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KNOWLEDGE MANAGEMENT IN THE AMAZON REGION: INTEGRATING TRADITIONAL KNOWLEDGE, DIGITAL INNOVATION, AND PUBLIC POLICIES FOR SUSTAINABLE DEVELOPMENT

GESTÃO DO CONHECIMENTO NO CONTEXTO AMAZÔNICO: INTEGRAÇÃO ENTRE SABERES TRADICIONAIS, INOVAÇÃO DIGITAL E POLÍTICAS PÚBLICAS DE DESENVOLVIMENTO SUSTENTÁVEL

GESTIÓN DEL CONOCIMIENTO EN EL CONTEXTO AMAZÓNICO: INTEGRACIÓN ENTRE CONOCIMIENTOS TRADICIONALES, INNOVACIÓN DIGITAL Y POLÍTICAS PÚBLICAS PARA EL DESARROLLO SOSTENIBLE

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ABSTRACT

Knowledge Management (KM) has increasingly consolidated as a strategic approach to sustainable development and innovation across regional contexts. In the Amazon region, characterized by vast biodiversity and sociocultural complexity, KM plays a crucial role in integrating traditional and scientific knowledge, promoting environmental conservation, and fostering sustainable socioeconomic development. This article discusses key challenges and opportunities for KM in Amazonia, focusing on the interfaces among science, technology, public policy, and local communities. Accordingly, the study examines how KM can be applied to preserve, systematize, and valorize Amazonian traditional knowledge while promoting innovation oriented toward sustainable development. It also identifies knowledge co-construction practices, challenges related to the inclusion of Indigenous peoples and local communities, and the political and institutional implications for territorial and environmental governance. The methodology combines a bibliometric review, interviews with KM researchers working in Amazonian contexts, government reports, an analysis of the trajectories of research groups, and a review of the scientific literature on KM in Amazonia. The results highlight the need for participatory conceptual models, transparency in data governance, and the institutionalization of inclusive dialogue channels. Recommendations are also presented for public policy and research practice.

Keywords: Knowledge Management. Amazon Region. Innovation. Sustainable Development Goals. Regional Development.

RESUMO

A Gestão do Conhecimento (GC) tem se consolidado como uma abordagem estratégica para o desenvolvimento sustentável e a inovação em diversos contextos regionais. Na Amazônia, território caracterizado por vasta biodiversidade e complexidade sociocultural, a GC assume papel crucial para integrar saberes tradicionais e científicos, promover a conservação ambiental e estimular o desenvolvimento socioeconômico sustentável. Este artigo discute os desafios e oportunidades da GC na Amazônia, abordando as interfaces entre ciência, tecnologia, políticas públicas e comunidades locais. Portanto, este estudo busca

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compreender como a GC pode ser aplicada para preservar, sistematizar e valorizar os saberes tradicionais da Amazônia, promovendo inovação com foco no desenvolvimento sustentável. Busca identificar as práticas de co-construção de conhecimento, os desafios de inclusão dos povos indígenas e comunidades locais, e as implicações políticas e institucionais para governança territorial e ambiental. A metodologia combina revisão bibliométrica, entrevistas com pesquisadores de GC no contexto amazônico, relatórios governamentais, trajetória de grupos de pesquisa e análise de produção científica sobre GC no contexto amazônico. Como resultados, destaca-se a necessidade de modelos conceituais participativos, transparência na governança de dados e institucionalização de canais de diálogo inclusivos. Aponta ainda recomendações para políticas públicas e para práticas de pesquisa.

Palavras-chave: GC. Amazônia. Inovação. Objetivos do Desenvolvimento Sustentável. Desenvolvimento Regional.

RESUMEN

La Gestión del Conocimiento (GC) se ha consolidado como un enfoque estratégico para el desarrollo sostenible y la innovación en diversos contextos regionales. En la Amazonía, un territorio caracterizado por una vasta biodiversidad y complejidad sociocultural, la GC desempeña un papel crucial en la integración de conocimientos tradicionales y científicos, la promoción de la conservación ambiental y el impulso del desarrollo socioeconómico sostenible. Este artículo analiza los desafíos y las oportunidades de la GC en la Amazonía, abordando las interfaces entre ciencia, tecnología, políticas públicas y comunidades locales. Por lo tanto, el estudio examina cómo la gestión del conocimiento puede aplicarse para preservar, sistematizar y valorar los conocimientos tradicionales amazónicos, promoviendo la innovación orientada al desarrollo sostenible. Además, identifica prácticas de co-construcción del conocimiento, desafíos para la inclusión de pueblos indígenas y comunidades locales, y implicaciones políticas e institucionales para la gobernanza territorial y ambiental. La metodología combina revisión bibliométrica, entrevistas con investigadores en GC en el contexto amazónico, informes gubernamentales, análisis de la trayectoria de grupos de investigación y revisión de la producción científica sobre GC en la Amazonía. Como resultados, se destaca la necesidad de modelos conceptuales participativos, transparencia en la gobernanza de datos e institucionalización de canales de diálogo inclusivos. También se formulan recomendaciones para políticas públicas y prácticas de investigación.

Palabras clave: Gestión del Conocimiento. Amazonía. Innovación. Objetivos de Desarrollo Sostenible. Desarrollo Regional.

1 INTRODUCTION

The Brazilian Amazon, recognized worldwide for its vast biodiversity and cultural diversity, faces complex socio-environmental challenges that require innovative and integrated solutions (Fearnside, 2018; Barlow, 2018; Artaxo, 2021). In this context, KM emerges as a strategic tool to organize, share and apply available knowledge, promoting both economic development, innovation and environmental sustainability (Nonaka; Takeuchi, 1997; Rezende, 2017; Olive tree; Saints; Martins, 2022)

The Amazonian context faces severe environmental challenges such as deforestation and economic pressure, which requires integrated management strategies and joint public policies between different government entities, according to studies by Fearnside (2005) and Ferreira, Venticinque; Almeida (2010). In the same vein, Barlow (2018) demonstrates the global relevance of Amazonian biodiversity and the growing challenges arising from human factors, agricultural expansion, mining, and climate change. It is evident that Amazonian challenges can only be faced with integrated approaches, involving science, communities, industries, and public policies (Brondizio, 2018; Almeida; Szwarcwald, 2020).

The study of Brondízio; Moran (2012) highlights cultural diversity and the need to integrate scientific and traditional knowledge in socio-environmental solutions. The importance of the cultural and historical diversity of the Amazonian peoples and their role in the ecological management of the region should be emphasized (Clement, 2015). Thus, it becomes relevant to implement the need for coordinated and transdisciplinary actions to face complex socio-environmental challenges, as highlighted by Nascimento (2015) and Artaxo (2021).

In this sense, the Amazonian context, due to its unique and peculiar characteristics, faces complex challenges that require innovative approaches to promote sustainable development (Brondízio; *et al.*, 2016; Silva; *et al.*, 2017; Fleury, Lobato; Dantas, 2019). Thus, KM and its foundation in an interdisciplinary science that permeates different scientific areas, becomes a strategy to integrate knowledge from traditional native peoples, advances in scientific knowledge with a focus on sustainability, promote regional technological advancement and provide opportunities for innovation in the industrial ecosystem (Bentes-Gama, 2012; Foster; Zaninelli, 2024; Castanha, 2025), strengthening local governance and driving adaptive solutions in the face of climate change and socio-environmental pressures, improving the performance of the industry and promoting an impact on society (Lima; Pozzobon, 2005; Silva, 2017; Mello-Théry; Fearnside, 2020)

It should be considered that the Amazon is one of the richest regions in biodiversity and cultural diversity on the planet, playing an essential role in global climate regulation and in the preservation of strategic natural resources (Lima; Pozzobon, 2005; Matos, Barroso Tenazor; Lopes, 2022). However, it faces historical challenges related to predatory exploitation, social inequalities and lack of integration between scientific, technological and traditional knowledge (Brondízio; Moran, 2012; Saints; Costa, 2021). It is relevant to highlight and highlight that the Brazilian Amazon is a complex space for the production, circulation and appropriation of knowledge, whether scientific, technological, community, social, indigenous, economic and ancestral (Fernandes; *et al.*, 2025; Magalhães, 2025). This knowledge coexists in a territory marked by structural asymmetries and intense sociocultural and immaterial diversity (Miranda; Schwaninger; Lucena, 2023). It can be said that it is essentially the sharing of tacit knowledge, passed from generation to generation or between subjects chosen by the leaders, so there is a challenge to the construction of collective knowledge (Chaves, Barbosa; Clement, 2018; Santos, *et al.*, 2023).

The notion of KM, originally developed in the business and organizational field (Nonaka; Takeuchi, 1997), has been gradually reinterpreted for contexts of territorial development, environmental conservation, and social innovation (Müller, 2024; Fonseca, 2024). It is clear that there is still an embryonic movement to transform this tacit knowledge into explicit knowledge. In this sense, scientific research and KM have much to contribute to the sustainable development of the Amazon region (Arruda Filho, 2019; Foster; Zaninelli, 2024; Castanha, 2025)

In this context, KM emerges as an instrument for integrating and valuing local knowledge, capable of guiding public policies and sustainable innovative practices (Ribeiro; Leite, 2021; Santos, *et al.*, 2023).

However, KM can contribute significantly to the construction of an Amazonian development model based on knowledge, innovation and sustainability, as described in the studies by Bentes-Gama, (2012); Silva, (2017) and Fleury, Lobato; Dantas (2019). This approach implies recognizing the plurality of actors such as universities, research centers, indigenous communities, indigenous peoples, government institutions, and companies articulating processes of creation, sharing, and application of knowledge focused on the Amazonian reality (Freire; Lima, 2020; Foster; Zaninelli, 2024; Castanha, 2025).

The present study is justified due to the integration between different forms of knowledge, being essential to strengthen public policies, innovation strategies and socio-

environmental governance mechanisms in the search to protect, preserve and seek a sustainable development plan (Freire; Lima, 2020; Mello-Théry; Fearnside, 2020; Saints; Costa, 2021). Another relevant point that justifies the study is that the Amazon, with its immeasurable environmental and sociocultural diversity, constitutes one of the most complex ecosystems of knowledge on the planet (Margulis, 2003; Porto-Gonçalves, 2006; Clement, 2015; Barlow, 2018).

In this context, KM assumes a strategic role by integrating scientific, technological and traditional knowledge in favor of sustainable development and social innovation (Leite; Marly 2019; Geraldo; Pinto, 2019; Silva; Bittencourt, 2021; Geraldo, Pinto; Duarte, 2022; Barbalho, *et al.*, 2023). Recent productions on the subject highlight the importance of thinking about KM in the Amazon from collaborative, interdisciplinary and territorially situated approaches (Ribeiro; Leite, 2021; Magalhães, 2025).

Some initial scientific research in the Amazonian context deals with the theme KM in the legal Amazon is characterized by a multidisciplinary and interdisciplinary field of study that ranges from organizational practices to traditional indigenous knowledge (Leite; Marly 2019; Silva; Bittencourt, 2021 Barbalho, Inomata; Fernandes, 2021; Geraldo; Dick; Duarte, 2022; Yanai, *et al.*, 2024).

Studies on the KM theme in the Amazonian context and in the northern region of Brazil are recent. In the study by Brito, *et al.*, (2016) a study was prepared in which it analyzes how credit unions in the Amazon apply KM practices, considering cultural and regional specificities.

The study by Souza, Barros and Gomes (2020) developed a bibliometric study that analyzes the works published on KM in university libraries in the Amazon, using the Web of Science database. The study by Fonseca (2024) explored initiatives of conceptual models of indigenous KM within the scope of Information Science, highlighting traditional practices and their contemporary application (Leite; Marly 2019; Silva; Bittencourt, 2021 Barbalho; Inomata; Fernandes, 2021.

Thus, no studies were found that connect KM to sustainable development, preservation, systematization and valorization of traditional knowledge of the Amazon based on the Sustainable Development Goals (SDGs) (Leite; Marly 2019; Silva; Bittencourt, 2021 Barbalho; Inomata; Fernandes, 2021; Geraldo; Dick; Duarte, 2022; Fonseca, Zaninelli; Simonetti, 2024).

A relevant and innovative question reinforces that KM in the Amazonian context is considered an interdisciplinary field that seeks to promote the creation, sharing, and efficient application of knowledge in organizations and communities (Davenport; Prusak, 1998). In the Amazonian context, however, knowledge is not limited to scientific or technological production, but includes traditional knowledge rooted in cultural, spiritual, and ecological practices (Fleury; Lobato; Dantas, 2019; Barreto; Freitas, 2020; Arreto; Brazil, 2021; Foster; Zaninelli; Simonetti, 2024). This knowledge is transmitted orally, sustaining ways of life and sustainable management strategies that have resisted for centuries (Diegues, 2000).

From this perspective, the Amazon constitutes a hybrid informational ecosystem, in which traditional knowledge and scientific systems coexist and, in many cases, are tensioned. KM in the region is not limited to technology transfer or data digitization, but involves valuing local practices, information governance, and the integration of diverse actors such as indigenous people, riverside communities, universities, public agencies, and companies and social organizations (Barreto; Freitas, 2020; Castro, Lima; Zucarelli, 2021; Arreto; Brazil, 2021; B; Inomata; Fernandes, 2021).

The Amazon, as a territory of biodiversity and sociocultural plurality, presents unique challenges and opportunities for KM (Santos, *et al.*, 2023; Foster; Zaninelli, 2024; Castanha, 2025). The integration between KM and traditional knowledge becomes, therefore, a strategic and ethical issue. Recognizing this knowledge as legitimate forms of scientific production broadens the notion of innovation, favoring intercultural dialogue and sustainability (Santos, 2007; Brook; Leite, 2021; Fernandes, *et al.*, 2025; Magalhães, 2025). Thus, this article seeks to understand how KM can be applied to preserve, systematize and value the traditional knowledge of the Amazon, promoting innovations focused on sustainable development without decontextualizing them or reducing them to mere scientific data.

2 THEORETICAL FRAMEWORK

The theoretical contribution of this study is structured and interrelated in the dialogue of classical and contemporary authors. When structuring the theoretical foundation of the study, it was understood that it would be innovative to present in the text the theoretical and scientific relevance establishing the interlocution of national and international articles given the complexity of *the locus* of study, the Amazonian context.

Thus, the theoretical framework is structured in four chapters. The first deals with the fundamentals and different approaches to KM. The second chapter addresses KM in the

Amazonian context, discussing its different characteristics. The third chapter addresses the Amazon as an ecosystem of knowledge, discussing its sociocultural, environmental and epistemological dimensions. The fourth chapter articulates KM integrated with traditional knowledge, dialoguing with digital innovation.

2.1 GC: FUNDAMENTALS, APPROACHES AND CONCEPTUAL EVOLUTION

KM has been consolidated, over the last three decades, as one of the pillars of organizational competitiveness, innovation and informational sustainability (Angeloni, 2008; Terra, 2013; Barbosa; Schneider, 2015; Baptist; Quandt, 2016; Pear tree; Angeloni, 2020; Geraldo; Dick; Duarte, 2022).

In the Brazilian context, the field of KM studies has taken on its own characteristics, influenced by institutional diversity, the public innovation agenda, the emergence of digital technologies, and the challenges imposed by complex territories such as the Amazon (Rosenberg; Ohayon; Batista, 2008; Alfenas, *et al.*, 2021; Bike; Fernandes; Angels, 2021; Müller; *et al.*, 2024). Thus, KM in Brazil has developed its own characteristics, especially in the public sphere, due to institutional diversity, the adoption of a governmental innovation agenda, and territorial particularities (Pinheiro; Araújo, 2023; Coast; Almeida, 2023; Pacheco; Yamaguchi; Madeira, 2023).

National studies show that KM in the public sector is still in the consolidation phase and requires contextual adaptations according to studies by Santos, (2022) and Cunha; Meirelles, (2022). The study by Alfenas *et al.* (2021) who conducted a literature review from 2008–2017 concluded that Brazilian public organizations need to establish specific KM models adapted to their reality. Conclusions from more recent scientific studies advance to consider KM stages adapted to complex regional realities, such as in the Amazon and in the Northeast region according to Pacheco, Yamaguchi; Madeira, (2023) and de Müller, *et al.*, (2024).

