The use of technologies for a more sustainable community-based ecotourism – an experience on an ecological trail in the Brazilian Amazon

O uso de tecnologias para um ecoturismo comunitário mais sustentável – uma experiência em trilha ecológica na Amazônia Brasileira

El uso de tecnologías para un ecoturismo comunitario más sostenible: una experiencia en un sendero ecológico en la Amazonía Brasileña

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ABSTRACT
Objective: The aim of this study was to analyze the correlation between technologies and community-based ecotourism in a traditional community in the Brazilian Amazon, focusing on the utilization of these tools in the selection, mapping, and facilitation of an ecological trail. Ecological trails have become a prominent practical activity in sustainable ecotourism in the Amazon region, serving as a means to generate income and promote the preservation of local culture and traditions. Method: The study employed action research in a community situated within an environmental protection area in the Amazon region. The data production process included engaging in self-reflection with community members regarding the utilization of technologies, conducting participatory mapping with guides, and implementing the trail with the support of GPS (Global Positioning System). Results: The data analysis reveals the community's expectations, difficulties, and challenges in utilizing technologies, while also discussing their potential in the context of sustainable community-based ecotourism. In an effort to give back to the community, Quick Response Code signage was created, and the georeferencing data for the points of interest along the trail under study was made accessible on a digital platform. Conclusion: The qualitative analysis indicates that the deliberate incorporation of digital tools in community-based ecotourism enhances the connection between ecology and technology. The study also revealed that the successful implementation of technologies in Amazon communities requires addressing practical and social obstacles, including technical support, connectivity, cost, and digital literacy.

Keywords: sustainable ecotourism, technologies, ecological trail, Amazon.

RESUMO
Objetivo: O objetivo deste estudo foi analisar a correlação entre tecnologias e ecoturismo de base comunitária em uma comunidade tradicional da Amazônia brasileira, com foco na utilização dessas ferramentas na seleção, mapeamento e facilitação de uma trilha ecológica. As trilhas ecológicas tornaram-se uma atividade prática de destaque no ecoturismo sustentável na região amazônica, servindo como meio de geração de renda e promoção da preservação da cultura e tradições locais. Método: O estudo utilizou pesquisa-ação em uma comunidade situada dentro de uma área de proteção ambiental na região amazônica. O processo de produção de dados incluiu a autorreflexão com os membros da comunidade sobre a utilização de tecnologias, a realização de mapeamento participativo com guias e a implementação da trilha com apoio de GPS (Sistema de Posicionamento Global). Resultados: A análise dos dados revela as expectativas, dificuldades e desafios da comunidade na utilização de tecnologias, ao mesmo tempo que discute o seu potencial no contexto do ecoturismo sustentável de base comunitária. Num esforço de retribuição à comunidade, foi criada sinalização com Código de Resposta Rápida e disponibilizados em plataforma digital os dados de georreferenciação dos pontos de interesse ao longo do percurso em estudo. Conclusão: A análise qualitativa indica que a incorporação deliberada de ferramentas digitais no ecoturismo de base comunitária aumenta a conexão entre ecologia e tecnologia. O estudo também revelou que a implementação bem-sucedida de tecnologias nas comunidades amazônicas exige a
abordagem de obstáculos práticos e sociais, incluindo suporte técnico, conectividade, custo e alfabetização digital.

