

DISCUSSION PAPER

268

**THE PLATFORMIZATION OF SCIENCE:
LATTES PLATFORM AT A CROSSROADS?**

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THE PLATFORMIZATION OF SCIENCE: LATTES PLATFORM AT A CROSSROADS?

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ABSTRACT

In this Discussion Paper, we focus our analysis on the Lattes Platform – a public initiative developed endogenously in the late 1990s which was very innovative – since it is a representative case of a scientific platform and is a paramount tool for the Brazilian scientific system. Although there are many academic studies published using data provided by the Lattes Platform, we identified a lack of official reports and articles that address Lattes as a digital platform and its adequacy in the context of the platform economy. We propose that the early-stage technology choices made by CNPq and the constant budget cuts for the Lattes Platform’s maintenance and technological upgrading have strongly affected the platform’s trajectory. As a consequence, the Lattes Platform may be locked-in to a technological trajectory that could lead to the stagnation of its functionalities, putting at risk its indispensable and infrastructural character.

Keywords: Lattes platform; platformization of science; platform infrastructuralization; science policy.

1 INTRODUCTION

Several scholars point to the platformization process that society is currently passing through (van Dijck, Poell and Waal, 2018; Kenney and Zysman, 2016; Poell, Nieborg and van Dijck, 2019). Although there are different perspectives, in general terms, platformization is understood as “the penetration of the infrastructures, economic processes, and governmental frameworks of platforms in different economic sectors and spheres of life” (Poell, Nieborg and van Dijck, 2019, p. 5-6). The spread of digital platforms has also encompassed the scientific field and many studies focus on the most “tangible” part of digital scientific platforms, that is, academic social networks (ASN) (Cozma and Dimitrova, 2021; Mason, 2020; Orduna-Malea et al., 2017; Thelwall and Kousha, 2015; Veletsianos, 2016; Zhao et al., 2020). ASNs were mostly developed in the early 2010s – the two largest ones being Academia.edu and ResearchGate¹ – following in the footsteps of conventional social networks – such as MySpace, Facebook, and LinkedIn – and they aimed to create virtual *loci* for individual communication and knowledge exchange, constituting a specific online community for researchers.

The growth of ASN platforms in the last decade has led researchers to question whether they were becoming private scientific infrastructures (Plantin, Lagoze and Edwards, 2018). This question is legitimate since it is possible to observe digital platforms being controlled by the private sector, which is positioning them as intermediaries between infrastructure platforms and sectorial platforms (van Dijck, 2020). That intermediate position allows them to control essential flows of data, services, and information across entire platform ecosystems. By becoming critical elements within this ecosystem, intermediary platforms generate a sort of “infrastructuralization of platforms” (Plantin et al., 2018). *Pari passu*, motivated by the control of data flows, intermediary platforms seek to expand “upstream” and “downstream”, occupying spaces of often public infrastructure platforms, causing what can be called the “platformization of infrastructures” movement (Plantin et al., 2018).

From the above, we seek to understand if and how the phenomenon of “infrastructuralization of platforms” is evolving in Brazil; more specifically, we focus on the possibilities and roles of established scientific platforms in the light of the new trends. In this Discussion Paper, we focus our analysis on the Lattes Platform – a public initiative developed endogenously in the late 1990s which was very innovative – since it is a representative case of a scientific platform and is

1. Humanities, Arts, Science, and Technology Alliance and Collaboratory (HASTAC) is considered the world’s first ASN and it was developed within the research community and was founded in 2002. ResearchGate and Academia.edu were both founded in 2008.

a paramount tool for the Brazilian scientific system. Although there are many academic studies published using data provided by the Lattes Platform, we identified a lack of official reports and articles that address Lattes as a digital platform and its adequacy in the context of the platform economy (Silva, Bonacelli and Pacheco, 2020). In doing so, not only do we dialogue with the latest literature on scientific “platform infrastructuring” (Plantin et al., 2018; Plantin, Lagoze and Edwards, 2018), but we also provide new insights for policy-making considering that both the early-stage technology choices made by the National Council for Scientific and Technological Development² (early adopter) and the constant budget cuts for its maintenance and upgrading have strongly affected the Lattes Platform’s trajectory. Consequently, the Lattes Platform may be locked-in to a technological trajectory that could lead to the stagnation of its functionalities, threatening its relevance in the long run.