In the Brazilian context, KM has been researched and discussed in different areas such as Information Science, Administration, Production Engineering, Information Systems, People Management and Organizational Studies according to Ziviani, *et al.*, (2025). In this way, the KM theme becomes relevant when relating it to open access policies, data governance, digital repositories, social innovation, and traditional knowledge (Barbalho, 2022; Tartarotti; 2023). At the same time, international studies reinforce the centrality of

knowledge flows as essential mechanisms for continuous learning, strategic renewal, and dynamic capacity building (Wiig, 1997; Davenport; Prusak, 1998).

KM in the scientific field has been discussed in universities, public and private companies, government entities and social organizations as an interdisciplinary field (Ziviani; Corrêa; Muylder, 2019; Would; Costa, 2020). Its evolution is directly linked to the transformation of knowledge into a central economic resource, as emphasized by Drucker (1993, p.83), when he states that "knowledge has become the main economic resource of modern organizations".

In this way, KM consolidates itself as a field of science, being one of the strategic areas for public, private, academic and community organizations in the twenty-first century (Francini, 2002; Souza; Corrêa, 2018; Silva; Menezes, 2013; Fialho; Barbosa; Santos, 2018). Inserted in a global context of digital transformations, intensification of information flows, and growing valuation of intangible assets, KM has become fundamental for innovation, process improvement, competitiveness, and decision-making (Batista; Quandt, 2016; Rezende, 2017; Olive tree; Santos, 2022).

Classic authors in the field of KM such as Nonaka; Takeuchi (1997) states that, in contemporary societies, knowledge constitutes the basis of economies, representing the main strategic resource of organizations. Thus, "the ability to create knowledge, disseminate it and incorporate it into products, services and systems is the most important source of competitive advantage" (Nonaka; Takeuchi, 1997, p. 13).

In this sense, Batista and Quandt (2016) argue that KM becomes essential for innovation and organizational competitiveness by allowing information to be systematized and transformed into action (Ziviani; et al, 2025; Correa; *et al.*, 2025). Terra (2019) argues that KM practices strengthen collaborative environments and contribute to the creation of public and social value.

In the contemporary scenario, characterized by dynamics of continuous innovation, technological advances, and growing organizational complexity, KM is now considered a strategic element for creating value, sustaining competitiveness, and promoting continuous learning (Correa; *et al.*, 2025; Ziviani; *et al.*, 2024). Davenport and Prusak (1998, p. 5) add that knowledge is "a fluid mixture of condensed experience, values, contextual information, and specialized insight."

In Brazil, the debate on KM has been expanded since the 2000s, when authors such as Fleury and Fleury (2000), Batista (2004), Valentim (2004) and Terra (2005), began to

articulate international theories with the reality of local organizations. Terra (2005) observes that KM in the country needs to consider cultural, institutional and structural specificities, especially in organizational environments marked by inequalities, discontinuity of policies and lack of informational integration.

Still within the Brazilian context, studies such as those by Angeloni (2008) and Batista; Quandt (2016) indicate that the adoption of KM practices is growing progressively, although it still faces structural, cultural and managerial limitations. Angeloni (2008, p. 27) highlights that "Brazilian organizations are still maturing their KM processes", emphasizing the need to consolidate incentive policies, learning structures and institutional recognition. Increasing digitalization has brought new challenges and opportunities for strengthening KM in the Amazonian context (Stradioto; Frazzon, 2023; Silva; File; Silva, 2025).

Davenport; Prusak (1998) point out that the growing volume of data and information does not necessarily translate into useful knowledge: it is necessary to interpret, contextualize, validate and apply this information. KM emerges exactly as a field capable of transforming dispersed data into strategic knowledge, favoring organizational learning, continuous improvement and adaptive capacity (Sá, *et al.*, 2018; Belinski; Martins, 2020; Klein; Azevedo; Silva, 2021).

Thus, understanding knowledge not only as an input, but as a dynamic process, becomes fundamental for the understanding of KM, with knowledge being the most relevant resource for organizations (Gonzalez; Martins, 2017; Pear tree; Macieira, 2020; Ziviani; *et al.*, 2025). Nonaka and Takeuchi (1995) argue that organizational knowledge results from the continuous interaction between tacit and explicit dimensions, operating in a cyclical and spiral process capable of promoting innovation. For the authors, "knowledge is created in a spiral process, which expands both at the individual and collective levels" (Nonaka; Takeuchi, 1995, p. 25).

Wiig (1997) reinforces this conception by arguing that KM involves systematic practices aimed at identifying, constructing and applying knowledge in order to improve organizational performance. In his perspective, "KM exists to ensure that the organization can act intelligently" (Wiig, 1997, p. 92), revealing the strategic character of this field.

On the international scene, Yu; *et al.*, (2022) and Pereira (2025), argue that KM should be understood as a multidimensional phenomenon, involving technology, social structures, and cognitive processes. According to the authors, knowledge is an intangible asset whose

effectiveness depends mainly on sharing mechanisms, collaborative culture and appropriate systems.

To contextualize this study, it is necessary to define CG. Therefore, KM constitutes an organized and intentional set of processes to create, capture, systematize, share and apply knowledge, whether tacit or explicit, in scientific organizations and institutions, with the purpose of transforming internal knowledge into strategic assets that promote innovation, organizational learning, institutional preservation and competitive advantage (Silva, 2004; Milk; Costa, 2007; Bike; Kobashi; Bettencourt; Cianconi, 2012; Correa, *et al.*, 2024; Ziviani; *et al.*, 2025a).

Table 1 presents the definition of KM discussed by different classical and contemporary authors and elucidates the concept of KM for this study.

Table 1

Definitions of KM

Author(s)	Year	Definition/Approximation of GC
Nonaka; Takeuchi	1997	KM as "a process of continuous creation of new knowledge, disseminating it widely throughout the organization and quickly incorporating it into new products/services, technologies and systems".
Davenport; Prusak	1998	KM is the "collection of processes that aim to govern the creation, dissemination, and use of knowledge to achieve organizational objectives."
Sveiby	2000	KM understood as the "art of creating value from the leverage of an organization's intangible assets", involving internal/external structure and employee competence.
Choo	2006	KM involves processes of knowledge creation, generation of meaning, and decision-making — that is, in addition to manipulating information, the focus is on how the organization generates meaning and decides based on knowledge.
Valentine	2008	KM is a set of activities that aims to work on the organizational/informational culture and institutional communication to provide a favorable environment for the generation, acquisition, sharing and use of knowledge. It focuses on transforming tacit knowledge into explicit knowledge to support ideas, problem solving, and organizational decision-making.
Corrêa, Ziviani; Muylder	2019	They propose a "holistic approach" to KM, highlighting that existing models are parsimonious and suggesting that effective KM should consider multiple dimensions of the organization (people, processes, culture, technology, etc.).

Source: survey data, 2025.

The literature presents a diversity of KM definitions: with approaches more centered on processes, capture and use of knowledge according to Davenport; Prusak (1998) and Sveiby (2000). It is also noted that integrated/holistic models (Corrêa, Ziviani; Muylder, 2019) value culture, technology, structure, and people simultaneously. The holistic approach of Corrêa, Ziviani; Muylder (2019) can serve as a modern and systemic reference, especially if his study addresses KM in companies/organizations that deal with sustainability, innovation,

and green technology focused on areas that require integration between processes, people, and technology.

For Nonaka; Takeuchi (1997, p. 83), "knowledge is created through the continuous interaction between tacit and explicit knowledge", articulated in the SECI model, which has become a world reference. Davenport; Prusak (1998) reinforce that knowledge is a strategic resource, stating that "valuable knowledge derives from experience, interpretation and reflection" (Davenport; Prusak, 1998, p. 5).

In addition to the corporate context, KM can also be applied to the academic and research environment: scientific KM involves practices of organization, communication, and dissemination of scientific knowledge, with a view to facilitating the production, exchange, and preservation of knowledge produced in teaching and research institutions. Scientific communication, documentation, recording of data and results, as well as the dissemination of knowledge are seen as essential elements for this type of KM (Leite; Costa, 2007; Sampaio; Menezes, 2021; Baptist; Farias, 2023).

It is important to highlight that, although there are several definitions and conceptual approaches to KM, there is a consensus among researchers and authors that KM is not reduced to the management of data or information. KM presupposes a mature organizational strategy, technology infrastructure, and organizational, socio-technical, and cultural culture that allows transforming knowledge into intellectual capital, that is, into a strategic resource (Menezes; Rodrigues, 2023; Correa, *et al.*, 2024; Ziviani; *et al.*, 2025a).

Finally, KM presents itself as a solid, dynamic and multidimensional field. The integration between technology, social processes, collaborative culture and ethics is indispensable. In Brazil, the relationship between KM and complex territories, such as the Amazonian context, is a strategic and little explored area, demanding critical, participatory approaches that are sensitive to epistemological diversity (Souza; Corrêa, 2018; Barbalho, 2023; Yanai, *et al.*, 2024).

2.2 KNOWLEDGE MANAGEMENT IN THE AMAZONIAN CONTEXT

The Brazilian Amazon is a territory of great socio-environmental and cultural complexity, home to a unique diversity of ecosystems, indigenous peoples, traditional communities, and teaching and research institutions. (Arruda Filho, 2019; Artaxo, 2019; B; Inomata, 2021). This scenario presents unique challenges for KM, especially with regard to the integration between scientific and traditional knowledge, the preservation of strategic

information and the promotion of sustainable innovation (Brito, *et al.*, 2016; Cardoso; Pimenta, 2019; Yanai, *et al.*, 2024; Fonseca, 2025)

According to Müller, Arruda; Vilches (2024, p. 12), "KM consists of a set of processes aimed at creating, organizing, disseminating and applying knowledge, considering it as strategic assets". In the Amazonian context, this definition requires expansion, given that the knowledge produced is not only technical or scientific, but also cultural, ancestral and collective (Castro; File; Zucarelli, 2021; Coast; Almeida, 2023). Thus, KM in the region should be thought of in an interdisciplinary way, incorporating social, environmental and epistemological dimensions specific to the Amazon territory (Chaves; Barbosa; Clement, 2018; Fleury; Lobato; Dantas, 2019; Castro; File; Zucarelli, 2021)

KM is a field that emerged at the end of the twentieth century, with the aim of organizing and maximizing the use of information within organizations and communities (Nonaka; Takeuchi, 1997). According to Müller, Arruda, and Vilches (2024), KM processes include: knowledge identification, creation, storage, distribution, application, and evaluation. Such processes make it possible to transform information into strategic assets capable of generating innovation and competitive advantage (Stewart, 1997; Sveiby, 1998).

However, in regional contexts such as the Amazon, the application of these concepts needs to be adapted and contextualized to the scenario and field of study (Fonseca; Zaninelli, 2022; Foster; Zaninelli; Simonetti, 2024; Magalhães, 2025). Researcher Fonseca (2024, p. 45) points out that "traditional KM models, usually developed in urban or corporate environments, do not always apply to the Amazonian reality, where oral, collective knowledge and linked to specific territorial and cultural practices predominate". This perspective shows that KM in the Amazon must incorporate not only technology and scientific documentation, but also practices of preservation and transmission of community knowledge (Little; Barreto Filho, 2012; Martins; Silva, 2019; Matos; Barroso Tenazor; Lopes, 2022).

The classic KM literature is not limited to the management of information or data, it involves the coordination of knowledge flows, the promotion of organizational learning, and the creation of cooperation networks that facilitate the production and exchange of knowledge (Davenport; Prusak, 1998). In regions of high cultural and environmental diversity, such as the Amazon, these elements assume strategic relevance (Moraes; Birth, 2021; Pine; Araújo, 2023; Pacheco; Yamaguchi; Madeira, 2023).

The Amazon is characterized by a mosaic of cultures, languages, and forms of knowledge. Indigenous and riverine knowledge, for example, has spiritual and collective

dimensions that make it difficult to codify it in traditional KM systems (Silva; Oliveira, 2021; Saints; Costa, 2021; Barbalho, 2022; Fonseca, 2024). Decoloniality and Traditional Knowledge in Scientific Practices in the Amazon argues that non-Western knowledge should be treated as legitimate epistemology, requiring KM models that respect their own logics (Silva; Saints; Ferreira, 2022; Schott; Steinmueller, 2023).

According to Fonseca (2024, p. 32), "indigenous knowledge is dynamic, collective, and deeply linked to the territory, and it is essential to ensure its preservation and transmission in an ethical and culturally sensitive way". Thus, the integration between scientific and traditional KM requires attention to ethical, legal, and cultural aspects, avoiding the misappropriation of local knowledge (Barbalho, 2022; Yanai; *et al.*, 2024)

Research carried out in cooperatives and institutions in the Amazon points to significant gaps in KM infrastructure. According to Brito, *et al.*, (2016), despite recent advances, the adoption of KM systems is still incipient, with a lack of adequate technologies for organizing, storing, and sharing information.

In addition, the lack of interoperability between different information systems prevents the efficient circulation of knowledge (Valentim, 2008; Martin; Nascimento, 2021). Fonseca (2024) highlights that Amazonian museums and libraries face challenges related to the standardization of vocabularies, cataloguing, and digital access, limiting the dissemination of scientific and cultural knowledge (Bernard; Jorgensen, 2022; Souza; Oak; Mendes, 2022; Yanai, *et al.*, 2024)

One of the greatest challenges is to reconcile traditional and scientific knowledge in a collaborative way (Silva; Oliveira, 2020; Silva; Bittencourt, 2021). According to Fonseca (2024), the creation of specific conceptual models, such as those developed for indigenous communities, allows for more ethical and effective knowledge management. Such models value orality, ancestry and the immaterial dimension of knowledge, integrating them with practices of social and technological innovation (Machado; Carvalho, 2019; Freire; Lima, 2020; Foster; Zaninelli; Simonetti, 2024).

Decoloniality and traditional knowledge reinforce that the dialogue between different knowledge regimes requires rethinking methodologies, indicators, and evaluation metrics (Battiste, 2019; Schott; Steinmueller, 2023). The simple transfer of urban or corporate KM techniques to Amazonian contexts is insufficient, as it ignores the cultural, social and environmental specificities of the territory (CASTRO, 2010; Foster; Zaninelli, 2022; Barbalho, 2023).

Fonseca (2024) proposes a conceptual model of KM for indigenous communities that values collectivity, orality, and connection to the territory. This model allows for the recording of knowledge in an ethical manner, ensuring intergenerational transmission and cultural protection. The integration of such practices with academic and technological initiatives strengthens the dialogue between science and tradition, promoting social innovation and territorial sustainability (Silva; Barreto, 2020; Wikepena, 2021).

In the context of indigenous peoples, knowledge is not just a set of information, but a historical and cosmological construction linked to the territory, community relations, spirituality and environmental practices (Arreto; Brazil, 2021; Bernard, 2022). In this sense, Berkes (2012, p.4) states that traditional ecological knowledge constitutes "a complex, adaptive, and cumulative system transmitted between generations," which implies understanding indigenous knowledge as living and dynamic systems. In addition, Almeida (2014, p. 90) highlights that indigenous territories are spaces for the production of identities and specific knowledge, constituting "territories of knowledge", a view that goes against the study of Carvalho, Pires; Ribeiro (2021). Thus, applying KM models to these contexts requires expanding epistemological references, avoiding colonizing and reductionist approaches (Battiste, 2019; French; Oliveira, 2020).

From the perspective of cognitive justice, Santos; Meneses (2019) argues that there is a long history of subordination of indigenous epistemologies in the Western scientific field. For the authors, recognizing indigenous knowledge implies adopting epistemologies from the South, which presuppose "the coexistence of different forms of knowledge and the refusal of epistemological hierarchization" (Santos; Meneses, 2019, p. 8). This view dialogues with Smith (2012), for whom indigenous knowledge is intrinsically linked to cultural sovereignty, and should be treated ethically and with respect for community protocols. The author states that "researching or recording indigenous knowledge is always a political act" (Smith, 2012, p. 59), reinforcing the need for collaborative approaches and free and informed consent.

