



Current Research Information Systems in Science: Challenges and Tendencies in Indicators of Science and Technology

Andrei Mikhailov¹;
Bernardo França Santos²;
Márcia Siqueira Rapini³;

Abstract:

Science constitutes a fundamental input for innovation, and the ways in which scientific activity is monitored, funded, and governed play a central role in shaping national innovation systems. In this context, Current Research Information Systems (CRIS) have emerged as key infrastructures for organizing research data, enabling accountability, coordination, and evidence-based science policy. Despite their growing relevance, comparative analyses of CRIS architectures across regions remain limited. This article conducts a benchmarking analysis of 15 CRIS from Latin America and the Global North, with the objective of identifying structural differences, strengths, and limitations embedded in their institutional design. Drawing on the concept of informational anchors, the study compares whether CRIS are primarily organized around funded research projects or research communities, such as research groups. Methodologically, the analysis combines systematic online searches and expert-supported artificial intelligence to identify and classify national and supranational systems across selected regions. The results reveal a clear divide between regions. CRIS in the Global North—particularly in Europe, North America, and East Asia—are predominantly funding-centered, reflecting strong accountability mechanisms and stable research funding environments. In contrast, Latin American CRIS tend to be community-centered, prioritizing the mapping of research groups and scientific capacity in contexts characterized by more constrained and volatile funding structures. The article argues that these differences are not merely technical but reflect broader governance logics, state capacities, and science policy priorities. By conceptualizing CRIS as governance infrastructures rather than neutral databases, the study contributes to a deeper understanding of how research information systems shape the visibility, interpretation, and coordination of scientific activity in diverse innovation systems.

Keywords: current research information systems; science; scientific systems; innovation.

Código JEL: O3;

Área temática: 5.7 Indicadores de Ciência, Tecnologia, Inovação

¹ Professor do Programa de Pós-Graduação em Administração (PPGA) UNOESC. E-mail: andreimikh@gmail.com

² Doutorando em Economia pela UFMG/Cedeplar. E-mail: bernardofs@cedeplar.ufmg.br

³ Professora titular do departamento de Economia UFMG/Cedeplar. E-mail: msrapini@cedeplar.ufmg.br

Sistemas de Informação Científica em Pesquisa: Desafios e Tendências nos Indicadores de Ciência e Tecnologia

Resumo:

A ciência constitui um insumo fundamental para a inovação, e as formas pelas quais a atividade científica é monitorada, financiada e governada desempenham papel central na configuração dos sistemas nacionais de inovação. Nesse contexto, os Current Research Information Systems (CRIS) emergem como infraestruturas-chave para a organização de dados de pesquisa, possibilitando maior accountability, coordenação e formulação de políticas científicas baseadas em evidências. Apesar de sua crescente relevância, análises comparativas das arquiteturas de CRIS entre diferentes regiões ainda são limitadas. Este artigo realiza uma análise de benchmarking de 15 sistemas CRIS da América Latina e do Norte Global, com o objetivo de identificar diferenças estruturais, pontos fortes e limitações presentes em seus desenhos institucionais. A partir do conceito de âncoras informacionais, o estudo compara se os CRIS estão organizados predominantemente em torno de projetos de pesquisa financiados ou de comunidades científicas, como grupos de pesquisa. Metodologicamente, a análise combina buscas sistemáticas online e o uso de inteligência artificial com suporte especializado para identificar e classificar sistemas nacionais e supranacionais em regiões selecionadas. Os resultados revelam uma clara divisão regional. Os CRIS do Norte Global — especialmente na Europa, América do Norte e Leste Asiático — são predominantemente orientados ao financiamento, refletindo fortes mecanismos de prestação de contas e ambientes estáveis de financiamento à pesquisa. Em contraste, os CRIS latino-americanos tendem a ser centrados em comunidades científicas, priorizando o mapeamento de grupos de pesquisa e da capacidade científica em contextos caracterizados por estruturas de financiamento mais restritas e voláteis. O artigo argumenta que tais diferenças não são apenas técnicas, mas refletem lógicas mais amplas de governança, capacidades estatais e prioridades de política científica. Ao conceituar os CRIS como infraestruturas de governança, e não como bases de dados neutras, o estudo contribui para uma compreensão mais aprofundada de como sistemas de informação científica moldam a visibilidade, a interpretação e a coordenação da atividade científica em diferentes sistemas de inovação.

Palavras-chave: sistemas de informação científica; ciência; sistemas científicos; inovação.

1. Introduction

There is a broad consensus across economic, social, and political sciences that Science, Technology and Innovation (STI) have become crucial conditions for economic development, social transformation, and state capacity, occupying a strategic position in both national and international agendas (Nelson & Winter, 1982; Lundvall, 1992; Freeman, 1987; Mazzucato, 2013; Castells, 1996). Governments, international organizations, and research institutions increasingly rely on STI indicators to guide public policies, allocate resources, and evaluate research performance. This growing relevance has stimulated the consolidation of quantitative approaches to science and technology studies (scientometrics, bibliometrics, and technometrics), which traditionally rely on publications, citations, and patents as proxies for scientific activity and impact (Glänzel et al., 2019).

Something important for this work is that the STI acronym does not imply a mandatory, linear, or evergreen relationship among science, technology, and innovation. These domains do not evolve in a deterministic sequence where science necessarily leads to technology and innovation. Rather, they operate as interconnected yet relatively autonomous systems, each with its own dynamics, institutions, and policy requirements. In this sense, science constitutes a distinct system that must be built, strengthened, and sustained on its own terms (Kline & Rosenberg, 1986; Godin, 2006; Whitley, 2007).

This article focuses specifically on scientific systems, while acknowledging their close connections with technology and innovation systems. Even though the relationship between science and innovation is not always linear, it is well established that a strong scientific base is a fundamental condition for the development of mature and resilient innovation systems. Moreover, scientific systems are more directly shaped by public policies and state interventions than other components of STI, making them particularly relevant for analytical and comparative purposes.

An important premise of this study is that, despite their widespread use, traditional STI indicators (particularly science indicators) face significant methodological and conceptual limitations. Publication and citation-based metrics capture only a partial view of scientific and research systems, privileging visible outputs while obscuring underlying processes, including institutional arrangements, funding structures, collaborative networks, and organizational dynamics. Recent trends in STI studies point to the need for broader, more granular, and context-sensitive indicators capable of addressing interdisciplinarity, societal impact, research funding dynamics, and the spatial distribution of scientific activities (Schöpfel et al., 2017; Sivertsen, 2019). These challenges have intensified with the expansion of big data, open science, and digital infrastructures, increasing demands for interoperability, standardization, and large-scale data integration (Chiarini & da Silva Neto, 2022).

