

INFORMATION AND KNOWLEDGE MANAGEMENT IN SCIENCE AND TECHNOLOGY INSTITUTIONS: AN ANALYTICAL MODEL FOR ENHANCING INNOVATION IN ACADEMIC PRODUCTION

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Abstract

Innovation systems in science and technology institutions remain oriented toward formalized outputs, such as patents and licenses, which tends to render applied and incremental knowledge invisible. Although the literature emphasizes innovation as a relational process, organizational practices continue to focus on formalized assets. This article identifies the absence of models capable of treating undergraduate capstone projects as strategic assets. Based on a systematic literature review and qualitative inductive analysis, the study proposes a model that articulates information management, knowledge management, and institutional intelligence. The model provides analytical parameters to support institutional diagnosis and strengthening.

Key-words: information management; knowledge management; institutional intelligence; institutional innovation; science and technology institutions.

GESTÃO DA INFORMAÇÃO E DO CONHECIMENTO EM INSTITUIÇÕES DE CIÊNCIA E TECNOLOGIA: MODELO ANALÍTICO PARA O FORTALECIMENTO DA INOVAÇÃO NA PRODUÇÃO ACADÊMICA

Resumo

Os sistemas de inovação em instituições de ciência e tecnologia permanecem orientados por resultados formalizados, como patentes e licenças, o que invisibiliza conhecimentos aplicados e incrementais. Embora a literatura enfatize a inovação como processo relacional, as práticas organizacionais seguem concentradas em ativos formalizados. Por meio desse artigo, identifica-se a ausência de modelos capazes de tratar produções da graduação, especialmente os trabalhos de conclusão de curso, como ativos estratégicos. Com base em revisão sistemática da literatura e análise qualitativa indutiva, propõe-se um modelo que articula gestão da informação, gestão do

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conhecimento e inteligência institucional. O modelo oferece parâmetros para diagnósticos e fortalecimento institucional.

Palavras-chave: gestão da informação; gestão do conhecimento; inteligência institucional; inovação institucional; instituições de ciência e tecnologia.

Introduction

The intensification of innovation, regional development, and social impact agendas has repositioned Science and Technology Institutions – STI – as central actors in contemporary knowledge systems (OECD, 2025). Traditionally, this role has been analyzed through technology transfer models oriented toward formal flows and institutional instruments such as patents, licenses, and spin-offs (Cunningham; Menter; Starke, 2025). Although these approaches played a relevant role in institutionalizing technology transfer, they have been widely criticized for their linear and selective nature, which limits their ability to capture the diversity of ways in which academic knowledge is produced, transformed, and mobilized in practice (Pinto, 2024).

Contemporary critiques of linear technology transfer models highlight a conceptual shift beyond transfer as a predominantly unidirectional process, advancing toward broader approaches such as knowledge exchange, knowledge translation, and innovation cooperation (Bejarano et al., 2023a; Fioravanti; Stocker; Macau, 2023). Within this framework, innovation is understood as the result of continuous interactions, cumulative processes, and institutional mechanisms of interpretation and mediation. This shift implies recognizing that the innovative capacity of STI depends less on the mere formalization of outputs and more on structures capable of identifying and articulating knowledge at different stages of maturity (Pedraja-Rejas; Rodríguez-Ponce; Rojas-Miranda, 2025).

In this context, information and knowledge management emerge as strategic components of institutional innovative capacity (Cristache; Croitoru; Florea, 2025). Effective innovation mechanisms depend on the organizational ability to transform dispersed information into actionable intelligence, linking academic production, institutional governance, and external innovation networks (Cheng et al., 2024). This perspective reinforces the importance of organizational learning, particularly in peripheral or low-innovation-maturity contexts where the activation of local knowledge is central.

Although theoretical debates have broadened the understanding of innovation processes, institutional models within STI continue to operate with a restricted scope regarding what is recognized as innovation (Cinar; Benneworth; Coenen, 2024; Gustina; Nurmasari; Liu, 2024; Taxt et al., 2022). Recognition patterns remain concentrated on formalized research outputs, often associated with postgraduate research, relegating other forms of applied knowledge production to a secondary position (Pinto, 2024).

In this scenario, undergraduate capstone projects – TCC –, in the Brazilian higher education context – tend to remain invisible within innovation management systems, despite their frequency, thematic diversity, and connection to concrete problems and territorial contexts. This applied production often incorporates technical solutions, process proposals, organizational models, and incremental innovations with potential to generate social and technological value (Shehab et al., 2025). However, in the absence of adequate analytical

and institutional mechanisms, such works are typically incorporated into passive repositories, without systematic processes of qualification or articulation with innovation and cooperation mechanisms (Shurin; Davidovitch; Shoval, 2021).

This situation reinforces the gap between expanded innovation concepts and institutional practices in STI. In the absence of analytical models oriented toward information and knowledge management that recognize capstone projects as strategic informational assets, institutional capacity to identify and mobilize projects with innovative potential is reduced (AlQhtani, 2025). This limitation is particularly acute in peripheral or emerging regions, where innovation depends on the articulation of local capacities and knowledge networks (Rossoni; Vasconcellos; Rossoni, 2024; Silva et al., 2025).

Given this gap, this article develops and conceptually grounds an analytical model oriented toward information and knowledge management in STI, focusing on identifying, organizing, qualifying, and valorizing the innovative potential embedded in capstone projects. The model conceives capstone projects as sources of latent innovation assets and structures institutional intelligence mechanisms aimed at their prospecting and qualification. By supporting the identification, maturation, and circulation of projects within and beyond institutional boundaries, the framework contributes to broadening the analytical scope of STI innovation systems and integrating knowledge management, institutional intelligence, and cooperation-oriented innovation.

