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Article

# Socioeconomic and Environmental Diagnosis of the Hotel Sector in the Municipality of Mossoró - RN

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**Abstract:** The hotel sector generates related environmental aspects from its construction process to the operation of its activities, products and services. In this way, corporate environmental management becomes directly linked, since it provides an adequate management of its resources, thus minimizing impacts. Thus, this research aims to carry out a socioeconomic and environmental diagnosis of the hotel sector in the municipality of Mossoró-RN. The study was classified in an exploratory, descriptive and explanatory way, with a qualitative-quantitative approach that is based on bibliographic, documentary and field research, carried out in 10 lodging facilities, through the application of questionnaires, on general aspects, initial environmental assessment and environmental aspects, and the data obtained were treated in Microsoft Excel software with the objective of creating a model and demonstrating results on the sustainable level of each establishment in question. The profile of the lodging facilities analyzed is characterized by 50% having from 10 to 30 rooms, 80% having between 10 and 30 employees, 80% being micro-enterprises, with 50% in an area of 750 m<sup>2</sup> to 2250 m<sup>2</sup> and 80% operating for more than 10 years. Point out a relevant result on the impacts of companies. The projects analyzed were built without any complaint for environmental crime and without negative impacts on the local population. Actions to reduce consumption were also observed, especially for the rationalization of water and energy. To this end, it points out that the adoption of the Environmental Management System (EMS) as a differential in the management of aspects and impacts of the hotel sector.

**Keywords:** environmental impacts of hotels; environmental management in lodging facilities; corporate sustainability

## 1. Introduction

The hotel sector plays a significant role in both the economy and society, providing various advantages such as generating internal and external revenues, attracting investments, creating employment opportunities, fostering professional growth, cultural exchange, driving the modernization of industries, promoting environmental sustainability, developing regions, and shaping specialized professionals [1].

However, according to Barbosa et al. [2], the hotel industry faces significant environmental challenges as it directly impacts water, energy, raw material consumption, and generates solid waste and domestic effluents that adversely affect the environment in various ways.

In light of the increasing demand in the hotel sector driven by global tourism, Reis and Toppei [3] discuss the urgency of adopting sustainable practices, addressing resource wastage and socio-environmental responsibility to mitigate the environmental impacts generated by hotel operations.

The environmental impacts and management practices of the hotel industry have been nationally debated over the past four years by [4]; [5]; [6]; [7]; [8]; [9]; [10]; [11]; [12]; [13]; [14]; [15]; [16]. However, these studies do not correlate the profile of lodging establishments, their initial environmental assessment, and the operational environmental aspects of the sector.

In the Western Region of the State of Rio Grande do Norte, the municipality of Mossoró-RN stands out for its economic evolution, predominantly driven by salt mining, oil extraction, and irrigated fruit cultivation. From this point on, Mossoró-RN assumes a leading role as a medium-sized city, centralizing functions, providing trade, and offering services. In this interim, Souza and Lopes [17] affirm that in Mossoró's tertiary sector, the dynamics of capital have accelerated the modernization of commercial and service enterprises.

Therefore, Mossoró-RN emerges as a regional hub for the trade of goods and service provision, as highlighted by [18], differentiating itself from neighboring cities, placing it at a 'superior' level in comparison to other urban spaces within its influential region, establishing itself as a central point.

Among the tertiary activities, the hospitality sector stands out, understood as a service industry that distinguishes itself from industrial and commercial sectors by offering accommodations and services to tourists and travelers at stopovers or destinations [1].

As the economy of Mossoró advances, the significance of the hotel sector grows, making environmental management in lodging establishments crucial, enabling a strategic approach that enhances their competitiveness.

Therefore, the general objective of this work is to conduct a socioeconomic and environmental diagnosis of the lodging facilities in Mossoró-RN. For this purpose, specific objectives were defined: conducting a socioeconomic description, assessing the initial environmental status, and identifying the main environmental aspects and impacts of the hotel sector.

Hence, this article is divided into four chapters: the first comprises the introduction, presenting the theme and problem, justification, and the work's objectives; the second chapter describes the methodology for the research, outlining the research classification, study area, and methodological procedures; the third chapter presents the findings, structured into General Aspects, Initial Environmental Assessment, Environmental Aspects of Lodging Facilities in Mossoró-RN, and the discussion; the fourth chapter contains the final considerations regarding the results obtained, description of study difficulties, the demonstration of the necessity for future work on the theme, and the fifth chapter lists the references used."

## 2. Materials and Methods

The development of this research was based on the definition delimitation of the object of study and deliberation of appropriate methodological procedures.