From the point of view of documentation and preservation, Brazilian authors have highlighted the importance of participatory processes (Freitas; Oliveira, 2020; Weitzel, 2021; Souza; Oak; Mendes, 2022). Freitas and Oliveira (2020) point out that the preservation of indigenous intangible heritage requires methodologies that consider oralities, rituals, and community dynamics, avoiding decontextualization. Likewise, Silva; Barreto (2020) discusses KM practices in Brazilian villages, emphasizing that oral transmission remains

central to the maintenance of knowledge, although digital tools can support registration processes when used under the governance of the community itself.

Another relevant axis is the role of indigenous knowledge in sustainability (Geraldo; Pinto, 2019; Geraldo; Dick; Duarte, 2022; Ziviani; *et al.*, 2025b). Nakashima *et al.* (2020), in a study published in *Science*, demonstrate that traditional knowledge is fundamental for global biodiversity conservation strategies, reinforcing its direct relationship with the territory and with ancestral sociocultural practices. In this sense, Diegues (2000, p. 21) states that this knowledge offers "singular interpretations of nature and its cycles", constituting references that complement modern science.

The integration between scientific institutions and indigenous peoples has demanded new KM practices based on collaboration. Carvalho, Pires; Ribeiro (2021) analyze partnerships between indigenous communities and research centers, emphasizing the importance of social innovation and the recognition of collective intellectual property. Similarly, Bernard; Jorgensen (2022) propose collaborative research models that include co-authorship, joint planning, and benefit-sharing.

In the methodological field, Kovach (2020) argues that indigenous epistemologies and methodologies should guide any KM process involving this knowledge, as they represent "ways of knowing based on relationship, territory, and belonging" (Kovach, 2020, p. 52).

From a critical perspective, Agrawal (2002) warns that many processes of recording indigenous knowledge carry logics of Western classification that disregard the proper ways of organizing knowledge. He argues that, without reflection, KM can reproduce epistemic inequalities. This leads to the contemporary challenge of developing intercultural KM practices, capable of integrating digital technologies, participatory methodologies, and principles of self-determination (Almeida, 2014; Oak; Saucer; Ribeiro, 2021; Mcgrew; *et al.*, 2023).

In this context, the ethical dissemination of indigenous knowledge requires intellectual protection policies, shared governance, and community control mechanisms over the use of information (Souza; Gomes, 2019; Nakashima; *et al.*, 2021). Souza; Gomes (2019) highlight that safeguard policies should ensure that the circulation of knowledge occurs according to cultural, legal and ethical principles agreed with the communities. Thus, KM applied to indigenous peoples cannot be limited to techniques for capturing and recording knowledge. It must involve active participation, reciprocity, respect and recognition of different ways of existing and knowing (Kovach, 2020; Wikepena, 2021; Bernard; Jorgensen, 2022)

In general, KM in indigenous contexts demands a plural epistemology, sensitive to the territory, oral narratives, community technologies, and spiritual relations that structure traditional knowledge (Barbalho, 2022; B; *et al.*, 2023; Fonseca, 2024). It is a field that expands the frontiers of KM, allowing the construction of more inclusive, ethical, and multicultural models of knowledge production and circulation. The preservation and dissemination of indigenous knowledge, therefore, can only occur legitimately when guided by the autonomy of peoples, by cognitive justice, and by collaborative processes that respect their complexity and historical depth (Freire; Lima, 2020; Foster; Zaninelli, 2022).

KM in the Amazon is also directly related to innovation and sustainable development policies (Lima; Pozzobon, 2005; Little; Barreto Filho, 2012; Matos; Barroso Tenazor; Lopes, 2022). Schott; Steinmueller (2023) highlight that integrative KM models can contribute to contextualized science, technology, and innovation (ST&I) policies, considering axes of territorial governance, environmental sustainability, social innovation, and informational sovereignty.

In this way, KM becomes a strategic tool for sustainable regional development, promoting not only the appropriation of scientific knowledge, but also the appreciation and protection of local knowledge (Rezende, 2017; Pear tree; Angeloni, 2020; Martin; Nascimento, 2021).

KM in the Amazonian context presents some fundamental and relevant guidelines. The first point is the epistemological plurality, which is essential when recognizing and integrating different types of knowledge such as scientific, technological, indigenous and community in management models that respect their specificities (Fonseca, 2024). Another issue is related to ethics and cultural preservation in which KM processes must ensure that traditional knowledge is used ethically, preserving cultural and territorial rights (Schott; Steinmueller, 2023).

The study by Brito, *et al.*, (2016) describes the need for institutional adaptation when implementing KM practices that must consider the particularities of Amazonian institutions, including technological, structural, and human resource limitations. In another sense, the integration with innovation and sustainability stands out. In this sense, KM must be articulated with social, technological and environmental innovation policies, contributing to the sustainable development of the region (Schott; Steinmueller, 2023).

The adoption of these guidelines implies rethinking traditional KM models, promoting flexible, interdisciplinary approaches that are sensitive to cultural and environmental diversity

(Santos; Costa, 2021; Silva; Bittencourt, 2021; Saints; *et al.*, 2023; Yanai; *et al.*, 2024a). In addition, the dialogue between modern science and traditional knowledge can generate social and technological innovation adapted to local realities. KM, in this sense, becomes a means of community empowerment, allowing Amazonian peoples to define their own sustainable development strategies (Silva; Barreto, 2021; Bernard; Jorgensen, 2022; Yanai, *et al.*, 2024b)

2.3 THE AMAZON AS AN ECOSYSTEM OF KNOWLEDGE: SOCIOCULTURAL, ENVIRONMENTAL AND EPISTEMOLOGICAL DIMENSIONS

The Amazon region concentrates one of the greatest biodiversity on the planet and, at the same time, a diversity of indigenous peoples, riverside dwellers, quilombolas and traditional communities that produce, transmit and resignify knowledge in close relationship with the environment (Fearnside, 2005; Brondízio; Moran, 2012; Fernandes; *et al.*, 2025). This knowledge, often referred to as traditional ecological knowledge (TEK), constitutes complex systems of observation, experimentation and classification of nature, which guide practices of use, management and conservation of natural resources (Hanazaki *et al.*, 2018).

Hanazaki *et al.* (2018) define traditional and local knowledge as a set of knowledge and practices that guide the sustainable use of biodiversity and that are fundamental to achieving global conservation goals, such as the Global Strategy for Plant Conservation (Becker, 2002; Barlow; *et al.*, 2018; Almeida; Szwarcwald, 2020; Artaxo, 2021). For the authors, "traditional ecological knowledge and local ecological knowledge are central to sustainable harvest and biodiversity conservation" (Hanazaki *et al.*, 2018, p. 1592), emphasizing that such knowledge is not a remnant of the past, but an active component of contemporary sustainability strategies.

In the Brazilian Amazon, Galvão *et al.* (2024), when studying the use of mangrove wood in coastal communities, show that the TEK organizes vocabularies, classifications, and practices of use of species such as *Rhizophora mangle* and *Avicennia germinans*, articulating technical, family, and intergenerational dimensions. The authors point out that local knowledge about wood has been validated by scientific research, which reinforces the idea of complementarity between traditional and academic knowledge (Galvão *et al.*, 2024). In this sense, the TEK studies go against the fundamental concepts of KM that defines tacit and explicit knowledge according to Nonaka; Tackeuchi (1997).

In this way, the Amazon can be understood as an ecosystem of knowledge in which biodiversity and sociodiversity are mutually reinforcing: biological wealth feeds multiple knowledge systems, while these systems are crucial for the maintenance of cultural and ecological landscapes (Lima; Pozzobon, 2005; Brondizio, 2016; Arreto; Brazil, 2021; Assad, 2022). In this sense, KM as a science assumes a strategic position in the Amazonian context (Machado; Oak. 2019; Mello-Théry; Fearnside, 2020; Matos; Barroso Tenazor; Lopes, 2022)

Amazonian knowledge is inseparable from the historical trajectories and forms of social organization of the peoples who inhabit the region (Santos; Costa, 2021; Silva; Bittencourt, 2021; Pine; Araújo, 2023). Fernandes; Moser (2021), when analyzing riverside communities, show that the socio-historical formation of the Amazon was marked by processes of colonization, forced migration, economic cycles, and public policies that, to a large extent, made the social and political place of these groups invisible (Silva; Oliveira, 2020; Fernandes; Moser, 2021; Silva; Saints; Ferreira, 2022).

These communities build a way of life in which territory, identity, and knowledge are intertwined. Padovani (2022), when presenting the Encyclopedic Atlas of Traditional Knowledge of the Amapá Amazon, highlights that traditional populations are groups "culturally established in a geoFigureical space, having intrinsic and interdependent connections with it", and that their knowledge involves practices, spiritual connections, and collective memories transmitted between generations (Padovani, 2022, p. 36).

In this sense, Amazonian knowledge is not limited to the "use of resources", but is structured in a) forms of community education (learning by observation, orality, rituals); b) local governance systems (assemblies, community councils, traditional leaders); and c) ethical values linked to reciprocity, care for the river, the forest, and non-human beings (Matheus, 2019; Alves; *et al.*, 2022; Souza; Oak; Mendes, 2022).

Araújo (2025), dialoguing with the Epistemologies of the South in rural education in the Amazon, argues that the ancestral knowledge of rural peoples can challenge hegemonic curricular logics and propose intercultural and democratic pedagogical practices, in which knowledge is not just content, but situated experience (Araújo, 2025). In this way, it is verified that knowledge in the Amazonian context is tacit essential (Sell; Gregori, 2018; Fernandes; Moser, 2021; Saints; *et al.*, 2023).

Thus, the sociocultural dimension of Amazonian knowledge shows that: a) the ways of life (riverside, quilombola, indigenous, extractivist) are matrices of knowledge; b) collective identities are built in the relationship with rivers, streams, forests and seasonal cycles; and c)

traditional knowledge is dynamic, resignified in the face of new technologies, public policies and markets (Arreto; Brazil, 2021; Castro; File; Zucarelli, 2021; Barbalho, 2022).

In order to understand the Amazon as an ecosystem of knowledge, numerous authors articulate the discussion with the Epistemologies of the South, formulated by Boaventura de Sousa Santos and collaborators (Santos, 2011; Santos; Meneses, 2019). Santos (2014) criticizes hegemonic Western reason, responsible for producing a true "epistemicide", that is, the disqualification and destruction of non-Western knowledge, considered backward, superstitious or unscientific (Santos, 2014).

In place of a monoculture of scientific knowledge, Santos (2014) proposes an "ecology of knowledge", understood as a practice of horizontal dialogue between scientific and non-scientific knowledge, in which no knowledge is a priori superior to another. This perspective is particularly fruitful for thinking about the Amazon, where the following coexist: a) indigenous, riverside, quilombola and other traditional peoples' knowledge; b) scientific knowledge produced by universities, research institutes and government agencies; and c) technical knowledge of public policy agents, NGOs and companies (Sell; Gregori, 2018; Matheus, 2019; Fernandes; Moser, 2021; Padovani, 2022).

In the Amazonian context, Gebara *et al.* (2023) explicitly dialogue with the Epistemologies of the South when discussing epistemic justice and bioeconomy, arguing that the construction of policies needs to recognize the pluriversality of epistemologies and ontologies present in the region, under penalty of deepening forms of biopiracy and biocolonialism (Gebara; Ramcilovic-Suominen; Schmidlehner, 2023; Galvão; *et al.*, 2024).

Casino; *et al.* (2025, p. 10), in turn, propose "thinking with Amazonian indigenous peoples" to expand knowledge systems, arguing that indigenous epistemologies should not only be "data sources" for science, but epistemic partners in processes of co-production of knowledge and socio-environmental governance (Almeida, 2014; Oak; Saucer; Ribeiro, 2021; B; *et al.*, 2023)

In the field of education, Araújo (2025) shows how the Epistemologies of the South can guide a reinvention of rural education in the Amazon, in dialogue with ancestral knowledge and with the experiences of historically subalternized peoples. For the author, curricula that ignore this knowledge reproduce colonial hierarchies; on the contrary, when traditional knowledge is recognized as legitimate, paths are opened for intercultural and democratic pedagogical practices (Souza; Oak; Mendes, 2021; Schott; Steinmueller, 2023; Araújo, 2025).

From this perspective, the Amazon ceases to be just an "object" of research and becomes an epistemic subject: a space for the production of theories, concepts, and categories capable of tensioning the scientific canon. The idea of the Amazon as an ecosystem of knowledge implies: a) recognizing the epistemic authority of indigenous peoples and traditional communities (Nakashima; *et al.*, 2020; Mcgrew; *et al.*, 2023); b) to practice an intercultural translation between scientific and traditional languages, without subordination (Brondízio; Moran, 2012; Chaves, 2018; Matos; Barroso Tenazor; Lopes, 2022); and c) to build research agendas and public policies anchored in cognitive justice, that is, in the right of different peoples to produce, validate and transmit their own knowledge (Bentes-Gama, 2012; Brondízio; et al, 2016; Battiste, 2019).

Finally, the Amazon needs to be understood as an ecosystem of knowledge. Recent literature shows that the Amazon should be understood, simultaneously, as:

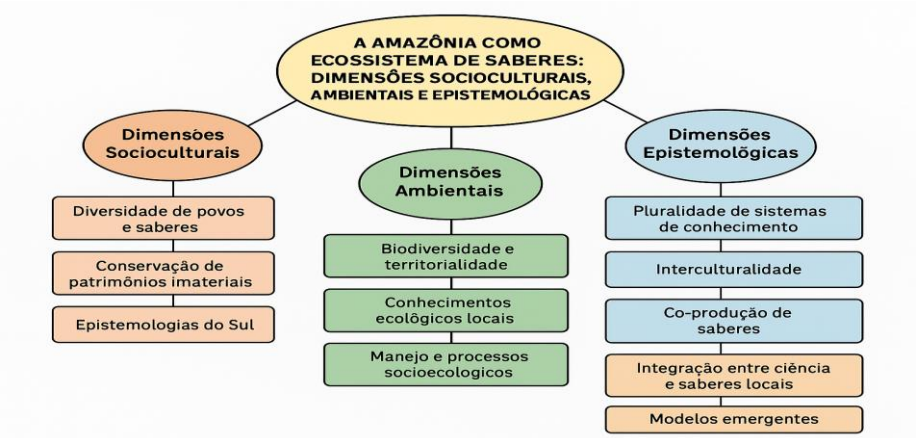
- Socio-environmental ecosystem in which biodiversity and sociodiversity are intertwined, and where TEK guides management and conservation practices (Hanazaki *et al.*, 2018; Galvão; *et al.*, 2024).
- A complex sociocultural space marked by trajectories of resistance, specific territorialities, and its own forms of education, work, and governance (Fernandes; Moser, 2021; Padovani, 2022; Alves; *et al.*, 2022).
- A field of political-legal disputes in which the rights of peoples and communities, intellectual property regimes, and bioeconomy strategies are confronted, often marked by asymmetries and risks of bioepistemicide (Matheus, 2019; Sell; Gregori, 2018; Gebara; *et al.*, 2023).
- A privileged place for epistemological reflection – which dialogues with the Epistemologies of the South and with the notion of ecology of knowledges, challenging the exclusive centrality of Western scientific knowledge (Santos, 2014; Araújo, 2025; Casino; *et al.*, 2025).

This understanding broadens the horizon of environmental management, public policies, and scientific research itself, by shifting the Amazon from the place of a "resource frontier" to that of an ecosystem of knowledge, in which different rationalities and ontologies cohabit and dispute meanings of development, sustainability, and justice (Padovani, 2022; Gebara; Ramcilovic-Suominen; Schmidlehner, 2023; Galvão; *et al.*, 2024)element.