From linear technology transfer to relational and knowledge-based innovation

For a long period, the consolidation of technology transfer systems was associated with a linear conception of innovation, in which scientific knowledge produced in universities and research institutes was converted into practical applications through formal mechanisms such as patents, licensing agreements, and spin-offs (Bejarano et al., 2023b). Although central to the institutionalization of innovation policies and the strengthening of the university–industry interface, this model privileged highly formalized and legally protected assets, limiting its capacity to capture the complexity and diversity of contemporary knowledge generation, circulation, and use (Hayter; Rasmussen; Rooksby, 2020; Scordato et al., 2022).

As a consequence, applied, incremental, and contextualized forms of knowledge remain at the margins of institutional innovation systems, despite their potential social, productive, and technological value. This limitation is particularly evident in heterogeneous and peripheral contexts, where innovation often emerges from non-linear trajectories and informal local interactions (Munaretti et al., 2025; Pappa; Amato; Lattanzi, 2025).

The expansion of theoretical debates on innovation has shifted the analytical focus from strictly formal technology transfer toward broader approaches such as knowledge exchange, knowledge translation, and innovation cooperation (Hayter; Rasmussen; Rooksby, 2020). Within this perspective, innovation is understood as a relational and cumulative process, dependent on the institutional capacity to interpret, translate, and transform knowledge over time, rather than merely transferring it between organizations (Soliani et al., 2025). Knowledge flows are thus recognized as bidirectional and mediated by individuals, organizational routines, and territorial contexts (Perkmann et al., 2021).

In this expanded framework, mediation activities, cooperation, and organizational learning become central to the progressive qualification of knowledge not yet formalized (Caloffi et al., 2023). This shift provides a basis for rethinking the internal information and knowledge systems of STI responsible for identifying and organizing intellectual outputs outside traditional innovation circuits.

In the context of transformations in innovation systems, information and knowledge management operate as institutional mechanisms for translating and recombining knowledge, connecting academic production, organizational structures, and external innovation dynamics (Cristache; Croitoru; Florea, 2025). Information and knowledge constitute complementary dimensions of the same organizational process. While information management is oriented toward the identification, organization, and availability of relevant data, knowledge management involves social and cognitive processes of interpreting, sharing, and strategically applying such data in decision-making contexts (Cheng et al., 2024).

In this sense, the availability of information alone is insufficient to sustain innovation processes (Damian et al., 2025). When mechanisms integrating information and knowledge are absent, informational accumulations with limited actionability tend to form, exerting little impact on organizational learning and decision-making (Dantas et al., 2024). Information management thus constitutes a necessary but insufficient infrastructure, requiring articulation with broader knowledge management practices (Moraes; Damian, 2025).

The creation of organizational knowledge has been understood as resulting from the interaction between tacit and explicit knowledge in continuous learning cycles. The SECI model (Nonaka; Takeuchi, 1995) systematizes this dynamic by showing that knowledge production depends on recurring processes of socialization, externalization, combination, and internalization. Subsequent studies associate this dynamic with the institutional capacity to convert individual experiences and dispersed information into shared cognitive assets oriented toward innovation (Arsanti; Rupidara; Bondarouk, 2024; Yıldız et al., 2025).

In this context, the notion of institutional intelligence emphasizes the strategic dimension of information and knowledge management, referring to the organizational capacity to transform information and knowledge into actionable inputs for decisions, internal policies, and innovative actions (Pedraja-Rejas; Rodríguez-Ponce; Rojas-Miranda, 2025). In peripheral regions or institutions with lower innovation maturity, the absence of structured mechanisms tends to intensify the fragmentation and invisibility of relevant knowledge (Pappa; Amato; Lattanzi, 2025). This reinforces the centrality of integrating information management, knowledge management, and institutional intelligence as a foundation for innovative capacity in environments marked by structural constraints and dependence on local cognitive assets (Cristache; Croitoru; Florea, 2025).

Applied knowledge, incremental innovation, and institutional limits of recognition in STI

The conceptual expansion of innovation has redefined the criteria for recognizing knowledge within innovation systems. Although formalized scientific research, often associated with graduate education, continues to play a fundamental role, incremental and applied knowledge has gained strategic relevance, particularly in contexts marked by socioeconomic challenges and structural constraints (Pacheco; Turro; Urbano, 2025).

Within this expanded framework, academic production is not limited to scientific articles or formally protected assets but encompasses diverse outcomes related to solving concrete problems, developing processes, proposing organizational models, and adapting existing technologies (Bejarano et al., 2023a). These forms of applied knowledge often emerge at early stages of technological maturity but may constitute essential steps in broader trajectories of innovation and technological cooperation (Gustina; Nurmasari; Liu, 2024).

Although STI produce substantial volumes of applied knowledge within undergraduate education, a significant portion remains underrepresented in institutional innovation systems (Frietsch; Reiß; Schmoch, 2024). Capstone projects exemplify this gap. Produced on a large scale, they frequently address real organizational demands and territorial contexts (Almeida; Maricato, 2022). Nevertheless, they are predominantly treated as formal academic requirements and incorporated into institutional repositories without systematic processes of qualification or articulation with innovation mechanisms (Marchant-Pérez; Ferreira, 2025).

This persistent underrepresentation reflects the selectivity of traditional innovation management models, which privilege formal transfer mechanisms and tend to overlook activities with significant socioeconomic impact potential (Gaffaro; Naranjo, 2025). Such selectivity compromises institutional capacity to recognize emerging opportunities and sustain organizational learning. This limitation is particularly relevant in environments where innovation depends on cooperative interactions, since the innovative value of knowledge and competencies relies on their articulation with learning and knowledge-sharing practices, rather than merely on the availability of isolated technologies (Gustina; Nurmasari; Liu, 2024; Soliani et al., 2025).