The high complexity of research and scientific systems necessitates systematic, standardized approaches to organizing scientific and research information. Beyond traditional scientometrics outputs, comprehensive analyses of scientific systems require the integration of heterogeneous data on projects, funding instruments, research groups, human resources, institutional structures, and policy instruments. Several scholars argue that fragmented and output-centered indicator systems fail to reflect the multidimensional nature of scientific activity and its governance, particularly within public research institutions operating in complex policy environments (Whitley & Gläser, 2007; Daraio & Glänzel, 2016; Sivertsen, 2019; Hicks et al., 2015). This situation can be conceptualized through an iceberg metaphor, in which publication-based indicators represent only the visible tip, while a much larger set of relevant scientific indicators remains submerged and analytically underexplored.

Given the centrality of STI related data and research information systems in a globalized, knowledge-based economy increasingly structured around networks and digital

platforms (Castells, 1996; Foray, 2004; Arocena & Sutz, 2010; van Dijck et al., 2018; Chiarini & da Silva Neto, 2022), this article addresses the following research problem: what is the importance of Current Research Information Systems (CRIS) in supporting the construction and consolidation of National Systems of Research, Science and Technology, and why is it analytically relevant to compare CRIS in the Global North and the Global South? CRIS, an acronym for Current Research Information System (Sivertsen, 2019), refers to an information infrastructure designed to aggregate up-to-date data on the scientific development processes of an organization, institution, or geographic region. By comparing different institutional, political, and infrastructural contexts, this study argues that CRIS play a critical role in shaping how scientific activities are recorded, evaluated, and governed. Such comparisons are essential for understanding asymmetries in data availability, governance capacity, and policy effectiveness, particularly in emerging and peripheral research systems, where centralized platforms often compensate for fragmented STI landscapes. Thus, the present study addresses the issue of comparing CRIS across the Global North and Global South.

This article makes three main contributions to academic literature. First, it advances a conceptual understanding of Current Research Information Systems (CRIS) by framing them not merely as technical databases, but as governance infrastructures that reflect national priorities, institutional capacities, and science policy rationales. Second, it provides original empirical evidence through a systematic benchmarking of CRIS across Latin America and the Global North, revealing persistent structural differences in how scientific activities are monitored and organized. Third, the study introduces the notion of informational anchors as an analytical lens for comparing CRIS architectures, offering a novel criterion for assessing how funding, research communities, and institutional arrangements shape the production and visibility of scientific knowledge.

2. Theoretical discussion - knowledge-based economy, networks and platforms

As noted, the rise of the knowledge-based economy has been addressed through institutional and evolutionary economics (Freeman; Perez, 1988; Foray; Lundvall, 1999; Leydesdorff, 2010), which emphasize the central role of assets such as knowledge, learning, and innovation in the functioning of contemporary economies. They have become major drivers of economic and social development, rather than the traditional factors of earlier phases of capitalism, such as capital accumulation, heavy industry, raw materials, and extensive labor. These assets have increasingly attracted the attention of social and economic agents for measurement and assessment. However, a fundamental analytical challenge is that such assets are unevenly codifiable, context-dependent, and often embedded in organizations, networks, and institutions. This is particularly true for knowledge.

While tacit knowledge remains difficult to observe and measure, information has become a strategic asset in contemporary political economy and represents a strong trend of the current era. Information can be understood as codified, standardized, and transferable representations of knowledge, although it is not knowledge itself (Polanyi, 1966; Cowan, David & Foray, 2000; Foray, 2004). This distinction is important, as both concepts frequently appear in the same analytical context.

Digital infrastructure growth has significantly expanded the production and dissemination of scientific information, but its measurement remains limited and poorly understood. As discussed in the *Springer Handbook of Science and Technology Indicators* (Glänzel et al., 2019), the growing availability of large-scale digital data has not eliminated measurement problems, but rather introduced new challenges related to data integration, interoperability, and interpretability across heterogeneous sources. This does not imply a deterioration in measurement capacity, rather indicates that the problem has become more

complex and potentially more productive, as it enables richer, more comprehensive analytical solutions.

The growing protagonism of information infrastructures in the knowledge-based economy is closely associated with broader transformations captured by the notion of the “network society”. According to Castells (1996), contemporary societies are increasingly structured around digital networks that organize economic activities, political power, and knowledge production through information flows. Within this informational paradigm, digital infrastructures do not merely support social processes but actively shape their organization and governance.

More recently, this transformation has been characterized by some scholars as the “platformization of society” (van Dijck, Poell and Waal, 2018; Poell, Nieborg and van Dijck, 2019), referring to the expansion of digital platforms as dominant intermediaries that organize social, economic, and informational exchanges. Platforms increasingly function as infrastructures, embedding governance mechanisms, data extraction logics, and standards that influence entire sectors (Plantin et al., 2018; van Dijck, Poell and Waal, 2018; Chiarinni and da Silva Neto, 2022). Science has not remained immune to this process. Scholarly communication, research evaluation, and academic visibility are progressively mediated by digital platforms, ranging from publication databases and citation indexes to academic social networks (ASN).

In the scientific domain, this process has been described as the “platformization of science”, in which research activities, outputs, and reputations become increasingly organized through digital platforms. Science-related platforms and digital systems can be highly heterogeneous with respect to access, ownership, means, and purposes. As highlighted by Chiarini and da Silva Neto (2022), public scientific platforms coexist and interact with private and commercial infrastructures, generating tensions regarding governance, data control, and long-term sustainability. The former, namely public platforms, are more closely related to the object of this research, as will be discussed below.

2.1 CRIS - Current Research Information Systems

In contrast to publication platforms and academic social networks, Current Research Information Systems (CRIS) are designed as comprehensive infrastructures for managing and integrating information on research activities at the institutional and national levels. CRIS typically encompasses data on projects, funding instruments, organizations, research groups, researchers, research outputs, and, increasingly, research data, allowing a systematic representation of scientific systems from an internal governance perspective (Schöpfel; Prost; Rebouillat, 2017; Sivertsen, 2019).

