Reverse logistics and sustainability: the case of the Federal Institute of Acre, Brazil

Logística reversa e sustentabilidade: o caso do Instituto Federal do Acre, Brasil

Logística inversa y sostenibilidad: el caso del Instituto Federal de Acre, Brasil

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ABSTRACT
The implementation of sustainable practices in the educational context is fundamental to foster a culture of environmental and social responsibility. This study investigates reverse logistics practices at the Rio Branco Campus of the Federal Institute of Acre (IFAC), aiming to identify implemented actions, challenges faced, and propose strategies to strengthen the institutional commitment to sustainability. Using a mixed-method approach, we combined documentary analysis of the internal regulations and the Institutional Development Plan (IDP) with semi-structured interviews with members of the academic community. The documentary analysis revealed institutional alignment with sustainable practices, evidenced by environmental and social responsibility goals in IFAC's IDP. However, the lack of specific guidelines for post-consumer reverse logistics suggests the need for improvement. Interviews highlighted employees' awareness of sustainability and reverse logistics as positive, but pointed to the lack of clear guidelines as a gap. Although the Rio Branco Campus of IFAC demonstrates a commitment to sustainability, there is room for improvement in integrating post-consumer reverse logistics practices. We recommend the inclusion of specific goals and strategies for solid waste management in the IDP, as well as a more comprehensive approach to sustainability in institutional policies. These final considerations establish a basis for future research and practical improvements, aiming to strengthen the institutional commitment to sustainability at IFAC.
Keywords: sustainability, reverse logistics, solid waste, sustainable development, educational institutions.

RESUMO
A implementação de práticas sustentáveis no contexto educacional é fundamental para fomentar uma cultura de responsabilidade ambiental e social. Este estudo investiga as práticas de logística reversa no Campus Rio Branco do Instituto Federal do Acre (IFAC), com o intuito de identificar ações implementadas, desafios enfrentados e propor estratégias para fortalecer o compromisso institucional com a sustentabilidade. Utilizando uma abordagem mista, combinamos análise documental do regimento interno e do Plano de Desenvolvimento Institucional (PDI) com entrevistas semiestruturadas com membros da comunidade acadêmica. A análise documental revelou um alinhamento institucional com práticas sustentáveis, evidenciado pelas metas relacionadas ao meio ambiente e responsabilidade social no PDI do IFAC. No entanto, a falta de diretrizes específicas para logística reversa pós-consumo sugere a necessidade de aprimoramento. As entrevistas destacaram a conscientização dos colaboradores sobre sustentabilidade e logística reversa como positiva, mas apontaram para a falta de diretrizes claras como uma lacuna. Embora o Campus Rio Branco do IFAC demonstre um compromisso com a sustentabilidade, há espaço para melhorias na integração de práticas de logística reversa pós-consumo. Recomendamos a inclusão de metas e estratégias específicas para a gestão de resíduos sólidos no PDI, bem como uma abordagem mais abrangente da sustentabilidade nas políticas institucionais. Essas considerações finais estabelecem uma base para futuras pesquisas e aprimoramentos práticos, visando fortalecer o compromisso institucional com a sustentabilidade no IFAC.

Palavras-chave: sustentabilidade, logística reversa, resíduos sólidos, desenvolvimento sustentável, instituições de ensino.

RESUMEN
La implementación de prácticas sostenibles en el contexto educativo es fundamental para promover una cultura de responsabilidad ambiental y social. Este estudio investiga las prácticas de logística inversa en el Campus Rio Branco del Instituto Federal de Acre (IFAC), con el objetivo de identificar acciones implementadas, desafíos enfrentados y proponer estrategias para fortalecer el compromiso institucional con la sostenibilidad. Utilizando un enfoque mixto, combinamos análisis documental del reglamento interno y del Plan de Desarrollo Institucional (PDI) con entrevistas semiestructuradas a miembros de la comunidad académica. El análisis documental reveló una alineación institucional con prácticas sostenibles, evidenciada por los objetivos relacionados con el medio ambiente y la responsabilidad social en el PDI del IFAC. Sin embargo, la falta de directrices específicas para la logística inversa posconsumo sugiere la necesidad de mejoras. Las entrevistas destacaron la conciencia de los empleados sobre la sostenibilidad y la logística inversa como positiva, pero señalaron la falta de directrices claras como una brecha. Aunque el Campus Rio Branco del IFAC demuestra un compromiso con la sostenibilidad, hay espacio para mejorar la integración de prácticas de logística inversa posconsumo. Recomendamos la inclusión de metas y estrategias específicas para la gestión de residuos sólidos en el PDI, así como un enfoque más integral de la sostenibilidad en las políticas institucionales. Estas consideraciones finales establecen una base para futuras investigaciones y mejoras prácticas, con el objetivo de fortalecer el compromiso institucional con la sostenibilidad en el IFAC.
INTRODUCTION

