias de marketing verde e cultivo de horta orgânica. O estudo aplica o conceito de EcoDesign ao segmento de restaurantes localizados em áreas de proteção ambiental, adaptando seus princípios aos negócios dependentes da preservação da natureza para sustentar suas operações. Além disso, amplia o entendimento de práticas sustentáveis em regiões com limitações estruturais. O trabalho contribui para a valorização local, redução de custos, turismo sustentável e preservação da região na qual o restaurante está inserido. Essas iniciativas oferecem um modelo replicável de planejamento e implementação para empresas que buscam alinhar sustentabilidade, viabilidade econômica e competitividade.

Palavras-chave: ecodesign, sustentabilidade, práticas sustentáveis, desenvolvimento sustentável, economia circular, restaurantes.

INTRODUCTION

The Maracajaú Beach, known for its biodiversity and natural beauty, stands out for its coral reefs and favorable conditions for tourism and diving activities (Silva; Hofstaetter; Alcobia, 2018; Silva; Fujii; Marinho-Soriano, 2012); regions with these characteristics can be enhanced through management models and public policies inspired by EcoDesign (Kardarsh et al., 2024; Silva; Maciel; Costa, 2018).

EcoDesign, defined as the development of products and services that minimize environmental impacts while meeting social needs, emerges as a solution for ecological balance (Charter; Tischne, 2001) and to meet consumers who increasingly value sustainability in food, seeking alternatives that reduce environmental impacts, especially in transportation and commercialization processes (Fabrim; Conto, 2020; MacDonald; She, 2015). However, about 30% of the world's food production is still wasted throughout the production cycle (Maia, 2018), making the adoption of sustainable practices essential. In this context, some consumers tend to prioritize companies committed to sustainability (Padilha et al., 2024; MacDonald; She, 2015).

The Sustainability Tripod model (Elkington, 1997) highlights the importance of considering the economic, environmental, and social impacts of organizations. In this context, Costa et al. (2020) point out that 80% of a product's environmental impacts are defined in its initial development phases, making it essential to adopt sustainable practices from the beginning. In the food sector, this concern is reflected in the critical issue of food waste, as pointed out by Jahno and Strasburg (2017), who highlight waste production as an inherent challenge to the activity. Given this scenario, both the Brazilian Support Service for Micro and Small Enterprises (SEBRAE, 2023, 2024) as well as academics (Madanaguli et al., 2022, Tasca et al. 2022) propose strategies to reduce waste and minimize environmental impacts in restaurants, including the conscious use of water and energy, preference for local suppliers, and the adoption of reuse and recycling practices.

In this context, EcoDesign can represent a competitive differential by aligning restaurants with consumer expectations and contributing to ecological balance (Madanaguli et al., 2022, Tasca et al. 2022; Fabrim; Conto, 2020). As Borchardt et al. (2008, p. 343) state, “sustainability is a goal to be achieved, not a direction to follow.” Thus, this study proposes EcoDesign practices to enhance

sustainability and reduce the environmental impacts of the operations of a restaurant in Maracajaú, through the analysis of current practices, proposition of improvements, and monitoring of the implementation of sustainable solutions.

THEORETICAL FRAMEWORK

Design encompasses the entire life cycle of a product, from its conception to disposal (Naime; Ashton; Hupffer, 2012). EcoDesign, in turn, integrates ecological principles into design, prioritizing sustainability in all stages of the production process (Kardarsh et al., 2024; Costa et al., 2020; Pazmino, 2007). Its objective is to develop sustainable and competitive products, minimizing environmental impacts and promoting the circular economy (Costa et al., 2020; MacDonald; She, 2015). Thus, EcoDesign allows for cost reduction, generation of competitive advantages, and resource optimization (Kardarsh et al., 2024; Vilaça et al., 2010).

The design phase is crucial for the cost, functionality, and environmental impact of the product, encompassing everything from raw material extraction to its final disposal (Kardarsh et al., 2024; Junior; Lima, 2015). The application of EcoDesign in companies is essential for environmental responsibility throughout the product's life cycle, contributing to innovation, cost reduction, and the development of new markets (Costa et al., 2020; Pigosso, 2014).