Contextualizing the theoretical discussion about the Amazon as an ecosystem of knowledge, it is assumed that the Amazonian context constitutes a *multilayered* space in which different knowledge systems are articulated in a dynamic, relational and historically constructed way (Porto-Gonçalves; 2006; Noble; Borma, 2009; Casino; *et al.*, 2025). Figure 1 presents a synthesis of these interactions, organizing them into three major dimensions, sociocultural, environmental and epistemological that, although analytically highlighted, operate in an integrated and synergistic way in the territory.

Figure 1

The Amazon as an ecosystem of knowledge: sociocultural, environmental and epistemological dimensions



Source: prepared by the authors, 2025.

Figure 1 systematizes an expanded view of the Amazon as an ecosystem of synergistic knowledge, in line with the conception of Santos (2018), for whom "all knowledge is situated, contextual and relational" (Santos, 2018, p. 47). Thus, understanding the region requires recognizing that its knowledge emerges from the continuous interaction between peoples, environments and sociocultural practices in a web of networks, cooperation, interactions and transfers of multiple knowledge (knowledge) relevant to society and organizations.

The first dimension highlighted refers to the sociocultural diversity of the Amazon, marked by the presence of indigenous peoples, riverside communities, quilombolas, and traditional populations that produce and preserve their own knowledge. Figure 1 highlights elements such as the diversity of peoples and knowledge, the conservation of intangible heritage, and the epistemologies of the South. These epistemologies, according to Santos

(2019), "affirm the legitimacy of historically subordinated knowledge" (Santos, 2019, p. 112), as opposed to the monoculture of scientific knowledge.

The second dimension refers to the role of Amazonian ecosystems as a basis for the production of local knowledge. Figure 1 presents elements such as biodiversity and territoriality, local ecological knowledge and socio-ecological management practices. Berkes (2015) calls this knowledge *traditional ecological knowledge*, defined as "bodies of adaptive knowledge derived from experience and transmitted culturally" (Berkes, 2015, p. 27).

The third dimension encompasses the plurality of knowledge systems present in the Amazon and the processes of intercultural dialogue that emerge from this encounter. Figure 1 highlights elements such as epistemological plurality, interculturality, co-production of knowledge, and integration between science and local knowledge.

Not to conclude, the articulation of the three dimensions reveals a web of knowledge networks in the Amazon as an ecosystem of deeply interconnected and interrelated knowledge. This view confirms the argument of Porto-Gonçalves (2017), who considers the region "a territory of epistemic insurgency and the invention of new possible futures" (Porto-Gonçalves, 2017, p. 203). Thus, any public policy, academic research, or KM initiative in the Amazon must recognize the inseparability between culture, environment, and epistemology.

2.4 INTEGRATION BETWEEN TRADITIONAL KNOWLEDGE, DIGITAL INNOVATION AND GC: MODELS, TENSIONS AND POTENTIALITIES

Traditional and indigenous knowledge have been understood as complex systems of production, circulation and use of knowledge, deeply rooted in specific territorial, cosmological and socio-political contexts (Becker, 2005; Assad, 2022; Coast; Almeida, 2023). The literature emphasizes that such knowledge cannot be reduced to a set of "local information", but constitutes "ways of knowing, doing and existing", articulating their own practices, values, narratives and technologies (Cunha, 2007, p. 25).

In this sense, researchers in Information Science and related areas have been advocating a broader reading of the concept of traditional knowledge, which encompasses knowledge about land management, biodiversity, medicinal plants, agroforestry systems, healing practices, and forms of social organization, often transmitted by orality and performance (Pereira; Espírito Santo, 2020; Foster; Zaninelli, 2025). As one of these studies summarizes, traditional knowledge "brings with it a broader element than the notion of

continuity", as it articulates collective memories, identity bonds and strategies of sociocultural reproduction in the long term (Pereira; Espírito Santo, 2020, p. 89.).

In the Amazonian context, documents from universities and scientific institutions emphasize that "traditional knowledge is inspiration for the decisions we need to make and to them are added the science we need to produce", pointing to the region as a strategic space for dialogue between local epistemologies and modern science (UFPA, 2023, p. 121). This perspective reinforces the Amazon as a privileged territory for experimenting with models of integration between scientific knowledge, indigenous knowledge and sustainable development policies (Porto-Gonçalves; 2006; Saints; Meneses, 2019; Pine; Araújo, 2023).

At the same time, critical authors warn of the risks of homogenization and "flattening" of internal differences when one speaks generically of "traditional knowledge", without considering the diversity of peoples, histories and cosmologies involved. Foster; Zanelli (2024), show that the tendency to treat indigenous knowledge as a single block, directly comparable to Western scientific knowledge, constitutes "a way to better homogenize it" and make its epistemological incommensurability invisible (Fonseca; Zaninelli, 2024, p. 29).

KM has emerged, in recent decades, as an interdisciplinary field that seeks to understand and structure processes of creation, organization, sharing and use of knowledge in different types of organizations, according to Correa, *et al.*, (2023) and Ziviani, *et al.*, (2025a). In a classic work, Davenport; Prusak (1998) defines knowledge as a fluid mixture of experience, values, contextualized information, and intuition, which provides a framework for evaluating and incorporating new experiences. For the authors, "Knowledge is a fluid mixture of interpreted experience, values, contextual information, and expert insight (Davenport; Prusak, 1998, p. 5), which implies recognizing the human, relational and situated dimension of knowledge.

In the debate on innovation, Nonaka; Takeuchi (1997) highlight the SECI dynamics (socialization, externalization, combination and internalization) as the engine of organizational knowledge creation, articulating tacit and explicit dimensions. The authors' perspective is relevant to thinking about the integration between traditional knowledge and digital innovation, as it emphasizes the procedural, collective, and historical character of knowledge production, central elements in indigenous and community contexts according to studies by Machado (2020).

In Brazil, KM has been appropriated and redefined by authors who situate it in public, academic and territorial contexts. Valentim (2010, 2008) argues that information

management and KM should occur in an articulated way, in order to promote behaviors of searching, sharing and using information aligned with the organizational culture. For the author, "information management in the organizational context occurs in a specific way and depends on the way knowledge is being managed" (Valentim, 2010, p. 42).

Batista (2023) reinforces this view by proposing a "simplified" KM, centered on accessible languages and practical tools for public administration, without losing sight of the complexity of organizational learning processes (Batista, 2023; Correa, *et al.*, 2023; Ziviani; *et al.*, 2025b). These contributions are important to contextualize, in Brazilian terms, the discussion on KM as a conceptual and operational infrastructure to integrate traditional knowledge, digital technologies and innovation policies (Cardoso; Pimenta, 2019; Belinski; Martins, 2020; Mark; Rodrigues, 2023)

More specifically, Fonseca; Santos (2023), when discussing "KM and traditional knowledge: an innovation proposal for indigenous organizations", propose the Collaborative Creativity Centers (NCC) as a KM model oriented to the valorization of indigenous knowledge. According to the authors, the NCC seek to foster a culture of innovation based on "the knowledge derived from the traditional knowledge of these peoples", articulating informational flows, KM practices and organizational innovation in companies and collectives linked to indigenous communities (Fonseca; Santos, 2023, p. 11.).

The expansion of digital technologies has profoundly reconfigured the ways of recording, storing, communicating, and appropriating traditional knowledge (Fleury; Lobato; Dantas, 2019; Costa, 2022; Oak; Saucer; Ribeiro, 2023). Steeves (2015) shows that, in various Indigenous contexts, digital technologies such as video, audio, photoFigurey, and online platforms have been appropriate to record, preserve, and share aspects of culture and knowledge with other Indigenous groups, the world, and future generations, while producing new challenges to cultural identity. In this sense, the author, "some digital technologies are helping Aboriginal groups record and share their traditional knowledge with other Aboriginal groups, the wider world, and future generations" (Steeves, 2015, p. 13).

Recent studies on *"indigenous knowledge management*" emphasize the role of technologies such as databases, RFID, GIS, 3D scanners, smartphones, and digital repositories to support the documentation, organization, and circulation of local knowledge, especially in the post-pandemic period (Matheus, 2019; Ajani, 2023). These works point out that digital innovation is not limited to the digitization of content, but involves the design of

socio-technical infrastructures sensitive to the community logics of ownership, access and use of knowledge (Pereira; Angeloni, 2020; Martin; Birth, 2021; Pine; Araújo, 2023).

From the point of view of sustainability, Anti (2025) discusses the challenges of preserving traditional knowledge in the digital age, highlighting that modernization and globalization have interrupted the intergenerational transmission of knowledge, putting its continuity at risk. The study emphasizes that "Accelerated modernization and globalization have disrupted the intergenerational transmission of this knowledge, putting it at risk of disappearing.", and that digital strategies need to be accompanied by robust ethical guidelines (Anti, 2025, p. 18).

In the same direction, Bellini; Raglianti (2025) analyze tensions and opportunities at the intersection between indigenous knowledge and digital technologies, showing that the introduction of platforms and information systems can both empower communities and reinforce power asymmetries and technological dependence if they are not co-designed with indigenous peoples themselves (Carvalho; Saucer; Ribeiro, 2021; Pine; Araújo, 2023). Studies focused on the Sustainable Development Goals also highlight that aligning traditional knowledge and digital technologies is strategic for goals such as climate action, biodiversity protection and quality education (Arvanitidis *et al.*, 2024; Fonseca, 2025).

In the Amazonian context, reports and case studies show experiences in which blockchain, big data, Internet of Things (IoT), and artificial intelligence have been used to support socio-bioeconomy chains, ensure traceability of forest products, monitor deforestation, and strengthen business models based on traditional knowledge (Santos; Costa, 2021; NESsT, 2025). These initiatives reinforce the potential of digital innovation as a mediator between local knowledge, global markets, and public policies for sustainable development (Souza; Gomes, 2019; Silva; Barreto, 2020; Saints; *et al.*, 2023)

Recent literature has advanced in the formulation of conceptual models of indigenous KM (GCI) and integration between traditional knowledge and contemporary KM approaches. Foster; Zaninelli (2024), carry out a review of international models of GCI, identifying different structures, varying according to geoFigureic location, community, and objectives of each initiative. The authors conclude that "the identified Indigenous KM models have different characteristics, structures, and approaches, according to the location, the community, and the proposed objectives", and point to the absence of models developed in Brazil as a research gap (Fonseca; Zaninelli, 2024, p. 19).

In a subsequent study, Fonseca; Zaninelli (2025) analyze African models of indigenous KM and show how ethno-knowledge systems articulate spiritual, environmental, and community dimensions in their own structures of classification and transmission, distinct from Western information systems. The study concludes that the integration between these systems and contemporary approaches requires recognizing "distinctive characteristics, sociocultural contexts and practical applications" of indigenous models, avoiding their mere translation into Eurocentric categories (Fonseca; Zaninelli, 2025, p13.).

In the Brazilian context, Fonseca; Santos (2023) proposes the aforementioned Collaborative Creativity Centers (NCC) as a KM model aimed at indigenous organizations, based on Choo's (2003) hypertext organization model. The NCC articulate three axes, namely, KM, innovation and traditional knowledge, and position indigenous knowledge as a central asset in the organizational innovation process (Fonseca; Santos, 2023).

The integration between traditional knowledge, digital innovation and KM is not without conflicts. The literature highlights different orders of tension: epistemological, political, legal, technological and institutional (Santos; Meneses, 2019; Freire; Lima, 2020; French; Oliveira, 2020). From the epistemological point of view, authors such as Cunha (2007) and Machado; Carvalho (2019), point out that traditional systems of classification and organization of information, based on Western logics, tend to exclude or distort indigenous knowledge.

On the technological level, there is a risk that digitization processes will reinforce "data colonialism", appropriating traditional knowledge without guaranteeing mechanisms of consent, community control and benefit sharing. Studies on indigenous databases and digital repositories insist on the need for governance models in which communities define the levels of access, use, and circulation of content, as well as criteria for contextualization and protection of sensitive knowledge (Steeves, 2015; Ajani, 2023).

Tensions related to intellectual property and traditional knowledge protection regimes are also at stake. Research on Amazonian socio-bioeconomy chains and on the use of traditional knowledge in technological innovation processes point to the importance of intellectual property policies that do not individualize collective knowledge, nor encourage its commodification without safeguards of cognitive justice and fair sharing of benefits (NESsT, 2025).

In the institutional dimension, authors who analyze KM in the public sector show that cultural factors such as resistance to change, power relations and forms of communication – constitute important obstacles to the implementation of collaborative KM practices (Batista;

Quandt, 2015; Silva; Barreto, 2020). Such challenges tend to intensify when it comes to incorporating traditional knowledge into institutions historically structured from Eurocentric epistemologies, such as universities, development agencies, and environmental agencies.

Finally, there are tensions within the communities themselves, related to generational, gender, and authority disputes over who can speak, record, and share certain knowledge, which requires KM and digital innovation models to be co-constructed in a way that is sensitive to local dynamics (Fonseca; Zaninelli, 2025).

Despite the tensions, the literature points to a wide range of potentialities in the integration between traditional knowledge, digital innovation and KM. Studies on the Amazonian socio-bioeconomy show that the articulation between traditional knowledge and emerging technologies has contributed to strengthening sustainable production chains, ensuring traceability of forest products, expanding access to markets, and fostering business models rooted in indigenous and community territories (NESsT, 2025)

On the scientific and technological level, initiatives coordinated by institutions such as RNP, universities and ST&I bodies have emphasized the construction of digital biodiversity management platforms that combine scientific data with traditional knowledge, providing for specific KM components and the development of open digital solutions (RNP, 2025; MCTI, 2025).

International authors highlight that aligning traditional knowledge and digital technologies contributes directly to several Sustainable Development Goals, especially those related to climate action, the protection of life on land, and the promotion of inclusive education (Arvanitidis; *et al.*, 2024). At the same time, workshops, networks, and international programs have been discussing models of research governance and rematriation of indigenous knowledge that use artificial intelligence and digital platforms to strengthen the rights, languages, and knowledge systems of indigenous peoples.

In the field of KM, these movements point to the need for more relational and ecosystemic models, which go beyond the view of knowledge as an exclusively organizational resource and recognize the existence of "knowledge ecosystems" marked by interdependencies between communities, scientific institutions, companies, technologies, and territories (Fonseca; Santos, 2023; Bellini; Raglianti, 2025).

Table 2

Theoretical synthesis: integration between traditional knowledge, digital innovation and KM

Dimension	Core elements	Main authors	Essential contributions
Traditional knowledge	Indigenous epistemologies; Territoriality; oral transmission; sociocultural complexity	Cunha (2007); Pear tree; Espírito Santo (2020); Foster; Zaninelli (2025); Smith (2012)	Smith (2012) demonstrates that indigenous epistemologies are often framed in inappropriate Western categories, generating invisibilizations. Cunha (2007) points out that traditional knowledge constitutes complex systems rooted in their own cosmologies.
GC	Processes of creation, organization, socialization and application of knowledge; tacit and explicit dimensions	Davenport; Prusak (1998); Nonaka; Takeuchi (1997); Valentim (2008, 2010); Baptist (2023)	Davenport and Prusak (1998) define knowledge as a fluid mixture of experience and contextualized information. Nonaka; Takeuchi (1997) propose the SECI model, integrating tacit and explicit dimensions in the creation of knowledge.
Digital innovation	Digitization of collections; data governance; platforms, AI, blockchain, GIS	Steeves (2015); Ajani (2023); Bawack (2025); Arvanitidis *et al.* (2024)	Steeves (2015) shows that digital technologies allow the recording and transmission of indigenous knowledge, while Bawack (2025) warns of the risks of data colonialism without community governance.
Integration Models	Indigenous GC (GCI); Collaborative Creativity Centers; Knowledge ecosystems	Foster; Santos (2023); Foster; Zaninelli (2024; 2025); Bellini; Raglianti (2025)	Fonseca and Santos (2023) propose the NCC, articulating KM, innovation, and traditional knowledge. Foster; Zaninelli (2024, 2025) evidence international diversity of GCI models.
Tensions and dilemmas	Epistemological colonialism; data governance; PI; Western frameworks; Institutional challenges	Smith (2012); Ajani (2023); Bawack (2025); Teixeira (2020); Santos *et al.* (2024)	Smith (2012) discusses colonial methodologies that distort indigenous knowledge. Teixeira (2020) highlights cultural barriers in public KM. Santos *et al.* (2024) show tensions in the appropriation of traditional knowledge (Baniwa peppers).
Potential	Sustainable innovation; socio-bioeconomy; digital ecosystems; informational sovereignty	NESsT (2025); Bioeconomy of Restoration (2024); RNP (2025); MCTI (2025)	NESsT (2025) shows how technologies can strengthen production chains based on traditional knowledge. RNP (2025) shows digital integrations between science and indigenous knowledge.