With the growing volume of solid waste in contemporary society, the issue of reverse logistics has transcended the exclusive scope of private companies, becoming an urgent concern for public institutions as well (Guarnieri et al., 2020). These institutions are now urged to make efforts to properly manage the disposal and reuse of products after their useful life cycle. In this emerging context, the responsibilities of public entities expand, encompassing not only collection but also the reuse and proper disposal of these materials, in accordance with the requirements of current environmental legislation (Batista et al., 2021).

In Brazilian legislation, specifically Law No. 12,305/2010, which establishes the National Solid Waste Policy (PNRS), the concept of post-consumer reverse logistics stands out (Brazil, 2010). The term "post-consumer" refers to the stage where products have already been used by consumers and have become waste, requiring proper disposal (Antonopoulos et al., 2021). Thus, post-consumer reverse logistics deals with the management of materials discarded after their use, aiming at their collection, reuse, recycling, or environmentally sound final disposal (Rebehy et al., 2019).

According to the PNRS, the responsibility for implementing reverse logistics after consumption is shared among the different links in the supply chain, consumers, and the government (Brazil, 2010). This sharing of responsibilities assigns to the productive sector the task of managing and financing the proper disposal of waste (De Souza et al., 2023). This approach seeks to ensure a more sustainable management of solid waste, promoting awareness of the importance of proper disposal and reuse of materials after consumption.

Sustainable thinking, at its core, manifests through simple practices, such as material reuse and the adoption of measures for saving natural resources, such as water and electricity, which can be adopted by each worker in their workplace environment (Barros et al., 2020). Brazil is among the leading global generators of solid waste, with inadequate disposal (Ferraz de Campos et al., 2021). According to Chen et al. (2020), substantial increase in waste recycling is
needed by 2030 to mitigate unsustainable waste generation and achieve a circular economy, thus alleviating pressures on the environment.

The complexity of product disposal at the end of its useful life highlights the urgent need to adopt innovative approaches. Faced with increasing consumption and the scarcity of natural resources, it becomes essential to explore new alternatives throughout the product lifecycle, from production to disposal (Yang et al., 2023). As highlighted by Klarin (2018) and Andrade et al. (2023), this paradigm shift is essential, as sustainable development, when integrated with economic growth, not only shapes present quality of life but also determines the course of the global future.

In the context of public sector organizations, educational institutions (EIs) emerge as fundamental pillars in promoting and disseminating sustainable thinking. As opinion formers and knowledge disseminators, EIs not only have the role of educating but also of leading by example, incorporating the principles of sustainable development into their daily practices (Serafini et al., 2022). It is important to note that the implementation of sustainable ideas in EIs is driven by the will and motivation of students, teachers, and administrative staff. Commitment to more environmentally efficient practices significantly contributes to the effective allocation of resources and the reduction of environmental impacts (Fissi et al., 2021).

With the aim of investigating post-consumer reverse logistics practices adopted by the Rio Branco Campus of the Federal Institute of Acre (IFAC), this article addresses a central question: How is the institution applying reverse logistics to meet the objectives outlined in the Institutional Development Plan (PDI) 2020-2024, which seeks to make IFAC a reference in professional, scientific, and technological education, contributing to sustainable development (IFAC, 2020)?

Therefore, the main objective of this research is to analyze the implementation of post-consumer reverse logistics at the Rio Branco Campus - IFAC, seeking to align with the purposes established in the PDI. With this purpose, the following specific objectives were established: to evaluate the context of sustainability and reverse logistics at the Rio Branco Campus - IFAC; to identify and analyze the process of implementing post-consumer reverse logistics, focusing on materials such as batteries, cartridges, fluorescent lamps, LED lamps, and electronic waste, aiming to reduce environmental impacts at the institution.
This study aims to contribute to the sustainable management of reverse logistics, seeking to minimize environmental impacts and ensure compliance with Law PNRS 12,305/2010. Furthermore, it seeks to disseminate sustainable practices in federal public institutions, raising awareness about the relationship between sustainability and reverse logistics, with the aim of achieving organizational goals.

2 THEORETICAL FRAMEWORK

In this section, the theoretical foundation will be addressed, briefly presenting the main concepts of sustainable development, sustainability, reverse logistics, and the environmental agenda of public administration. The importance of promoting environmental awareness in educational institutions is highlighted, aiming to achieve sustainable management of reverse logistics to minimize environmental impacts and comply with PNRS.