### 2.1. Characterization of the Study Area

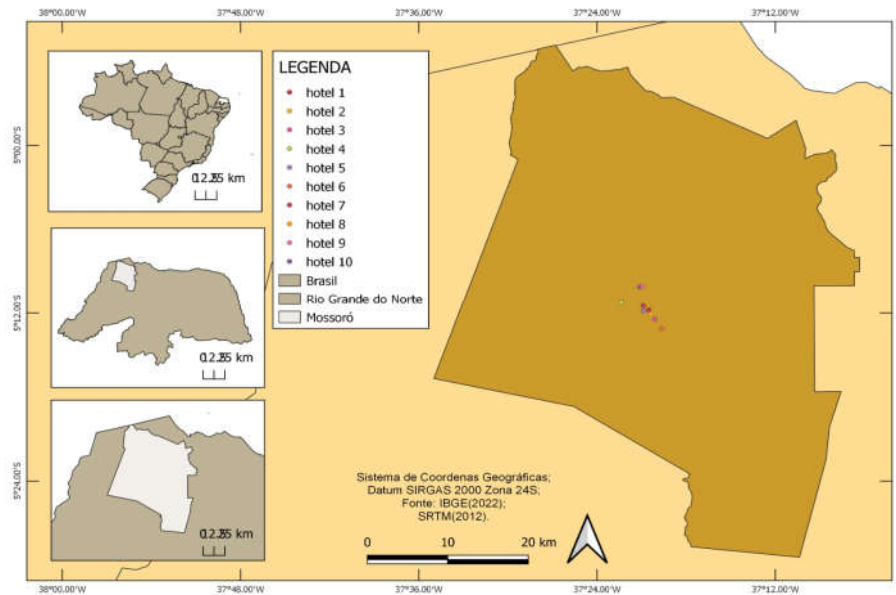
The study has a deductive approach [19], assuming that the governance of water resources enables different forms of participation, which involves contextualized performances of their respective segments. Thus, the study is established according to five stages, namely: objectives, technical procedures, approach method, procedural methods, and typology [19].

Mossoró is situated in the interior of Rio Grande do Norte, in the Northeast region of Brazil, positioned between the capital cities of Fortaleza-CE and Natal-RN, at distances of 245 and 278 kilometers, respectively. Geographically, it is bounded to the north by the state of Ceará and the municipality of Grossos; to the south by the municipalities of Governador Dix-Sept Rosado and Upanema; to the east by Areia Branca and Serra do Mel; and to the west by Baraúna. The total area of the municipality spans 2,099.344 square kilometers, with a population of 264,577 individuals, ranking first and second, respectively, in terms of territorial extension and population in the state of Rio Grande do Norte [20].

Presently, irrigated fruit cultivation, the salt industry, and extractive industries stand as the prominent economic sectors in the city. Mossoró is recognized as the largest producer of salt in the country and the primary onshore oil producer, contributing significantly to a GDP of 6,926,042.23 million [21]. In this context, Mossoró-RN solidifies its influence on the region through trade offerings and service provision, with the tertiary sector being responsible for the modernization of commercial and service enterprises [17].

As a result, Mossoró-RN's tertiary sector presents an opportunity to regionalize the offering of goods and services within this municipality, particularly because the diversity of these activities sets it apart from neighboring cities [18]. This scenario directly influences the occupation of individuals. In the age group of 18 years and above, 5.67% were employed in agriculture; 4.50% in extractive industries; 8.52% in manufacturing; 9.78% in construction; 0.76% in public utilities; 19.72% in commerce, and 43.71% in the service sector [20].

Therefore, the centrality of Mossoró-RN is established through the existing commercial and service activities in the locality, notably in the hospitality sector, which caters to individuals frequenting the city. By consulting official records, approximately 50 such enterprises were cataloged [20], with this study focused on 10 lodging facilities, the majority of which are situated in the central region (Figure 1).



**Figure 1.** Study Area Location: City of Mossoró – RN.

## 2.2. Research Procedures

For conducting this research, the methodological procedures were defined through the following steps: I) Definition of the Study Theme; II) Theoretical Survey of the Theme; III) Definition of the Study Area; IV) Definition of Collection Instruments; V) Enrollment in the Research Ethics Committee (CEP); VI) Data Collection in the Field; VII) Data Organization; VIII) Data Analysis; IX) Data Interpretation; and X) Conclusion of the Research.

### I) Definition of the Study Theme

The theme was defined based on the observation of contemporary world changes, particularly the absence of environmental practices in lodging facilities. Environmental Business Management evolves from a corrective stage to a preventive and, ultimately, proactive scenario. The study aimed to investigate sustainability within organizations, describing activities, services, and products, conducting an initial environmental assessment, and identifying the environmental aspects and impacts of lodging facilities in Mossoró-RN.

### II) Theoretical Survey of the Theme

With the study theme defined, a theoretical survey was conducted through a literature review of articles published in journals regarding environmental impacts and management practices in the hotel industry over the past 4 years.