Source: survey data, 2025.

Table 2 shows that the integration between traditional knowledge, digital innovation, and KM requires the recognition of the complexity and epistemic autonomy of indigenous peoples. Cunha (2007) and Pereira; Espírito Santo (2020) show that traditional knowledge constitutes territorial and pluriepistemic systems, while Smith (2012) warns that Western categories tend to distort these epistemologies.

In GC, authors such as Davenport; Prusak (1998), Nonaka; Takeuchi (1997) and Valentim (2008; 2010) demonstrate that knowledge is relational and depends on structured processes of creation and circulation, favoring its articulation with indigenous epistemologies. In the digital field, Steeves (2015), Ajani (2023) and Bawack (2025) highlight that technologies can support cultural preservation, but also generate risks of data colonialism. Models such as the Collaborative Creativity Centers (Fonseca; Santos, 2023) and the studies on indigenous GC of Fonseca; Zaninelli (2024; 2025) show paths for sociotechnical integrations.

Finally, studies such as Santos *et al.* (2024) show ethical tensions and misappropriation. On the other hand, initiatives such as NESsT (2025), Bioeconomy of Restoration (2024) and RNP (2025) show that this integration has strong potential for sustainable innovation and the strengthening of Amazonian ecosystems.

Not to conclude, the theoretical review indicates that:

- traditional knowledge constitutes complex knowledge systems, which challenge Western models of information and KM;
- KM, by articulating processes of creation, organization and sharing, offers a fertile conceptual basis to model the integration between different epistemologies;
- digital innovation introduces opportunities and risks, requiring socio-technical infrastructures co-governed by indigenous communities and partner institutions;
- the emerging models of ICM and knowledge ecosystems point to ways to integrate traditional knowledge, digital technologies, and sustainable development policies, as long as they are attentive to the ethical, political, and epistemological tensions involved.

3 METHODOLOGY

The present research is characterized as a qualitative, exploratory and descriptive study, aimed at understanding KM in the preservation, systematization and valorization of traditional knowledge of the Amazon, promoting innovation with a focus on sustainable development. According to Gil (2019), the exploratory study aims to provide greater familiarity with the problem, making it more explicit or building hypotheses based on a set of preliminary observations.

The choice for a qualitative approach is justified by the interest in dialoguing with different interfaces of the regional context, with traditional knowledge, science, technology, innovation, public policies and sustainability. The qualitative approach allows the investigation

of complex phenomena, capturing meanings, perceptions and social practices in depth (Gil, 2008; Minayo, 2017).

A descriptive study is a type of research whose main objective is to describe characteristics, phenomena or relationships observable in a given context, without necessarily establishing cause and effect relationships or testing hypotheses. It seeks to organize, systematize and analyze data in detail, providing an in-depth overview of the object of study (Gil, 2008; Santos, 2014).

The study is based on interdisciplinary theoretical contributions from Information Science, Administration, Education, Sociology, Technology, Education, Production Engineering and anchored in the KM literature, which offer conceptual tools to analyze the processes of production, organization, sharing and use of knowledge in the academic sphere.

Information Science, according to Borko (1968) and Le Coadic (2004), is concerned with the informational cycle and the role of information and knowledge as strategic resources for decision-making and innovation. KM, on the other hand, according to Nonaka and Takeuchi (1997), involves processes of creation and dissemination of knowledge in organizations, favoring collective learning and continuous innovation.

The methodological approach was structured in five complementary axes: a) integrated literature review; b) survey of empirical data with KM researchers in the Amazonian context; c) documentary and institutional analysis of government agencies and social institutions; d) analysis of the activities of research groups in KM in the Amazonian context; and e) collection of secondary data from institutional websites of different actors that discuss KM in the Amazon. Each axis contributes to understanding different dimensions of KM in the regional context.

In the first phase, an Integrated Literature Review was carried out with the objective of mapping the scientific production on KM in the Amazon, identifying trends, research gaps, authors and institutions most active in the theme. National and international databases were consulted: Scielo, Web of Science, Scopus, Spell and Google Scholar.

The selection criteria included: i) Publications between 2000 and 2025; b) Language: Portuguese or English; and c) Content related to KM, integration of traditional knowledge and technological innovation. It should be inferred that this first phase of the research did not consider the methodological aspects and scientific rigor required for a Systematic Review of the Literature. Therefore, the studies highlighted in the research results were selected for the

convenience of researchers based on the scientific production of Brazilian research groups that deal with KM themes in the Amazon context.

The review aimed to map authors, concepts, theoretical approaches and research gaps, as advised by Tranfield, Denyer; Smart (2003) in conducting systematic reviews. The descriptors used included: GC, Amazon, traditional knowledge, sustainable innovation, public policies, and regional development. The data were analyzed through metrics such as annual volume of publications, frequency of keywords, enabling the identification of the main concepts and approaches (Bornmann; Daniel, 2008). Finally, the information was organized in Figures, tables and figures, being discussed and analyzed based on the discussions and foundations described in the theoretical framework.

The survey of empirical data with the purpose of understanding KM practices in the Amazon was carried out with data collection through semi-structured interviews with KM researchers in the Amazonian context. Two semi-structured interviews were conducted, as it allows flexibility and depth in the answers, as recommended by Triviños (2015). The interviews were conducted online (via Teams), lasting 60 minutes each, through a Free and Informed Consent Form (ICF). The participants were informed about the objectives of the research and consented to the recording and use of data, following ethical standards (BRASIL, 2016).

The data collection instrument was elaborated from the theoretical foundation discussed in the previous chapter, addressing the trajectory of scientific research in KM in the Amazon, understanding of research projects developed or in progress, scientific production in KM, training of human resources and understanding of themes such as knowledge of native peoples and the understanding of the role of KM in the context of economic development, technological and social aspects of the Amazon. Topics such as community participation, preservation of knowledge, technological innovation and territorial governance were addressed, allowing for deepening according to the answers (Gil, 2008).

The selection of the interviewed researchers was intentional and non-probabilistic, selected based on the following criteria: a) Work in graduate programs recognized by CAPES; b) Participation in projects or research groups with a KM focus in the Amazonian context; and c) Recent scientific production on KM in the Amazon. Table 3 presents the profile of the researchers interviewed. The data were recorded, transcribed and organized into thematic categories.

Table 3

Profile of the Interviewed Researchers

Interviewed	University	Training	Research Group	Years as a researcher
BETWEEN 1	UFAM UFPA	PhD in Information Science. Bachelor of Library Science	GICA	15
BETWEEN 2	UFAM	PhD in Communication and Semiotics. Degree in Library Science.	GICA	33

Source: survey data, 2025.

The transcripts of the interviews resulted in a volume of approximately 30 (thirty) pages of qualitative text. Only part of this volume of data was used in this study. Therefore, a vast and rich material in the development of scientific research in KM in the Amazon is still available for other analyses. A relevant strategy for future studies may be to use qualitative data analysis software NVIVO, MAXDATA or ATLAS TI.

In the analysis of government reports, institutional guidelines and official documents, technical and institutional documents dealing with Amazonian development and policies related to KM and the protection of traditional knowledge were examined. The analysis included:

- reports from federal and state agencies linked to territorial, socio-environmental management and regional development of the Amazon;
- public policies for science, technology and innovation, with a focus on guidelines for open data, protection of traditional knowledge and encouragement of sustainable innovation;
- regulations and regulatory frameworks aimed at safeguarding traditional knowledge, including guidelines related to the rights of indigenous peoples and traditional communities;
- institutional documents from BNDES, MCTI, CNPq, IBAMA and indigenous organizations, which offer strategic guidelines, development programs and ongoing projects in the region.

This documentary analysis allowed us to identify guidelines, institutional actors, regulatory weaknesses, and structural gaps that affect the implementation of KM practices in the Amazon, especially with regard to interinstitutional collaboration, data governance, and social participation.

The research also involved mapping the trajectory of groups registered in the Directory of Research Groups of Brazil (DGP/CNPq) that develop studies on the Amazon, traditional knowledge, sustainable innovation and KM. The following elements were analyzed: a) lines of research and their thematic evolution; b) scientific production (articles, theses, dissertations, books and technical reports); c) collaboration networks between researchers, institutions, traditional communities and government organizations; and d) scientific and community partnerships aimed at the collective construction of knowledge and innovation in the Amazonian context.

The findings were integrated into the results of the literature review, making it possible to identify emerging trends, conceptual centralities, research gaps, and potential interdisciplinary convergences.

The qualitative data from the interviews, institutional documents and biblioFigureic reviews were submitted to thematic content analysis, according to the procedures of Bardin (2016). This technique allowed the organization and interpretation of the textual corpus in analytical axes, such as: a) integration of knowledge (traditional and scientific); b) sociopolitical challenges of KM in the Amazon; c) governance of local information and knowledge; d) sustainable innovation and social technologies; and e) inclusion of indigenous peoples and local communities.

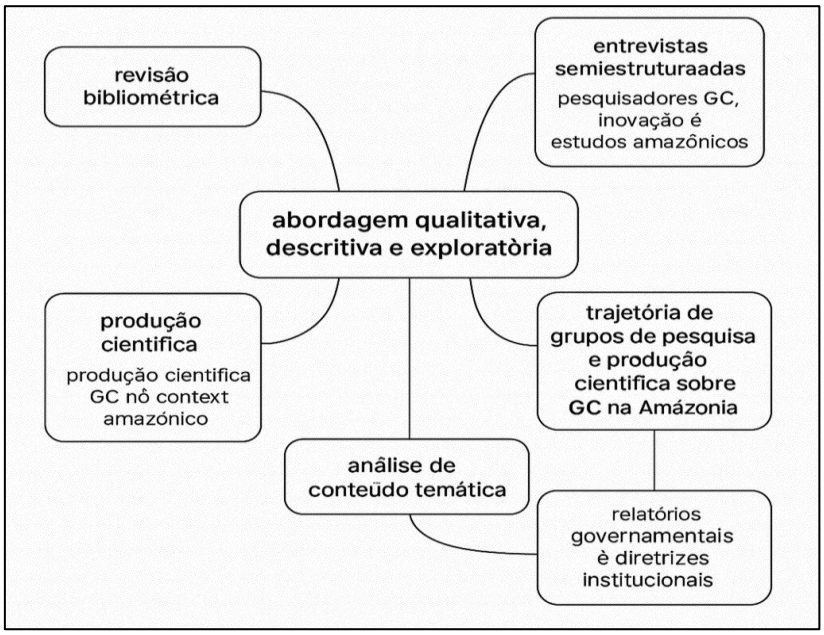
Combining bibliometric methods, document analysis and qualitative interviews, the methodology adopted enabled a comprehensive view of the state of the art of KM in the Amazon. The results made it possible to highlight the need for participatory models, transparent governance mechanisms and integrated policies that value both traditional knowledge and scientific and technological innovations.

As procedures for analyzing the collected data, we opted for data triangulation between bibliometric review, interviews and document analysis, ensuring reliability and robustness in the results (Triviños, 2011). The emerging categories were organized in tables and concept maps, facilitating the visualization of the relationships between actors, KM practices, public policies and promotion of innovation with a focus on sustainable development.

The conceptual map of the methodological path presented in figure 1 was elaborated to visually organize the relationships between the actors (local communities, researchers and government), the KM processes (co-creation, documentation, sharing) and the expected results (sustainable development, environmental preservation and innovation).

Figure 2

Conceptual Map of the Methodological Path



Source: survey data, 2025.

Finally, it should be noted that the research respected the ethical principles defined by Resolution No. 510/2016 of the National Health Council (2016), ensuring the anonymity of the participants and the use of the data exclusively for scientific purposes. All interviewees agreed to the Informed Consent Form (ICF).

The combination of methods such as: bibliometric review, document analysis and qualitative interviews made it possible to build a comprehensive understanding of KM in the Amazonian context. The results showed:

- the need for participatory KM models, which articulate scientific knowledge and traditional knowledge;
- the importance of transparent data governance mechanisms that are sensitive to territorial and identity agendas;
- the urgency of integrated public policies, capable of strengthening collaborative networks, ensuring respect for the rights of indigenous peoples and fostering innovations aligned with sustainable development.

4 PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

Section 4 presents, analyzes and discusses the results in the light of the central objective of the study, which is to understand how KM can be mobilized to preserve,

systematize and value traditional knowledge in the Amazon and, simultaneously, guide innovation committed to sustainable development. It is based on the assumption, consolidated in the classic literature, that KM constitutes a framework for the creation, sharing and application of knowledge in socio-technical organizations and networks (Davenport; Prusak, 1998; Nonaka; Takeuchi, 2008). However, when shifted to a socio-ecological and epistemically plural territory such as the Amazon, this agenda tends to be tensioned by dimensions that conventional organizational models often deal with in a peripheral way, such as territoriality, historical asymmetries, collective regimes of knowledge ownership, and ethical safeguards against misappropriation (Berkes, 2015; Saints; Meneses, 2010). Thus, in this section, it is argued that the results should not be read only as a description of the state of the art, but as evidence of a field in dispute, in which KM is reconfigured as a socio-territorial practice, simultaneously cognitive, political and institutional. The presentation of the findings is organized on three methodologically complementary fronts: (i) results of the integrated literature review, which outline trends, semantic nuclei, actors and gaps; (ii) qualitative analysis of interviews with reference researchers, which explains convergences and tensions between theory and situated experience; and (iii) documentary analysis of reports, guidelines, and regulatory frameworks, which allows us to observe how policies and institutions condition, enable, or block inclusive knowledge ecosystems. By articulating these layers, it is intended to highlight implications for research and public policies, with an emphasis on participatory models, transparency in information governance, and institutionalization of effectively inclusive dialogue channels (Whittemore; Knafl, 2005; Tranfield; Denyer; Smart, 2003).

4.1 RESULTS OF THE FIRST PHASE OF THE RESEARCH: INTEGRATED LITERATURE REVIEW

The first phase of the research consisted of conducting an Integrated Literature Review (RIL), whose objective was to map the scientific production on KM in the Amazonian context, identifying trends, recurrences and research gaps. This type of review allows you to analyze and synthesize existing knowledge in a broad and flexible way, especially when it comes to complex and multifaceted phenomena. As Whittemore and Knafl (2005) point out, the integrated review is particularly useful when the literature is heterogeneous, as it "allows the combination of theoretical and empirical studies, enabling a more complete understanding of the phenomenon investigated" (Whittemore; Knafl, 2005, p. 547).

To search for the studies, recognized national and international databases such as: SciELO, Web of Science, Scopus, Spell and Google Scholar were consulted, considering publications between 2000 and 2025, in Portuguese or English and related to KM, the integration between traditional and scientific knowledge and technological innovation aimed at Amazonian development.

However, unlike a Systematic Review of the Literature (RSL), this stage did not follow strict protocols, such as PRISMA. RSL is characterized by standardized, reproducible procedures guided by methodological rigor. For Tranfield, Denyer and Smart (2003), the systematic review works as a structured investigation process, as it "follows a robust, transparent and replicable method to identify, evaluate and synthesize existing evidence" (Tranfield; Denyer; Smart, 2003, p. 209). Thus, the absence of these protocols implies that the results obtained here are exploratory, not exhaustive within the methodological parameters.

In this study, the integrated approach was intentionally chosen, due to the particularities of the theme. As Botelho, Cunha and Macedo (2011) point out, the integrated review "enables the inclusion of different methodologies, expanding the analytical scope and favoring critical and reflective syntheses" (Botelho; Wedge; Macedo, 2011, p. 126).