STI occupy a strategic position within national and regional innovation systems, acting as producers of knowledge, developers of human capital, and agents of socioeconomic development (Perkmann et al., 2021). Theoretical models such as the Triple Helix reinforce this centrality by conceiving innovation as the outcome of structured interactions among academia, industry, and government (Zadegan; Ghazinoory; Nasri, 2025).

In the Brazilian context, technology transfer offices were established as units responsible for innovation policy management, intellectual property protection, and articulating technology transfer processes (Spier; Silva, 2025). The national legal framework assigns these units responsibilities including evaluating projects' innovative potential, negotiating contracts, and disseminating innovation culture within academia (Brazil, 2004; Brazil, 2016). Despite this framework, empirical evidence indicates that many centers face structural limitations that constrain their effectiveness, particularly in smaller or peripheral institutions (Munaretti et al., 2025).

Within debates on STI innovation governance, fragile internal information systems for identifying innovation assets and limited coordination between innovation centers and academic units emerge as recurring obstacles to mobilizing internally generated knowledge. The difficulty of granting visibility to research outcomes with innovative potential further compounds these challenges (Rossoni; Vasconcellos; Rossoni, 2024). Such factors hinder more consistent institutional trajectories of innovation and technology transfer.

From this analytical perspective, overcoming these fragilities requires more than isolated regulatory adjustments or infrastructure expansion. AlQhtani et al. (2025) and Pedraja-Rejas, Rodríguez-Ponce e Rojas-Miranda (2025) emphasize the need to strengthen institutional capacities in information and knowledge management to sustain

systematic processes of identifying and organizing academic production. Nevertheless, the literature still lacks analytical models capable of operationalizing the integration between information management, institutional intelligence, and the systematic valorization of applied academic production.

Methodology

This study adopts a qualitative, theoretical-conceptual approach with an exploratory and analytical character, aimed at developing a conceptual model in the field of information management, knowledge management, and innovation in STI. This methodological choice reflects the intended contribution of the article, as it does not seek to test hypotheses, estimate effects, or measure causal relationships. According to Jaakkola (2020), articles of this nature should present a clear research design capable of organizing and articulating concepts and theories to generate conceptual advancements.

The construction of the conceptual model was based on a systematic literature review, aimed at identifying and analyzing relevant studies on technology transfer, information and knowledge management, institutional innovation, and academic production in Science and Technology Institutions. In line with Sauer and Seuring (2023), the SLR was employed to organize and integrate dispersed theoretical contributions, enabling the development of analytical structures directed at conceptual advancement. The dimensions structuring the model were defined throughout the analysis and synthesis process, based on the identification of recurring conceptual patterns, thematic convergences, and interpretative gaps.

The bibliographic search was conducted in the Scopus, Web of Science, and Scielo databases, covering articles published between 2020 and 2025 to capture recent debates aligned with contemporary transformations in innovation, knowledge management, and technology transfer in STI. Combinations of descriptors in Portuguese and English were used, related to the core themes of the study, such as technology transfer, knowledge exchange, knowledge management, institutional innovation, and higher education institutions. The search strategy was progressively refined and adjusted to the specificities of each database to increase retrieval sensitivity without compromising thematic relevance.

Initially, all records retrieved from the selected databases were screened, removing duplicates and excluding studies outside the established temporal or linguistic scope, non-peer-reviewed documents, and publications without full-text access. Subsequently, titles and abstracts were qualitatively analyzed to verify thematic alignment with the institutional focus on innovation, knowledge management, and technology transfer in STI. Studies were included if they presented explicit discussion of organizational dynamics, institutional mediation, innovation governance, or structural implications for knowledge management in higher education institutions. Strictly normative works, predominantly technical studies without an organizational perspective, and publications focused exclusively on quantitative performance indicators without institutional analysis were excluded. Finally, the remaining texts underwent full-text reading, resulting in the final selection of articles that grounded the conceptual analysis and structuring of the proposed model.

Qualitative analysis and construction of analytical categories

The selected articles were subjected to qualitative content analysis aimed at identifying recurring concepts, analytical categories, and theoretical relationships relevant to the study's objective. This stage examined how the literature addresses processes of knowledge production, organization, circulation, and valorization within STI, as well as the limits and tensions associated with institutional models of innovation and technology transfer.

The analytical process was grounded in inductive qualitative procedures systematized by Al-Eisawi (2022) and structured into three complementary movements. Coding was conducted manually by the authors through successive readings and iterative revisions to ensure interpretative consistency in consolidating the categories.

First, open coding identified preliminary themes, concepts, and recurring approaches in the analyzed texts. At this stage, references were mapped concerning forms of knowledge production and circulation, institutional mechanisms related to innovation, limitations of traditional technology transfer models, and the roles attributed to information and knowledge management within STI.

Next, axial coding reorganized the identified concepts into broader and more coherent categories. This step structured the review material into analytical axes related to institutional intelligence, knowledge maturation processes, forms of interorganizational articulation, and the valorization of latent innovation assets.

Finally, theoretical integration of the categories was undertaken through relational analysis to understand how these axes articulate and interact within STI, considering their institutional, organizational, and territorial specificities. This procedure enabled the study to move beyond describing isolated concepts toward an analytical understanding of the dynamics that condition the transformation of academic knowledge into innovative value.

Based on this analysis, structuring elements associated with institutional capacity to convert academic production into innovation were identified. These include processes for identifying and qualifying knowledge, mechanisms for institutional organization and visibility, learning and maturation dynamics over time, forms of articulation with internal and external actors, and governance and decision-making conditions.