### III) Definition of the Study Area

The study area was determined based on the characteristics of Mossoró-RN, an important economic center in Northeast Brazil, the second-largest municipality in terms of population in the state of Rio Grande do Norte. The city hosts significant economic sectors (oil, salt, and irrigated

agriculture), which contribute to the provision of services in the region. This led to the development of a network of lodging facilities for this research.

#### IV) Definition of Collection Instruments

At this stage, the research involved the definition of data collection instruments, initially focusing on documentary investigations of the analyzed facilities, identifying legal lodging facilities in Mossoró-RN, and describing the municipality. To describe the environmental management of these lodgings, primary data collection was performed through semi-structured interviews to measure characteristics, initial environmental assessments, and environmental aspects and impacts. The questionnaire included room and staff quantities, establishment income, property area, duration of existence, opening hours, services offered, construction impacts, restoration practices, water consumption, energy consumption, and inputs.

Finally, a field diary was created, containing active observation notes made during visits to the companies. This method, justified by producing and maintaining open attention while expanding the presence of research in the researcher's everyday life. Reading and writing in the diary help create attention, reshaping the relationship with the research theme and invoking related memories [22].

#### V) Enrollment in the Research Ethics Committee (CEP)

After defining the research's data collection instruments, it was observed that there was a need for enrollment in the Research Ethics Committee (CEP) and subsequently its approval to proceed with the study. Initial contact was made through email and/or telephone with the lodging facilities in Mossoró-RN that fell under the research, with the aim of identifying their active participation in the dissertation and scheduling the collection of consent forms, which was completed by April 20, 2023, totaling 15 consent forms.

This research followed the guidelines of resolutions No. 466/12 and 510/16 of the National Health Council and its complements regulating research involving human subjects, ensuring the "respect for human dignity and the special protection due to participants in scientific research involving human subjects" [23]. Before registration on the Brazil Platform, a dedicated computer folder was created to store the necessary files for the research submission, including the complete project, the instruments to be used—questionnaire, standard consent form, model consent form, consent forms from the facilities analyzed, list of hotels, title page, institution statement, and research initiation statement.

Registration on the Brazil Platform was done in compliance with all requirements set by the Committee for research submission. After filling in the ordered fields, the title page was generated, completed, and signed by the coordination of the Graduate Program to which this research is linked.

Ultimately, the research was submitted to the Research Ethics Committee (CEP) of the State University of Rio Grande do Norte (UERN) by the researcher, with all the required files attached to the platform, gaining approval as per substantiated opinion No. 6,252,060 on August 21, 2023.

#### VI) Data Collection in the Field

The first step involved an on-site exploratory visit to understand the analyzed lodging facilities, from August 25 to 30, 2023. Meetings were scheduled with each facility to administer questionnaires. Afterward, the research was presented, along with formalization documents such as the Informed Consent Form, Authorization for Image Use, and Authorization for Audio Use.

Subsequently, questionnaires were administered to 10 lodging facilities in Mossoró, comprising 5 hotels and 5 inns, from September 11 to 15, 2023, as per the availability of interviewees. Then, a checklist was applied to the investigated facilities during the interviews with managers to characterize the establishment and assess the employees' level of knowledge regarding environmental management in the hotel industry.

Finally, between September 25 and 29, 2023, the analyzed facilities were visited to create a photographic archive that documented the identified environmental practices.

#### VII) Data Organization

The material used in the research, both qualitative and quantitative data collected through semi-structured interviews and field diaries, was transcribed into the Word tool to facilitate analysis, with results tabulated in Microsoft Excel.

The photographic records were screened to exclude unusable files and select those that best portrayed the environmental practices of the lodging facilities in Mossoró-RN.

#### VIII) Data Analysis

The data analysis can be non-probabilistic, which does not apply statistical formulas, and probabilistic, which can undergo statistical analysis to correct errors and give significance to the research [19]. In this study, both forms of analysis were employed.

Non-probabilistic data analysis involved observing the environmental practices of lodging facilities in Mossoró-RN and conducting a photographic essay of actions taken in the analyzed establishments. The authenticity of participants' statements and images was assessed.

Probabilistic data analysis involved the data collected from the questionnaires, where the data was quantified. Subsequently, graphs and tables were produced using Microsoft Excel, calculating the percentage of each response. The graphs were then presented, compared with studies by other authors, and conclusions were drawn for each response.

#### IX) Data Interpretation

The interpretation sought a broader meaning for the analyzed data, integrating them harmoniously with available knowledge and theory. To interpret the results, the researcher needed to move beyond data reading, integrating them into a broader universe where they could make sense [24].

Therefore, the obtained data was interpreted by comparing it with other studies on environmental aspects of lodging facilities to identify similarities and differences and ultimately provide an outcome regarding applied environmental management.

#### X) Conclusion of the Research

The data collected through in-person semi-structured interviews were analyzed, generating a database that remained under the full responsibility of the lead researcher and was securely stored for 5 years.