2.1 SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY

Sustainable development, as a fundamental concept, seeks to harmonize economic growth with the conservation of natural resources and the promotion of social well-being (Eisenmenger et al., 2020). Over the decades, this concept has evolved to incorporate a more holistic and integrated view of development, recognizing the interconnections between economic, social, and environmental aspects (Hajian; Jangchi Kashani, 2021).

Within the theme of sustainability, characterized as the process by which human activity minimally impacts the terrestrial ecosystem, the sustainability tripod stands out. This model establishes three fundamental dimensions for organizations and society as a whole: economic, environmental, and social (Khan et al., 2021; Ranjbari et al., 2021; Soliani, 2022). While the economic dimension focuses on financial viability and efficiency of production processes, the environmental dimension refers to the preservation of natural resources and the minimization of negative impacts on the environment. Finally, the social dimension concerns equity, social justice, and the well-being of communities (Purvis et al., 2019).

In addition to environmental aspects, sustainability encompasses specific social, political, and ideological debates that vary between countries and regions, reflecting pressures anchored...
in different logics (Sengers et al., 2019). These debates may address issues such as income distribution, access to basic services, human rights, cultural diversity, and social inclusion, highlighting the complexity of the sustainability concept (Leal Filho et al., 2019).

Environmental awareness plays a fundamental role in promoting sustainability. By encouraging a change in mentality regarding the use of natural resources and adopting sustainable practices in communities and the political sphere, environmental awareness contributes to building more resilient and equitable societies (Hariram et al., 2023). This awareness can be promoted through environmental education, dissemination of information about the impacts of human activities on the environment, and encouragement of civic and political participation in sustainability-related issues (Boca; Saraçlı, 2019).

2.2 REVERSE LOGISTICS

Reverse logistics, as a specialized segment of logistics, plays a crucial role in post-sale management and after delivery to the customer. The Council of Supply Chain Management Professionals (CSCMP), an international entity composed of logistics professionals based in the United States, defines reverse logistics as the set of activities aimed at the movement and management of products and resources after their use by the consumer (CSCMP, 2024). This definition encompasses not only the physical return of products to the originating company but also includes aspects such as repair, recycling, remanufacturing, and proper waste disposal.

In addition to addressing environmental concerns, reverse logistics is seen by companies as an economic strategy to increase competitiveness and generate value for customers. Studies such as those by Fernando et al. (2023) and Gomes et al. (2023) highlight that efficient reverse logistics management can significantly contribute to reducing operational costs and maximizing profits, as well as strengthening customer loyalty and brand image.

An approach that has been gaining prominence in this context is collaborative logistics, in which companies come together in networks to optimize the reverse logistics process. Through this collaboration, it is possible to share resources and knowledge, reducing costs and improving the efficiency of the system as a whole (Soliani et al., 2022).

However, to optimize the reverse logistics process, it is essential to highlight the advantages and overcome the challenges inherent in this system (De Souza et al., 2023). Among
the advantages, the recovery of materials and resources, the reduction of production costs, and the promotion of the circular economy stand out. However, it is important to recognize challenges such as difficulties in maintaining logistic performance, high operational costs, and unexpected product returns (Soliani et al., 2019).

In addition to contributing to the economic efficiency of companies, reverse logistics plays a fundamental role in reducing pollution and promoting the reuse and recycling of waste (Rebehy et al., 2019). The effective implementation of reverse logistics can strengthen the organizational image of the company, demonstrating its commitment to environmental responsibility and sustainability (Richnák; Gubová, 2021). Thus, reverse logistics not only meets regulatory requirements but also adds value to the brand and the company's reputation with its consumers and stakeholders.

2.3 REVERSE LOGISTICS IN EDUCATIONAL INSTITUTIONS

Educational institutions play an important role in promoting sustainability, as they are spaces where knowledge is generated, disseminated, and applied. By integrating sustainable practices into their operations and curricula, educational institutions not only demonstrate a commitment to environmental preservation but also empower students to become agents of change in their communities and future careers (Kioupi; Voulvoulis, 2019). Educational institutions have adopted various initiatives to promote internal changes and contribute to sustainable development, whether through academic research, educational programs, or waste management strategies (Fissi et al., 2021).

Effective waste management in educational institutions is essential to reduce environmental impact and promote sustainability. Encouraging the reduction, reuse, and recycling of materials, as well as directing them to proper final disposal, are fundamental practices in this process (Anthony Jnr, 2019). In the Brazilian context, several educational institutions have implemented programs for selective waste collection on their campuses, while the effectiveness of these programs may vary in terms of scope and efficiency (Barros et al., 2020; Drahein et al., 2019; Ottoni et al., 2022).