**Palavras-chave:** ecoturismo sustentável, tecnologias, trilha ecológica, Amazônia.

**RESUMEN**
Objetivo: El objetivo de este estudio fue analizar la correlación entre tecnologías y ecoturismo comunitario en una comunidad tradicional de la Amazonia brasileña, enfocándose en la utilización de estas herramientas en la selección, mapeo y facilitación de un sendero ecológico. Los senderos ecológicos se han convertido en una actividad práctica destacada en el ecoturismo sostenible en la región amazónica, sirviendo como un medio para generar ingresos y promover la preservación de la cultura y las tradiciones locales. Método: El estudio empleó investigación-acción en una comunidad situada dentro de un área de protección ambiental en la región amazónica. El proceso de producción de datos incluyó la autorreflexión con miembros de la comunidad sobre la utilización de tecnologías, la realización de mapeos participativos con guías y la implementación del sendero con el apoyo de GPS (Sistema de Posicionamiento Global). Resultados: El análisis de datos revela las expectativas, dificultades y desafíos de la comunidad en la utilización de tecnologías, al mismo tiempo que analiza su potencial en el contexto del ecoturismo comunitario sostenible. En un esfuerzo por retribuir a la comunidad, se creó la señalización del Código de Respuesta Rápida y los datos de georreferenciación de los puntos de interés a lo largo del sendero en estudio se hicieron accesibles en una plataforma digital. Conclusión: El análisis cualitativo indica que la incorporación deliberada de herramientas digitales en el ecoturismo comunitario mejora la conexión entre ecología y tecnología. El estudio también reveló que la implementación exitosa de tecnologías en las comunidades amazónicas requiere abordar obstáculos prácticos y sociales, incluido el soporte técnico, la conectividad, el costo y la alfabetización digital.

**Palabras clave:** ecoturismo sostenible, tecnologías, sendero ecológico, Amazonía.

**1 INTRODUCTION**
Ecotourism is a distinct type of nature-based tourism that prioritizes the welfare of the local community, environmental preservation, and the provision of a fulfilling nature experience for tourists (Xu, Liu & Cai, 2023). In Brazil, ecotourism is regulated by a number of laws and regulations designed to uphold environmental conservation, ensure the safety of visitors, and promote sustainable benefits for the communities involved. The Law No. 9.985/2000, also known as the National System of Conservation Units, serves as a legal framework that outlines regulations for the management of tourist...
activities within protected natural areas. The objective is to foster comprehension of the environment and promote the conservation of natural resources (Lei nº 9.985, 2000).

Community-based ecotourism has emerged as a widely utilized approach for the preservation of biodiversity, grounded in the belief that biodiversity should be self-sustaining through the generation of economic advantages, especially for the local populace (Kiss, 2004). In this interaction, community members not only offer services but also assume important roles as local guides, providing guidance and sharing cultural and ecological stories of the local ecosystems. The primary goal extends beyond simply providing services, with the aim of fostering a deep ecological consciousness in which visitors and community members collaboratively develop a narrative of reverence for nature. Community-based ecotourism is more than a mere commercial exchange; it represents a collective endeavor towards ecological comprehension and the advancement of sustainability. Each interaction in this context adds to the creation of a meaningful and genuinely locally embedded experience. This form of tourism seeks to create a sustainable activity that is driven by community participation. The objective is to guarantee that the majority of the income generated from this activity remains within the communities (Nassar, Cobra & Vieira, 2017).

Community-based ecotourism involves local control and participation in the ownership and utilization of tourist resources and infrastructure, engagement in the planning and decision-making processes related to tourism, and the management of tourism enterprises, including the collective administration of at least a portion of the benefits. Tourism activity within the framework of community-based ecotourism serves as a supplement to the local and family economy. It is important to recognize that ecotourism should not be viewed as a form of economic monoculture. Additionally, community-based ecotourism is not solely motivated by profit. The development and organization of this encompass a communal logic (Ruiz-Ballesteros, 2023).

The expansion of sustainable tourism has been shown to contribute to the growth of primary economic indicators in certain destinations where it has been implemented, thereby enhancing the global competitiveness of these locations (Song & Han, 2023).
In the Amazon, successful community-based tourism models already exist, such as the Mamirauá Reserve for Sustainable Development (Mamirauá SDR) in Brazil. Its ecotourism packages, which provide opportunities for nature exploration and interaction with the local population, have drawn visitors from around the globe and generated approximately US million in economic revenue for local communities (Lebrão et al., 2021).