Thus, it should be inferred that the selection of studies was not intended to be exhaustive or replicable, typical characteristics of the RSL, but was guided by convenience and thematic relevance, considering the production of Brazilian research groups that stand out in discussions on KM in the Amazon, traditional knowledge, innovation and public policies in the Amazonian context. As Cooper (1988) points out, integrative reviews are appropriate when the objective is to "synthesize existing knowledge, identify patterns and propose new directions of research", especially in developing fields.

The adoption of this approach proved to be pertinent to the purpose of this exploratory phase, allowing to map the state of the art, organize relevant contributions, and subsidize subsequent more in-depth analyses, including epistemological, bibliometric, and political discussions related to KM in the Amazonian context.

The results are organized into seven sections: (i) temporal evolution, (ii) frequency of themes and keywords, (iii) co-authorship networks and clusters, (iv) outstanding authors and institutions, (v) thematic synthesis, (vi) gaps, and (vii) implications for public policies and future research.

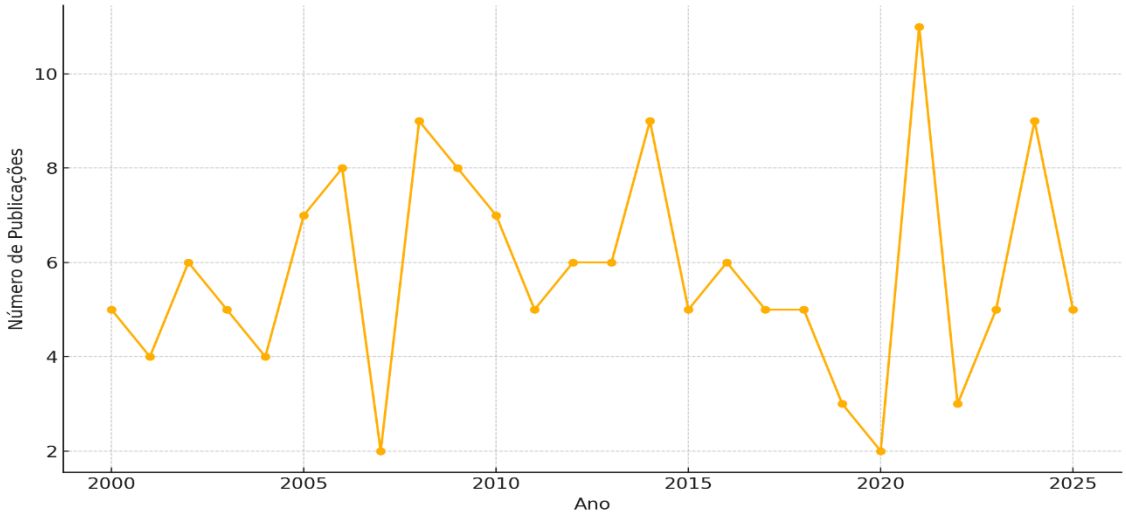
4.1.1 Overview of Scientific Production (2000–2025)

The search carried out in the SciELO, Web of Science, Scopus, Spell and Google Scholar databases initially resulted in 1,147 studies related to the established descriptors. After applying the inclusion criteria (period 2000–2025; Portuguese/English languages; thematic adherence to KM, traditional knowledge, sustainable innovation, or the Amazon), 178 articles were selected for full reading and 92 articles for detailed analysis.

The breadth of the time frame allowed us to observe the gradual consolidation of the theme, especially from 2010 onwards, when interest in sustainable innovation, public ST&I policies and integration between traditional and scientific knowledge grew.

Figure 3

Temporal distribution of publications on KM in the Amazon (2000–2025)



Source: survey data, 2025.

The literature analyzed reveals a significant increase in studies after 2010, coinciding with the expansion of government agendas aimed at promoting innovation, science and technology in the Amazon. From 2015 onwards, there has been a greater density of studies on bioeconomy, governance of common goods, intercultural education, digital documentation systems, and management of traditional knowledge.

Silva and Gomes (2021) emphasize that "understanding the Amazon as a complex system requires KM approaches capable of integrating plural and technological epistemologies". Likewise, Santos (2010) argues that the ecology of knowledges is fundamental to address historical epistemic inequalities between scientific knowledge and traditional knowledge.

Figure 1 shows important oscillations, with production peaks in 2008, 2014, 2021, and 2024, suggesting key moments in which themes related to the Amazon, GC, bioeconomy, and traditional knowledge gained prominence in public and scientific agendas.

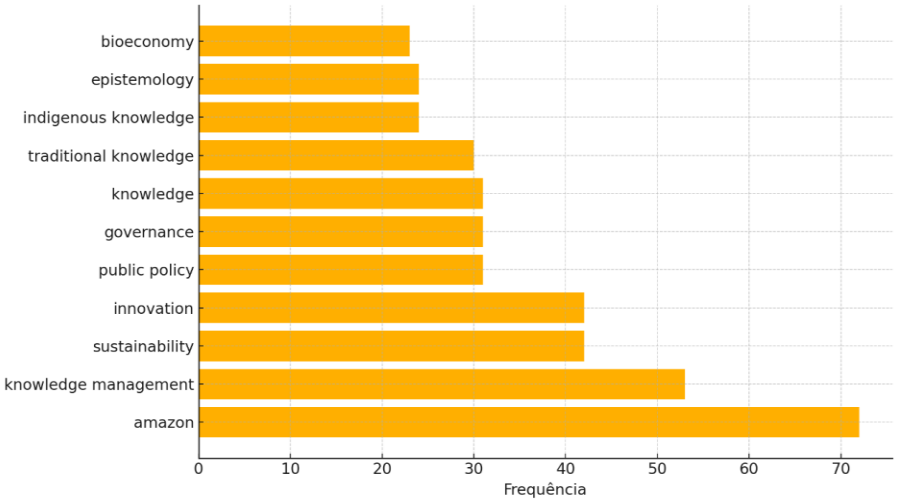
Main possible interpretations:

- The increase after 2015 coincides with the advancement of the discussion on PPCDAm, territorial governance and international agendas (SDGs).
- The jump in 2021–2024 may be associated with the rise of the Amazon bioeconomy, digitalization, and research on traditional knowledge.
- The occasional drops indicate periods of lower public funding or national thematic reorientation.

Figure 4 of keyword frequency reveals that the dominant terms are: Amazon, knowledge management, Sustainability and innovation. The central themes that articulate KM and sustainable development. Emerging terms linked to the identity agenda include: traditional knowledge, indigenous knowledge and epistemology. By analyzing the key words, a growing appreciation of Amazonian epistemologies and local knowledge can be perceived. Finally, a political-institutional axis is contacted, such as: public policy, governanceIt shows that part of the literature analyzes KM as an instrument of territorial management and public policies.

Figure 4

Keyword Frequency



Source: survey data, 2025.

The analysis of keyword frequency reveals five central semantic cores: a) GC (*Knowledge Management*); b) Traditional Knowledge / Indigenous Knowledge; c) Innovation and Digital Transformation; d) Bioeconomy and Sociobiodiversity; and e) Regional Development / Territorial Governance.

This set suggests a field guided by hybrid approaches, which articulate organizational knowledge (Sveiby, 1998; Nonaka; Takeuchi, 2008;), epistemologies of the South (Santos, 2011, 2014) and socio-ecological systems (Brondízio *et al.*, 2016).

Table 4

Institutions with the highest production related to KM in the Amazon (2000–2025)

Institution	Predominant themes	Evidence from the literature
UFPA	Territorial information systems, socio-biodiversity	Lima (2018), Farias (2017)
INPA	Ethnoknowledge, biodiversity, documentation	Menezes (2020)
UFAM	S,T policies; I, digital governance	Braga (2022)
UFOPA	Traditional and riverine communities	Santos (2019)
FIOCRUZ Amazon	Traditional knowledge in health	Rocha (2019)

Source: survey data, 2025.

The predominance of Amazonian institutions (UFPA, INPA, UFAM, UFOPA) confirms the thesis of Barbalho *et al.* (2023) that the production of traditional knowledge and KM must emerge from the territory, avoiding decontextualized readings of hegemonic centers of the Global South or South-Southeast axis

Authors such as Farias (2017), Lima (2018) and Menezes (2020) reinforce the role of sociobiodiversity and traditional ecological knowledge in territorial governance. These productions respond to Berkes' (2015) warning about the urgency of integrating scientific knowledge and local knowledge for resilient adaptive systems.

The growing presence of research on innovation and social technologies (D'Ávila; Moreira, 2020 and Braga, 2022;) shows the region's alignment with global Industry 4.0 trends, but with an Amazonian reading — inclusive, communitarian and relational (Stradioto; Frazzon, 2023).

The interpretative analysis allowed us to identify five structuring thematic trends in the literature, presented in Table 5.

Table 5

Thematic trends identified in the literature on KM in the Amazon

Tendency	Description	Author contributions
Integration of knowledge	Articulation between scientific and traditional knowledge	Santos (2010), Rocha (2019)
Technological innovation	Digital platforms, GIS, databases	Braga (2022)
Territorial governance	Public policies, planning and management	Acselrad (2015)
Sociobiodiversity	Sustainable production chains	Lima (2018)
Education and broadcasting	Youth training and intergenerational practices	Menezes (2020)

Source: survey data, 2025.

The theme of integration of knowledge in literature highlights the centrality of indigenous, quilombola, and riverine epistemologies (Almeida, 2014; Battiste, 2019; Saints; Meneses, 2019). On the other hand, the "ecology of knowledges" of Santos (2010) is the main theoretical lens highlighted here. In Santos' view, (2011, p.13), "There is no cognitive justice without the recognition of multiple ways of knowing."

This perspective dialogues with Toledo's ethnoecology; Barrera-Bassols (2009) and with Agrawal's (2002) critique of the fragmentation between indigenous knowledge and Western knowledge.

Regarding technological innovation, Ferreira; Mendes (2019), Braga (2022) and Schott; Steinmuller (2023) articulates with Bellini's vision; Raglianti (2025) on digital knowledge ecosystems, in which digitalization does not replace, but enriches traditional systems.

The emergence of documentation and digital preservation platforms (Steeves, 2015; McGrew *et al.*, 2023; NESsT, 2025) reinforces opportunities and risks, namely: the opportunities: visibility, registration, legal protection and the risks: misappropriation, digital colonialism, bioepistemicide (Gebara *et al.*, 2023).

The governance of these systems is highlighted by RNP (2025), which defends ethical protocols for sensitive data.

Regarding the territorial governance trend, Acselrad (2015), Cardoso; Pimenta (2019) and Castro, Lima; Zucarelli (2021) argue that KM in the Amazon is inseparable from environmental management, land conflicts, and social participation. This view is reinforced by Brondizio *et al.* (2016), who describe the Amazon as a socio-ecological complex, in which territorial decisions depend on situated knowledge flows.

Amazonian Sociobiodiversity and Bioeconomy, according to Schmitz (2020) and EMBRAPA (2021) needs KM models capable of documenting, tracking, and protecting

knowledge associated with biodiversity. In this sense, Silva's criticism; Oliveira (2020) to biopiracy reinforces the need for KM that respects collective rights, as provided for in the Nagoya Protocol.

Gebara; *et al.* (2023) warn of the risk of bioepistemicide, when production chains ignore traditional knowledge. Thus, KM is not mere "registration", but protection, recognition and fair redistribution of benefits.

Finally, with regard to education and intergenerational transmission Rocha (2019), Loureiro; Almeida (2022) and Menezes (2020) argue that Amazonian knowledge is transmitted through community immersion, orality, and bodily practices. Therefore, KM in the Amazon needs a people-centered approach, not only in databases (Polanyi, 1966; Wenger, 1998).

4.1.2 Shortcomings identified – critical comments

From the integrated literature review, it was possible to identify some theoretical, methodological and contextual gaps. Thus, it can be highlighted as the main critical points evidenced in the literature.

- Absence of Amazonian theoretical models

  Confirmed by Fonseca; Zaninelli (2024; 2025), who propose models of indigenous KM.
- Deficit of longitudinal studies.

Barbalho (2021) argues that there are many descriptive analyses and few impact assessments.

- Lack of university-community integration.

Almeida; Szwarcwald (2020) highlights sociopolitical barriers that hinder the inclusion of traditional populations.

- Fragility of ethical digital platforms

  Teeves (2015) and McGrew *et al.* (2023) show risks of leakage of sensitive data.
- Little articulation between KM and public policies

  Teixeira (2020) and Santos; Costa (2021) reinforce this gap.

These gaps are not only scientific, but structural and linked to the limited historical recognition of Amazonian populations in science and technology policies.

4.2 QUALITATIVE ANALYSIS OF INTERVIEWS WITH KNOWLEDGE MANAGEMENT RESEARCHERS IN THE AMAZONIAN CONTEXT

KM has evolved, in recent decades, from a field guided by organizational models related to business strategy such as those defined by Alavi and Leidner (2001), Davenport and Prusak (1998) and Nonaka; Takeuchi (2008) and for a more diverse field of study, capable of dialoguing with different epistemologies, cultural realities and modes of knowledge production. In the Amazonian context, this transition becomes even more evident, as territorial dynamics, traditional knowledge regimes, sociocultural diversity, and the history of structural inequalities impose unique challenges and possibilities, as highlighted by the researchers interviewed.

The empirical corpus used for this analysis consists of qualitative interviews with Profa. Célia Regina Simonetti Barbalho, a pioneer in KM research in the Amazon, and Profa. Danielly Oliveira Inomata, a researcher at UFAM and UFPA whose contemporary work articulates KM, sustainability and information flows in the Amazonian context.

The analysis was conducted according to the methodology of Content Analysis (Bardin, 2011), with thematic categorization and critical interpretation of the corpus, confronting it with contemporary literature on a) integration of knowledge (traditional and scientific); b) sociopolitical challenges of KM in the Amazon; c) governance of local information and knowledge; d) sustainable innovation and social technologies; e) inclusion of indigenous peoples and local communities; f) trajectory of KM research in the Amazonian context; g) KM research groups in the Amazon; and h) ongoing and future research agenda of KM in the Amazon.

From the interviews and literature, it is possible to outline a robust contemporary agenda on the KM theme in the Amazonian context.

The research agenda on KM in the Amazon has as its starting point studies on indigenous KM and intellectual protection. As highlighted in the studies by Fonseca (2024) who studies the conceptual modeling of indigenous KM and studies by Gebara, et.al., (2023) who deals with analyses on bioepistemicide and the National Observatory of Indigenous Production.

The researcher ENTRE 1 highlights GC research, information flows, and climate change as an agenda. According to the researcher ENTRE 1, research on climate disinformation and organizational resilience in the face of environmental effects in the Amazon is underway.

Castro Studies; Zucarelli, (2021) deal with integrated information governance. Focused on building systems that unite scientific, socio-environmental and traditional data.

On the other hand, Cardoso; Pimenta (2019) discuss KM and bioeconomy/sociobioeconomy when developing studies on sociobiodiversity production chains and social technologies.

Finally, studies such as Correa, *et al.*element. (2023) put KM in public organizations in the Amazon on the research agenda. Contributing to this agenda Cunha; Meirelles, (2022) deal with innovation mechanisms for public policies in the Amazon context.

Summarizing the current and future agenda of KM research in the Amazon, Table 6 presents the foundations for understanding and substantiating the studies.

Table 6

Current and Future Agenda for KM Research in the Amazon

Line of Research	Researchers/Evidence	Scientific developments
Indigenous GC	The researcher ENTRE 2 reports that the formation of a network of researchers is essential to strengthen research in the Amazonian context; It reinforces the need to investigate epistemological models.	Conceptual models (Fonseca, 2024) and intellectual protection.
Climate Misinformation	The researcher ENTRE 1 coordinates studies on information flows.	GC-climate articulation; evidence-based decision-making.
Bioeconomy and social technologies	Research on Baniwa Pepper and sustainable chains.	GC Integration – Territorial Innovation (EMBRAPA, 2023).
Information Governance	Integrated repository projects and Amazonian thesauri.	Knowledge ecosystems (Bellini, 2025).

Source: survey data, 2025.