Among the benefits of EcoDesign are the optimization of energy and water consumption, waste reduction, and improvement in consumer relations (Costa; Mendonça, 2022). However, its implementation faces challenges such as lack of strategic commitment, inadequate structure, high initial costs, and scarcity of specialized labor (Costa et al., 2020; Luiz et al., 2017).

In the food industry, restaurants have significant environmental impact due to gas emissions, resource waste, and waste generation (Madanaguli et al., 2022, Tasca et al. 2022; Mohammad; Abouelezz, 2020). The adoption of

recycling programs and good sustainable practices improves their environmental responsibility and attracts consumers (Fabrim; Conto, 2020). According to NBR 15.401 (ABNT, 2014), sustainable restaurants should prioritize fresh food, organic inputs, and regional ingredients, preserving local fauna and flora.

Food waste reduction is a crucial factor for sustainability in the sector. Efficient planning can minimize waste generation and environmental impacts (Madanaguli et al., 2022; Fabri; Conto, 2020). Alternatives such as rainwater reuse systems are also recommended for conserving water resources (Tugoz et al., 2017).

Sustainability is also reflected in green marketing, which strengthens profitability and corporate image (Kardarsh et al., 2024; Costa et al., 2020). Restaurants that adopt sustainable practices achieve greater customer satisfaction, reduce costs, and stand out in the market (Padilha et al., 2024; Madanaguli et al., 2022). Sustainable companies increase their stability and crisis prevention (Costa et al., 2020; Claro; Claro, 2014), ensuring a competitive differential.

Food waste represents 9% of the global ecological footprint, making it crucial for restaurants to adopt sustainable measures to reduce waste and gas emissions (Mannis; Bragança; Noppeney, 2024). Implementing EcoDesign allows resource optimization, cost reduction, and strengthening customer relationships, becoming a strategic factor for the food sector (Kardarsh et al., 2024).

The implementation of EcoDesign in the restaurant sector can be facilitated through environmental certifications, such as the Green Seal and ISO 14001, which validate sustainable practices and encourage the adoption of environmentally responsible processes (Silva & Almeida, 2021). These certifications help ensure compliance with environmental regulations, increasing

the credibility and competitiveness of companies in the market (Madanaguli et al., 2022, Tasca et al. 2022).

Furthermore, the use of biodegradable and compostable packaging significantly reduces the environmental impact of solid waste generated by restaurants (Mohammad; Abouelezz 2020). Replacing disposable plastics with sustainable materials such as recycled paper, bamboo, and bioplastics contributes to the circular economy and pollution reduction (Tugoz et al., 2017).

The digitization of processes also plays a fundamental role in restaurant sustainability. The adoption of digital menus, automated inventory management, and waste control software are strategies that minimize resource consumption and optimize operational efficiency (Padilha et al., 2024). Technologies such as artificial intelligence and IoT (Internet of Things) enable predictive analysis of consumption, reducing losses and improving input management (Kardarsh et al., 2024; Claro; Claro, 2014).

On the social front, EcoDesign also promotes positive impact by encouraging conscious consumption and environmental education for customers and employees. Awareness programs about food waste, correct waste separation, and valuing local production strengthen sustainable engagement and create an organizational culture focused on socio-environmental responsibility (Silva; Maciel; Costa, 2018).

Thus, implementing EcoDesign in restaurants not only reduces environmental impacts but also drives innovation, improves the company's reputation, and generates economic and social benefits. By integrating sustainable practices into their operations, restaurants can strategically position themselves in the market and meet the growing demand for ecological and responsible solutions (Kardarsh et al., 2024; Madanaguli et al., 2022, Tasca et al. 2022).

Chart 1 synthesizes the main proposed changes based on the theoretical framework on EcoDesign and sustainability, highlighting the focus areas, suggested actions, and possible benefits of implementation in the restaurant.