One of the activities that can be conducted in community-based ecotourism is the exploration of ecological trails. Trails are pathways designed to facilitate access for individuals interested in exploring and appreciating nature. They offer both recreational opportunities and environmental education through the use of signage and interpretive materials. Hence, trails possess significant potential for enhancing attractiveness and utility in environmental management and education through the redefinition of natural characteristics and protected areas.

Nevertheless, it is essential to pinpoint locations with higher potential appeal to visitors in order to enhance their satisfaction and engagement during interactive experiences (Lei nº 9.985, 2000). Given the significance of mapping points of interest and the attractiveness of ecological trails, along with their potential for sustainable development, the objective of this study was to examine the correlation between the utilization of technologies and community-based ecotourism. This achievement was made possible by the utilization of technologies to aid in the management and mapping of ecological trails.

2 MATERIALS AND METHODS

This study represents an extension of a previous work that was presented at the 5th Euro-Mediterranean Conference for Environmental Integration.

The study is qualitative in nature and is classified as action research. It was conducted in an Environmental Conservation Unit located in the Amazon. The research was conducted as part of the "ECOLOGY, CONSERVATION AND MANAGEMENT OF ECOSYSTEMS" discipline in the Postgraduate Program in Society, Nature and Development at the Federal University of Western Pará. All participants in the research
study completed an Informed Consent Form that included comprehensive information about the nature of the study, its potential risks and benefits, ensuring that their decision to participate (or not) was made freely and with full awareness. The authors have made a commitment to refrain from disclosing the names and images of the participants.

A comprehensive self-reflection on the use of technologies was carried out to gather data and gain a deeper understanding of the challenges associated with utilizing technology to support community-based ecotourism activities. Pre-arranged moments of collective dialogue were scheduled with the participants, followed by individual semi-structured interviews.

During the second stage, participatory mapping was carried out with the assistance of two community members who served as tour guides. Participatory Mapping is a method that has been extensively investigated in environmental, social, and urban research. This process stems from a collaborative endeavor aimed at recognizing environmental perception, incorporating the insights of local stakeholders in the planning, conservation of natural resources, diagnosis, territorial organization, and resolution of socio-environmental conflicts (Barros, 2012). The aim of this activity was to deliberate and establish the actions to be implemented on the ecological trail, which was the focal point of the current study. As part of this activity, the guides were directed to produce a thorough map or drawing of the trail to be explored. The map is intended to highlight potential points of interest and natural tourist attractions along the trail, drawing from information stored in the collective memory of the guides. Recognizing the challenges associated with translating traditional knowledge into a map and the necessity for local residents to have proficiency with mapping tools, the researchers employed basic materials for this activity, including cardboard, black brushes, and post-it notes. Figure 1 presents a summary of the process used to create the points of interest, which were based on participatory mapping.
In the third stage, the researchers carried out an on-site survey of the trail. Throughout the journey, with the assistance of a local tour guide, the points of interest along the trail were documented and mapped using GPS technology through the widely utilized Wikiloc application, popular among enthusiasts of trail activities. Furthermore, specific points of interest along the trail were selected for the production of signs featuring bar codes (QR Code - Quick Response Code), which offer comprehensive information about the tourist attraction. Figure 2 depicts the comparison between the trail's official mapping conducted by the conservation unit's management body (Fig. 2a) and the mapping performed by the researchers (Fig. 2b). It emphasizes the points of interest previously identified in the participatory mapping.
3 RESULTS

3.1 THE MAIN POINTS OF INTEREST ON THE TRAIL

The ecological trail examined in this study shows great potential as an attraction for the community. The area not only offers potential for ecotourism but also plays a vital role in advancing environmental education.