In addition to being spaces for teaching and research, higher education institutions have the potential to be models of sustainability and good environmental practices. By adopting
policies and initiatives focused on waste management, these institutions not only fulfill their social and environmental role but also contribute to the formation of environmental awareness among their students, teachers, and staff, positively impacting society as a whole (Debrah et al., 2021).

3 METHODOLOGY

In this section, the methodological procedures adopted for the completion of this research are presented. This work is a qualitative study, with the administrative collaborators of IFAC - Campus Rio Branco as the research object, aiming to answer the following question: What are the post-consumption reverse logistics practices adopted by the Rio Branco Campus of the Federal Institute of Acre - IFAC?

3.1 RESEARCH CHARACTERIZATION

The study in question, aligned with the teachings of Gil (2019), is characterized as applied research, centered on the interest in the application, utilization, and practical consequences of knowledge. Vergara (2016) reinforces that applied research is driven by the need to solve concrete problems. Regarding the temporal dimension, the research adopts a cross-sectional approach, as explained by Richardson (2017), providing an instantaneous view of the social situation during data collection, especially suitable for research in the social sciences. The methodological approach is qualitative, in accordance with the understanding of the nature of the social phenomenon (Yin, 2016).

The objective of this study is to analyze the application of post-consumption reverse logistics at the Rio Branco Campus of IFAC, as established in the Institutional Development Plan (PDI) 2020-2024, with the aim of reducing environmental impacts. To achieve this purpose, a semi-structured interview will be conducted, using a script with questions previously formulated by the researcher.
3.2 IFAC CONTEXTUALIZATION

The trajectory of IFAC began in 2006 with the Federal Technical School of Acre, which in December 2008 was transformed into the federal educational institution IFAC, formalized by Law No. 11.892/2008 (Brazil, 2008). The appointment of the first rector took place in December 2009, and practical activities began in July 2010, with the offering of subsequent technical courses, PROEJA (a modality of education that integrates professional education with basic education for young people and adults), and higher education courses in teaching, technology, and bachelor's degrees. Currently, IFAC has 6 on-site units, with more than 3,000 students enrolled in technical courses and more than 2,000 in higher education courses, demonstrating its scope and impact in the region.

For its management and organization, IFAC has two essential documents: the Internal Regulations and the Institutional Development Plan (PDI). The Internal Regulations establish internal guidelines, competencies of the organs, and regulate the functioning of the institution, promoting transparency, efficiency, and accountability (IFAC, 2018b). They serve as a guide for the organization and proper functioning of activities within IFAC. In turn, the Institutional Development Plan (PDI) outlines objectives, goals, and strategies for a period of five years, directing actions and investments of the institution to improve teaching, research, extension, and administrative management (IFAC, 2020). It allows IFAC to chart a clear path to achieve its institutional goals, promoting continuous improvement and sustainable development. Both documents are crucial not only for internal management but also for obtaining resources and institutional progress.

In the Strategic Plan 2017-2036, which guides the institutional strategy, mission, vision, values, strategic objectives, and strategic projects for the period are detailed. IFAC's vision is established as a local and regional reference in professional, scientific, and technological education, contributing to sustainable development. The clarity of values is fundamental to guide strategic management, representing fundamental beliefs that direct social relations and concretize strategic thinking. The purpose of IFAC is to offer professional and technological education at various levels, promote applied research, and develop extension programs, with an emphasis on environmental preservation (IFAC, 2018a).
3.3 DATA COLLECTION AND ANALYSIS

The data collection plan was carried out in two distinct stages. Firstly, a documentary analysis on the subject was conducted to select the most suitable collaborators for the research. The selected individuals included an administrative coordinator, the director of administration, and the information technology coordinator. In the second stage, after obtaining the necessary authorization, the interviews were conducted. These were carried out in audio format, with prior identification of the interviewees and questions aimed at understanding the theme of post-consumption reverse logistics and the PDI (2022-2024) at the Rio Branco campus. In order to ensure the confidentiality of the participants and to guarantee impartiality in the analysis of the results, the interviewees will be referred to as Interviewee 1, Interviewee 2, and Interviewee 3, respectively.

The interviews were organized and previously scheduled, taking place between October and November 2023, ensuring flexibility in the participation of the collaborators. During these sessions, various topics were addressed, including the importance of sustainability, post-consumption sustainable practices, and partnerships with companies specialized in proper waste disposal. During the interview process, confidentiality and the exclusive use of data for academic purposes were emphasized. The collaborators were duly informed about the confidentiality and ethical stance of the researcher, thus ensuring the anonymity of the participants.