Construction of the conceptual model

The construction of the conceptual model followed an inductive–deductive analytical procedure consistent with the theoretical nature of the study, aligned with conceptual systematic review approaches that combine inductive identification of analytical elements with subsequent theoretical integration (Schreiber; Cramer, 2022). In the first, inductive stage, systematic analysis of the selected literature enabled the identification and systematization of the analytical elements underpinning the model. This process resulted in mapping recurring conceptual patterns, theoretical relationships, and interpretative categories associated with information management, knowledge management, institutional innovation, and the valorization of academic production in STI.

In the second, deductive stage, these elements were integrated in light of the theoretical frameworks discussed throughout the article. The identified concepts were reinterpreted and organized in alignment with debates on expanded technology transfer, institutional intelligence, and innovation as a relational process. The combination of

induction and deduction avoided both a merely descriptive reproduction of the literature and the arbitrary formulation of a conceptual proposal disconnected from solid theoretical foundations.

The resulting model constitutes an interpretative conceptual synthesis designed to organize and render intelligible theoretical relationships dispersed in the literature. Its purpose is not to prescribe operational solutions or present a closed technical instrument, but to offer an analytical framework capable of articulating previously fragmented contributions. In doing so, the model provides a structured basis for institutional diagnoses and strategic reflections on knowledge and innovation management in STI, particularly regarding the identification and valorization of knowledge assets produced in academic contexts.

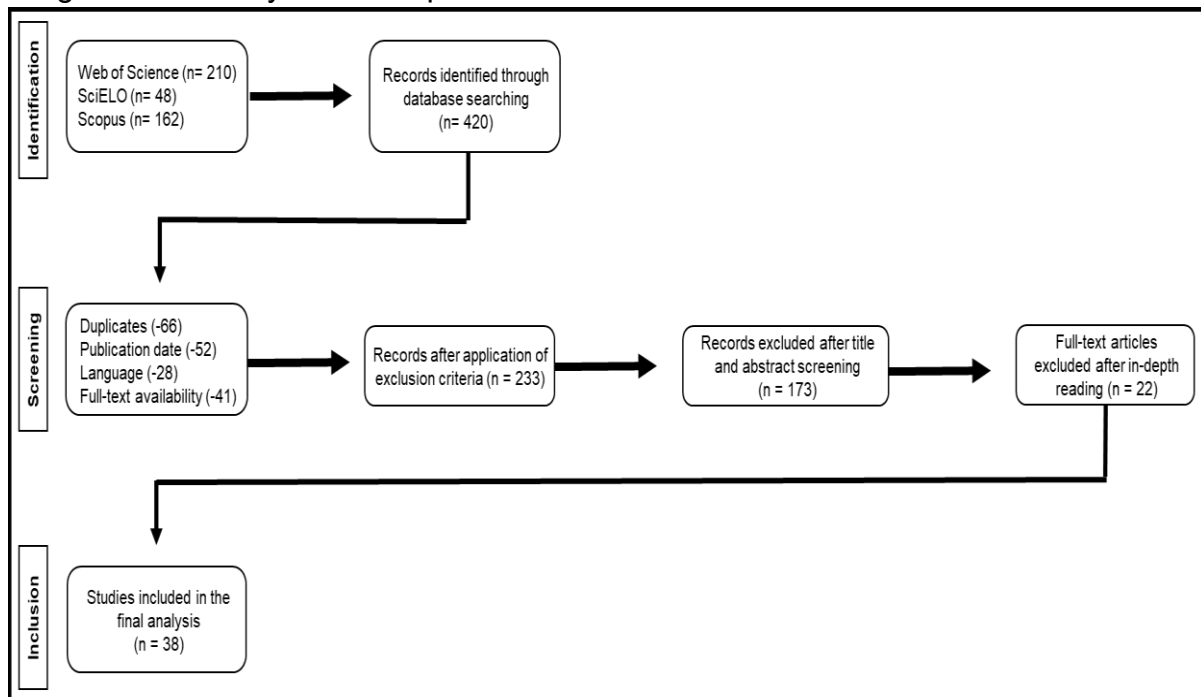
Although conceptual in nature, the proposed structure allows the derivation of analytical guidelines that may inform future empirical applications and institutional implementation initiatives. These include criteria for identifying innovation assets in academic outputs, parameters for qualifying and prioritizing projects with innovative potential, principles for integrating academic units and TTOs, and foundations for designing information systems oriented toward institutional intelligence.

Results and discussion

The SLR reveals a recurring mismatch between the conceptual expansion of innovation advocated in recent studies and the predominant institutional practices in STI, particularly with regard to the criteria used to recognize, organize, and valorize knowledge produced within academic contexts. Beyond identifying this tension, the analysis highlights recurring theoretical patterns and interpretative gaps that help explain how the innovative potential generated in this context is filtered, prioritized, or, in many cases, neglected by institutional structures.

Figure 1 summarizes the stages of the study selection process underlying the review, from the initial identification of records in the databases to the definition of the final set of analyzed articles.

Figure 1
Stages of the study selection process in the SLR.



Source: authors (2026).

The 38 selected articles concentrate on four main thematic axes: the evolution of innovation and technology transfer models, with emphasis on critiques of linear models and the expansion of the innovation concept through approaches such as knowledge exchange and cooperative innovation; the role of information management, knowledge management, and institutional intelligence as foundations of innovative capacity and organizational learning; challenges associated with applied academic production and its integration into institutional innovation systems; and structural and governance limitations faced by STI, including the role of TTOs and the invisibility of academic outputs with innovative potential.