The journey, which has a duration of approximately 5 hours, covers a significant distance of around 12.81 kilometers. The trail, classified as "moderate to difficult," presented challenges that enriched the experience, including reaching the peak elevation of 179 meters. Table 1 presents a thorough overview of the significant points of interest along the surveyed trail, encompassing the entirety of the information provided by the guide during the GPS mapping of the route. These locations not only function as geographical landmarks but also offer opportunities for education and the appreciation of the natural and cultural wealth of the environment.
Table 1 The main points of interest along the trail

<table>
<thead>
<tr>
<th>Nº</th>
<th>Point of interest</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Guaruba</td>
<td>The specimen belongs to the Vochysia genus and is of significant interest for its timber properties.</td>
</tr>
<tr>
<td>2</td>
<td>Cipó Anaconda</td>
<td>The vine is frequently known as the Anaconda because of its significant length.</td>
</tr>
<tr>
<td>3</td>
<td>Pequizeiro</td>
<td>The fruit tree, characterized by a large and leafy crown, yields the Amazonian piquiá, which is highly valued in the region.</td>
</tr>
<tr>
<td>4</td>
<td>Carapanáuba</td>
<td>The tree species, originating from the Tupi term &quot;casa de carapaná&quot; (referring to the habitat of a mosquito species in the region), is extensively utilized for its medicinal attributes.</td>
</tr>
<tr>
<td>5</td>
<td>Tauari</td>
<td>The Curupira tree. Apart from its commercial utility, the Curupira's beating of the Tauari trunk is also culturally significant, as it is thought to deter hunters from the forest.</td>
</tr>
<tr>
<td>6</td>
<td>Beetle larva</td>
<td>Certain species of edible larvae are present along the trail.</td>
</tr>
<tr>
<td>7</td>
<td>Samaúma</td>
<td>The Queen of the Amazon rainforest can grow to a height of 70 meters and live for up to 120 years. The tree is regarded as sacred by the indigenous communities of the Amazon region.</td>
</tr>
<tr>
<td>8</td>
<td>Redário</td>
<td>A hammock dormitory is currently under construction along the trail to offer lodging for tourists who are interested in night hiking.</td>
</tr>
<tr>
<td>9</td>
<td>Apuí</td>
<td>The tree possesses medicinal properties and holds significance in Amazonian folklore, particularly in the &quot;Legend of Apuí&quot;.</td>
</tr>
<tr>
<td>10</td>
<td>Jatobá</td>
<td>Tree species subject to exploitation through logging activities.</td>
</tr>
<tr>
<td>11</td>
<td>Sauva's Nest</td>
<td>Leaf-cutter ant species.</td>
</tr>
<tr>
<td>12</td>
<td>Tento</td>
<td>The tree species produces seeds that are utilized in the production of bio jewelry.</td>
</tr>
<tr>
<td>13</td>
<td>Jabuti Ladder</td>
<td>The tortoise ladder (Schnella sp.), also commonly referred to as pata-de-vaca, is a prevalent vine species native to the Amazon rainforest. During growth, concentric lateral layers are formed in ring shapes.</td>
</tr>
<tr>
<td>14</td>
<td>Fire Vine</td>
<td>The circular arrangement of the vines, referred to as &quot;Cipó de Fogo&quot; (Fire Vine) by the guide, was subsequently found to be inaccurate in later research.</td>
</tr>
<tr>
<td>15</td>
<td>Our Lady of Conception Church</td>
<td>The location where the trail ends.</td>
</tr>
</tbody>
</table>

Source: Own authorship (2024)
During the exploration of the trail, participants had the chance to not only assess their abilities in a demanding setting, but also to acquire valuable insights into the flora, fauna, and geographical characteristics of the Amazon region.

3.2 TRAIL GPS MAPPING FOR THE GLOBAL WIKILOC COMMUNITY

Participatory mapping with community tour guides not only fostered dialogue among stakeholders but also assisted in the initial identification of potential points of interest and the attractiveness of the ecological trail within the community. In this procedure, the guides identified 15 potential points as key landmarks along the trail and then recorded and mapped their locations using GPS technology.

Figure 3 illustrates the GPS mapping of the trail, carried out by researchers utilizing the Wikiloc application. This process revealed discrepancies between the official information and the data collected during the trail visit. The discrepancies involved differences between the route officially designated and the route actually taken by researchers. Figure 4 depicts that the mapping also shows an elevation gain of approximately 180 meters along the trail, requiring tourists to exert more physical effort. Following the on-site trail assessment, the researchers classified its level of difficulty as moderate to difficult, consistent with the official trail information.