Importantly, CRIS are most often developed as public, government-led infrastructures, embedded within national science and technology administrations. This institutional positioning reflects the strategic role of CRIS in research governance, data collection and legitimacy, policy formulation, and funding allocation. As discussed by Schöpfel; Prost; Rebouillat (2017) and Sivertsen (2019), the strength of CRIS lies in their proximity to core processes of scientific systems, such as project approval, funding flows, and institutional reporting. Consequently, CRIS tend to be more robust and comprehensive in contexts where public research governance infrastructures are strong, as illustrated by cases such as the Lattes Platform in Brazil (Chiarini and da Silva Neto, 2022).

Table 1 – Platformization of science: comparison of information systems

Dimension	Publication platforms	Academic Social Networks (ASN)	CRIS
Core function	Scientific visibility, indexing, citation tracking	Interaction, self-presentation, dissemination	Research governance, integration, monitoring
Primary focus	Research outputs	Individual researchers and informal networks	Research systems and institutional processes
Governance	Private / commercial	Private / commercial	Public / state-led
Ownership of data	Proprietary (opened)	Proprietary	Public / governmental
Main data source	Publications and citations	User-generated profiles and content	Institutional and administrative research data
Level of validation	Editorial / bibliographic	Self-declared	Institutionally validated
Public policy relation	Indirect	Weak	Strong
Analytical use	Performance metrics, rankings	Visibility, networking	Policy design, funding allocation, system evaluation
Examples	Web of Science, Scopus, Google Scholar	ResearchGate, Academia.edu	GEPRIS (Germany), KAKEN (Japan), Scienti (Colombia), Lattes Platform / DGP (Brazil)

Source: elaborated by authors based on the extensive review of current information systems in science.

The distinct informational position of CRIS within national scientific systems can be conceptualized through the iceberg metaphor of Science and Technology indicators. Traditional indicators based on publications and citations (and, in some cases, patents) represent only the visible tip of the iceberg, capturing outputs that are easily observable and standardized. Beneath the surface lies a much larger and analytically richer set of information related to research processes, non-physical institutions and behaviors, funding dynamics, organizational structures, collaboration patterns, and human resources.

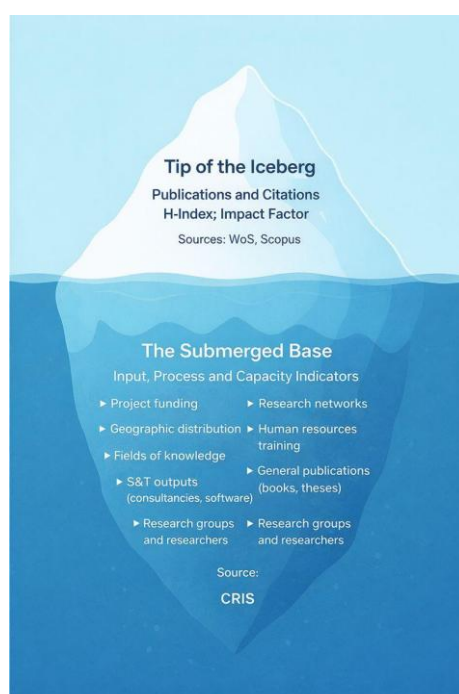
We argue that CRIS-based information is particularly valuable for strengthening national scientific systems (and, by extension, innovation systems) because it is generated directly from the core processes of scientific systems. Other science-related data systems tend to be disadvantaged for this purpose due to issues such as: (i) lack of access to detailed research information; (ii) misalignment with private ownership objectives, such as profit generation and digital engagement; and (iii) reliance on ex post inference from published outputs (e.g., Hicks et al., 2015).

Taken together, the literature on the knowledge-based economy, innovation systems, networks, and platforms suggests that CRIS should be understood as institutional infrastructures for governing science, rather than neutral repositories of information. They operationalize specific visions of how knowledge is produced, coordinated, and evaluated, embedding assumptions about accountability, collaboration, and impact. From this perspective, CRIS are central instruments through which states and funding agencies seek to render scientific activity visible, comparable, and actionable within broader innovation strategies.

In this sense, CRIS contributes to revealing the submerged part of the iceberg, providing access to data that are crucial for understanding how national scientific systems operate, evolve,

and respond to public policies. This privileged informational position reinforces the relevance of CRIS as analytical tools for STI studies and comparative research. However, CRIS remains relatively new, both as a conceptual framework and as an operational tool, which means that there is limited accumulated knowledge about this type of system and that several gaps remain for future research.

Image 1 – Iceberg metaphor to Science indicators



Source: elaborated by authors based on the extensive review of current information systems in science

Another important aspect of CRIS is that, because they are closely linked to governmental systems responsible for funding and disseminating science and technology, they are conditioned by the administrative and institutional heterogeneity of nation-states worldwide. This opens a feasible path of investigation that will be developed in the following sections of this article. Little is currently understood about how CRIS should be defined or which general features a public digital data system must possess to be classified as a CRIS. Even less is known about the main differences among CRIS worldwide, as well as about possible clusters of characteristics that could group them by similarity.

Table 2 – Types of information captured by different scientific platforms

Informations	Publication platforms	Academic Networks	Social	CRIS
Publications	✓	✓		✓
Citations / impact metrics	✓	✓		✗
Researchers (profiles)	Limited	✓ (self-declared)		✓ (validated)
Researchers details (gender, race,	Limited	Limited		✓ (complete)

degree, formation, scholarships etc.)			information)
Research projects / groups	✗	✗	✓
Funding data	✗	✗	✓
Organizations and institutions	Limited	✗	✓
Collaboration networks	Inferred	Self-reported	Direct / administrative
Technical production (prototypes, consultancies, applied outputs)	✗	✗	✓
Geographical localization	✗	✗	✓
Use for STI policy analysis	Limited	Limited	High

Source: Schöpfel; Prost; Rebouillat (2017); Sivertsen (2019); Chiarini and da Silva Neto (2022)

3. Method

Data collection was conducted between June and August 2025. To identify existing national research information systems across countries, the researchers employed two complementary strategies: organic searches (through direct consultations of institutional portals and search engines) and the use of artificial intelligence, specifically the ChatGPT tool, as support for tracking, cross-checking, and validating information.

Although there are approximately 200 countries and territories recognized by the United Nations (2025), the search was deliberately restricted to specific regions of the globe. The regions considered were:

- South America
- North America
- Europe
- Selected Asian countries (India, China, Japan, South Korea, Taiwan, and Singapore)

The selection of these regions was based on distinct criteria. Europe, North America, and selected Asian countries were included due to their high levels of scientific development, which increase the likelihood of robust, well-established research information systems. South American countries, in turn, were included because of their geographical and cultural proximity to Brazil, based on the assumption that their national research information systems might exhibit structural similarities to the DGP-CNPq.