Table 1 systematizes the SLR findings into ten analytical categories that organize the main theoretical foundations and conceptual patterns identified in the literature. These categories highlight recurring convergences and gaps and constitute the empirical-conceptual basis supporting the interpretation developed in the following section.

Table 1 –
Analytical categories and theoretical foundations identified in the SLR.

Analytical category	Theoretical foundation	Main findings
Limits of traditional technology transfer models	Critique of linear logic and formal Technology Transfer mechanisms	Models based on patents, licenses, and spin-offs capture only part of the value generated by STI and are insufficient to explain contemporary innovation processes.
Expansion of the concept of innovation and knowledge exchange	Innovation as a relational and cooperative process	Innovation emerges from continuous interactions, knowledge translation, and knowledge cooperation,

		involving multiple actors and non-linear trajectories.
Information management as institutional infrastructure	Information as an organizational asset	Information management organizes and structures strategic data but, in isolation, does not guarantee the generation of innovative value.
Knowledge management and organizational learning	Knowledge as a dynamic process	Innovation depends on the institutional capacity to convert tacit knowledge into explicit knowledge and to sustain continuous cycles of organizational learning.
Institutional intelligence and dynamic capabilities	Organizational intelligence	The transformation of information into actionable intelligence is a central condition for strategic decision-making and the strengthening of innovative capacity.
Academic production as a source of incremental innovation	Applied knowledge	Non-formalized academic outputs, including incremental productions, hold innovative potential that is frequently underexplored.
Institutional invisibility of student production	Institutional gaps	Student academic works remain invisible within innovation systems due to the absence of analytical mechanisms for qualification and valorization.
Institutional challenges in peripheral STI	Governance and territorial context	Structural, informational, and coordination limitations reduce the capacity of STI to mobilize knowledge for innovation.
Role of TTOs and innovation governance	Institutional mediation	TTOs play a strategic role but face operational and informational constraints that hinder the prospecting of latent innovation assets.
Need for systemic approaches to information management, knowledge management, and innovation	Institutional integration	The literature converges on the need to integrate information management, knowledge management, and innovation as a foundation for more robust institutional trajectories.

Source: authors (2026).

The integrated analysis of categories related to technology transfer models and contemporary innovation approaches indicates significant convergence in the critique of traditional models, considered insufficient to capture the diversity of knowledge produced

within STI. As argued by Taalbi (2025), formal mechanisms such as patents and licenses privilege formalizable and legally protected assets, leaving aside incremental, applied, and context-specific forms of knowledge with potential social and productive impact.

Regarding information and knowledge management, the literature converges in treating them as structural foundations of institutional innovative capacity (Cristache; Croitoru; Florea, 2025). The absence of systematic processes for identifying, organizing, and qualifying knowledge limits the conversion of dispersed information into institutional intelligence, restricting its strategic use (Dantas et al., 2024). Innovation thus shifts from being understood as the accumulation of formal artifacts to the expression of organizational capabilities oriented toward interpreting, prioritizing, and articulating knowledge in alignment with institutional objectives (AlQhtani, 2025).

The synthesis of categories associated with academic production and innovation governance reveals that student production, although recognized as a potential source of applied knowledge, remains structurally underintegrated into institutional innovation systems. The invisibility of outputs such as capstone projects stems less from a lack of innovative potential than from the absence of institutional mechanisms capable of qualifying and incorporating them into formal decision-making and transfer processes (Vyas, 2024). This exposes a structural gap between knowledge production in higher education and its incorporation into institutional innovation dynamics.

More broadly, the challenges faced by STI, particularly in peripheral or lower-maturity contexts, are associated with weaknesses in governance, coordination, and organizational intelligence. These limitations extend beyond resource constraints and reflect the absence of arrangements capable of systemically integrating information management, knowledge management, and innovation processes. The articulation of these dimensions constitutes an organizational condition for identifying, maturing, and circulating internally produced knowledge, enhancing its capacity to generate innovative value and support strategic decision-making. The following section develops this interpretation by presenting the proposed analytical model and its implementation guidelines.

Proposed analytical model for information and knowledge management in STI

The proposed analytical model results from the conceptual systematization of the relationships identified in the SLR, integrating into a coherent analytical structure the elements that condition the valorization of knowledge produced within STI. It articulates information management, knowledge management, and innovation processes in a relational manner, taking academic production as its central axis. In doing so, it clarifies the mechanisms through which incremental, applied, and context-specific knowledge can be identified, qualified, and institutionally mobilized, overcoming fragmented approaches centered on formal technology transfer instruments.

Emerging from the identification of theoretical convergences and analytical gaps in the reviewed literature, the model addresses the absence of structures capable of linking academic production to institutional processes of information management, knowledge management, and innovation. Based on this diagnosis, it shifts the analytical focus from formal transfer instruments to organizational capabilities related to the identification, qualification, maturation, and circulation of internally produced knowledge, including that originating from undergraduate education.