The proposed changes encompass waste and process management, efficient use of natural resources, supply chain, and staff training, resulting in benefits such as waste reduction, operational cost optimization, and strengthening of the establishment's image. Furthermore, the inclusion of social and environmental responsibility practices reinforces the importance of community engagement and adopting sustainable positioning as a competitive differential in the sector, integrating different theoretical perspectives (Madanaguli et al., 2022).

Chart 1: Summary of EcoDesign for Restaurant

FOCUS AREA	CHANGES IN SERVICE AND PRODUCT DESIGN	POSSIBLE BENEFITS
Waste management	Implement recycling programs for separation and disposal of organic and inorganic waste.	Reduction of environmental impact, lower emissions of polluting gases, generation of natural fertilizers.
	Send organic waste for composting.	
	Properly dispose of cooking oil.	
	Conduct selective collection of recyclable waste	
	Replace plastics with biodegradable or recyclable materials.	
	Offer biodegradable packaging for customer leftovers.	
	Make artisanal products from food leftovers.	
Process management	Forecast demand to avoid raw material waste.	Reduction of food waste, cost savings in production, full use of food, efficiency in resource use.
	Implement PVPS system for stock control and storage.	
	Standardize and portion dishes.	
Natural resource management	Monitor and control water and energy consumption.	Reduction of operational costs, lower environmental impact, resource optimization, sustainability in operations.
	Use renewable energy sources.	
	Adhere to water capture and reuse systems.	
	Reuse water for watering the grass.	
	Save water in cleaning the building and food.	
Supply chain management	Choose local suppliers.	Stimulation of the local economy, lower cost and pollution from transportation, fresh and quality food, ecological differential.
	Cultivate an organic garden.	
People management	Train the team to minimize waste when cooking and preparing food.	Greater team engagement, reduced waste, increased efficiency, operational savings.
	Train the team on reducing water and energy waste.	
Social and environmental responsibility	Contribute to community development and nature conservation.	Strengthening the restaurant's image, positive environmental contribution, engagement with the community.
	Establish collaborative programs with other local restaurants.	
	Support and participate in environmental and social events.	
Sustainable strategy and positioning	Invest in Green Marketing.	Attraction of new audiences, customer loyalty, strengthening of partnerships. |

Source: Elaborated by authors.

METHODOLOGY

This case study investigates the sustainable practices of a coastal restaurant in Maracajaú/RN, through a qualitative and descriptive approach (Costa et al., 2020; Creswell, 2010). The research analyzes the implementation of EcoDesign in the establishment, identifying challenges, opportunities, and proposing improvements. Focusing on operations, from resource management to service, the study considers environmental, economic, and social impacts, highlighting the interest of the owners and customers in adopting ecological measures.

Data collection and analysis

The research was conducted in complementary stages. Initially, a literature review was performed to theoretically support EcoDesign and its practices in restaurants. Subsequently, the field research collected primary data through semi-structured interviews, structured observation, and document analysis (Creswell, 2010).

Based on the data collected, the PDCA methodology was employed, which guides continuous improvement through the stages Plan (P), Do (D), Check (C), and Act (A) (Santos; Filho, 2024; Pereira; Soares, 2016). This model directed the proposal of EcoDesign practices, with corrective measures and monitoring mechanisms based on the literature on the subject.

The data obtained from the interviews were triangulated with information from the literature review and structured observation. This approach allowed for a detailed analysis of the restaurant’s sustainability policy and the formulation of recommendations for the implementation and monitoring of new practices. Chart 2 synthesizes the collected data, highlighting its relevance for the analysis and identification of challenges and opportunities in the adoption of EcoDesign.