Conversely, countries in Africa, the Caribbean, Central America, and the Pacific Islands were deliberately excluded from the search. This exclusion was based on the assumption that, given the comparatively lower levels of economic, social, and human (measured by IDH) and scientific development in these regions, the existence of a national-level CRIS with a high degree of sophistication would be unlikely.

The identified data were subsequently compiled in a spreadsheet that included the CRIS name, country of origin, primary informational orientation (i.e., whether the system is anchored in funded research projects or in research communities, such as research groups), and other relevant characteristics.

In this study, the concept of informational anchor refers to the primary analytical unit around which a CRIS organizes, validates, and aggregates research-related data. Informational anchors shape how scientific activity becomes visible within a system, determining whether

projects, research communities, institutions, or individual researchers serve as the core reference points for data integration and analysis. Two dominant types of anchors are identified: funding-centered anchors, in which funded research projects are the primary unit of analysis, and community-centered anchors, in which research groups or scientific communities are the primary unit of analysis.

CRIS were classified according to their dominant informational anchor, defined as the unit around which search functionalities, data aggregation mechanisms, and reporting structures are primarily organized. Systems were considered funding-centered when funded projects constituted the main entry point for data retrieval and validation, while systems were classified as community-centered when research groups or scientific communities served as the primary reference unit. When both dimensions were present, classification was based on the system's predominant orientation.

4. RESULTS AND DISCUSSION

Table 3 presents a comprehensive overview of the Current Research Information Systems (CRIS) identified in the benchmarking exercise. The table summarizes the main institutional characteristics of each system, including the country or region, the responsible organization, system name, core informational focus, primary informational anchor, and the extent of government involvement. This detailed mapping supports the comparative analysis developed in the main body of the article.

Table 3: main CRIS worldwide

Country / Region	Responsible institution	System	Main focus of the system	Informational anchor	Government-linked?
Argentina	Ministry of Science, Technology and Innovation	SICYTAR	Personnel, projects, institutions, outputs, equipment	Funded projects / organizations	Yes
Chile	National Agency for Research and Development (ANID)	SISID / DATACIENCIA	Publications, institutions, regions	Outputs / institutions	Yes
Colombia	Ministry of Science, Technology and Innovation	Scienti (GrupLAC / CvLAC)	Research groups, researchers, outputs	Research communities (groups)	Yes
Brazil	CNPq / MCTI	Lattes Platform / DGP	Research groups, researchers, outputs	Research communities (groups)	Yes
United States	NSF / NIH / USDA	Research.gov / RePORTER / USDA CRIS	Projects, funding, institutions	Funded projects	Yes

Canada	Tri-Agency (CIHR, NSERC, SSHRC)	CCV ResearchNet	/	CVs, proposals, funded projects	Funded projects	Yes
European Union	European Commission	CORDIS		EU-funded projects and results	Funded projects	Yes
Germany	German Research Foundation (DFG)	GEPRIS		Funded projects and results	Funded projects	Publicly funded foundation
United Kingdom	UK Research and Innovation	Gateway Research	to	Funded projects and institutions	Funded projects	Yes
Sweden	Swedish Research Council	SWECRIS		Research projects and funding	Funded projects	Yes
Finland	Ministry of Education and Culture	Research.fi		Researchers, projects, funding	Funded projects	Yes
Japan	MEXT / JSPS	KAKEN Researchmap	/	Grants, researchers, outputs	Funded projects	Yes
South Korea	KISTI / Government	NTIS		R&D projects, funding, institutions	Funded projects and groups	Yes
Taiwan	National Science and Technology Council	NSTC Project Search		Funded projects and groups	Funded projects	Yes
Singapore	National Research Foundation	NRF / NUS Research Portal		Centers, strategic projects	Mixed institutional	/ Yes

Source: elaborated by authors based on internet research over current information systems.

3.1 - Global North CRIS: The Importance of Funding-based Research Information Systems

The analysis of European and Global North CRIS platforms shows that several national systems are structured around research funding as their primary informational anchor, as exemplified by Japan (KAKEN) and Germany (GEPRIS/DFG). This architecture offers strategic advantages, given that financial resources are critical inputs for scientific production, enabling project execution, infrastructure acquisition, and the generation of measurable outcomes.

It is further argued that countries with ample budgetary resources and stable funding tend to adopt funding-centered CRIS models because continuous, competitive grant flows make it feasible to design systems that support direct traceability between investment and impact. In these contexts, funding is not only an administrative variable but a structuring element of research ecosystems, allowing platforms to integrate data on institutions, researchers, outputs, and results through the lens of awarded projects.

This design choice also reflects systemic conditions. In mature innovation systems, where research funding is abundant, predictable, and recurrently distributed through competitive calls, organizing CRIS data around funding anchors becomes methodologically viable, as it mirrors how science is effectively governed and operationalized at the national level. Conversely, in environments characterized by financial constraints or discontinuous funding cycles, such logic would face structural limitations, which helps explain why funding centrality in Global North CRIS is not arbitrary but rather a consequence of system maturity, where the platformization of science functions as a state policy instrument focused on transparency, accountability, and evidence-based impact evaluation.

While community-centered CRIS offer a rich and detailed mapping of scientific capacity, they also face inherent limitations. These systems often rely on self-reported information, which may lead to inconsistencies, uneven updating, and difficulties in data validation. Moreover, the limited integration of systematic funding data constrains their capacity to support impact assessment and accountability-oriented analyses.

In summary, Global North CRIS platforms did not adopt funding anchors by chance—they did so because funding already operates as the core organizer, enabler, and legitimizer of national research activity, supporting more effective science-based innovation governance and impact assessment.

3.2 Particularities of Global North CRIS

Beyond their institutional architecture, funding-centered CRIS observed in Global North countries reflects deeper structural characteristics of mature scientific and innovation systems. In these contexts, research funding is not merely an administrative variable but a core organizing principle of scientific activity, shaping how knowledge production is structured, monitored, and evaluated. Public funding for science and research addresses issues of appropriability, uncertainty, and indivisibility that often deter private investment (Arrow, 1962). One of the primary advantages of funding is that it motivates scientists to maintain productivity throughout their careers and fosters the creation of high-quality research. From the standpoint of the economics of science and technology, sustained financial investment is essential for ensuring the stability and continuity of scientific systems. Such investment supports long-term research agendas, the development of advanced infrastructure, and the accumulation of knowledge over time.