In order to systematize the instruments, techniques, and sources used in the study to meet the objectives proposed by this research, Table 1 is presented.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Technique</th>
<th>Instrument</th>
<th>Data type</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Documentary analysis</td>
<td>Documents provided by IFAC</td>
<td>Secondary</td>
<td>IFAC's 2021-2024 PDI and Internal regulations</td>
</tr>
<tr>
<td>2</td>
<td>Semi-structured interview</td>
<td>Semi-structured script</td>
<td>Primary</td>
<td>Administrative staff</td>
</tr>
</tbody>
</table>

Source: Authors (2024).

The information collected during the structured interview was analyzed through content analysis, which, according to Marconi and Lakatos (2021), takes into account the meaning of the content. According to Cardoso et al. (2021), content analysis deals with communication
messages, aiming to manipulate these messages to highlight indicators that allow inference about a reality beyond the message itself.

Based on this collected information, a descriptive and interpretative analysis of the data was conducted, aiming to identify the reverse logistics practices adopted by the institution and the results achieved in terms of environmental and economic impact. The results were then presented and discussed in relation to the existing literature on sustainability and reverse logistics, with an emphasis on the importance of implementing sustainable practices in public institutions.

4 RESULTS AND DISCUSSION

The aim of the research was to analyze the post-consumer reverse logistics practices implemented by IFAC - Campus Rio Branco, in accordance with the guidelines established in its Institutional Development Plan for the period from 2020 to 2024. Data were collected through semi-structured interviews with administrative staff of the institution, and the analysis was conducted using a qualitative approach. Table 2 below describes the profile of the interviewees.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Interviewee 1</th>
<th>Interviewee 2</th>
<th>Interviewee 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Bachelor's, Master's, and Doctorate in Business Administration</td>
<td>Bachelor's in Economics and Master's in Economics and Management of Science, Technology, and Innovation</td>
<td>Bachelor's in Information Technology</td>
</tr>
<tr>
<td>Position</td>
<td>Administrative Coordinator</td>
<td>Director of Administration</td>
<td>IT Coordinator</td>
</tr>
<tr>
<td>Length of service at IFAC</td>
<td>11 years; 5 years as administrative coordinator</td>
<td>10 years; 4 years as director of administration</td>
<td>6 years; 1 year and 6 months in the IT coordination</td>
</tr>
<tr>
<td>Main activities</td>
<td>Administrative support to various sectors of the institution</td>
<td>Financial, economic, and asset management</td>
<td>Management of technological infrastructure</td>
</tr>
<tr>
<td>Interview date</td>
<td>26/10/2023</td>
<td>27/11/2023</td>
<td>27/11/2023</td>
</tr>
<tr>
<td>Interview duration (min)</td>
<td>13:13</td>
<td>15:16</td>
<td>14:17</td>
</tr>
</tbody>
</table>

Source: Authors (2024).

The analysis of the results reveals a diversity in the backgrounds and roles of the interviewees, providing a more comprehensive view of sustainable reverse logistics practices within the institution. Interviewee 1 stands out in the administrative area, Interviewee 2 in the financial area, and Interviewee 3 in technological management. This diversity of roles
underscores the importance of multidisciplinary approaches in implementing sustainable practices.

The professionals have solid experience combined with effective financial management and the integration of technological solutions, which are important factors for the success of IFAC's post-consumer reverse logistics initiatives. The results presented below demonstrate the relevance of considering different perspectives and competencies in formulating and implementing sustainable strategies aligned with the institutional objectives outlined in IFAC's PDI. This comprehensive approach not only enriches the understanding of sustainable practices but also strengthens the institution's ability to effectively achieve its environmental and socioeconomic goals.

4.1 KNOWLEDGE OF THE PDI AND REVERSE LOGISTICS PRACTICES AT IFAC

The interviewees demonstrated knowledge of the Institutional Development Plan (2020-2024), but there are gaps in internal communication regarding the sustainable guidelines of the PDI. Although there are sustainable practices, such as waste separation, the lack of details regarding the final destination of materials highlights the need to improve campus traceability and documentation. Their responses reflected an understanding of the goals and emphasized the importance of strategic planning in higher education institutions.

Interviewee 1 mentioned: "Here, we receive follow-up on the PDI from the rectorate. We have a spreadsheet with all the goals corresponding to the Rio Branco Campus to be accountable as we carry out our tasks. We report to a board located in the rectorate. They monitor, make demands, and we provide responses about what has been done, what hasn't, why it hasn't, and if any structures are needed. Thus, the process occurs continuously."