Our Discussion Paper is organized as follows. Firstly, we present our research design, and afterwards we make a brief presentation of digital platforms as infrastructures. Subsequently, we present the Lattes Platform (its brief history and its components) using the multilevel framework proposed by Manca (2017) for analyzing ASN; however, we improve her proposition by including new categories. Finally, we close the paper with some concluding remarks and policy implications.

2 RESEARCH DESIGN

The discussion we propose in this article sheds light on digital platforms, showing that they are very pervasive and, thanks to the ever-continuing advances and diffusion of a constellation of interconnected technologies, they are progressively transforming socio-economic and techno-cultural spheres. In that context, they are altering science as well by using some strategies:

- creating new ways to assess academic and scientific activities;
- transforming the way scholars conduct their work (Borgman, 2007; Veletsianos, 2016; Veletsianos, Johnson and Belikov, 2019; Veletsianos and Kimmons, 2012; Weller, 2011), by shaping e-publishing (Taha et al., 2017); and
- allowing policymakers, funders, institutions, and managers to have access to a great deal of data, guiding their policy propositions to allocate resources for the development of scientific and technological activities.

2. Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

By scientific digital platform, we refer to an assemblage of distinct digital technologies used by policymakers, scientific communities, and profit-seeking companies, for example, to gather scientific information (repository function), to disseminate scientific knowledge (transfer function), and to facilitate interactions (network function). With this previous definition, we do not want to propose a “straightjacket concept”; rather, we intend to use a very broad conceptualization able to cover technologies with different maturity levels.

Manca (2017) proposed a descriptive approach to analysing ASN by drawing up a multilevel framework, blending the contributions of van Dijck (2013) and Veletsianos and Kimmons (2012). She considered ASN’s systemic/infrastructural and personal/individual dimensions in three layers:

- socio-economic (i.e., macro-level considering components related to ownership, governance, and business model);
- techno-cultural (i.e., meso-level considering components related to the technology itself, user/usage, and content); and
- networked scholar (i.e., micro-level considering components related to networking, knowledge sharing, and identity).

Using the socio-economic and techno-cultural layers proposed by van Dijck (2013), Manca (2017) reiterated that platforms encompass “coevolving networks of people and technologies with economic infrastructure and legal-political governance and blends techno-cultural and political economy views” (Manca, 2017, p. 23). Finally, the networked participatory layer was inspired by Veletsianos and Kimmons (2012) who acknowledge individuals’ learning and knowledge in networked spaces.

We use the same three layers; however, we bring forward other components, advancing her framework. We do it since Manca’s proposition was thought of “in the light of theoretical frameworks developed in the educational technology sector and aimed at analyzing social digital scholarship practice” (Manca, 2017, p. 22). We are also concerned about deepening our knowledge on technological upgrading (considering platforms’ infrastructure role and their open innovation mechanisms) and about other socio-economic components (platforms’ market scope, economic effects, and the path-dependent dynamics).

TABLE 1
Multilevel framework for analyzing academic platforms

Level	Layer	Component	Description
Macro	Socio-economic	Ownership	Components that govern commercial and non-profit platforms according to different policies
		Governance	Technical and social protocols and sets of rules for managing user activities
		Business model	Components that mediate the engineering of connectivity through subscription models
		Market scope	National, regional, or global scope
		Economic effects	Scope, network, or feedback effects at work
		Infrastructure	features of the infrastructural role
		Path dependent dynamics	Mechanisms of the trajectory that may lead to lock-in effects
Meso	Techno-cultural	Technological components	Components that help encode activities into a computational architecture that steers user behavior
		User/usage	Components that orient user agency and implicit and explicit participation
		Content	Components that determine the standardization of content and the uniform delivery of products
		Open innovation mechanism	Components that allow the generation of new ideas, products, and services
Micro	Networked-scholar	Networking components	Components that allow connectivity of communication and collaboration
		Knowledge sharing	Components that allow knowledge sharing, concerning the collective and distributed learning dimension
		Identity	Components that shape academic personae (reputation and trust)

Source: Manca (2017).
 Authors' elaboration.