One key aspect that helps explain the prevalence of funding-centered informational anchors in Northern CRIS is the productive structure of these economies. Countries in Europe, North America, and parts of East Asia are characterized by diversified industrial systems, higher technological intensity, and stronger integration between academia and the private sector. Such structural conditions generate a sustained demand for scientific research, both from public policy agendas and from firms seeking technological advancement. As a result, private-sector participation in research funding tends to be more significant, creating a dense and capillary funding landscape that reinforces project-based governance models. Within these environments, CRIS organized around funded projects, mirrors the operational logic of scientific production itself, where projects function as the primary unit linking researchers, institutions, resources, and expected outcomes.

Moreover, the intrinsic characteristics of science, technology, and innovation help explain why funding becomes a central informational anchor in mature systems. Scientific research is inherently uncertain, cumulative, and characterized by long maturation periods, often requiring substantial and sustained financial commitments before observable results emerge. Unlike short-term market activities, scientific endeavors frequently involve

exploratory research, high risk, and delayed returns, which demand stable funding mechanisms capable of supporting experimentation and long-term knowledge accumulation. These features align with classic arguments in the economics of science, which emphasize uncertainty, indivisibility of investments, and the need for large-scale resource mobilization as defining traits of scientific and technological activities (Freeman & Perez, 1988; Nelson & Winter, 1982; Mazzucato, 2013).

In this sense, funding-centered CRIS should be understood not only as technical infrastructure but also as institutional responses to the economic nature of scientific production in advanced innovation systems. By structuring information around funded projects, these platforms enable traceability between financial inputs and scientific outputs, facilitating accountability, impact assessment, and strategic policy coordination. Such configurations are consistent with the broader platformization of science discussed earlier, in which digital infrastructures embed governance logics aligned with state priorities, market dynamics, and institutional capacity (van Dijck et al., 2018; Chiarini & da Silva Neto, 2022).

Therefore, the predominance of funding-based CRIS in the Global North reflects more than a technological preference; it signals the interplay among productive structure, financing regimes, and the intrinsic economic properties of scientific activity. These systems emerge within environments where stable investment flows, strong institutional coordination, and diversified industrial demand make funding a natural organizing principle for research information infrastructures.

3.3 - South American CRIS and the Importance of Group-Based Research Information Systems

In South America, Current Research Information Systems (CRIS) have developed distinctive institutional configurations compared with those found in countries of the Global North and their more advanced scientific systems. It is therefore necessary to consider the Brazilian case, in which the Lattes Platform has become a successful model adopted and/or adapted by several countries in South America, as discussed by Silva Neto and Chiarini (2022).

The Lattes Platform represents CNPq's experience in integrating databases on curricula vitae, research groups, and institutions into a single information system. Its scope extends beyond the planning and management activities of CNPq itself, reaching other federal and state agencies, such as state foundations for the support of science and technology, as well as higher education institutions and research institutes. Moreover, it has become a strategic instrument for policy formulation by the Ministry of Science, Technology and Innovation (MCTI) and other governmental bodies in the field of science, technology, and innovation (CNPq, 2020, p. 17).

Focusing specifically on the CRIS that stood out in the benchmarking exercise, the *Diretório de Grupos de Pesquisa* (DGP), attached to the Lattes Platform in Brazil, and *GrupLAC*, attached to the Scienti Platform in Colombia, represent consolidated national efforts to organize and map scientific activity through research groups, rather than through funded projects alone. As core components of their respective scientific platforms, these systems have become central references for understanding the structure, composition, and dynamics of their national scientific systems.

These CRIS organize information around research groups as the primary unit of analysis, registering group members, institutional affiliations, fields of knowledge, lines of research, scientific and technical outputs, and training activities. This approach reflects a specific understanding of how scientific production occurs in contexts where research funding is relatively scarce and discontinuous, and where collective organization plays a central role in

sustaining scientific activity. It is also worth noting that the Colombian CRIS is more advanced and comprehensive than the Brazilian one, particularly in data integration across scientific information systems within a unified national platform.

Emphasizing research groups is well-supported by the literature on scientific collaboration, which highlights their pivotal role in advancing knowledge and innovation. As noted by Barbosa, Sasso, and Berns (2009).

modern science is increasingly collaborative, and in Brazil the production of knowledge is predominantly carried out by teams of researchers, whether fully trained or in formation, organized as research groups. When structured, these groups are characterized by ideological sharing, norms, values, beliefs, and interdependent relations among their members (Meadows, 1999; Orrico; Oliveira, 2005).

Such characteristics make research groups not merely administrative units, but socially embedded communities of scientific practice.

A CRIS anchored in research groups is therefore able to capture dimensions of scientific activity that are less visible in output-oriented systems. By mapping stable teams, long-term collaborations, and collective trajectories, systems such as the DGP can leverage the collaborative structure of Brazilian science, providing richer information on scientific capacity, human resources, and knowledge accumulation.

A complementary sociological perspective is offered by Storper (2005), who emphasizes the role of interpersonal associations and localized communities in economic development. Although his analysis does not explicitly focus on research groups, it draws a critical distinction between community and society, highlighting how smaller, less bureaucratic, and more cohesive associations facilitate intense social interaction and knowledge exchange. These environments are particularly conducive to the transmission of tacit knowledge, understood as the non-codified dimension of knowledge. Within evolutionary approaches to innovation systems, tacit knowledge is recognized as a central cognitive input for development and structural economic change (Nelson; Winter, 1982; Nelson, 1999; Lundvall, 1992).

The relevance of group-based CRIS becomes particularly evident in consolidated approaches to Science, Technology, and Innovation studies. Rodríguez-Pose (2013) highlights the crucial role of institutions, especially informal and tacit ones, in shaping regional development and regional innovation systems, a perspective that can also be extended to the national scale. However, these institutions, despite their importance for economic development and social change, are difficult to measure because of their intangible and noncodified nature.

Although it would be overly ambitious to claim that CRIS fully captures informal institutions, they may be among the closest available proxies, particularly when they include detailed information on interactions between universities, firms, and other organizations. In this sense, data on research groups, collaborations, and university–industry interactions may be especially valuable for investigating patterns of learning and knowledge flows, at geographical or sectoral levels, that lead to or are associated with innovation.

From this perspective, research groups should not be interpreted as institutions in themselves, nor as substitutes for firms or governments, but rather as social arenas in which repeated interactions generate informal ties and continuous flows of knowledge. It is precisely these interactional spaces, where knowledge (including tacit knowledge) circulates, that underpin the effectiveness of scientific communities. Group-based CRIS, such as those in Brazil and Colombia, are therefore especially relevant, as they make visible the social structures through which scientific knowledge is produced and transmitted.