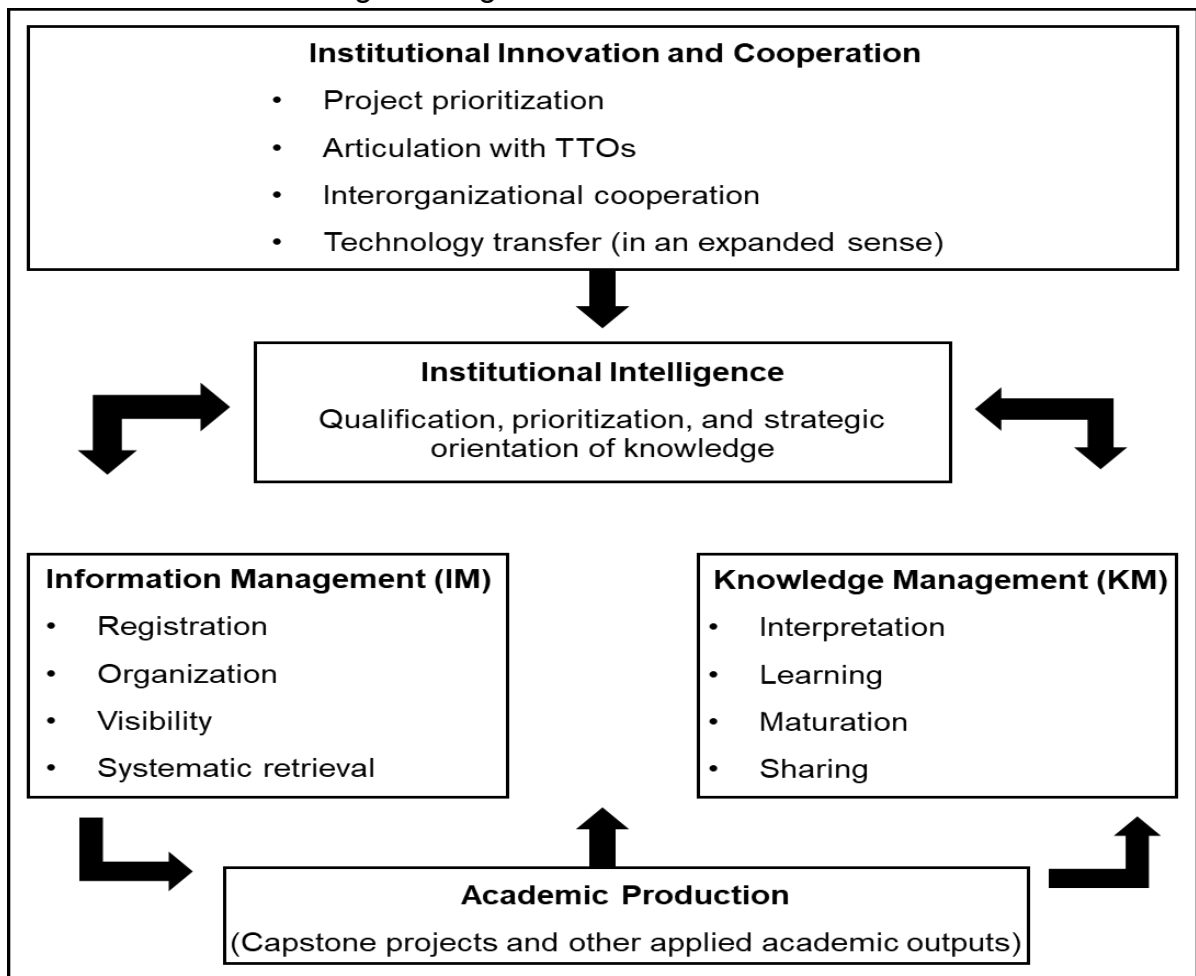
Grounded in the premise that the innovative potential of academic production does not materialize automatically through its mere existence or registration in repositories, the framework emphasizes that its activation depends on the organizational capacity to convert dispersed information into institutional intelligence through articulated processes of information management, knowledge management, and strategic decision-making (Feng et al., 2022). Academic production is thus conceived as a source of latent innovation assets whose valorization requires institutional structures oriented toward interpretation, prioritization, and strategic articulation.

Structured as a set of interdependent dimensions, the framework should not be interpreted as a sequence of linear stages or normative prescriptions. Rather, it constitutes an analytical arrangement enabling examination of how academic knowledge is identified, organized, qualified, and mobilized within STI, highlighting the flows of information, learning, and decision-making that condition its innovative valorization.

Figure 2 presents a synthetic representation of the model, providing a visual reference for the articulation among its components and the relational logic connecting information management, knowledge management, and institutional innovation in the valorization of academic production.

Figure 2

Analytical model for the institutional valorization of academic production through information and knowledge management in STI.



Source: authors (2026).

In the proposed model, academic production constitutes the initial informational input from which articulated processes of information and knowledge management are structured. These processes operate interdependently through feedback flows mediated by institutional intelligence, which guides strategic decisions regarding prioritization, cooperation, and the insertion of knowledge into innovation trajectories (Cristache; Croitoru; Florea, 2025). Such decisions materialize at the level of institutional innovation and interorganizational cooperation, where knowledge is mobilized in projects, partnerships, and expanded technology transfer mechanisms. The graphical representation distinguishes informational infrastructure, organizational learning processes, and decision-making capacities, reinforcing the model's relational nature.

Analytically, information management organizes, registers, and provides visibility to produced knowledge, enabling its systematic identification (Damian et al., 2025). Knowledge management sustains learning and maturation processes, facilitating the transformation of structured information into contextualized and shareable knowledge (Vyas, 2024). The interaction between these dimensions feeds institutional intelligence, which guides decisions concerning project prioritization, articulation with internal and external actors, and the integration of knowledge into innovation trajectories.

The model thus constitutes an analytical framework designed to support institutional diagnoses, particularly where the absence of systematic criteria hinders the identification and mobilization of knowledge produced within STI. By enabling analysis of bottlenecks, asymmetries, and opportunities in knowledge and innovation management processes, it clarifies limitations associated with weak integration between academic production and institutional innovation systems (Perkmann et al., 2021).

Although conceived at a conceptual level, the model allows analytical developments that may guide the formulation of criteria for identifying innovation assets, strengthening integration between academic units and TTOs, and designing information systems oriented toward institutional intelligence. In doing so, it broadens the debate on innovation in STI by repositioning academic production as a strategic element within institutional knowledge valorization systems.