3 DIGITAL PLATFORMS AS INFRASTRUCTURES

It is possible to find in the platform economy components also present in the classical infrastructure literature such as scale, ubiquity, essentiality. The analogy is with the relational nature of what it means to be infrastructure: when platforms offer digital services that become indispensable to other actors, such as other platforms and even public bodies, they have become infrastructures (Kenney and Zysman, 2016; Poell, 2020), that is, "infrastructuralization of platform" (Plantin et al., 2018).

Platforms and infrastructures do have some similarities, such as “embeddedness, a degree of invisibility, extensibility, and broad coverage” (Plantin et al., 2018, p. 14). However, they also have a considerable difference: unlike infrastructure, platforms deliberately avoid building gateways between systems to force users to lock-in. However, this is not an attribute inherent to the platform as an organizational model, but only to private platforms. The bottom line is that the current digital infrastructures are largely private, which is a crucial difference from the public and universal infrastructure of the 20th century (van Dijck, Poell and Waal, 2018). By the same token, there are claims that platforms differ from traditional infrastructure in terms of the need for a smaller investment to generate network effects, dynamism, and geographic scope³ (Montero and Finger, 2017).

Practically, it is possible to identify three non-excludable ways in which platforms merge with infrastructure (Plantin and Punathambekar, 2019). The first, in terms of user experience, highlights the indispensability/criticality of certain platforms for participating in the digital economy. There are also reports of the practical impossibility of participating in the digital economy without depending on the services of the main U.S. (Hill, 2020) and Chinese platforms (Plantin and de Seta, 2019). For instance, without the rail-hailing platform DiDi Chuxing, “it would be substantially difficult to obtain a taxi service nowadays” (Chen and Qiu, 2019, p. 277).

The second, at the level of traditional infrastructures, highlights how platforms are merging with traditional public utility providers. Chen and Qiu (2019, p. 280) outline DiDi Chuxing’s trajectory of intertwining with public transport infrastructure in dozens of Chinese cities, making efforts to “datafy the urban transport ecosystem, including taxis, and occupy the centre of the converging networks of information, traffic, and transactions involving all kinds of vehicles and transport services”. In this way, platforms become a mandatory “partner” for local authorities who wish to have access to their data in real-time. This strategy, for instance, “has enabled DiDi to become a central component in the datafied urban transport infrastructure”. Other studies investigate the interpenetration of generations of infrastructure in the port (di Vaio and Varriale, 2020), telecommunications (Montero and Finger, 2017; Mukherjee, 2019; Plantin and de Seta, 2019), international remittance (Rodima-Taylor and Grimes, 2019), cartography (McQuire, 2019), education (van Dijck, Poell and Waal, 2018; Sellar and Gulson, 2021), energy (Montero and Finger, 2017), scholarly communication (Plantin et al., 2018), health and media (van Dijck, Poell and Waal, 2018) sectors.

3. McQuire (2019, p. 159) draws attention to the fact that traditional infrastructures had well-defined accountability and control mechanisms, which allowed public agencies to evaluate their performance in offering services within the expected quality and universality standards. The same has not happened so far with the new generation of infrastructuralized platforms.

Finally, the third way in which platforms approach infrastructures is through investments in infrastructure projects. Mosco (2017) presents a collection of initiatives in which Big Tech is involved, from investments in data centres to investments in submarine cables and its satellite constellations.

Given this multilevel phenomenon, researchers have resorted to different perspectives, usually developing insightful case studies. Nechushtai (2018) investigated the relationship between platforms and media companies, and she proposed the effect of the risk of infrastructural capture: when auditing entities must scrutinize entities that provide infrastructure services to them, things can go wrong. Chen and Qiu (2019), when analysing the infrastructural role of DiDi Chuxing in the urban transport sector in China, proposed the concept of digital utility to highlight how some platforms develop a strategy of becoming critical in the digital economy exploiting both regulatory loopholes and informal labour practices. They also distinguished traditional providers of public utilities from platform providers of digital utilities: the latter depends on the extraction of surplus data to become a central node in data networks.

Still, Plantin et al. (2018) have pointed out that platforms assume the role of infrastructures at a specific historical moment: when public bodies retreat from the responsibility of offering universal infrastructure, under the aegis of neoliberal ideology.⁴ Montero and Finger (2017, p. 223) also stressed that “as network industries [infra] have been fragmented both vertically and horizontally by liberalization policies, platforms can play a role in enhancing coordination”. In this respect, a recent report by the European Commission (Busch et al., 2021) highlights the links between the platforms’ infrastructural role and the different types of power they leverage over users, markets, and governments. This range of power stances comes from their ability to position themselves as infrastructures. This diagnostic leads almost naturally to the following inquiry: how to protect public values when private platforms dominate the infrastructures of society (van Dijck, Poell and Waal, 2018; Srnicek, 2017).