Interviewee 2 explained: "Well, regarding the reverse logistics policy, we follow the disposal guidelines. It applies not only to consumable materials but specifically to our assets. In addition to batteries, we need to dispose of all materials, such as broken chairs and other items. We held a disposal bidding process and followed all federal government guidelines to ensure the proper disposal of these materials after use. This includes all our assets, such as vehicles, tables, and chairs. Regarding consumable materials, specific projects were developed at times to ensure the correct disposal of certain types of materials. For example, there was a project in collaboration
with the library to collect used batteries in a specific location and give them the correct disposal. However, currently, this specific project is not in effect on campus. It is important to highlight this because we need to ensure the correct disposal of these materials."

From the perspectives of the interviewees and the considerations of Cebrián et al. (2020) and Orenstein et al. (2019), it is clear that educational institutions face the challenge of not only establishing sustainable goals but also implementing and maintaining effective practices over time. Although the interviewees demonstrate an understanding of the PDI goals and have emphasized the importance of strategic planning, their responses indicate gaps in internal communication and consistent execution of sustainable policies.

To truly drive sustainability, it is essential for institutions to adopt a holistic approach, integrating innovative technologies, as suggested by Lima et al. (2023), to improve traceability and documentation of environmental processes within units. Furthermore, closer collaboration with municipal environmental policies is fundamental, as highlighted by Souza et al. (2020), to ensure effective integration with local communities.

4.2 CHALLENGES IN IMPLEMENTING SUSTAINABLE POLICIES AND REVERSE LOGISTICS

The research results reveal a significant challenge in implementing sustainable policies and reverse logistics, despite recognizing their importance. The analysis of environmental policies from product acquisition to final disposal highlights the complexity and obstacles faced in this process. Studies such as those by Dalla Gasperina et al. (2022), Leal Filho et al. (2021), and Serafini et al. (2021) demonstrate the tensions during the implementation of sustainability in Brazilian universities, emphasizing the relevance of focusing on initiatives aligned with the Sustainable Development Goals (SDGs). In this context of challenges in implementing sustainable policies, the experiences and observations of the interviewees illustrate the obstacles faced in practice.

In practice, the bidding process is carried out at the rectorate. We manage the product delivery, and so on. However, we have not yet included this forecast in our bidding process. Especially in the region where we live, we know that logistics are very complex. Therefore, to
ensure reverse logistics, we need to start demanding that the supplier collect the product in the end when it is no longer useful. But we are not doing that yet," expressed Interviewee 1.

However, the effective implementation of these policies faces challenges. As noted by Interviewee 2: "We have policies, in fact, since acquisition, which provide us with guidance to acquire more sustainable products. Recently, for example, we acquired air conditioning and used the environmental policy as a prerequisite to indicate the correct material to be purchased. We opted for inverter air conditioning, which consumes less energy. Additionally, at the Rio Branco Campus, all light bulbs were replaced with LED bulbs due to an environmental policy in which IFAC committed to minimizing energy consumption. We also installed solar panels, which contribute to this goal. Therefore, various policies have been adopted, from the acquisition of goods or services to the final disposal, which is what I mentioned earlier, disposal when we have materials considered unusable and that no longer meet the needs of public administration."

In the face of these challenges and experiences, it is essential to learn from previous studies and seek innovative solutions to promote sustainable practices and effective reverse logistics. In the next section, we will explore in more detail the issues related to material disposal and strategies to promote a culture of sustainability at IFAC's Rio Branco Campus.

4.3 SUSTAINABLE DISPOSAL AND COMMUNITY ENGAGEMENT

Sustainability, as highlighted by Barbieri (2023) and Dias (2022), emerges as a central theme that demands special attention in manufacturing processes. To achieve this goal, it is imperative to implement significant changes, making these processes more cyclical and reducing environmental damage (Araújo et al., 2024). In line with this perspective, Interviewee 1 emphasized the importance of sustainable disposal practices, such as donations to laboratories and proper waste forwarding for recycling.

Interviewee 1: "We store and assess the materials we receive. At one point, we asked computer maintenance course students if they are interested in some parts. Sometimes, they need a specific part to assemble or repair something. In this way, some parts are reused in this manner. Additionally, we had some cabinets that were donated to professors and students who wanted to use them to assemble other computers."
The concept of sustainability, as discussed by Sharma et al. (2021), Soliani (2017), and Yazdani and Lakzian (2023), emphasizes the need for proper solid waste disposal. This not only contributes to environmental preservation, avoiding soil, water, and air contamination but also enables the recovery of recyclable materials, reducing the demand for natural resource extraction. Interviewee 2 reinforces the importance of these sustainable disposal practices, emphasizing the guidance provided to individuals for the correct material disposal on campus.