4.2.1 Integration of Knowledge (Traditional and Scientific)

The integration between traditional and scientific knowledge emerged, in the interviews, as one of the central axes of the resignification of KM in the Amazonian context. The literature also points to this movement as essential to face socio-environmental challenges and build sustainable development alternatives (Berkes, 2015; Escobar, 2016; Leff, 2021)

ENTRE 2 stresses that indigenous knowledge operates through dynamics that completely challenge traditional KM models. In his words: "It deconstructs absolutely all concepts" of KM by observing the relational, ritualistic and cosmological logic that governs indigenous knowledge

This view dialogues with Agrawal (2002), who argues that Western classifications tend to reduce the complexity of traditional knowledge, and with Battiste (2019), who defends epistemological decolonization as a condition for understanding indigenous knowledge systems.

Table 7 below was elaborated considering the qualitative data collected in the interviews and their relationship with the theoretical framework and the authors on which this study is based.

Table 7

Integration of Knowledge (Traditional and Scientific) in the Amazon GC

Dimension	Corpus Evidence	Relationship with Literature
Nature of traditional knowledge	Knowledge transmitted by rites, coexistence, collective practices and spiritual choices; "deconstructs absolutely all the classic concepts" of KM as stated by ENTRE 2.	Berkes (2015) on sacred ecology; Agrawal (2002) on the classification of knowledge; Foster; Zaninelli (2024) on indigenous GC.
Science-tradition co-production	Amazonian GC should incorporate local values and knowledge into organizations, according to reports from ENTRE 1.	Jasanoff (2004) and Cassino; *et al.* (2025) on co-production of knowledge systems.
Epistemological tensions	Need to abandon rigid Western categories to understand indigenous cosmologies according to ENTRE 2.	Leff (2021) and Escobar (2016) on territorial and decolonial epistemologies.

Source: survey data, 2025.

The interviewed researcher (ENTRE 2) reinforces that "knowledge management in the Amazonian context means incorporating values and knowledge into the organizational culture" and recognizing that Amazonian institutions already assume elements of sustainability and tradition in their missions and institutional practices. This understanding is close to Jasanoff (2004), for whom scientific and social knowledge are co-produced; and Casino; *et al.* (2025), who argue that thinking with the peoples of the Amazon can expand contemporary knowledge systems

In this sense, the interviewed researcher ENTRE 2 explains that, among indigenous peoples, socialization occurs: a) by rites; b) dances; c) coexistence in the preparation of food; d) community crops; and e) spiritual choice of apprentices, as in the case of shamans.

Therefore, these results contrast with Nonaka's SECI cycles; Takeuchi (2008), based on tacit-explicit conversion. As Polanyi (1966) points out, tacit knowledge is always greater than explicit knowledge and in the Amazon, it remains primarily tacit for cultural, spiritual and collective protection reasons, according to the researchers interviewed.

4.2.2 Sociopolitical Challenges of Knowledge Management in the Amazon

Sociopolitical challenges form a cross-cutting category, articulating historical inequalities, institutional barriers, environmental pressures, and geopolitical disputes. According to a report by ENTRE 1, it can be said that researchers from the North live with "the asymmetry of graduate studies", which requires interstate partnerships and the strengthening of regional programs such as UFAM and UFPA

This asymmetry has been widely documented by Bentes-Gama (2012) and Bursztyn (2015) who describe the historical marginalization of the Amazon in science and technology policies

As highlighted by ENTRE 2, research with indigenous peoples requires multiple authorizations, such as FUNAI and the Ethics Committee, making the process "extremely complex" and bureaucratic, especially in ethnoFigureic approaches. CNS Resolution 510/2016 reinforces the need for ethical care in research with vulnerable populations, also foreseen by Diegues (2000) and Bernard; Jorgensen (2022) in the discussion of collaborative ethics in traditional knowledge.

ENTRE 1 reports that it has been investigating information flows and disinformation related to climate change, a critical issue in a region that lives under ecological "tipping points", an issue also reported in Nobre's studies; Borma (2009) and political tensions associated with environmental disinformation. Therefore, KM thus becomes a mechanism of cognitive governance in the face of narrative conflicts about climate, forest, and territory.

One should reflect on the economic exploitation of knowledge. ENTRE 2 warns of the vulnerability of traditional knowledge in the face of the interest of pharmaceutical and biotechnology industries, stating: "Imagine the pharmaceutical industry crazy to get their hands on the pile of knowledge they have".

This concern is corroborated by Matheus (2019) and Gebara *et al.* (2023), which discuss the threat of bioepistemicide, that is, the appropriation and erasure of indigenous knowledge systems by the global biotechnology economy.

Table 8 summarizes the sociopolitical challenges of KM in the Amazon and relates the challenges to the literature.

Table 8

Sociopolitical Challenges of KM in the Amazon

Category	Interview Evidence	Dialogue with Scientific Studies
Academic and regional asymmetries	ENTRE 1 reports the historical disparities between the North and other regions related to the training of human resources. It reinforces the need to strengthen regional graduate studies.	Bursztyn (2015); Bentes-Gama (2012) on inequality of scientific infrastructure.
Bureaucracy and ethics in research with indigenous people	Need for multiple authorizations (BETWEEN 2).	Bernard; Jorgensen (2022); CNS Resolution 510/2016.
Economic exploitation of knowledge	"Pharmaceutical industry eager to get its hands on knowledge" (ENTRE 2)	Matheus (2019); Gebara *et al.* (2023) on bioepistemicide.
Climate misinformation	This is a central theme of projects coordinated by ENTRE 1.	Noble; Borma (2009); Brondízio *et al.* (2016).

Source: survey data, 2025.

4.2.3 Governance of Information and Local Knowledge

The theme of governance of information and local knowledge, described in Table 9, emerges as a strategic axis for integrating data, protecting traditional knowledge and structuring information ecosystems.

Table 9

Governance of Information and Local Knowledge

Dimension	Corpus Situations	Theoretical Framework
Informational fragmentation	Lack of an integrated system on the Amazon; projects for unified repositories (ENTRE 2).	Castro; Zucarelli (2021); Freire; Lima (2020).
Intellectual protection	Demand for access and safeguard restrictions (ENTRE 2).	McGrew *et al.* (2023); Matos; Tenazor (2019).
Community governance	Collective and non-commodified knowledge (ENTRE 2).	Almeida (2014); Cunha (2007) on traditional collectivities.

Source: survey data, 2025.

The researcher ENTRE 2 argues that there is a lack of a "large referential system of integrated information about the Amazon" and that her projects seek precisely to "structure a unified repository" that connects scientific, socio-environmental and traditional data.

This gap is recognized by authors such as Freire; Lima (2020) and Castro, Carvalho; Zucarelli (2021) and that highlight the need for integrated informational governance for environmental and territorial policies in the Amazon context.

It becomes evident that it is necessary to safeguard and protect the intellectual territory of the Amazon. Study by McGrew *et al.*, (2023), points out that traditional knowledge requires

specific protection mechanisms, such as: a) adequate licensing; b) legal protection; c) specific metadata; and d) ethical governance of information.

The researcher and interviewee ENTRE 2 who has been working since CBA and PROFNIT with intellectual property issues and states that GC in the Amazon needs to consider access restrictions, as certain knowledge cannot be widely opened without risk of external exploitation.

Indigenous governance systems are not based on Western notions of property, but on collectivity, reciprocity, and territoriality, as highlighted in the studies of Cunha (2007) and Almeida (2014).

Therefore, the practice of governance directly implies KM strategies that must respect: a) distributed decision-making; b) cultural and spiritual authority and c) cosmological protection of knowledge.

4.2.4 Sustainable Innovation and Social Technologies

KM is recognized as a structuring resource for sustainable innovation, as ENTRE 1 points out when it states that KM can "direct knowledge aligned with sustainability in the cultural, economic, environmental and technological dimensions"

This view corresponds to the notion of informational sustainability highlighted in Barbosa's studies; Schneider (2015) and in the seminal studies of Geraldo, Pinto; Duarte (2022). Also discussed in the approaches to knowledge ecosystems by Bellini; Raglianti (2025).

By highlighting social technologies as an Amazonian solution, ENTRE 2 highlights the production of baniwa pepper as an example of KM in social technology: community production, traditional division of roles and innovation oriented to indigenous economic autonomy.

In this sense, authors such as Fleury, Lobato; Dantas (2019) and D'Ávila (2020) argue that social technologies are more effective in Amazonian territories because they respect local traditions, collectivities, and ecological systems

Reflecting on academic and technological innovation, it was evident that ENTRE 2's performance in the CBA, implementing KM structures, competitive intelligence and intellectual property, demonstrates a pioneering model of institutional innovation oriented to the bioeconomy. The literature on Amazonian bioeconomy (EMBRAPA, 2021; Coast;

Almeida, 2023) reinforces this articulation between science, territory, and traditional knowledge.

4.2.5 Inclusion of Indigenous Peoples and Local Communities

Indigenous KM as an epistemological rupture is discussed in the reports of the researcher ENTRE 2 when she states that working KM with native peoples requires "detaching oneself from many concepts of knowledge management" because indigenous knowledge has a cosmological, spiritual and relational nature.

This understanding dialogues with Fonseca; Zaninelli (2024), who propose conceptual models of indigenous KM, and with Escobar's (2016) approach to "feeling-thinking with the Earth".

The researcher ENTRE 2 mentions the creation of a national observatory of the production of indigenous academics, which seeks to map intellectual trajectories and strengthen the epistemological autonomy of these groups.

In this sense, the researcher ENTRE 1 reinforces that her UFAM-UFPA work contributes to expanding indigenous and regional participation in graduate programs, reducing historical inequalities in the regional context.

4.2.6 Trajectory of KM Research in the Amazon Context

The genesis of KM research in the Amazonian context has as its starting point studies based on the field of librarianship and management. The researcher ENTRE 2 reports that she began her research in the 1990s, when she was still "the only doctor in the library science course for almost 20 years" and began investigating library management and technological diagnoses at UFAM.

The turning point was the performance of ENTRE 2 in the field of biotechnology. Thus, his work at the Amazon Biotechnology Center (CBA) for 12 years marks a significant turning point that positioned GC as a strategic tool to support the nascent biobusiness hub in the region. This phase anticipated current trends in the territorial bioeconomy, as evidenced in Fernandes' studies; *et al.*, (2025).

Table 10 summarizes the trajectory of KM research in the Amazon.

Table 10

Groups and Trajectories of KM Research in the Amazon

Theme	Interview Evidence	Interpretative Synthesis
Origin of studies	Initial research by ENTRE 2 in the 1990s in librarianship and organizational diagnoses.	The Amazonian GC was born within information science, with a strong institutional look.
Biotechnological turn	12 years of experience at CBA structuring KM, innovation and intellectual property. (OF 2)	Framework that links KM to the bioeconomy and regional industrial policy.
Network expansion	Simultaneous performance UFAM-UFPA and expansion of graduate studies (ENTRE 1).	Institutional strengthening and new lines of research in sustainability and information flows.
GICA	Structuring of lines focused on KM; Inclusion of GC in the name of the group and Amazon focus.	Consolidation of the GC research ecosystem in the North.

Source: survey data, 2025.

Finally, in 2019, the reformulation of the research group culminated in the creation of GICA, definitively inserting KM as a central research axis at UFAM and strengthening studies of traditional knowledge, women in science and intellectual protection as reported by the researchers.

4.2.7 Research Groups in Knowledge Management in the Amazon

This study sought to understand the KM strategy in the Amazonian context. In this sense, the researcher ENTRE 1 describes GICA as a continuation of the historical NEPCI, aimed at studying characteristics of information and knowledge as managerial elements, with "special focus on the Amazonian context".

Under the coordination of the researcher and interviewee ENTRE 2, GICA began to develop research on: a) indigenous knowledge; b) GC in public organizations; c) social technologies; d) informational sustainability; and e) bioeconomy.

The researchers' reports reinforce And highlight some emerging national networks such as the observatory of indigenous academics and national partnerships reflect the maturation of KM in the Amazon as a relevant field of research.

Table 11 summarizes the KM research groups in the Amazon, the lines of research and the main contributions to the regional context.

Table 11

KM Research Groups in the Amazon

Group / Institution	Interview Evidence	Line of Action	Contributions to the Amazon GC
GICA – Research Group on Information and Knowledge Management in the Amazon (UFAM)	Reformulated in 2019; Includes CG in the name of the group as reported in ENTRE 1.	Information, GC, innovation, sustainability.	It integrates teaching, research and extension; history of training regional staff.
DICA – Development, Information, Knowledge and the Amazon (UFAM)	Structured by the researcher and interviewee ENTRE 2; Strong performance in ICTs, indigenous KM and intellectual property.	Traditional knowledge, governance, bioeconomy.	Pioneer in the discussion of indigenous KM and safeguarding knowledge..
PPGIC – Graduate Program in Information and Communication (UFAM)	Created with the participation of the researcher and interviewee ENTRE 1; interdisciplinary focus.	Interdisciplinarity, culture and KM.	It expands epistemological and theoretical boundaries of KM.
PPGCI – UFPA	Simultaneous performance of the researcher (ENTRE 1) strengthens UFAM-UFPA integration.	KM, sustainability, information flows.	It reduces regional asymmetries and strengthens Amazonian scientific production.
National Networks/Observatory of Indigenous Scholars	Initiative coordinated by the researcher ENTRE 2 in a multidisciplinary network.	Indigenous epistemologies and critical open science.	It promotes visibility and autonomy of indigenous researchers.

Source: survey data, 2025.

4.2.8 Ongoing and Future Research Agenda of KM in the Amazon

From the interviews and literature, it is possible to outline a robust contemporary agenda on the KM theme in the Amazonian context.

The research agenda on KM in the Amazon has as its starting point studies on indigenous KM and intellectual protection. As highlighted in the studies by Fonseca (2024) who studies the conceptual modeling of indigenous KM and studies by Gebara, et.al., (2023) who deals with analyses on bioepistemicide and the National Observatory of Indigenous Production.

The researcher ENTRE 1 highlights GC research, information flows, and climate change as an agenda. According to the researcher ENTRE 1, research on climate disinformation and organizational resilience in the face of environmental effects in the Amazon is underway.

Castro Studies; Zucarelli, (2021) deal with integrated information governance. Focused on building systems that unite scientific, socio-environmental and traditional data.

On the other hand, Cardoso; Pimenta (2019) discuss KM and bioeconomy/sociobioeconomy when developing studies on sociobiodiversity production chains and social technologies.

Finally, studies such as Correa, *et al.*element. (2023) put KM in public organizations in the Amazon on the research agenda. Contributing to this agenda Cunha; Meirelles, (2022) deal with innovation mechanisms for public policies in the Amazon context.

Summarizing the current and future agenda of KM research in the Amazon, Table 12 presents the foundations for understanding and substantiating the studies.

Table 12

Current and Future Agenda for KM Research in the Amazon

Line of Research	Researchers/Evidence	Scientific developments
Indigenous GC	The researcher ENTRE 2 reports that the formation of a network of researchers is essential to strengthen research in the Amazonian context; It reinforces the need to investigate epistemological models.	Conceptual models (Fonseca, 2024) and intellectual protection.
Climate Misinformation	The researcher ENTRE 1 coordinates studies on information flows.	GC-climate articulation; evidence-based decision-making.
Bioeconomy and social technologies	Research on Baniwa Pepper and sustainable chains.	GC Integration – Territorial Innovation (EMBRAPA, 2023).
Information Governance	Integrated repository projects and Amazonian thesauri.	Knowledge ecosystems (Bellini, 2025).

Source: survey data, 2025.

4.2.9 Convergences Between Interviews and KM Theories

KM has been consolidated as a strategic field for private, public, and social organizations since the 1990s. Authors such as Davenport and Prusak (1998), Nonaka; Takeuchi (2008) and Choo (2006) established theoretical frameworks that define knowledge as an essential organizational asset for innovation, competitive advantage, and continuous learning.