Chart 2: Summary of Data and Collection Methods

DATE	RELEVANCE	COLLECTION METHOD
Current sustainable practices	Identify and evaluate ecological actions already implemented.	Interview and structured observation.
Sustainability challenges	Understand operational and cost limitations.	Interview
Improvement opportunities	Identify potential areas for EcoDesign practices.	Structured observation, literature review, and interview.
Customer profile	Analyze customer behavior.	Structured observation and interview.
Operational costs	Understand the main costs.	Interview
Processes with the greatest environmental impact	Identify areas that require greater attention.	Structured observation and interview.
Use of technologies that reduce environmental impact	Investigate infrastructure.	Structured observation and interview.
Use of natural resources	Diagnose consumption.	Structured observation and interview.
Collective actions with other businesses	Explore opportunities for local partnerships.	Interview
Waste management and disposal	Identify disposal failures.	Structured observation and interview.
Stock management and input storage	Identify waste and failures in stock management.	Structured observation and interview.
Areas for EcoDesign implementation	Identify priority areas for implementation.	Structured observation and interview.

Source: Elaborated by author.

Through this research, the aim is to contribute a replicable model for restaurants interested in integrating sustainability principles into their operations, promoting conscious tourism and environmental preservation.

Company description

Maracajaú, known as the “Brazilian Caribbean,” stands out for tourism, driven by its crystal-clear waters and coral reefs. The local cuisine, based on seafood, complements outdoor activities, reinforcing the region’s tourist appeal (Silva; Fujii; Marinho-Soriano, 2012). The implementation of sustainable practices in the gastronomic sector can, therefore, generate positive economic and environmental impacts (Madanaguli et al., 2022).

The restaurant studied is a family business founded in 2001, serving national and international tourists seeking authentic experiences in contact with nature and local culture. It is notable for its menu specialized in fish and seafood and its privileged location with a view of the northern coast of the state. Besides gastronomy, it offers quad bike and boat tours for diving, as well as leisure facilities with a spa, pool with a swim-up bar, variety store, and beach tennis courts.

The management is conducted by a team consisting of the owner, administrative partner, director, manager, and 23 employees. Tax-wise, it falls under the Simples Nacional regime.

Seasonality is a determining factor for the company, with high demand between November and February. During the low season, in June, operations are impacted by the temporary closure of boat tours due to environmental legislation. On average, the restaurant serves 1,900 customers per month in the high season and 1,100 in the other months.

The main operational costs include maintenance of facilities and boats, payroll, and supply replacement. Business challenges involve attracting enough customers to cover costs and ensure financial return, as well as maintaining quality standards in service. In terms of sustainability, the company is committed to environmental preservation, promoting awareness among its employees and participating in coral reef conservation projects.

RESULTS AND DISCUSSION

Direct observation identified sustainable practices, such as the use of natural lighting and ventilation, optimized by the physical structure, and the use of solar panels for energy generation. However, practices such as irrigation with hoses, use of plastic bottles, and plastic bags for portioning food represent negative environmental impacts. The absence of proper separation of recyclable

waste contrasts with the planned placement of trash bins, indicating concern with waste management in the environmental preservation area where the restaurant is located.

Food management is efficient, with no significant leftovers on customers' tables, reflecting waste control. However, challenges persist in the separation and proper disposal of solid waste. The analysis of the semi-structured interview revealed that managers consider waste generation the main environmental impact, aggravated by high costs of sustainable packaging and the mandatory use of seasoning sachets imposed by health surveillance. The absence of selective waste collection in the region makes correct disposal of recyclables and cooking oils unfeasible, hindering the hiring of private services due to costs and distances.

Despite these limitations, the restaurant adopts good input management practices. High turnover avoids waste due to expiration, aided by proper storage and the FIFO (First In, First Out) system. The use of technical sheets standardizes food preparation, optimizing inputs and reducing operational costs. The partnership with local suppliers strengthens the regional economy and reduces logistical impacts.

The restaurant does not adopt composting or green marketing strategies. However, the solar panels guarantee energy self-sufficiency and surplus. The use of hoses for irrigation and cleaning, without monitoring water waste, points to opportunities for improvement in water management. Cleaning of food and dishes with machines is a positive practice, reducing waste.

Environmental awareness is promoted by training employees, enabling them to guide customers about the impacts of plastic waste, especially in marine ecosystems. In addition, participation in ASSEMTURM reinforces the commitment to sustainable tourism and environmental preservation.