### 3. Results

The obtained results are organized in the thematic axes of the research questionnaires, covering the following components: general aspects, initial environmental assessment, and environmental aspects of the establishments.

#### 3.1. General Aspects of Lodging Facilities in Mossoró – RN

The interest in questioning the size of the hotel establishments is, in fact, to identify potential challenges in implementing an EMS. In this regard, a diagnosis was conducted on the general aspects of lodging facilities in Mossoró-RN (Table 01), encompassing the number of rooms, staff count, gross income, property area, longevity, operating hours, external and internal services, as well as kitchen services offered. Supporting this justification, [25] emphasizes that especially micro and small businesses face significant limitations due to financial conditions and a lack of technical guidance to assist in planning and implementing actions aimed at improving the environmental performance of these businesses.

In this context, it is evident that the Profile of Lodging Facilities in Mossoró-RN is characterized by having 10 to 30 rooms (50%), employing between 10 to 30 staff members (80.00%), operating as micro-enterprises (80.00%), with an area between 750 m<sup>2</sup> to 2250 m<sup>2</sup> (50%), being in operation for more than 10 years (80.00%), operating full time (100%), offering restaurant services to external patrons (70.00%), providing in-house restaurant services (80.00%), and offering breakfast in all (100%) (Table 1).

**Table 1.** General Aspects of Lodging Establishments in Mossoró-RN (2023).

REQUIREMENT	QUANTITY (%)			
	10 to 30	30 to 50	50 to 70	Over 70
Rooms	50%	10,00%	20,00%	20,00%

<b>Employees</b>	10 to 30	30 to 50	50 to 70	Over 70
	80,00%	0,00%	20,00%	0,00%
<b>Gross Income</b>	Micro-Individual	Microenterprise	Small Business	Medium-Sized Business
	0,00%	80,00%	0,00%	20,00%
<b>Property Area Up</b>	To 750 m <sup>2</sup>	To 750m <sup>2</sup> a 2250m <sup>2</sup>	To 2250m <sup>2</sup> a 6750m <sup>2</sup>	Over 6750m <sup>2</sup>
	20,00%	50,00%	0,00%	30,00%
<b>Time in Existence</b>	Up to 1 year	From 2 to 5 years	From 6 to 9 years	Over 10 years
	0,00%	0,00%	20,00%	80,00%
<b>Operating Hours</b>	Morning	Afternoon	Daytim	Full-time
	0,00%	0,00%	0,00%	100,00%
<b>External Services</b>	Tours	Restaurant	Bar	Others
	0,00%	70,00%	30,00%	0,00%
<b>Internal Services</b>	SPA	Restaurant	Bar	Recreation
	0,00%	80,00%	20,00%	20,00%
<b>Kitchen Services</b>	Breakfast	Lunch	Dinner	Others
	100%	50,00%	50,00%	0,00%

Source: Own data (2023).

As depicted in the table above, upon investigating the area of the property and the quantity of rooms in the lodging facilities of Mossoró, RN, it was found that 30.00% of them exhibit an area exceeding 6,750m<sup>2</sup>; 50.00% have an area ranging between 750m<sup>2</sup> to 2,250m<sup>2</sup>, and 20.00% are below 750m<sup>2</sup>. The number of rooms is divided with 50.00% having between 10 to 30 rooms, while the remainder is split into 10.00% for 30 to 50, 20.00% for 50 to 70, and 20.00% with over 70 rooms.

It was observed that the structures of the surveyed lodging facilities make use of natural elements in their designs. These include the utilization of natural lighting in the rooms (Figure 2.a), landscape designs (Figure 2.b), and the utilization of thermal waters (Figure 2.c).



**Figure 2.** Services Offered in Lodging Facilities in Mossoró-RN.

It's also possible to highlight that the services offered in Lodging Facilities in Mossoró-RN occur in a varied manner. It's observed that 70% offer leisure activities such as the use of a pool (Figure 3.a), only 30% offer open event spaces (Figure 3.b), and just 20% provide kitchen services for external use (Figure 3.c).



**Figure 3.** Services Offered in Lodging Facilities in Mossoró-RN.

From the perspective of the lodging sector's significance, [14] asserted its relevance to the global economy as it contributes to economic and social development. However, in carrying out their activities, processes, and services, establishments within this sector generate environmental impacts that can contribute to global warming and the depletion of natural resources.

To comprehend the environmental impacts of this sector, it becomes fundamental to conceive the concept of sustainability within lodging facilities. According to [10], sustainability involves the execution of planning that encompasses the people in their surroundings, employees, guests, and the community, including awareness-raising lectures, workshops, and announcements about the significance of the issue, through networking and engagement in social programs. This approach is refined through training by integrating good practices and enhancing the ability to execute them.

### 3.2. Initial Environmental Assessment of Lodging Facilities in Mossoró-RN

The section highlights the initial environmental assessment of lodging facilities in Mossoró-RN, focusing on how the establishments were constructed, the related impacts, and their relationship with the neighborhood.