However, when analyzing specific contexts, especially the Amazon, marked by sociocultural diversity, traditional knowledge, its own cosmologies, complex ecosystems and unique territorial dynamics, it is observed that the classical models do not fully account for reality. It is at this point that fundamental contributions emerge from the interviews conducted with Prof. Dr. Célia Regina Simonetti Barbalho and Prof. Dr. Danielly Oliveira Inomata, pioneering researchers at the interface between GC, the Amazon and traditional knowledge.

The researcher (ENTRE2) points out that, in the case of indigenous peoples and other Amazonian communities, it is necessary to "deconstruct absolutely all [traditional] concepts of knowledge management," given the way knowledge circulates, is shared, and protected in these contexts. On the other hand, researcher ENTRE 1, in turn, highlights that the Amazon GC must incorporate contextualized values, knowledge, and practices, integrating sustainability, institutional mission, and territoriality.

This chapter deepens these convergences, articulating them with the conclusions of the Integrated Literature Review on KM in the Amazon (2000–2025), prepared by the research project to which this work is linked. Thus, the central objective is to demonstrate how interviews and theories complement each other, tension and generate new understandings about KM in the Amazonian context.

The convergence between interviews and KM theories points to KM as a social and cultural practice. Both the literature and the interviewees converge on the idea that knowledge is socially constructed. Brown and Duguid (2001) state that KM should be understood as a social practice, not as a mere technical process. This understanding appears strongly in the statements of the researcher ENTRE 2.

Researcher ENTRE 2 points out that "Socialization [among indigenous people] is much broader. It occurs through rites, dances, daily coexistence." The researcher ENTRE 1 adds that, in Amazonian organizations, KM depends on the incorporation of regional values into the organizational culture. Thus, he states: "To think about knowledge management in the Amazon is to incorporate values and knowledge into the culture of organizations."

Table 13

Theoretical and Empirical Convergences between Interviews and KM Classics

Dimension	Classical theories	Interview – ENTRE 2	Interview – ENTRE 1	Convergence
Nature of knowledge	Tacit and explicit (Nonaka; Polanyi)	Indigenous knowledge is mostly tacit and non-externalizable	Knowledge must incorporate regional values	Knowledge is social and contextual
Socialization	Interaction and learning	Rituals, dances, expanded coexistence	Amazonian organizational culture	Expanded socialization
KM as a strategy	Innovation and advantage	Cultural safeguarding and protection	Sustainability and SDGs	KM as a socio-territorial practice
Public management	Moderate role	GC in libraries	KM in universities and public agencies	Expanding the KM Field

Source: survey data, 2025.

Traditional knowledge challenges the SECI model. Classical literature assumes that knowledge tends to be transformed into explicit for management purposes. However, ENTRE 2 clarifies: "They are not concerned with transforming tacit knowledge into explicit knowledge". This statement converges with Berkes (2015) and Battiste (2019), who argue that indigenous knowledge is holistic, contextual, and not reducible to formal records.

The interviews converge with recent literature linking KM and sustainability (LEITE; BAPTISTA, 2019). Researcher ENTRE 1 emphasizes: "Our research is directly related to the SDGs, especially sustainability, climate change, and organizational resilience."

This perspective dialogues with authors who highlight the Amazon as an essential ecosystem for global climate balance (Artaxo, 2019; Brondizio *et al.*, 2016).

The researcher ENTRE 1 states that a large part of her scientific production involves KM in public management, especially universities and research bodies. "We have many projects focused on knowledge management in public organizations, including organizational maturity and innovation."

The literature confirms the historical gap in studies on KM in public institutions in the Amazon (Alfenas *et al.*, 2021; Baptist; Quandt, 2015).

KM contributes to the preservation of knowledge and generational continuity. In this sense, ENTRE 2 reports the implementation of KM in the UFAM Library System to avoid loss of critical knowledge with retirements: "Several people had mastery of the system's knowledge and this could be lost."

Davenport; Prusak (1998) already emphasized the importance of retaining organizational knowledge, but in the Amazonian context this dimension acquires more urgent contours due to regional asymmetries, an issue emphasized by ENTRE 2.

Table 14

Convergences between Interviews and KM Theories

Concept	Interview BETWEEN 2	Interview BETWEEN 1	Literature
Tacit knowledge	Indigenous knowledge is not easily converted into explicit; are culturally protected.	GC must recognize territorialities and subjectivities.	Polanyi (1966); Nonaka; Takeuchi (2008).
KM and sustainability	KM applied to the protection of traditional knowledge.	Projects aligned with the SDGs and climate resilience.	Barbosa; Schneider (2015); Geraldo; Pinto (2019).
Social innovation	Traditional production chains as social technologies.	KM as a driver of sustainable innovative practices.	Fleury *et al.* (2019); D'Ávila (2020).

Source: survey data, 2025.

4.3 DOCUMENTARY ANALYSIS OF GOVERNMENT REPORTS, INSTITUTIONAL GUIDELINES AND REGULATORY FRAMEWORKS IN THE AMAZON

The analysis of government reports, institutional guidelines, and normative documents allowed us to deepen the understanding of the policies that guide Amazonian development and their relationship with KM. Technical documents from federal and state agencies linked to territorial, socio-environmental and regional development management were examined, including environmental monitoring reports, strategic plans for sustainable development and territorial planning instruments. Public policies for science, technology, and innovation were also analyzed — especially those aimed at promoting open data, protecting traditional knowledge, and stimulating sustainable innovation, which make up the normative framework for KM practices in the Amazonian context.

In addition, regulatory and normative frameworks related to the safeguarding of traditional knowledge were considered, including guidelines related to the rights of indigenous peoples and traditional communities, with emphasis on benefit-sharing mechanisms, access to genetic heritage, and shared governance of knowledge. Institutional documents from agencies such as BNDES, MCTI, CNPq, IBAMA and indigenous organizations were also included, since they present strategic guidelines, development programs and structuring projects being carried out in the region.

This documentary analysis made it possible to identify key guidelines, institutional actors involved, normative weaknesses and structural gaps that directly affect the implementation of KM practices in the Amazon. Among the main challenges identified, the following stand out: low interoperability between government information systems; the fragmentation of initiatives for the production and circulation of knowledge; insufficient interinstitutional articulation; and limited social participation in decision-making processes. Such elements reinforce the need for collaborative governance models and robust data management and openness policies that strengthen the integration between science, traditional knowledge, and sustainable innovation in the region.

Reports from federal and state institutions responsible for territorial and environmental management and regional development were examined, including:

- State Master Plans and Economic-Ecological Zoning (ZEE);
- Environmental monitoring reports from IBAMA and ICMBio;
- Strategic plans for sustainable development linked to SUDAM and the Ministry of Integration and Regional Development;

- Evaluation reports on bioeconomy policies and Amazonian production chains.

These documents provide an overview of the use of socio-environmental data, territorial information infrastructure, and shared governance challenges, which are fundamental to KM.

Regulations and guidelines of Science, Technology and Innovation (ST&I) policies were also analyzed, especially those related to:

- data openness and interoperability (Federal Government Open Data Policy);
- protection and sustainable use of genetic heritage and traditional knowledge (Law No. 13,123/2015);
- encouragement of applied research in bioeconomy;
- digital governance and integration of information systems.

These policies are directly related to the ability to produce, manage and share knowledge strategically.

The analysis included regulatory frameworks such as:

- National System for the Management of Genetic Heritage and Associated Traditional Knowledge (SisGen);
- Guidelines of the Convention on Biological Diversity (CBD);
- Norms on the territorial rights of indigenous peoples and traditional communities (FUNAI, ILO Convention 169);
- Community protocols for consultation and prior consent.

These instruments regulate the use, recognition, and protection of traditional knowledge—an essential element of KM in the Amazon.

Institutional documents were also analyzed from:

- BNDES (funds for bioeconomy, innovation notices and resources for sustainable production chains);
- CNPq (research calls, scholarships for traditional knowledge, INCTs focused on the Amazon);
- MCTI (National Innovation Strategy, National Open Science Policy);
- IBAMA and ICMBio (management of conservation units and environmental data policies);

- Indigenous organizations (consultation protocols, territorial and environmental management plans – PGTAs).

These documents reveal how different institutions produce and circulate knowledge, with varying degrees of integration.

Table 16

Institutional actors and their functions in the GC of the Amazon

Actors	Main functions	Contributions to KM	Weaknesses identified
MCTI / CNPq / CAPES	ST&I policy formulation; Promotion of research	Scientific production, research networks, data infrastructure	Low integration with traditional knowledge; Fragmentation between bases
BNDES / Finep	Economic and technological development	Supporting sustainable innovation and the bioeconomy	Few actions integrated with territorial governance
IBAMA / ICMBio	Environmental inspection and management	Large environmental databases	Systems not interoperable with universities and local organizations
SUDAM / State Governments	Regional planning	Territorial and socio-economic plans	Lack of informational standardization and KM mechanisms
Indigenous organizations	Territorial management, advocacy	Consultation protocols and safeguarding of knowledge	Poor integration with government systems
Universities / INCTs	Research and training	Scientific production and dissemination	Difficulty accessing up-to-date government data

Source: survey data, 2025.

5 FINAL CONSIDERATIONS

KM in the Amazon presents itself as a crucial tool for sustainable development, capable of integrating traditional and scientific knowledge, strengthening local governance and promoting innovation. The strengthening of these practices contributes to the preservation of biodiversity and the improvement of the socioeconomic conditions of Amazonian communities.

The Amazonian context, due to its vast biodiversity and cultural diversity, faces complex challenges that require innovative approaches to promote sustainable development. In this sense, KM emerges as a strategic tool to integrate traditional and scientific knowledge, strengthen local governance and drive adaptive solutions in the face of climate change and socio-environmental pressures seeking sustainable development and committed to the UN Sustainable Development Goals (SDGs).

KM in the Amazon is essential for building sustainable solutions that respect the cultural and environmental diversity of the region. Integrating traditional and scientific knowledge, strengthening local governance, and promoting innovation are essential steps to ensure a sustainable future for the Amazon and its peoples.

KM in the Amazon represents a strategic path to integrate science, technology and traditional knowledge in favor of a sustainable and innovative development model. Valuing cognitive diversity and creating collaborative networks are essential for the knowledge produced in the region to effectively contribute to global solutions to environmental, social, and economic challenges.

When applied ethically and interculturally, KM can strengthen the appreciation of traditional knowledge from the Amazon, promoting cognitive justice and sustainability. The articulation between scientific and traditional knowledge requires institutional, political and cultural mediations that respect the rights of communities and recognize epistemic plurality.

The preservation of this knowledge is not only a matter of memory, but of environmental and cultural survival. Thus, integrating KM into the protection of traditional knowledge represents a promising path for the future of the Amazon and humanity.

Among the main challenges are the asymmetry of power between social actors and the risk of misappropriation of traditional knowledge. The implementation of policies for the protection and recognition of collective intellectual rights is indispensable. In addition, KM in the Amazon must be based on ethical, collaborative, and intercultural principles that recognize epistemological diversity and strengthen the autonomy of local peoples (Barreto; Freitas, 2020).

The advancement of information and communication technologies can enhance the sharing and integration of knowledge, but it requires adequate infrastructure and cultural mediation to avoid exclusions (Moraes; Birth, 2021; Mark; Rodrigues, 2023).

KM in the Amazon represents a fertile field for social and environmental innovation. Knowledge dialogues between local and scientific knowledge are essential pillars for participatory and sustainable governance. Thus, the integration of KM practices can contribute not only to the strengthening of public policies, but also to the appreciation of cultural diversity and the protection of the forest and its peoples.

The Amazon presents complex challenges, but also unique opportunities for the implementation of innovation and sustainability strategies. The integration between bioeconomy, technology, environmental conservation, and inclusive socioeconomic

development is essential to ensure the preservation of the biome and the well-being of local populations. Robust public policies, investments in research, and the active participation of communities are essential to transform potential into concrete and lasting results.

KM in the Amazonian context is a challenging field, but strategic for sustainable development and for the valorization of local knowledge. The integration of scientific and traditional KM practices requires adapted models that respect cultural plurality, the collectivity of indigenous knowledge, and the institutional specificities of the region.

The literature shows that KM can serve not only as a tool for organizing and disseminating knowledge, but also as an instrument for social, technological and environmental innovation. The Amazon, therefore, should not be seen only as an object of study or a source of natural resources, but as a strategic space for the production of plural, ethical, and sustainable knowledge, capable of contributing to regional and global science, technology, and innovation policies.

The application of KM in the Amazon has proven to be essential to strengthen social inclusion and regional sustainability. According to Brito, Lima and Oliveira (2016), KM practices in credit unions in the states of Rondônia, Acre and Amazonas allowed the dissemination of knowledge to local communities, expanding opportunities for socioeconomic development.

Studies such as the one by Brito *et al.* (2016) analyze KM practices in credit unions in the states of Rondônia, Acre and Amazonas, highlighting the importance of disseminating knowledge for social inclusion and income distribution in the region.

In addition, citizen science projects, such as ForestEyes, use KM tools to monitor deforestation and generate data in real time, allowing for more efficient decision-making by public and private managers (Silva *et al.*, 2022).

KM is understood as the systematic process of creating, storing, sharing and using knowledge to generate value and innovation (Davenport; Prusak, 1998). In the territorial context, especially in regions such as the Amazon, knowledge management needs to go beyond traditional corporate models, incorporating sociocultural, environmental, and cultural dimensions (Martins; Silva, 2019).

The main challenges for KM in the Amazon involve the lack of technological infrastructure, limited connectivity, scarcity of incentive policies, and the difficulty of legal recognition of traditional knowledge. However, there are promising prospects with the

advancement of digital transformation, the expansion of research networks, and the strengthening of the bioeconomy (Menezes; Rodrigues, 2023).

The articulation between GC and SDGs represents a promising path for sustainable development, especially in megadiverse and socio-culturally rich regions such as the Amazon. From the interviews analyzed, it is observed that For Barbalho, the Amazonian KM requires alternative conceptual frameworks and respect for the cosmologies of the original peoples, deconstructing classical models. For Inomata, KM in the Amazon must integrate knowledge, sustainability and organizational mission, strengthening institutions and innovating in social and environmental practices.

Thus, the KM Research Agenda must be plural, ethical, inclusive, and territorially situated, contributing to addressing global and regional challenges, and consolidating KM as an instrument for social and environmental transformation in alignment with the SDGs.

KM in the Amazonian context is today a unique field, which requires epistemological decolonization, respect for territorialities, integration between science and tradition, and strengthening of governance structures. More than adapting classic models, it is necessary to create new paradigms that reflect the complexity of the region, as Célia and Danielly defend in their trajectories and productions.

The convergence between traditional and scientific knowledge, social technologies, bioeconomy, and informational governance points to a future in which KM can contribute decisively to the cognitive, cultural, environmental, and political sustainability of the Amazon.

The bibliometrics carried out point to a promising and consolidating field: KM in the Amazon is currently articulated with central themes of the socio-environmental agenda (bioeconomy, governance, traditional knowledge and digital innovation). However, there is an urgent need for sensitive methodological models, applicable metrics and ethical protocols for KM to contribute in a fair and sustainable way to regional development and the protection of Amazonian epistemological heritage.

The literature analyzed demonstrates that KM in the Amazon: a) is emergent, interdisciplinary and politically situated; b) it requires articulation between science and traditional epistemologies; c) it is deeply linked to environmental governance, bioeconomy and cognitive justice; and d) it requires its own conceptual models, ethically sustainable and digitally integrated.

As Escobar (2016), Santos (2018) and Leff (2021) argue, the future of the region depends on post-decolonial approaches, capable of respecting Amazonian ways of producing knowledge.

This study has some limitations that can be observed in the results, such as: a) Many studies are qualitative, focusing on specific cases or restricted communities, which may make generalizations difficult; b) the availability of public data, validated models or specific "Knowledge Management" metrics in the Amazonian context is still limited; c) the practical implementation of KM models adapted to the Amazon encounters logistical, cultural, and financial barriers many studies point to the challenges, but even fewer show models widely implemented and evaluated with robust quantitative data; and d) There is a risk of applying imported models without adaptation to the Amazonian context, which can lead to failures in adaptation or local rejection.

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