Managers see water management as a viable area for implementing EcoDesign practices, suggesting waste monitoring and rainwater harvesting. They also consider cultivating an organic garden as a strategy to reduce environmental impacts of input transportation and operational costs.

The main barrier to expanding sustainable practices is the inexistence of selective waste collection in the region, making proper disposal of recyclable waste difficult. This structural obstacle significantly limits the restaurant's environmental management in the short term.

The analysis of current practices, challenges, and opportunities suggests that the restaurant is well positioned for sustainability advances. Strategies focused on waste management, optimization of natural resources, and green marketing can consolidate its position as a reference in socio-environmental responsibility. Chart 3 synthesizes sustainable practices and identified gaps, categorized into key dimensions: waste management, processes, natural resources, supply chain, people, socio-environmental responsibility, and sustainable strategy.

The restaurant shows an initial commitment to sustainability, adopting practices aligned with EcoDesign. Noteworthy are the generation of surplus solar energy, natural lighting and ventilation, as well as efficient management of inputs and food. Waste control is favored by the use of technical sheets, dish standardization, and FIFO system, contributing to input optimization and mitigation of environmental impacts.

Chart 3: Analysis of the restaurant's focus areas

FOCUS AREA	OBSERVED PRACTICE	ANALYSIS
Waste management	Planned use of trash bins.	Effort to keep the environment clean and prevent pollution in the environmental protection area.
	Use of plastic water bottles and condiment sachets.	High waste generation due to financial and sanitary restrictions.
	Absence of selective collection.	Lack of a proper system for separation and disposal of recyclable waste.
	Absence of composting practices.	No practices for organic waste reuse.
Process management	FIFO system for stock control.	Efficient product control, avoiding waste and optimizing inputs.
	Standardization of dishes with technical sheets.	Aims to reduce waste and operational costs.
Natural resource management	Use of energy generation panels.	Ensures the restaurant's energy self-sufficiency and clean energy production.
	Irrigation of grass and building cleaning with hoses.	Water waste due to lack of monitoring and control.
	Cleaning of food and dishes using machines.	Reduces waste related to manual washing.
	Natural lighting and ventilation.	Saves energy resources.
Supply chain management	Partnerships with local suppliers.	Use of fresh food, reduced logistical resources, and support for the regional economy.
	Absence of an organic garden.	The restaurant does not cultivate its own garden.
People management	Environmental awareness training.	Guidance to customers about environmental impacts.
Social and environmental responsibility	Participation in ASSEMTURM.	Integration in environmental protection initiatives.
Sustainable strategy and positioning	Absence of green marketing practices.	No strategies to promote sustainable practices.

Source: Elaborated by author.

The partnership with family farming suppliers reduces logistical impacts and strengthens the regional economy. Additionally, the staff receives environmental training, reinforcing ecological protection and local development.

The adopted practices reflect concepts discussed in the literature, such as food management (Fabrim; Conto, 2020), use of family farming inputs

(SEBRAE, 2023), and good practices for food safety, according to NBR 15.401 (ABNT, 2014).

Chart 4 synthesizes the restaurant's sustainable practices, highlighting efforts in waste management, operational efficiency, sustainable use of natural resources, supply chain, training, and socio-environmental responsibility. The absence of strategies for sustainable positioning indicates a possible area for development.

Chart 4: Analysis of the sustainable practices currently adopted by the restaurant

FOCUS AREA	ADOPTED SUSTAINABLE PRACTICE
Waste management	Distribution of trash bins to avoid waste on the ground and in the environmental protection area.
Process management	Use of the FIFO system for proper storage of inputs and waste reduction.
Natural resource management	Use of solar panels for clean energy generation.
Supply chain management	Standardization of dishes and input control.
People management	Employee training to guide customers about the environmental impacts caused by plastic waste.
Social and environmental responsibility	Partnership with local suppliers from the family farming plan.
Sustainable strategy and positioning	No current practices recognized.

Source: Elaborated by author.