Interviewee 2: "So, we always instruct people to properly dispose of materials, both organic and paper and plastic, so that selective collection is effective here on campus."

In line with the sustainability principles presented, Interviewee 3 reports concrete actions taken on campus to promote responsible disposal and material recycling: "I know we have trash cans here that separate waste, so when we discard these materials, we always separate them. We carried out some return actions, such as a collection project, where the Campus collected some materials. I know there were some separate things, like chairs and tables, due to demand, and there were also some requests for computer parts that were delivered to the office."

The reports highlight the commitment of the school community to environmental management and the pursuit of sustainable practices. They emphasize the importance of sustainable disposal and highlight the need to promote awareness and engage the school community in environmental issues.

4.4 SCHOOL COMMUNITY INVOLVEMENT AND AWARENESS

For Antón-Peset et al. (2021) and Gherheş et al. (2022), the importance of research on environmental behavior and education in the educational context is emphasized, emphasizing the need to address sustainability practices, such as implementing selective collection bins and integrating the theme into curricular subjects. Interviewee 1 shares examples of the efforts made by IFAC to promote awareness and engagement of the school community regarding sustainable issues.

Interviewee 1: "Here at the institution, we have a group of students involved in sustainable initiatives. We installed separation bins in various locations to encourage and facilitate waste separation. Sustainability is a cross-cutting theme in all subjects because it is part of our institutional culture. Unfortunately, we have not met all demands yet, but we are doing our best.
In addition to the bins, we have selective collection by the municipality and even composting of organic waste."

The cross-cutting approach to sustainability enables the integration of sustainable principles and practices into all disciplines and areas of study. By adopting this approach, students have the opportunity to understand the interconnection between environmental, social, and economic issues, developing a holistic and critical view of the challenges facing the contemporary world (Rieckmann, 2018). This integration not only enriches learning but also empowers students to develop essential skills and values for building a more sustainable future (Biberhofer; Rammel, 2017). In this sense, Interviewee 2 highlights the ongoing efforts to ensure the effectiveness of selective collection on campus, emphasizing the importance of constant guidance on proper material disposal.

The active involvement of the school community in sustainability actions at the units is essential for the success of these initiatives. The active participation of students, teachers, staff, and other members of the community is crucial for promoting a sustainable and conscious culture (Gey et al., 2023). Through activities such as awareness campaigns, practical sustainability projects, and collaboration in recycling and waste reduction programs, the school community not only contributes to environmental preservation but also strengthens the sense of collective responsibility and commitment to a more sustainable future (Hegab et al., 2023; Sewak et al., 2021). Interviewee 3 corroborates with colleagues, emphasizing the importance of school community involvement.

Closing this section, the connection between academic efforts and sustainable practice in education is evident. In the next section, we will further explore the academic community's engagement in promoting sustainability within and beyond the campus.

4.5 ACADEMIC ENGAGEMENT IN SUSTAINABILITY

Kioupi and Voulvoulis (2019) and Leal Filho et al. (2021) agree that a proper understanding of the SDGs, associated with political partnerships, can drive sustainable development education outcomes. In this regard, Interviewee 1 highlights that external pressures affect organizations, and university authorities have been increasingly concerned with managing their external reputations.
Interviewee 1: "At first, the sustainability proposal was much more widespread. Then, we talked a little less about it. However, we resumed the reverse logistics theme, as I mentioned earlier, because now we are considering including it in bidding notices. Thus, the ideas we are trying to put into practice have resurfaced."

By seeking to align institutional objectives with the principles of the SDGs and establishing effective partnerships, it is possible to promote initiatives that integrate sustainability into all aspects of education (Ferrer-Estévez; Chalmeta, 2021). This includes revising curricula to cover sustainability-related topics and implementing environmental and social management practices on campus. By working together with companies, political bodies, and other stakeholders, educational institutions can maximize their impact on shaping conscious citizens engaged with environmental and social issues (Sepetis et al., 2020). Interviewee 2 mentions collaboration with teachers and companies to develop projects to utilize waste generated at the Rio Branco Campus.

Interviewee 2: "We have talked to several professors, our partners here, to develop projects in this direction with companies, seeking to take advantage of some types of waste, such as organic material and other items that we cannot absorb. This is done through awareness-raising in lectures and courses within the area."

By actively involving the academic community in the review and evaluation of the results achieved, the institution promotes a transparent and collaborative environment, where all members have the opportunity to contribute to the improvement of PDI strategies and actions. This approach demonstrates the institution's commitment to accountability and the ongoing pursuit of academic and institutional excellence by providing regular feedback on progress towards established goals (Fleacă et al., 2018).