4. Other authors support the interpretation that platforms become infrastructural due to the withdrawal of public power: “to understand how datafication, commodification, and selection tie in with contemporary governance strategies, it is especially important to see how in neoliberal or advanced liberal democracies, calculative regimes of accounting, and financial management have been employed to enable what Miller and Rose (2008, p. 212-213) call a ‘degovernmentalization of the state’ (...). It is in this framework of calculative regimes and deregulation that platform datafication takes shape” (van Dijck, Poell and Waal, 2018, p. 46). The same is applied even in the State-led Chinese economy: “in 2016, the Measures for Administration of Urban Taxi Business Operations and Services defined the taxi service as a ‘supplement’ to public transport, which means that the business can be privately owned or operated” (Chen and Qiu, 2019, p. 278).

4 LATTES PLATFORM: A PIONEER BRAZILIAN INITIATIVE

The Lattes⁵ Platform, an indigenous initiative, was officially launched in the late 1990s, in a decade when many governments worldwide were architecting their online presence as a result of the penetration of ICT-based technologies in both public and private sectors.

4.1 Brief history

The Lattes Platform was developed in a fruitful collaborative network formed by government agencies, universities, and the private sector. It was funded with public resources coordinated by CNPq, and other public organizations of the Brazilian Innovation System were also involved in the partnership, such as the Coordination for the Improvement of Higher Education Personnel,⁶ the Studies and Projects Financing Agency⁷ and research groups from public universities (*Stela* from Federal University of Santa Catarina – UFSC, and *Cesar* from Federal University of Pernambuco – UFPE, which later became independent).⁸ The private sector was also involved: Multisoft⁹ (20 anos..., 2019).

In the early 2000s, the expected budget for running the Lattes Platform programme amounted to BRL 15.08 million (about USD 7.36 million)¹⁰ for just two years (about 0.30% of the total CNPq budget for both 2000 and 2001), as described in figure 1.

5. The name of the platform is a homage to a Brazilian physicist called Cesare Mansueto Giulio Lattes, who participated in experiments that proved the existence of the pi-meson – a composite subatomic particle – and encouraged the development of experimental physics in the country, including for instance the foundation of the Brazilian Centre for Research in Physics (Centro Brasileiro de Pesquisas Físicas – CBPF) (Nascimento, 2015).

6. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes).

7. Financiadora de Estudos e Projetos (Finep).

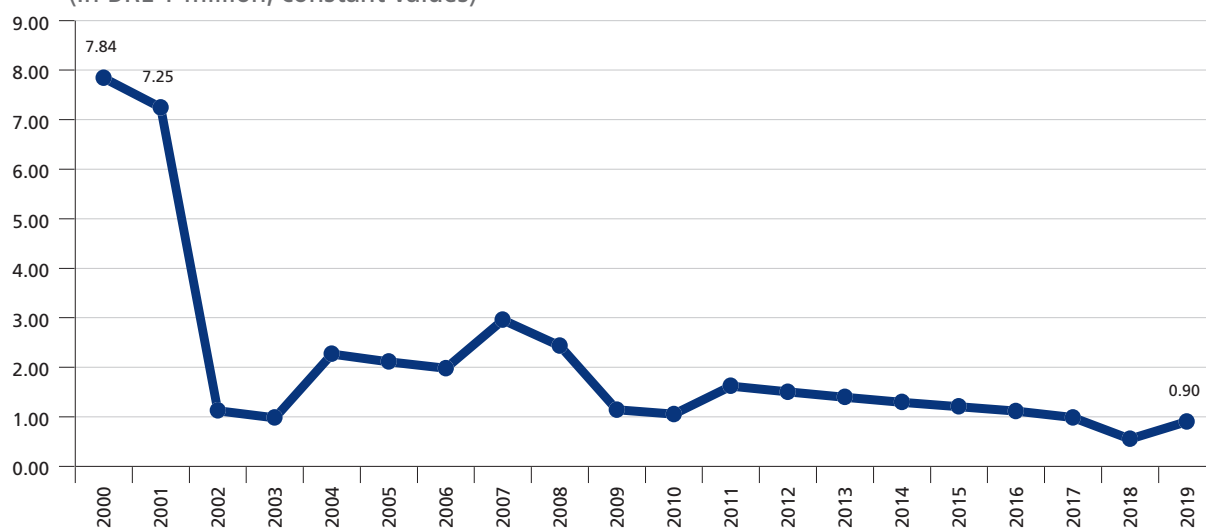
8. Available at: <<https://bit.ly/3OseiAc>>; <<https://bit.ly/3MeQVio>>. Accessed on: June 1, 2021.