The analysis highlights the search for a balance between economic efficiency and environmental responsibility. The use of available resources minimizes costs, reduces negative impacts, and promotes sustainability. However, challenges persist, such as dependence on plastic packaging due to sanitary requirements and high costs of sustainable alternatives (Costa et al., 2020). Excessive water use in cleaning and irrigation also represents a barrier to optimizing natural resources, highlighting the need for more effective water management strategies.

Chart 5 synthesizes the comparison between the practices adopted by the restaurant and the bibliographic recommendations, showing that structural and financial challenges still limit the implementation of more effective

environmental solutions, such as selective waste collection, sustainable water resource management, and green marketing.

Chart 5: Comparative relation of difficulties encountered in the restaurant and in the literature

DIFFICULTY ENCOUNTERED IN THE RESTAURANT	DIFFICULTY ADDRESSED IN THE LITERATURE	COMPARISON
Nonexistence of selective collection in the region and high costs to hire specialized companies.	Lack of proper structure and high costs hinder the implementation of sustainable practices (Pereira; Bezerra, 2021; Costa et al., 2020).	Both show that the absence of local infrastructure and high costs are significant barriers.
Use of plastic bottles due to the high cost of more sustainable options.	The implementation of sustainable practices is considered costly compared to traditional methods (Costa et al., 2020).	Both show that high costs are a significant barrier.
Lack of monitoring and inefficient water use, such as irrigation of grass and building cleaning.	Lack of knowledge of practices is an obstacle related to their adoption (Pereira; Bezerra, 2021).	The literature emphasizes that lack of knowledge is an obstacle, as the restaurant lacks water resource practices and therefore does not know how to implement them.
Lack of green marketing to highlight existing sustainable practices.		The literature emphasizes that lack of knowledge of practices is an obstacle, as the restaurant lacks green marketing strategies for this reason.
Absence of composting for organic waste.	Lack of proper structure and knowledge of practices is an obstacle related to their adoption (Pereira; Bezerra, 2021; Luiz et al., 2017).	The literature emphasizes that lack of knowledge of practices is an obstacle, as the restaurant lacks composting practices because it does not know how to implement them. |

Source: Elaborated by author.

Based on the study of current practices, it is possible to identify necessary improvements and suggest strategies for their implementation and enhancement. Since the problems in the restaurant's current actions have already been identified, some improvement proposals are suggested according to the PDCA cycle. The use of this cycle aims for continuous process improvement through planning (P) action plans and goals to be achieved,

executing (D) them, followed by monitoring (C) and corrective actions (A) (Santos; Filho, 2024; Pereira; Soares, 2016).

Planning (PLAN) is fundamental to identifying and structuring actions aimed at solving problems and improving processes. Thus, an analysis of existing practices was carried out, where inefficient use of water resources, the lack of composting practices, organic gardening, and green marketing were highlighted as points needing improvement. Based on this, action plans and objectives were suggested to solve these problems, promote sustainability, optimize resources, and reduce operational costs, aligning the restaurant's operations with sustainable and economic principles.

Chart 6: Planning (P) of PDCA cycle

PLAN — WHAT HAS TO BE DONE?		
PROBLEM	ACTION PLAN	OBJECTIVE
Use of hose to water the grass	Implement rainwater harvesting systems to water the grass.	Reduce waste of running water in grass irrigation.
Use of hose to clean the building	Use buckets of water to clean the building.	Reduce waste of running water in building cleaning.
Nonexistent water monitoring and control	Implement actions for monitoring and controlling water use.	Monitor and control water use to reduce waste.
Does not adopt green marketing	Implement the use of green marketing strategies.	Use green marketing strategies to promote the restaurant and attract and retain customers.
Does not perform composting	Separate organic waste for composting.	Reduce organic waste disposed of.
Costs with organic products	Implement an organic garden.	Have fresh food and optimize costs.

Source: Elaborated by author.

Chart 7 presents the Do stage of the PDCA cycle, ensuring clarity and efficiency in the implementation process. It is represented by a 5W2H matrix, detailing the planning of necessary actions to address the identified difficulties. It specifies what, why, where, when, by whom, and how the tasks should be carried out, as well as the estimated cost for each action plan previously presented in the previous table.