Figure 3 Information collected in trail GPS Mapping

<table>
<thead>
<tr>
<th>Distância</th>
<th>Desnivel positivo</th>
<th>Tempo em movimento</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,81 km</td>
<td>179 m</td>
<td>3 horas 28 minutos</td>
</tr>
<tr>
<td>Dificuldade técnica</td>
<td>Desnivel negativo</td>
<td>Hora</td>
</tr>
<tr>
<td>Difícil</td>
<td>173 m</td>
<td>5 horas 3 minutos</td>
</tr>
<tr>
<td>Elevação máx</td>
<td></td>
<td>Coordenadas</td>
</tr>
<tr>
<td>179 m</td>
<td></td>
<td>2263</td>
</tr>
<tr>
<td>Elevação min</td>
<td>Tipo de trilha</td>
<td>Enviada em</td>
</tr>
<tr>
<td>10 m</td>
<td>Mão Única</td>
<td>29 de abril de 2023</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Registrada em</td>
</tr>
<tr>
<td></td>
<td></td>
<td>abril 2023</td>
</tr>
</tbody>
</table>

Source: Own authorship (2024)
The Wikiloc application enabled the researchers to record the complete trail route, even in offline mode. Furthermore, it facilitated the annotation and documentation of the main points of interest along the route through the use of images. The absence of signage along the trail was noted, which could present a significant obstacle in the event of accidents. In this context, seven points of interest have been identified for the installation of QR Code signs, aimed at offering comprehensive information to prospective trail users. Figure 5 depicts an instance of an information sign featuring a QR Code for the Samaúma Point of Interest.
The researchers suggested using QR codes with information signposts at selected points of interest and to promote the use of the Wikiloc app among future visitors. Two signs were created: one to facilitate app downloads and another to easily locate the trail recorded on Wikiloc by the researchers.

3.3 COLLECTIVE SELF-REFLECTION

The 12technolog members’ collective self-reflection revealed their awareness of the tourist potential of exploring ecological trails. They also believe that technology can benefit the 12technolog by attracting tourists and disseminating information. Although they lack knowledge about various 12technologies, they believe there is 12technologies investment from public authorities in the region.

Initially, our aim was to evaluate the existing level of technological knowledge among 12technolog members by understanding their perceptions of the subject and the 12technologies with which they were acquainted. The analysis of the subjects revealed that the smartphone was the most popular technology among them.

Apart from its everyday utility, members of the 12technolog acknowledged the smartphone’s potential as a versatile instrument for enhancing local tourism. Acquaintance with this device establishes a 12techno basis for the implementation of technological solutions aimed at enhancing the visibility of ecological trails, thereby consolidating them as tourist attractions for a broader audience. This perspective emphasizes the significance of making targeted investments in the incorporation of accessible and efficient technologies to enhance the local ecotourism industry.

4 DISCUSSION

The majority of community members emphasized the challenges and difficulties related to the utilization of technologies in their responses. Paying attention to the points mentioned by community members facilitates the overcoming of challenges by identifying effective tools for eliminating or reducing gaps. The community members' statements highlighted a range of factors that need to be taken into account when
implementing technologies, including connectivity, cost, ease of use, technical support, and effective utilization.

The acquisition and implementation of technology present a significant challenge in ecotourism, with a substantial impact on communities due to the required substantial investments. Nevertheless, despite this challenge, it is feasible to surmount it by employing no-cost tools that can facilitate the connection between community members and technology. The options are accessible for Android and iPhone (iOS) mobile devices and aim to enhance the tourist experience. Apps can enhance the safety of the journey by providing maps that enable users to locate the precise route of the trail, for instance. In order to enhance interaction with nature and facilitate a mutually beneficial relationship between humans and the environment, it is feasible to utilize specific applications that leverage the smartphone's camera for the identification of local fauna and flora species.