Analytical guidelines for the institutional implementation of the model

The operationalization of the proposed analytical model requires translating its conceptual foundations into institutional orientations capable of engaging with the structural diversity of STI. Given its theoretical nature, the guidelines presented here are not prescriptive; rather, they function as analytical references aimed at mediating between conceptual structure and organizational practice (Schreiber; Cramer, 2022).

Derived from the articulation between the findings of the systematic literature review and the internal logic of the model, these guidelines operate as instruments for institutional reflection, supporting processes of organizational reconfiguration that are sensitive to the territorial and structural specificities of each STI. Table 2 systematizes the main analytical guidelines for the institutional implementation of the model, relating analytical dimensions, institutional objectives, and general implications.

Table 2 –
Analytical guidelines for the institutional implementation of the model.

Analytical dimension of the model	Institutional guideline	Objective of the guideline	General institutional implications
Information management	Structure institutional mechanisms for recording, categorizing, and ensuring the visibility of academic production	Ensure systematic identification of produced knowledge	Review of institutional repositories, metadata standardization, and integration among academic databases
	Treat academic outputs as strategic informational assets	Overcome the logic of passive storage	Redefinition of repositories as decision-support instruments
	Establish processes for qualification and interpretation of academic knowledge	Promote conceptual and technical maturation of academic works	Involvement of committees, evaluation groups, or collegial bodies
	Foster organizational learning mechanisms based on student production	Convert individual knowledge into institutional assets	Integration among teaching, research, extension, and innovation
Institutional intelligence	Develop institutional criteria for prioritizing innovation assets	Support strategic decisions on knowledge valorization	Support for TTOs and innovation governance bodies
	Articulate information flows between academic units and TTOs	Reduce internal informational asymmetries	Strengthening of cross-sector coordination
Innovation governance	Integrate the model into institutional innovation and STI policies	Align analytical practices with institutional strategy	Review of internal regulations and institutional plans
	Recognize student academic production as a legitimate source of innovation	Expand the institutional scope of innovation	Inclusion of capstone projects in technology portfolios and institutional diagnostics
External articulation	Create conditions for knowledge circulation with external actors	Expand possibilities for cooperation and transfer	Interface with companies, public sector, and social organizations
Progressive implementation	Adopt an incremental and adaptive implementation approach	Avoid rigid and decontextualized solutions	Implementation through phases, pilot initiatives, or experimental units

Source: authors (2026).

The guidelines indicate that implementing the model depends less on the adoption of specific technological solutions and more on strengthening institutional capacities oriented toward interpretation, coordination, and decision-making. Organized across interdependent dimensions, they should be understood relationally, avoiding fragmented or sequential readings.

The centrality attributed to information and knowledge management underscores the need for structures capable of transforming academic production into a strategic input for institutional innovation. Complementarily, the emphasis on governance and institutional intelligence suggests that valorizing the innovative potential of student production requires alignment among institutional policies, information systems, and decision-making practices.

The proposed guidelines thus constitute a flexible analytical framework, adaptable to different organizational contexts and consistent with the understanding of innovation as a relational, cumulative, and institutionally mediated process. Rather than prescribing procedures, they provide interpretative criteria through which STI may systematically recognize and mobilize knowledge assets that remain underexplored within their institutional innovation systems.

Valorization of academic knowledge and the redefinition of innovation objects in STI

Within STI, formal technology transfer mechanisms – particularly patents, licenses, and spin-offs – have historically guided the institutional recognition and measurement of academic production (Perkmann et al., 2021). This approach captures only part of the value generated, associating innovation with formalization and commercialization, where technology transfer office performance acts as a proxy for institutional innovation (Taalbi, 2025). However, this framework has limitations, especially regarding informal and cumulative impact generation, as discussed in critiques of linear models and easily observable metrics.

Approaches focusing on alternative knowledge exchange pathways converge on the understanding that academic knowledge diffusion is not confined to formal channels. It happens through combinations of formal and informal mechanisms, mediated by platforms, networks, and open practices (Bejarano et al., 2023b). By linking innovation with knowledge exchange and cooperation, this body of work shifts the focus from formalized end products to processes of interaction, translation, and knowledge use, where value emerges from circulation and recombination in specific contexts (Hayter; Rasmussen; Rooksby, 2020). This shift is particularly important in emerging ecosystems, where innovation relies more on the activation of distributed knowledge aligned with territorial demands (Pinto, 2024).

In this context, the interplay between information management, knowledge management, and institutional intelligence, highlighted in the categories presented in Table 1, enhances understanding of innovation dynamics within STI. The mere existence of academic production does not automatically translate into innovation. Information management, which deals with registration, organization, and availability, differs from knowledge management, which involves interpretation, sharing, learning, and application in decision-making routines (Moraes; Damian, 2025).

In complex environments, information accumulation may result in data volumes with low actionable capacity when lacking qualification, prioritization, and translation mechanisms useful for decision-making and interorganizational coordination (Dantas et al., 2024). Institutional intelligence extends this integration by converting information and knowledge into strategic direction and adaptive capacity, contributing to dynamic capabilities and organizational learning (Cristache; Croitoru; Florea, 2025; Feng et al., 2022). The proposed model addresses this by positioning information management, knowledge

management, and innovation as a relational chain that conditions the visibility, maturation, and circulation of knowledge within STI, directly influencing expanded cooperation and technology transfer.

Another structural aspect concerns the definition of legitimate innovation assets. While literature has expanded the concept of innovation beyond disruptive and protected outcomes, institutional practices still focus on outputs from *stricto sensu* research and classical technology transfer (Cinar; Benneworth; Coenen, 2024; Gaffaro; Naranjo, 2025). In this framework, recurrent, territorially embedded productions, such as capstone projects, often remain outside formal innovation recognition systems.