It was observed that environmental impacts were partially minimized (30.00% in all locations and 30.00% in some), with construction work reported without any environmental crime allegations (100.00%) and no occurrences of impact on fauna, flora (100.00%), or the population (100.00%). There are anticipated positive impacts (100.00%), particularly in terms of job creation during construction (100.00%) and local goods consumption (100.00%). However, it was noted that there were limitations related to a lack of concern regarding deforestation (80.00%) and post-construction restoration (70.00%) (Table 2).

**Table 2.** The initial environmental assessment of lodging facilities in Mossoró-RN.

REQUIREMENT	QUANTITY (%)			
<b>Were impacts minimized in construction?</b>	Yes, everywhere	Yes, somewhere	No	I have no knowledge
	30,00%	30,00%	0,00%	40,00%
<b>Was there a report of environmental crime in construction?</b>	Very frequently	Frequently	Rarely	Never
	0,00%	0,00%	0,00%	100,00%
<b>Was there concern about deforestation in construction?</b>	Very frequently	Frequently	Rarely	Never
	20,00%	0,00%	0,00%	80,00%
<b>Did construction have an impact on local fauna and flora?</b>	Very frequently	Frequently	Rarely	Never
	0,00%	0,00%	0,00%	100,00%
<b>Was there restoration after construction?</b>	Very frequently	Frequently	Rarely	Never
	30,00%	0,00%	10,00%	60,00%
	Very frequently	Frequently	Rarely	Never

<b>Did the construction cause an impact on the population?</b>	0,00%	0,00%	0,00%	100,00%
<b>Did the construction generate jobs for the population?</b>	Very frequently 100,00%	Frequently 0,00%	Rarely 0,00%	Never 0,00%
<b>Was the consumed raw material from a local supplier?</b>	Very frequently 100,00%	Frequently 0,00%	Rarely 0,00%	Never 0,00%
<b>Did the hotel construction cause visual changes?</b>	Very frequently 20,00%	Frequently 30,00%	Rarely 20,00%	Never 30,00%
<b>Did the construction cause more impact on the population?</b>	Very frequently 100,00%	Frequently 0,00%	Rarely 0,00%	Never 0,00%

Sustainable practices in the construction of lodging facilities in Mossoró-RN can be more evidenced in relation to architectural projects, as 20% carried out the restoration of green areas (Figure 4.a), 30% included green spaces in their structure (Figure 4.b), and 40% integrated the hotel's aesthetics with natural elements to offer additional services, such as hiking (Figure 4.c).



**Figure 4.** Lodging Areas in Mossoró-RN.

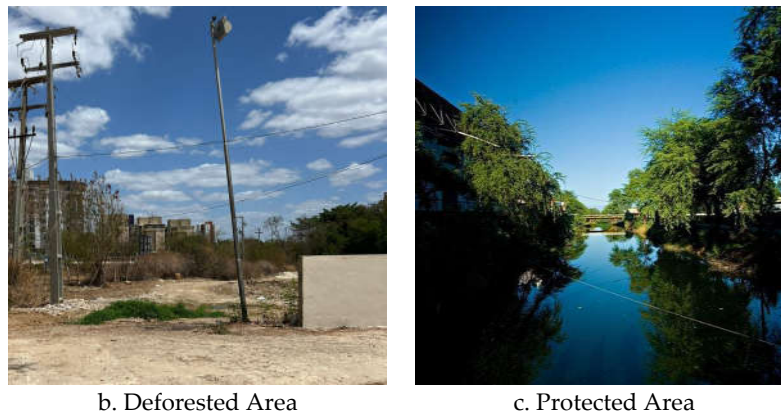
The obtained results are not exclusive to lodging facilities in Mossoró-RN, as [12], while investigating the sustainable practices of members of the Brazilian Association of Resorts, found that in terms of construction, only 33.3% of the ventures lack a comprehensive policy for the use of sustainable materials, either in construction or renovation.

This scenario becomes challenging, especially because the motivation to adopt environmental practices is more related to the entrepreneurs themselves, as confirmed by [4]. They report that for the majority of lodging facilities in the coastal regions of Piauí and Ceará, the motivation for implementing environmental practices comes solely from the interests of the company itself, even though they do not consistently practice all dimensions of sustainability appropriately.

It's important to reflect that despite examples of environmental practices in lodging facilities in Mossoró-RN, they still cannot be classified as sustainable ventures when compared to other realities. Thus, when compared to the results obtained by [6], who identified the preservation of local fauna and flora in construction while conducting a case study at the Grande Hotel São Pedro, located in Águas de São Pedro, São Paulo state.

Continuing along this line of thought, [12] state that the process of establishing a lodging facility recognized as sustainable involves sustainable principles that encompass its construction using sustainable materials and construction methods, including the reuse of containers.