This integration not only strengthens the sense of belonging and engagement of the academic community but also promotes a culture of organizational learning, where reflection and adaptation are valued as essential tools for the sustainable growth and development of the institution (De Carvalho-Filho et al., 2020; Souza et al., 2024). In this sense, Interviewee 1 suggests sharing the results of the present study with the academic community of IFAC, aiming to disseminate the sustainability culture.

Interviewee 1: "So, it would be interesting for you to propose a presentation, inviting the employees to the auditorium and showing them the results of your work. Additionally, it would
be useful to forward this work to the sector at the Rectorate responsible for the development and monitoring of the PDI, as this helps us disseminate the culture of sustainability."

Considering the above, active participation and engagement of the academic community are essential elements for the success of sustainability proposals. This collaboration not only promotes awareness but also offers a valuable opportunity for the development of managerial skills among members of the academic community, such as leadership, decision-making, communication, and teamwork, as well as more efficient management of resources and projects (De Oliveira et al., 2022; Ribeiro et al., 2023).

The suggestion to present the results to employees and forward them to the relevant department in the Rectorate highlights the importance of integrating practical actions with the institution's strategic goals. This practice makes a significant contribution to improving and succeeding in sustainable practices within the university environment.

On the other hand, although reverse logistics is not detailed in the PDI, it plays a vital role in environmental management, covering proper collection and treatment of waste. IFAC can adopt it through partnerships, promoting awareness and effective solid waste management. Therefore, it is crucial to integrate sustainable practices, including reverse logistics, into IFAC activities, representing a significant step towards building a more conscious institution committed to sustainable development.

Despite recognizing the importance of sustainability, challenges in implementing sustainable policies and reverse logistics are significant. To overcome them, it is essential to learn from previous studies and seek innovative solutions. Thus, the study not only enriches the understanding of sustainable practices but also strengthens the institution's ability to achieve its environmental and socioeconomic goals effectively.

5 FINAL CONSIDERATIONS

The research conducted provided a broader understanding of sustainable reverse logistics practices in the context of an educational institution, identifying actions already implemented and the challenges to be faced. The documentary analysis focused on the internal regulations and the Institutional Development Plan (PDI) of the Federal Institute of Acre (IFAC). Although the internal regulations do not explicitly mention sustainable practices, the PDI presents goals related
to the environment and social responsibility, indicating institutional alignment with sustainable practices. However, the absence of specific guidelines for post-consumer reverse logistics suggests the need for improvement.

By seeking to align institutional objectives with the principles of the Sustainable Development Goals (SDGs) and establishing effective partnerships, it is possible to promote initiatives that integrate sustainability into all aspects of education. This includes everything from revising curricula to cover sustainability-related topics to implementing environmental and social management practices on campus. Working together with companies, political bodies, and other stakeholders, educational institutions can maximize their impact on shaping conscious citizens engaged with environmental and social issues. Interviewee 2 mentions collaboration with teachers and companies to develop projects to utilize waste generated at the Rio Branco Campus.

By actively involving the academic community in the process of reviewing and evaluating the results achieved, the institution promotes an environment of transparency and collaboration, where all members have the opportunity to contribute to the improvement of PDI strategies and actions. This demonstrates the institution's commitment to accountability and the ongoing pursuit of academic and institutional excellence by providing regular feedback on progress towards established goals. This approach not only strengthens the sense of belonging and engagement of the academic community but also promotes a culture of organizational learning, where reflection and adaptation are valued as essential tools for the sustainable growth and development of the institution. In this sense, Interviewee 1 suggests sharing the results of the present study with the academic community of IFAC, aiming to disseminate the culture of sustainability.

The research contributes to raising awareness about the need to improve sustainable practices at Campus Rio Branco - IFAC, reinforcing the importance of incorporating sustainability more comprehensively into institutional policies. These final considerations establish a basis for future research and practical improvements in the sustainability scope at IFAC. Awareness among employees about sustainable practices is positive, however, the absence of specific guidelines for reverse logistics in the PDI can be considered a gap. It is recommended to include goals and strategies for post-consumer solid waste management in the PDI and to integrate them more effectively into the institution's daily activities, strengthening the institutional commitment to sustainability. The research had limitations, such as the exclusive focus on the Rio Branco Campus of IFAC and the reliance on data provided by the interviewees.
It is recommended to expand the study to other IFAC campuses and to conduct follow-up on environmental actions to provide more accurate data on solid waste management.
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