The institutional invisibility of student production, identified in this study, is less about a lack of innovative potential and more about the absence of institutional mechanisms to qualify and integrate these works into formal decision-making and transfer processes (Vyas, 2024). This aligns with critiques of models that prioritize end results and easily observable indicators over intermediate processes of knowledge maturation and recombination (Bejarano et al., 2023a; Hayter; Rasmussen; Rooksby, 2020). By treating capstone projects as strategic informational assets and sources of latent innovation, the model highlights a potential institutional shift: from passive storage to institutional intelligence infrastructure, guided by analytical metadata, prioritization criteria, and interaction flows between academic units and external actors.

This reorientation can be understood within innovation governance debates and the role of intermediaries in STI. Approaches like the Triple Helix emphasize that innovation arises from stable institutional arrangements and systematic interactions between universities, government, and industry, not isolated initiatives (Zadegan; Ghazinoory; Nasri, 2025). Therefore, institutional innovative capacity depends on how functions, responsibilities, and coordination flows are distributed and sustained over time.

At the organizational level, studies on technology transfer offices highlight the need to broaden their scope beyond commercialization, incorporating ecosystem engagement and intermediation among actors (Hayter; Rasmussen; Rooksby, 2020). This perspective reinforces the coherence of the proposed guidelines, shifting focus from technological solutions to coordination rules, qualification criteria, and institutional interfaces capable of reducing informational asymmetries and preventing fragmented efforts. The centrality of internal flows between academic units and TTOs aligns with diagnoses identifying informational and coordination limitations as barriers in contexts with lower innovation maturity (Pinto, 2024; Munaretti et al., 2025).

The article contributes at two levels: theoretical and institutional. The theoretical contribution synthesizes critiques of linear technology transfer models, expands the innovation concept through knowledge exchange approaches, and emphasizes the importance of institutional capacities in information and knowledge management, as well as institutional intelligence. It shifts the focus from formalized outputs to organizational processes that influence academic knowledge's visibility and mobilization.

At the institutional level, the analytical model and guidelines provide an interpretive framework to support institutional diagnostics and decisions related to identifying, qualifying, and mobilizing knowledge. They reposition outputs like capstone projects within the focus of internal innovation systems. Rather than proposing a universal protocol, the framework supports progressive and adaptable implementation, enabling STI to calibrate registration

mechanisms, screening criteria, and governance arrangements according to their capacities and territorial contexts, while remaining consistent with innovation as a relational and institutionally mediated process.

Final considerations

This article began by recognizing a persistent mismatch between the conceptual expansion of innovation in recent literature and the institutional practices that still dominate STI. Although approaches such as knowledge exchange and innovation cooperation have broadened understanding of how academic knowledge generates impact, STI innovation systems remain strongly oriented toward selective models centered on formalized assets and metrics associated with traditional technology transfer. In this context, a significant portion of applied academic production, particularly from undergraduate education, remains invisible or underexplored.

The SLR indicated that this limitation stems not from a lack of innovative potential, but from insufficient analytical and institutional structures capable of identifying, qualifying, and articulating such knowledge systematically. Capstone projects exemplify a recurring, territorially embedded form of production often oriented toward solving concrete problems, yet weakly integrated into formal STI innovation systems. Their invisibility reflects broader weaknesses in information management, knowledge management, and institutional intelligence.

In response to this gap, the article developed an analytical model oriented toward information and knowledge management, conceived as an interpretative framework for examining how academic knowledge is identified, organized, qualified, and mobilized within STI. By repositioning academic production as a strategic informational input and articulating information management, knowledge management, and institutional intelligence within a relational chain, the model shifts focus from formal technology transfer instruments to institutional capacities related to organizational learning, coordination, and strategic decision-making. Rather than prescribing linear steps, it offers analytical parameters to support institutional diagnoses and strategic reflection.

The analytical guidelines derived from the model reinforce that valuing the innovative potential of academic production depends less on isolated technological solutions than on building organizational capacities for interpretation, prioritization, and articulation of knowledge. Integration among academic units, TTOs, and information systems is a key condition for reducing internal asymmetries, making latent assets visible, and sustaining cooperation, maturation, and knowledge mobilization trajectories. This perspective is particularly relevant in peripheral or lower innovation-maturity contexts, where innovation depends on activating distributed knowledge and aligning it with territorial demands.

At the theoretical level, the study integrates debates often treated in a fragmented manner, connecting critiques of linear technology transfer models, the expanded concept of innovation, and the strategic role of information management, knowledge management, and institutional intelligence. By incorporating capstone projects as a legitimate analytical object, it broadens the scope of STI innovation systems and reinforces innovation as a relational, cumulative, and institutionally mediated process. At the institutional level, the model offers a flexible analytical framework adaptable to different organizational realities, without claiming normative universality.

As with any theoretical-conceptual study, this research has limitations. The proposed model was not empirically applied and does not aim to measure specific institutional impacts. Future research may explore its application through case studies, comparative analyses among STI, and empirical investigations focused on operationalizing criteria for qualifying and prioritizing innovation assets in academic production, as well as examining the organizational effects of integrating knowledge management, institutional intelligence, and cooperation-oriented innovation.

Expanding the innovative capacity of STI therefore requires rethinking not only technology transfer instruments but also the internal systems of information, knowledge, and decision-making that condition the visibility and mobilization of produced knowledge. By treating student academic production as a source of latent innovation assets and proposing an analytical model oriented toward its valorization, this study contributes to debates on institutional innovation and territorial development, offering conceptual foundations for innovation trajectories more sensitive to context and to multiple modes of value creation.

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