3.4 Particularities of South American CRIS

Beyond Brazil and Colombia, other South American CRIS exhibit different organizational logics. In Argentina, the *Sistema de Información de Ciencia y Tecnología Argentino* (SICYTAR), linked to the Ministry of Science, Technology and Innovation, provides a rich open-data portal encompassing information on scientific personnel, research projects, institutions, scientific and technological outputs, equipment, and specialized programs. While the system offers a high level of detail and strong organizational structure, particularly regarding institutional and organizational linkages, it does not treat research groups as a distinct analytical unit. Data are primarily indexed by individuals, organizations, projects, or equipment, which limits the analysis of stable collective research units comparable to those captured by the DGP.

In Chile, the *Sistema de Información de la Investigación* managed by the National Agency for Research and Development offers the open-data platform *DATACIENCIA*. Although the Chilean system presents a modern and interactive interface, it is the least developed among the South American cases analyzed, focusing mainly on publications, authors, institutions, and geographic location, with limited capacity to represent research processes or collaborative structures in greater depth.

Despite their relative scarcity of funding-related information, South American CRIS tend to compensate by integrating data more extensively and achieving greater analytical granularity across specific dimensions. This characteristic is partly explained by the greater protagonism of public research in these countries, which places governments in a central position to integrate and manage scientific information systems. Additionally, the prominence of research groups, and to some extent research projects in the Argentine case, facilitates detailed analyses of collaboration networks, university–industry–government interactions, and the geographic distribution of research activities.

As a result, international benchmarking of CRIS systems reinforces the analytical relevance of the Brazilian and Colombian models. Among the fifteen systems identified, the majority of CRIS in developed countries are anchored in funded research projects, reflecting strong concerns with accountability, impact evaluation, and monitoring of public investments. In contrast, only a small subset of systems is anchored in scientific communities and research groups, as is the case in Brazil and Colombia.

This distinction reflects structural differences between advanced and emerging research systems. While developed countries benefit from abundant and stable research funding, allowing projects to serve as the central organizing unit, emerging countries often face funding scarcity and fragmentation. In such contexts, research groups become a more appropriate analytical and organizational unit, capturing both installed scientific capacity and the collective dimension of knowledge production. The Colombian Scienti platform, with its integrated *GrupLAC* and *CvLAC* systems, exemplifies this approach and illustrates how group-centered CRIS can achieve high informational richness and institutional validation.

3.5 A Comparative Synthesis: CRIS across the globe and its different contributions for development of Scientific/Academic Systems

From the perspective of the economics of science, technology and, innovation, funding data represent a central dimension for understanding the functioning and performance of scientific systems (Kevin; Boyack; Klavans, 2019; Borner; Milojevic, 2019). In mature innovation systems, financial flows are not merely administrative inputs, but structural signals of economic coordination between science, firms, and the broader productive system (Rosenberg, 2000; Suzigan; Albuquerque, 2008; Chiarini, 2021). In this sense, CRIS in the Global North,

which frequently organizes information around funded projects, provides an additional analytical layer by directly linking scientific activity to resource allocation, which may affect economic impact and innovation performance. Such configurations allow discussions about development, accountability, and university–industry links to be grounded in measurable financial data, reflecting scientific systems that are institutionally and economically integrated with their national innovation systems (Nelson, 1993).

The prominence of funding in many Northern CRIS is therefore consistent with institutional environments characterized by stable R&D investment, diversified financing sources, and strong private-sector participation. In these contexts, project-based indexing becomes a logical organizing principle, since projects represent the primary operational unit of scientific production and economic interaction.

In contrast, CRIS in several South American countries operates under structurally different economic and institutional conditions. In economies where private-sector R&D investment is comparatively limited and often concentrated in low-technology sectors such as agriculture and services, and where firms exhibit weaker absorptive capacity, the direct linkage between funding and innovation dynamics is less pronounced (Suzigan; Albuquerque, 2008; Albuquerque, 1999). Under such circumstances, scientific activity is more heavily dependent on public institutions and state-led funding mechanisms. As a result, CRIS in these countries may have evolved toward cataloguing a broader range of research-related information beyond financial inputs.

Rather than centering exclusively on funding volumes, South American CRIS tend to emphasize other structural attributes of scientific activity. These include detailed data on human resources, such as the number of researchers, their academic qualifications, and training trajectories; scientific and technical production, including books, articles, theses, prototypes, and technical reports; patterns of collaboration with other research centers, both domestic and international; and interactions with government and firms. In addition, some systems incorporate socio-demographic and regional information, including gender, race, and geographic location, dimensions that are politically and socially salient in countries such as Brazil. Such features provide a multidimensional view of scientific capacity and its social embeddedness, often with a level of granularity not commonly found in project-based systems.

Crucially, much of this information is frequently organized around research groups as the primary analytical unit, reflecting their structural role in knowledge production, their relative stability over time, and their function as socially embedded communities of scientific practice, as discussed above. Research groups operate at an intermediate scale, larger than the individual researcher yet smaller and more cohesive than the university as a whole, enabling more precise fragmentation and observation of scientific communities and their internal dynamics.

It would be inaccurate to interpret the relative scarcity of funding information in South American CRIS as a lack of concern with the economic dimension of research. Rather, in contexts where financial resources are limited and unevenly distributed, funding data alone may not adequately capture the structure or capillarity of scientific activity. In such cases, alternative proxies, including university–industry collaboration networks and the organizational density of research groups, may offer more meaningful indicators of the interaction between academia and the productive sector. Moreover, legal and institutional constraints on the disclosure of financial data may affect the availability and standardization of funding data across national systems.

At the same time, Northern CRIS should not be assumed to reduce scientific activity solely to funded projects. Although project-based indexing is common, some systems increasingly incorporate broader dimensions such as gender, human resources, geographic distribution, and collaboration networks. Nevertheless, the possibility remains that relevant and

socially embedded aspects of scientific activity, particularly those captured by group-centered CRIS in Latin America, may not be fully represented in some Northern infrastructures. Whether this reflects institutional priorities, historical trajectories, or differences in governance structures remains an open empirical question.