According to reference (Guzzo et al., 2013), the application of electronic support in sustainable tourism can enable tourists and local communities to utilize social networks for promoting the territory and sustainable tourism, as well as for sharing information with the goal of fostering widespread awareness of sustainable tourism. Moreover, as indicated by the aforementioned authors, the utilization of technologies to support sustainable tourism can serve to promote the region and sustainable tourism, disseminate information with the goal of fostering a broad understanding of sustainable practices, enhance local economies, facilitate interaction with individuals from distant locations, strengthen the sense of community, add value to local products, establish thematic routes, and organize fairs that distinguish a country. Additionally, it can lead to the creation of new jobs and opportunities, as well as the development and sharing of new services to enhance the quality of tourism, and stimulate innovation (Guzzo et al., 2013).

The community is equipped with strategically placed internet connectivity, facilitated by a fiber optic connection delivered through land infrastructure. The availability of connectivity enables the implementation of various initiatives that the community can undertake to support the use of technology in ecotourism activities.

Given the agents' limited technical expertise in the trial, it is crucial to allocate resources towards their training and education. Furthermore, it is imperative for all
individuals participating in the operation to possess a thorough understanding of the technologies in order to optimize their utilization. In this context, it is crucial to have a support team that assists the community by addressing inquiries, adjusting settings, and facilitating their acclimation to the new tools (Lal & Paul, 2016).

It is also crucial to establish a digital presence team within the community and allocate resources from the revenue generated by the trails to support it. Essentially, this team would have the responsibility for:

- Utilizing technology to establish and define community goals and objectives;
- It is important to maintain a website with high usability, ensuring it is responsive and accessible via smartphones.
- It is advisable to allocate resources towards establishing a presence on social media platforms.
- It is important to prioritize the customer experience when sharing on social networks.
- And establish environments that are visually appealing for sharing on Instagram.

Upon the introduction of new technology, it is essential to provide comprehensive education to the entire community regarding the potential risks and hazards associated with the new tools. Additionally, it is important to emphasize the significance of exercising caution when disseminating content on the Internet. The influence of the Internet on the promotion of ecotourism advertising is undeniable. This phenomenon primarily benefits tourists, who now have access to an increasing array of tools and information to aid in trip planning and decision-making. This allows them to compare prices and make purchases from the comfort of their own homes. The influence of technology on consumer preferences has led to a transformation in market dynamics and the structure of organizations (Kumar & Sharma, 2016). The utilization of social media data may also involve the implementation of big data technology in the realm of ecotourism (Talebi et al., 2021). Big data comprises significantly larger datasets capable
of capturing information on a much larger scale and potentially reflecting longitudinal changes in real-time (Kitchin, 2013).

The trail does not have internet connectivity. In this scenario, the decision was made to develop informational boards containing text content that can be accessed without an internet connection. The solution was found to be satisfactory, given that the majority of smartphones are equipped to read QR Codes using the camera, eliminating the necessity to install extra applications.

Exploring the ecological trail provides a valuable opportunity to engage with the fauna and flora of the Amazon region. The community has significant potential for ecotourism, which could have a positive impact on the local economy and create opportunities for community members to take social initiative (Maciel, Siles & Bitencourt, 2011). The incorporation of the trail into the Wikiloc application serves as a means of contributing to the global promotion of this activity. The application previously contained limited information regarding the trail and the community.

The deliberate incorporation of technology into the framework of ecotourism in the community demonstrates potential as a strategy for addressing challenges and optimizing economic and social advantages. By addressing concerns related to connectivity, affordability, and education, the community can utilize readily available resources to improve the tourist experience and safeguard the region's natural resources. The success of this initiative hinges on technical training, the formation of a digital presence team, and a thorough understanding of digital risks. Moreover, the incorporation of the ecological trail into the Wikiloc application highlights the significance of enhancing the global recognition of the community and its sustainable initiatives. By embracing a balanced and integrative approach, the community not only surmounts technological barriers but also enhances its position as a proponent of responsible ecotourism and the harmonious coexistence of humans and nature.