9. Available at: <<https://bit.ly/386Kf7k>>. Accessed on: June 1, 2021.

10. Constant BRL values were converted into USD using the official exchange rate. It was calculated as an annual average based on monthly averages (local currency units relative to the USD). Data was sourced from the World Bank.

FIGURE 1**Annual Budget Law¹ expenditure estimation for Lattes Platform (2000-2019)**

(In BRL 1 million, constant values)



Source: Sistema Integrado de Planejamento e Orçamento (SIOP). Available at: <<https://bit.ly/3vtpOJI>>. Accessed on: June 6, 2021.

Note: ¹ Annual Budget Law (Lei Orçamentária Anual – LOA) estimates revenues and establishes the estimate of how much the Brazilian Federal Government is authorized by Congress to spend throughout the year. As it is an estimate, LOA can be amended by additional credit bills once Congress approves provisional measures proposed by the president. Government expenditure can therefore vary from what was proposed by LOA, however, we opt to use it, as expenditure estimation. For all years, the Budget Unit (Unidade Orçamentária) considered was CNPq (code number 24201). From 2000 to 2012 we used data from *Ação Orçamentária 4208 – Sistema Integrado de Informação em Ciência e Tecnologia (Plataforma Lattes)*; from 2013 to 2018, *Plano Orçamentário 000A – Sistema Integrado de Informações em Ciência e Tecnologia (Plataforma Lattes)*; and for 2019, *Plano Orçamentário 000A – Sistemas Integrados de Informações em Ciência, Tecnologia e Inovação (Plataformas Digitais)*, considering all types of expenditure (*grupo de despesa: corrente e investimento*).

Obs.: Current BRL values were deflated using the GDP deflator (year base 2019) from the World Bank database.

The main goal with the Lattes Platform was the standardization of Brazilian researchers' curricula vitae. This standardization aimed at constructing a database, making it possible to find specialists and provide statistics on the distribution of scientific research countrywide. Since it was launched, the Lattes Platform has been increasing its scope and its base of users. The Lattes Platform is now being used by most universities and research institutes, and foundations that support scientific and technological activities in the country. According to Günther et al. (2020), science, technology and innovation (ST&I) institutions and funding agencies have informational and interest links with the CV-Lattes, one of the Lattes Platform components. In a recent report issued by CNPq, it was stated that:

The Lattes Platform represents CNPq's experience in database integration of Curricula Vitae, Research Groups, and Institutions in a single system of information. Not only does its current dimension extend to planning and management actions of CNPq, but also to other federal and state agencies, such as state foundations to support science and technology, in addition to higher education institutions and research institutes. Besides that, it has also become strategic for the formulation of policies by the Ministry of Science, Technology, and Innovations (MCTI) and other government agencies in the field of science, technology, and innovation (CNPq, 2020, p. 17).

Implicit in the above quote is how network effects have operated to consolidate the Lattes Platform. As more scholars use the platform to publicize their expertise and the results of their research, it becomes more important for all entities in the science and technology (S&T) system to use the same database. It was undoubtedly a disruptive innovation in terms of gathering and organizing information of the Brazilian scientific communities (Pacheco, 2003).¹¹ It was so successful that the Lattes Platform was licensed through bilateral agreements mainly within the scope of ScienTI,¹² and its technology and methodology were adopted and/or adapted such as for the Sistema de Información de Ciencia y Tecnología Argentina (Sicytar) of the Ministerio de Ciencia, Tecnología e Innovación (Torres, 2019), the CvLAC Peru of the Consejo Nacional de Ciencia, Tecnología e Innovación (CONCYTEC); the CvLAC Ecuador of Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT); the CvLAC Directory of Venezuela of the Observatorio Nacional de Ciencia, Tecnología e Innovación (ONCTI); and the CVuy of the Agencia Nacional de Investigación e Innovación (ANII) from Uruguay (D'Onofrio, 2009).