In summary, the apparent paradox that countries such as Brazil and Colombia may display more comprehensive CRIS architectures than several Global North counterparts can be explained by their institutional and economic configurations. In contexts where research and development are strongly centralized within public institutions, the state assumes a central role in integrating and consolidating scientific information. The predominance of public universities and federal research agencies facilitates large-scale coordination and database integration. Furthermore, beyond formal institutional arrangements, political traditions and academic cultures that emphasize universities' public mission may reinforce efforts to catalog, systematize, and make transparent scientific activities.

This argument should not be interpreted as implying a direct or linear causal relationship between the existence of CRIS and the level of scientific or economic development. Innovation systems do not evolve through single, deterministic mechanisms (Nelson; Winter, 1982; Suzigan; Albuquerque, 2008). Rather, CRIS constitutes an infrastructural component within broader institutional ecosystems. Their presence alone does not automatically generate development, but it strengthens the organizational and informational conditions under which scientific and innovation systems operate.

Even in resource-constrained environments, the existence of organized, transparent, and publicly accessible scientific databases produces relevant institutional effects. First, it contributes to a process of societal and governmental persuasion, as since structured information about scientific activity is publicly available and can be scrutinized by researchers themselves. This transparency reinforces public debate, supports reflexivity within the scientific community, and strengthens the legitimacy of science in relation to society and the state.

Second, CRIS provide privileged and often unprecedented information about the internal processes of scientific activity, including human resource formation, collaboration patterns, production dynamics, and institutional articulation. Such information is fundamental for understanding how scientific systems function and how their activities reverberate in broader economic and innovation processes, not only domestically but also in comparative and international contexts. Third, the availability of detailed and systematized data creates a strategic informational base for public authorities in designing and adjusting science and innovation policies. It may also reduce informational asymmetries between academia, government, and industry, thereby facilitating more informed decision-making by both public and private actors.

From this perspective, CRIS should not be seen as a definitive solution to structural challenges in national innovation systems. Instead, they represent an increasingly crucial institutional tool for strengthening governance capacity and articulating scientific, educational, and innovation subsystems. Although still evolving and unevenly developed across countries, CRIS reflects a broader structural trend toward the digital organization and coordination of science. As scientific systems become more complex and interconnected, their role in shaping transparency, policy design, and systemic integration is likely to expand.

4. Concluding remarks

The findings of this study reinforce that Current Research Information Systems are not merely technical repositories, but institutional infrastructures shaped by broader scientific, economic, and governance arrangements. The comparative analysis of fifteen systems showed

a clear predominance of funding-centered informational anchors in Europe, North America, and parts of East Asia, where stable public investment, stronger private-sector participation in R&D, and mature accountability mechanisms make funded projects the main organizing unit of scientific information. In contrast, the cases of Brazil and Colombia revealed the analytical relevance of community-centered systems, in which research groups operate as more stable informational anchors than individual projects, particularly in contexts marked by discontinuous funding flows and greater institutional volatility. These differences indicate that CRIS architectures reflect not only technical choices in database design, but also distinct policy priorities regarding how scientific activity is monitored, coordinated, and made visible within national innovation systems.

Despite the contributions of this study, some limitations should be acknowledged. First, the benchmarking exercise focused on a restricted set of countries and regions, prioritizing Europe, North America, selected Asian countries, and South America. While this choice was theoretically and methodologically justified—given the maturity of scientific systems and the likelihood of identifying relatively consolidated CRIS—it necessarily excludes other regions, particularly Africa, Central America, the Caribbean, and the Pacific. As a result, the findings cannot be generalized to all global research systems, especially those operating under markedly different institutional or economic conditions

Second, the identification and classification of CRIS relied on a combination of organic searches and expert-supported artificial intelligence tools. Although this mixed approach enhanced coverage and validation, it may still have overlooked emerging, hybrid, or less visible research information systems, particularly those not explicitly labeled as CRIS or not available in widely accessible languages. Consequently, some national or subnational initiatives may not have been captured in the analysis.

Third, the study adopts a comparative and descriptive perspective, emphasizing institutional design, informational anchors, and governance models. It does not include a systematic evaluation of CRIS performance, such as data quality, completeness, user adoption, or policy effectiveness. Nor does it empirically assess how CRIS outputs are used by policymakers, funding agencies, or research institutions in decision-making processes.

Finally, while the article highlights the analytical relevance of funding and group-based informational anchors, it does not quantitatively test the relationship between CRIS design choices and innovation outcomes, scientific productivity, or societal impact. The advanced arguments are grounded in CRIS theoretical approach and qualitative assessment, but causal relationships remain beyond the scope of this study.

Building on these limitations, several avenues for future research emerge. First, future studies could extend the comparative scope to underrepresented regions, particularly Africa and other parts of the Global South, to better understand how CRIS (or CRIS-like systems) operate in contexts characterized by fragmented research infrastructures and limited public funding. Such analyses would contribute to a more inclusive global mapping of research information systems.

Second, there is significant potential for in-depth case studies examining how CRIS are actually used in practice by governments, funding agencies, universities, and researchers. This would allow scholars to move beyond system architecture and explore issues of governance, legitimacy, user behavior, and institutional learning associated with CRIS adoption.

Third, future research could explore hybrid CRIS models that integrate both funding- and community-centered informational anchors. Comparative analyses could assess whether such hybrid designs are better suited to capturing the full complexity of scientific systems, particularly in emerging economies seeking to strengthen both accountability and capacity-building functions.

Fourth, quantitative research could investigate the relationship between CRIS

characteristics and science-based innovation outcomes, such as collaboration intensity, interdisciplinarity, regional development, or university–industry collaboration. Linking CRIS data with other datasets (e.g., innovation surveys, patent databases, regional indicators) would allow for more robust empirical testing of the claims advanced in this article.

Finally, future studies should address the challenges posed by platformization, interoperability, and data governance in CRIS development. As research information systems increasingly interact with private platforms, open science infrastructures, and international data standards, understanding the political economy of CRIS—including issues of data ownership, transparency, and long-term sustainability—will be critical for both scholars and policymakers.