Hence, when utilized responsibly, tourism has the potential to enhance both the environment and the economy (Song & Han, 2023). In order to achieve these objectives, several measures should be put into place. Firstly, the establishment of ecotourism systems will be entrusted to and managed by local residents, enabling the local
community to benefit financially from ecotourism. Secondly, those in charge of ecotourism activities will enhance the quality of ecological, cultural, and heritage education and interpretive programs, and regularly update information platforms, thereby fostering a greater sense of responsibility among ecotourists. Thirdly, ecotourists and operators will voluntarily uphold the ecotourism system with a heightened sense of responsibility, in order to ensure the sustainability of ecotourism, based on an understanding of the need to tolerate inconveniences within the attraction and the significance of conserving natural resources (Choi et al., 2017).

Other authors emphasize the following as essential elements for community-based ecotourism: 1) gradual political empowerment, 2) deep-level economic incentives, 3) extensive educational support, 4) fair distribution of community benefits, and 5) stakeholder cooperation (Kiss, 2004; Gui, Fang & Liu, 2004). There are numerous instances of projects that generate income for local communities and enhance local attitudes toward conservation. However, the impact of community-based ecotourism on conservation and local economic development is constrained by factors such as the limited geographic scope and participation, restricted earnings, weak connections between biodiversity preservation and financial success, and the competitive and specialized characteristics of the tourism industry (Kiss, 2004).

5 CONCLUSION

The study aimed to examine the correlation between technologies and community-based ecotourism. The qualitative analysis of the actions indicated that the community under investigation possesses significant potential for the advancement of community-based ecotourism. However, it is evident that the community requires technical support to ensure the efficient execution and administration of this endeavor. It is evident that this endeavor has the potential to function as a substantial supplementary revenue stream for members of the community, particularly when supported by the presence of technological advancements. Technology enables individuals to engage with the environment, facilitating the sharing of knowledge and experiences, as well as the exploration of the biodiversity of the Amazon region.
Additional benefits of incorporating technology into community ecotourism were also observed in the course of this investigation. If implemented, these initiatives have the potential to enhance processes and services for visitors, increase the digital presence of the community, and promote environmental education. Nevertheless, it is important to note that numerous challenges persist in the successful integration of various technologies into ecotourism activities within communities in the Brazilian Amazon, particularly those associated with infrastructure. The primary reason for this phenomenon is the physical location of most tourist attractions, which are typically situated in areas distant from urban centers. Additionally, many community leaders and members perceive ecology and technology as having little connection. Consequently, gaining an understanding of the underlying causes of problems can lead to more assertive and effective solutions, as a single problem may have multiple potential resolutions. In this context, the glamour of the solution is not necessarily important; rather, its effectiveness is the key consideration. Nevertheless, it is important to acknowledge that the reverse is not always true; a technological solution may not be applicable to multiple problems, potentially resulting in a waste of time and financial resources for the community if the focus is solely on the solution rather than the underlying problem.

In light of the growing focus on and understanding of the ecological environment, ecotourism is gaining popularity. However, it continues to pose problems and challenges to the sustainable development of the environment. The incorporation of digital tools into community-based ecotourism has the potential to enhance the connection between ecology and technology. Additionally, it could enhance the competitive positioning of the community, showcasing it as a sustainable and innovative destination for nature enthusiasts and conscious tourists. Understanding this novel concept of tourism and fostering coordination and integration among families in the community are essential for the success of this endeavor. Learning should be a daily, continuous, and multifaceted process involving both research and practice.
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COMPLIANCE WITH ETHICAL STANDARDS

On behalf of all authors, the corresponding author states that there is no conflict of interest. All participants in the research study completed an Informed Consent Form that included comprehensive information about the nature of the study, its potential risks and benefits, ensuring that their decision to participate (or not) was made freely and with full awareness. The authors have made a commitment to refrain from disclosing the names and images of the participants.
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