Chart 7: 5W2H presenting the Do (D) of PDCA cycle

DO – HOW IT HAS TO BE DONE? - 5W2H						
what?	why?	where?	when ?	who ?	how ?	how much ?
Implement rainwater harvesting systems to water the grass	Reduce consumption and waste of potable water	Outdoor area	March 2025	Hire specialized company	Install gutters, reservoirs and automa-ted irrigation systems	R$ 3.000
Use buckets of water to clean the building	Reduce consumption and waste of potable water	Entire restau-rant area |	Imme-diately	Managers and cleaning staff	Instruct the cleaning staff to use buckets when washing common areas of the restaurant	No cost
Implement actions for monitoring and controlling water use	Reduce potable water waste and operational costs	Areas of highest water consum-ption (bath-room and kitchen)	Imme-diately	Managers	Add notices guiding the conscious use of potable water and attention to its waste	No cost

Continues

Chart 7: 5W2H presenting the Do (D) of PDCA cycle (continuation)

DO – HOW IT HAS TO BE DONE? - 5W2H						
what?	why?	where?	when ?	who ?	how ?	how much ?
Implement the use of green marketing strategies	Attract new customers and strengthen the restaurant's sustainable image	Social media, website, visual communications of the restaurant	Immediately	Marketing team	Emphasize sustainable practices adopted by the restaurant in its advertisements and promotions	No cost
Separate organic waste for composting	Reduce disposed waste and produce natural fertilizers	Kitchen and compost area	March 2025	External maintenance team and kitchen staff	Plan the appropriate space to acquire composters and train the team to handle them	R$ 600
Implement an organic garden in the restaurant	Reduce ingredient costs and offer fresh food	Outdoor area	March 2025	External maintenance team	Plan the appropriate space and provide training for cultivation and acquire seeds	R$ 1,000

Source: Elaborated by author.

Monitoring (C) is the fundamental stage for evaluating the implemented actions by comparing them with the expected results. In this phase, a systematic and detailed analysis should be carried out to identify inconsistencies or opportunities for improvement in the action plan. Chart 8 presents how the analysis should be conducted, by whom, and with what frequency. This way, it will be possible to assess whether the previously defined objectives have been achieved, identifying points of success and failure in the process, thus ensuring an accurate diagnosis of the initiatives' performance.

Chart 8: Monitoring (C) of PDCA cycle.

CHECK – HOW IT HAS TO BE EVALUATED AND MONITORED?			
ACTION PLAN	HOW?	WHO?	WHEN?
Implement rainwater harvesting systems to water the grass.	Track monthly water consumption data and compare with periods prior to system installation.	Managers	Monthly
Use buckets of water to clean the building.	Monitor water handling in cleaning common areas of the restaurant.	Manager	Weekly
Implement actions for monitoring and controlling water use.	Observe adherence to sustainable practices and check if excessive water use has been reduced.	Manager	Monthly
Implement the use of green marketing strategies.	Analyze engagement metrics (likes, shares, and comments) of posts.	Marketing team	One week after each post
Separate organic waste for composting.	Evaluate the amount of waste destined for composting.	External maintenance team	Weekly
Implement organic garden.	Evaluate the amount of harvested food and cost reduction.	Manager and external maintenance team	Monthly

Source: Elaborated by author.

The Act (A) stage focuses on corrective and preventive actions to address failures detected during monitoring (C). It is essential to ensure that identified failures are addressed, continuously improving the process. If the expected results are achieved, the PDCA cycle can serve as a reference for other processes and organizational sectors, strengthening a culture of continuous improvement. However, if the objective is not reached, the process must be re-evaluated, followed by the development of new solutions, as presented in Chart 9.

Chart 9: Act (A) of PDCA cycle.