ACKNOWLEDGMENTS

We acknowledge CNPq for its financial support. Processes 422942/2025-1 and 311722/2023-7

REFERENCES

- ALBUQUERQUE, E. *National systems of innovation and non-OECD countries: notes about a tentative typology*. *Revista de Economia Política*, v. 19, n. 4, 1999.
- AROCENA, R.; SUTZ, J. Weak knowledge demand in the South: learning divides and innovation policies. *Science and Public Policy*, v. 37, n. 8, p. 571–582, 2010. DOI: <https://doi.org/10.3152/030234210X12778118264537>
- ARROW, K. J. Economic welfare and the allocation of resources for invention. In: UNIVERSITIES-NATIONAL BUREAU COMMITTEE FOR ECONOMIC RESEARCH; SOCIAL SCIENCE RESEARCH COUNCIL. *The rate and direction of inventive activity*. Princeton: Princeton University Press, 1962. p. 609–626.
- BARBOSA, R. R.; SASSO, S. A. Z.; BERNES, M. C. Grupos de pesquisa: organização do trabalho científico no Brasil. *Ciência da Informação*, v. 38, n. 2, p. 25–39, 2009.
- BÖRNER, K.; MILOJEVIĆ, S. Science forecasts: modeling and communicating developments in science, technology, and innovation. In: GLÄNZEL, W. et al. (ed.). *Springer handbook of science and technology indicators*. Cham: Springer, 2019. p. 145–155.
- BOYACK, K. W.; KLAVANS, R. Creation and analysis of large-scale bibliometric networks. In: GLÄNZEL, W. et al. (ed.). *Springer handbook of science and technology indicators*. Cham: Springer, 2019. p. 187–210.
- CASTELLS, M. *The rise of the network society*. Oxford: Blackwell, 1996.
- CHIARINI, T.; SILVA NETO, R. Public scientific platforms and research information systems: governance, integration and challenges. *Science and Public Policy*, v. 49, n. 5, p. 673–686, 2022. DOI: <https://doi.org/10.1093/scipol/scac034>
- COWAN, R.; DAVID, P. A.; FORAY, D. The explicit economics of knowledge codification and tacitness. *Industrial and Corporate Change*, v. 9, n. 2, p. 211–253, 2000. DOI: <https://doi.org/10.1093/icc/9.2.211>
- DARAIIO, C.; GLÄNZEL, W. Grand challenges in data integration for science policy. *Scientometrics*, v. 108, n. 1, p. 5–14, 2016. DOI: <https://doi.org/10.1007/s11192-016-1914-5>
- FORAY, D. *The economics of knowledge*. Cambridge: MIT Press, 2004.
- FORAY, D.; LUNDVALL, B.-Å. The knowledge-based economy. In: FORAY, D.; LUNDVALL, B.-Å. (ed.). *Employment and growth in the knowledge-based economy*. Paris: OECD, 1996. p. 11–32.
- FREEMAN, C. *Technology policy and economic performance: lessons from Japan*. London: Pinter, 1987.

FREEMAN, C.; PEREZ, C. Structural crises of adjustment, business cycles and investment behaviour. In: DOSI, G. et al. (ed.). *Technical change and economic theory*. London: Pinter, 1988. p. 38–66.

GLÄNZEL, W. et al. (ed.). *Springer handbook of science and technology indicators*. Cham: Springer, 2019. DOI: <https://doi.org/10.1007/978-3-030-02511-3>

GODIN, B. The linear model of innovation. *Science, Technology & Human Values*, v. 31, n. 6, p. 639–667, 2006. DOI: <https://doi.org/10.1177/0162243906291865>

HICKS, D. et al. Bibliometrics: the Leiden Manifesto for research metrics. *Nature*, v. 520, n. 7548, p. 429–431, 2015. DOI: <https://doi.org/10.1038/520429a>

KLINE, S. J.; ROSENBERG, N. An overview of innovation. In: LANDAU, R.; ROSENBERG, N. (ed.). *The positive sum strategy*. Washington: National Academy Press, 1986. p. 275–305.

LEYDESDORFF, L. The knowledge-based economy and the Triple Helix model. *Annual Review of Information Science and Technology*, v. 44, n. 1, p. 367–417, 2010. DOI: <https://doi.org/10.1002/aris.2010.1440440116>

LEYDESDORFF, L.; IVANOVA, I.; MEYER, M. Synergy in innovation systems. In: GLÄNZEL, W. et al. (ed.). *Springer handbook of science and technology indicators*. Cham: Springer, 2019. p. 421–438.

LUNDVALL, B.-Å. *National systems of innovation*. London: Pinter, 1992.

MAZZUCATO, M. *The entrepreneurial state*. London: Anthem Press, 2013.

MEADOWS, A. J. *Communicating research*. San Diego: Academic Press, 1999.

NELSON, R. R. *The sources of economic growth*. Cambridge: Harvard University Press, 1999.

NELSON, R. R.; WINTER, S. G. *An evolutionary theory of economic change*. Cambridge: Harvard University Press, 1982.

ORRICO, E. G. D.; OLIVEIRA, M. Redes sociais e grupos de pesquisa. *Revista de Administração Contemporânea*, v. 9, n. 3, p. 121–140, 2005.

PLANTIN, J.-C. et al. Infrastructure studies meet platform studies. *New Media & Society*, v. 20, n. 1, p. 293–310, 2018. DOI: <https://doi.org/10.1177/1461444816661553>

POELL, T.; NIEBORG, D.; VAN DIJCK, J. Platformisation. *Internet Policy Review*, v. 8, n. 4, 2019. DOI: <https://doi.org/10.14763/2019.4.1425>

POLANYI, M. *The tacit dimension*. London: Routledge, 1966.

RODRÍGUEZ-POSE, A. Do institutions matter for regional development? *Regional Studies*, v. 47, n. 7, p. 1034–1047, 2013. DOI: <https://doi.org/10.1080/00343404.2012.748978>

SCHÖPFEL, J.; PROST, H.; REBOUILLAT, V. Research information systems and libraries. *Journal of Librarianship and Information Science*, v. 49, n. 4, p. 395–405, 2017. DOI: <https://doi.org/10.1177/0961000616654965>

SIVERTSEN, G. Developing CRIS as data sources. *Research Evaluation*, v. 28, n. 3, p. 245–254, 2019. DOI: <https://doi.org/10.1093/reseval/rvz018>

STORPER, M. Society, community, and economic development. *Studies in Comparative International Development*, v. 39, n. 4, p. 30–57, 2005. DOI: <https://doi.org/10.1007/BF02686320>

SUZIGAN, W.; ALBUQUERQUE, E. M. *A interação entre universidades e empresas em perspectiva histórica no Brasil*. Belo Horizonte: UFMG/Cedeplar, 2008.

VAN DIJCK, J.; POELL, T.; DE WAAL, M. *The platform society*. Oxford: Oxford University Press, 2018.

WHITLEY, R. *The changing governance of the sciences*. Dordrecht: Springer, 2007.

WHITLEY, R.; GLÄSER, J. *The changing governance of the sciences*. Dordrecht: Springer, 2007.