Despite this earlier revealed scenario, the construction of Lodging Facilities in Mossoró-RN presented limiting factors regarding environmental issues, especially concerning deforested areas without purpose (Figure 5.a) and the proximity to environmental protection areas (Figure 5.b).



**Figure 5.** Lodging Areas in Mossoró-RN.

The scenario of timid sustainable actions in lodging facilities is explained by [5] as they comment that the implementation of environmental management practices is intrinsically linked to reducing operational costs for ventures. Adopting environmental management is still perceived as a high investment by the managers.

Given the above, it becomes necessary to more clearly conceive the environmental aspects of these investigated ventures, as it allows understanding the environmental impacts of daily activities, thereby promoting sustainable practices to enhance the competitiveness of the hotel sector. This notion is affirmed by [12], mentioning that the operation of a recognized sustainable lodging facility involves sustainable principles that encompass its daily operations, waste reuse, guest awareness, and the adoption of local labor.

Therefore, according to [15], lodging facilities play an important role in environmental sustainability, as tourists begin to use their services, intervening and altering the natural functioning of the ecosystem. Added to this is the variable of seasonality, which exponentially increases the number of tourists during peak seasons, consequently raising energy and water consumption, solid waste generation, and liquid effluents, leading to direct and indirect consequences for the environment.

### 3.3. Environmental Aspects of Lodging Facilities in Mossoró-RN

Organizations in their operation consume raw materials, inputs, water, and energy, which are characterized as inputs of the production process. In this line of thought, [26] highlights that the objective of understanding the environmental aspects of an organization is to highlight which stages of the process or activity could pose risks to the environment and cause environmental accidents.

Thus, when assessing the Environmental Aspects and Impacts of Lodging Facilities in Mossoró-RN, it was found that water consumption, for the most part (50.00%), exceeds 301 m<sup>3</sup>/month, with all establishments using water distributed by CAERN. Additionally, 30.00% also use water trucks (carro pipa), showing constraints in proper management methods, as 60.00% never reuse water, never treat water, and 50.00% never use water flow regulators (Table 03).

Regarding energy consumption, different results are observed when it comes to aspects related to energy use. It's possible to identify actions aimed at reducing consumption, especially in terms of energy rationalization (70.00%), the use of devices for consumption reduction (70.00%), and the use of renewable energies (80.00%) (Table 3).

**Table 3.** Environmental aspects of lodging facilities in Mossoró-RN.

REQUIREMENT	QUANTITY (%)			
	Up to 100 m <sup>3</sup> /month	101 to 200 m <sup>3</sup> /month	201 to 300 m <sup>3</sup> /month	Above 301 m <sup>3</sup> /month
Monthly Water Consumption	0,00 %	50,00 %	0,00 %	50,00 %

<b>Origin of Water Used</b>	Well	CAERN	Water Truck	Other
	10,00%	100,00%	30,00%	100,00%
<b>Water Reuse</b>	Very frequently	Frequent	Rarely	Never
	20,00%	0,00%	20,00%	60,00%
<b>Water treatment</b>	Very frequently	Frequent	Rarely	Never
	30,00%	0,00%	0,00%	70,00%
<b>Use of Water Flow Regulator</b>	Very frequently	Frequent	Rarely	Never
	30,00%	0,00%	20,00%	50,00%
<b>Monthly Energy Consumption</b>	Up to 100	101 to 200	201 to 300	Above 301
	Kwh/month	Kwh/month	Kwh/month	Kwh/month
	0,00%	0,00%	0,00%	100,00%
<b>Energy Rationalization</b>	Very frequently	Frequent	Rarely	Never
	70,00%	30,00%	0,00%	0,00%
<b>Use of Devices to Reduce Energy Consumption</b>	Very frequently	Frequent	Rarely	Never
	70,00%	0,00%	0,00%	30,00%
<b>Use of Renewable Energies</b>	Yes	No	Interested	Not Interested
	80,00%	0,00%	20,00%	0,00%
<b>Use of Electric Power Generator</b>	Very frequently	Frequent	Rarely	Never
	20,00%	0,00%	20,00%	60,00%

The service activity requires inputs (resources) and consequently generates outputs (releases) that can cause adverse effects on the environment. Therefore, the inputs and outputs in the product life cycle (goods and services) clarify the relevant environmental aspects for the systematic consideration of environmental issues and understanding how the product interacts with the environment [9].