ACT – HOW IT HAS TO BE FIXED?			
ACTION PLAN	HOW?	WHO?	WHEN?
Implement rainwater harvesting systems to water the grass.	Identify and correct technical failures in the system, such as leaks or installation errors.	External maintenance team and system supplier	If the objective is not achieved.
Use buckets of water to clean the building.	Review the method and identify operational bottlenecks.	Cleaning team	If the objective is not achieved.
Implement actions for monitoring and controlling water use.	Implement new corrective actions, such as replacing faucets with timers.	Managers	If the objective is not achieved.
Implement the use of green marketing strategies.	Reformulate messages and use more effective channels.	Marketing team	If the objective is not achieved.
Separate organic waste for composting.	Identify failures at the source of the waste separation process.	External maintenance team and kitchen	If the objective is not achieved.
Implement organic garden.	Review plant management.	External maintenance team	If the objective is not achieved.

Source: Elaborated by author.

The application of the PDCA cycle in the restaurant's context highlighted critical points to be addressed, such as inefficient resource use, the absence of some sustainable practices, and unexplored opportunities to improve the company's environmental image.

In the end, even though viable solutions were not found for the absence of selective waste collection and the use of plastic bottles based on the theoretical framework, the PDCA cycle was essentially used to suggest how to promote sustainability, boost operational efficiency, and strengthen the restaurant's competitiveness. The commitment to continuous improvement established a model that can be expanded to other processes and sectors, consolidating an organizational culture focused on innovation and socio-environmental responsibility.

FINAL CONSIDERATIONS

This study proposed the implementation of EcoDesign practices in a restaurant in Maracajaú, with the objective of promoting sustainability and reducing operational impacts. To this end, existing environmental practices were evaluated, opportunities for improvement identified, sustainable strategies proposed, and monitoring measures established to ensure the effectiveness of implementation.

The analysis of current practices revealed that the restaurant already adopts some sustainable strategies, focusing on resource optimization, environmental protection, and strengthening the regional economy. Among the initiatives identified are the use of solar panels for energy generation, dish standardization, participation in a regional environmental preservation association, input management based on the FIFO system, and partnership with family farming, contributing to the strengthening of local suppliers.

However, significant limitations were identified, such as the absence of selective waste collection in the region, the use of plastic water bottles and condiment sachets, and water resource waste. These factors represent challenges for efficient environmental management, as high costs and sanitary requirements hinder the adoption of more advanced solutions, restricting sustainable progress in these areas. The analysis did not identify viable alternatives to mitigate some of these limitations. Hiring selective waste collection in the region is currently unfeasible due to distance and high service costs. Furthermore, replacing plastic water packaging with sustainable alternatives would imply a significant cost increase, which might not be accepted by consumers. Similarly, there are no documented solutions in the theoretical framework to replace condiment sachets, as their use follows hygienic regulations of health surveillance.

Nevertheless, opportunities for improvement were identified in areas not yet explored by the restaurant, such as efficient water use, adoption of green marketing strategies, implementation of composting practices, and cultivation of an organic garden. Based on the literature review and application of the PDCA cycle, low-cost sustainable actions were proposed, including the implementation of rainwater harvesting systems, use of buckets for cleaning to reduce water consumption, adoption of control measures for conscious water use, development of green marketing strategies to strengthen the restaurant's sustainable image, and implementation of composting and organic garden practices, enabling the reuse of organic waste and reduction of input costs.

Additionally, monitoring measures were suggested to track the impact of these actions, such as monthly recording of water consumption and inspection of cleaning practices, observation of progressive water consumption reduction over time, analysis of customer engagement in sustainable marketing campaigns, assessment of the amount of waste destined for composting, and reduction of costs with organic inputs. These measures aim to ensure the restaurant's ongoing commitment to sustainable development principles.

For future research, it is recommended to explore alternatives to overcome financial and regulatory barriers, as well as analyze public policies that encourage sustainable practices in tourist regions. Moreover, broadening the study to other establishments in the region could strengthen understanding of the feasibility and impacts of EcoDesign practices in the restaurant sector.

Commitment to EcoDesign not only enables the reduction of environmental impacts but also represents a competitive differentiation opportunity in the market. It is concluded, therefore, that this study presents viable practices for sustainability and improvement of environmental performance in the enterprise's operations.

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