In lodging facilities, the provision of services requires the following inputs: water, energy, food and beverages, cleaning products, personal hygiene products, chemicals, fossil fuels, and other products. It also generates outputs: organic and inorganic waste, effluents and atmospheric emissions, noise, odors [9]

In this context, investigating the lodging facilities in Mossoró-RN revealed that water is an indispensable element, with consumption directly related to the size of the establishments. The data obtained also revealed that despite the dependence on public supply, there are visible strategies for supplementary water supply in case of scarcity. For example, about 30% of the establishments use water trucks (Table 3), and water is stored in reservoirs (Figure 6).



c. Protected Area

**Figure 6.** Origin of Water in Lodging Facilities in Mossoró-RN.

Given this context, it's important to highlight that the lodging facilities in Mossoró-RN cannot remain with reactive actions to ensure water security in their operations, especially because the

means (Figure 7) to reduce water consumption are scarce, with only 20% reusing water and 30% using water flow regulators (Table 3). Thus, the adoption of proactive strategies in reducing water consumption becomes necessary, allowing for the planning of new service offerings and the expansion of activities.



**Figure 7.** Ways to Reduce Water Usage in Lodging Facilities in Mossoró-RN.

In this line of thinking, adopting proactive strategies to reduce water consumption, [11] stated that it is the responsibility of hotel and inn managers to sensitize guests and staff, motivating them to avoid excessive water consumption in the use of taps, showers, bathroom flushes, as well as in the scheduling of changing towels and bed sheets in the rooms.

Analyzing environmental practices more expansively, it was observed that in addition to specific reductions in water consumption, energy usage is the primary environmental aspect in lodging facilities in Mossoró-RN. 100% implement energy rationalization (70% very frequently and 30% frequently). The most common methods include natural lighting, natural ventilation, areas integrated with the outdoors, and areas without walls to use natural light (Figure 8).



**Figure 8.** Methods to Rationalize Energy in Lodging Facilities in Mossoró-RN.

The above results are supported by [7] when analyzing sustainability practices in terms of water, waste, and energy in accommodations in Porto Alegre-RS. They found that these ventures, in their management, exhibit concern for the environment, showing care for the better use of natural resources in their daily operations. However, it's noticeable that there could be more investments in certain sectors for an even more sustainable management.

Specifically investigating the use of devices to reduce energy consumption in the studied establishments (Figure 9), there's a variation in these mechanisms, with a prevalence of intelligent switches and card switches.



Smart switches



Card switches



Automated equipment



Energy-efficient labeled equipment

**Figure 9.** Devices to Reduce Energy Consumption.

Similar findings were determined by [16] when studying the limitations and possibilities for sustainability in lodging facilities in Rio Verde-MS. They identified sustainability actions in the establishment related to the use of LED bulbs, low-consumption air conditioning units, spaces with light colors, and the use of automated products.

Enhancing the management of environmental aspects of energy consumption involves diversifying energy generation. It was found that lodging facilities in Mossoró-RN practice this, with 80% using renewable energy (Table 03), primarily through solar energy. These structures are also optimized for parking areas (Figure 10).



**Figure 10.** Renewable Energies in Lodging Facilities in Mossoró-RN.

Within this energy aspect, it's crucial to discuss the strategies that companies adopt to compensate for the absence of energy. It was found that only 20% (Table 03) use power generators (Figure 11), and these establishments are directly related to their size and the types of services they offer. Therefore, it's essential to understand that management practices are directly correlated with the size of the establishment, as well as the activities, products, and services they offer. Thus, to appropriately define which measures to adopt, it becomes paramount to conduct a socioeconomic and environmental diagnosis.



**Figure 11.** Use of Generators in Lodging Facilities in Mossoró.

In summary, a prevalent focus on sustainability actions was observed in the input phase of the production process in lodging facilities in Mossoró-RN. Similar outcomes were also identified in studies conducted by [15], indicating that the sustainable practices being promoted in lodging facilities in Caxias do Sul and Canela - RS have higher percentages of information related to water consumption reduction (17.92%), water consumption (12.74%), energy consumption (10.85%), reduction in energy consumption (10.61%), and promoting environmental conservation (9.91%).

Analyzing the outputs of the production process in lodging facilities in Mossoró-RN revealed a reliance on public services, waste disposal (70%), and effluent disposal (80%) (Table 4).

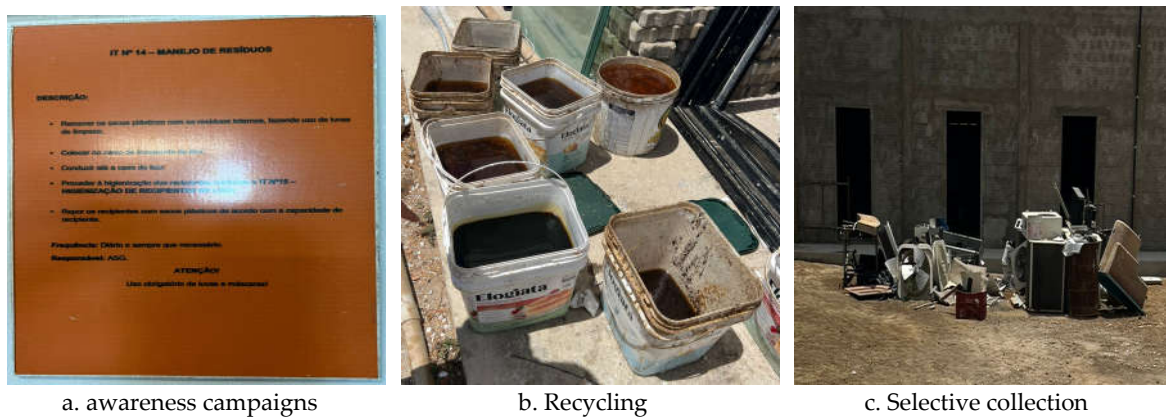
**Table 4.** Outputs of activities in Lodging Facilities in Mossoró-RN.

REQUIREMENT	QUANTITY (%)			
	Reduction	Recycling	Composting	Others
Waste Solid Treatment	30,00%	30,00%	0,00%	40,00%
Solid Waste Disposal	Public Collection	Donated	Disposed	Others
	70,00%	0,00%	0,00%	30,00%
Liqui Effluent Treatment	Reduction	Direct Reuse	Indirect Reuse	Other
	20,00%	20,00%	20,00%	20,00%

Liquid Effluent Disposal	Public Sewer	Septic Tank	Discharged	Others
	80,00%	20,00%	0,00%	0,00%

Within this discussion, it's essential to clarify that despite the disposal of solid waste and liquid effluents into public collection and public sewer, respectively, there were identifiable methods for treating these materials.

Concerning solid waste treatment, experiences of promoting the importance of waste reduction, recycling, composting, and selective collection were observed (Figure 12).



**Figure 12.** Methods for treating solid waste in the establishments.

From these results, we can infer the importance of solid waste management in these types of establishments, signaling the need for advancements in both structural and non-structural actions, given the widespread adoption of these practices. To illustrate, the study by [13], which analyzed the significance of waste management for tourism in Porto de Galinhas, Pernambuco, found that the surveyed establishments have good practices in solid waste disposal, environmental preservation, and a clear understanding of how these practices positively impact tourism.

In this perspective, the success of these initiatives requires an investment in environmental awareness among both the staff and users of these lodging facilities. As supported by [15], environmental communication within lodging facilities in Caxias do Sul and Canela, Rio Grande do Sul, is limited, with scarce implementation in these establishments (24.24% of indications).

Regarding the treatment of liquid effluents, instances of environmental awareness, organic effluent separation, and the reuse of wastewater were observed (Figure 13).



**Figure 13.** Treatment methods for liquid effluents in the establishments.

The findings mentioned previously align with those of [8], who identified the environmental impacts of the lodging network in the northern part of the Fortaleza coastline, reporting significant

impacts related to landscape alterations, waste and effluent production, and unsuitable areas for bathing.

Within this scenario offering opportunities for adopting environmental management practices, it's important to note that limitations persist, notably due to insufficient environmental marketing promotion. [5] identified that awareness of the significance of environmental management remains minimally disseminated within the organizational culture of lodging companies in Natal, Rio Grande do Norte. This situation is further underscored by [14], who examined if the sustainable practices implemented in lodging establishments were deciding factors in choosing these enterprises (with 65.46% indicating 'no' or 'never considered'). Thus, [5] stated that environmental management still contributes in a limited manner to the competitiveness of lodging establishments.

#### 4. Conclusions

The hospitality sector in Mossoró, RN, has been gradually solidifying over time, particularly due to the economic characteristics of this city, which increasingly serves as a hub for commerce and services, thus becoming a central point for surrounding cities.

In this context, the economic sector under study is characterized heterogeneously concerning variables such as location, occupied area, number of available beds, quantity of employees, and services offered. This scenario is directly influenced by the type of establishment (inns or hotels) and their function in providing services (lodging, dining, recreation, leisure, meetings, and events).

Upon analyzing the Initial Environmental Assessment of the establishments under study, it's evident that in the older establishments, environmental concerns were partially considered at the time of construction. Specifically, the issues related to their location in environmentally protected areas and the alteration of the landscape. Conversely, the more recent establishments have considered variables of socio-environmental responsibility, namely the involvement of the local population in the services offered, the consumption of materials sourced from local suppliers, and the absence of reports of environmental crimes.

The aspects and impacts resulting from the activities, products, and services of the investigated enterprises are associated with water and energy consumption, as well as inputs, waste generation, effluents, and emissions. While preventive and corrective measures have been observed, it cannot be asserted that proactive actions exist, which could directly influence the environmental management of these businesses and their competitiveness.

During the research process, difficulties were encountered in obtaining data, particularly in convincing representatives of the establishments to participate in the study. Additionally, logistical challenges in scheduling interviews impacted the research process. To address these issues, it is suggested that future research be conducted with the support of institutions providing technical consultancy for this economic sector.

As a suggestion for future work, it is recommended to conduct an assessment of environmental compliance, identify environmental practices, and implement environmental management models in the Lodging Establishments of Mossoró, RN.

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