In 2005, the CNPq nominated a commission to evaluate, reformulate and improve Lattes (Comissão de Gestão do Lattes – Comlattes), however, it seems it was focused more on correcting

11. Available at: <<https://bit.ly/3LoUeU7>>. Accessed on: Mar. 26, 2022.

12. The International Network of Information and Knowledge Sources for Science, Technology and Innovation Management (ScienTI) provided a public and cooperative forum for stakeholders of national ST&I systems and communities of the member-countries (Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Panama, Paraguay, Peru, Portugal, and Venezuela) to interact and it was designed to have an updated identification of human resources, institutions, and research projects for development and assessment of national policies and capacities in ST&I. Available at: <<https://bit.ly/3Osk3Vm>>. Accessed on: June 1, 2021.

deviations and designing incremental improvements.¹³ This can also be reflected in the CNPq's constant budget reductions (figure 1). After the Lattes Programme was launched, there were drastic budget reductions, and this worsened especially from 2016, probably as a result of the approval of a Constitutional Amendment (95A), capping public spending for 20 years (Rossi and Dweck, 2016). Its goal was to control public debt and regain the confidence of foreign investors by capping the federal budget at the expenditure of the previous year, adjusted for inflation (Chiarini et al., 2020).

There were attempts in 2018 to organize Comlattes in two different committees (management and technical). One of the attributions of the technical committee was the proposition of new technologies for the solutions and evolution of the Lattes Platform and the conducting of studies, benchmarking, and prospect solutions for its technological innovations.¹⁴ However, in 2019 the two-committee division was undone.

With the ambition of promoting a nationwide discussion on the evaluation of ST&I policies using data from the Lattes Platform, the CNPq, and the Centre for Strategic Studies and Management¹⁵ – a thinktank organization supervised by the Brazilian Ministry of Science, Technology, and Innovation – organized the “First ST&I Policy Evaluation Seminar”.¹⁶ Besides examples of applied research using the databases (Caliari, Rapini and Chiarini, 2018; Duarte, Weber and Pacheco, 2018; Guidini et al., 2018; Leite et al., 2018; Rossi, Damaceno and Mena-Chalco, 2018), the seminar fostered the inventive capacity of Brazilians in a special section called “EXPOLattes” where inventors who proposed technological solutions for data mirroring and data extraction could present their gadgets. Besides the presentation of e-Lattes and *Intelligentia Lattes*, two other softwares were presented by a start-up (Indeorum) based at Universidade Federal de Pelotas (UFPel): *Ranquium* and *Cientum*.

Comlattes demonstrated its intention of inviting “EXPOLattes” winners to present their solutions to CNPq and discuss ways of internalizing their technologies. This is part of a recent strategy to find ways to develop partnerships to make the Lattes Platform sustainable in the long run. Consequently, Comlattes proposed verifying the possibility of monetizing for the use of Lattes

13. Most of the marginal improvements focused on the inclusion (or exclusion) of more adequate information from scholars, as is demonstrated in *Relatórios de Gestão*. For example, in 2012 CNPq launched its new Lattes Platform with new functionalities in CV-Lattes, where scholars could register information on innovation, education, and the popularization of science and technology and patent records, and in 2019 maternity leave was also included in CV-Lattes.

14. Resolução Normativa No. 025/2018 (CNPq).

15. Centro de Gestão e Estudos Estratégicos (CGEE).

16. I Seminário de Avaliação de Políticas de CT&I.

Platform data.¹⁷ This “strategy” may be a result of budget reductions, as presented in figure 1. Consequently, some pressures force the Lattes Platform’s maintainers to find monetizing possibilities. However, it may also reflect a “government as a platform” perspective (O’Reilly, 2010). In a few words, it means that open data from the government is offered publicly for recombination aiming at generating new products and services (O’Reilly, 2010).

Opening up Lattes data creates value; however, if the majority of them are gathered outside CNPq, there is a risk in “turning vital public resources into proprietary assets”. Van Dijck, Poell and Wall (2018, p. 154) highlight this issue in a very clear way: “businesses can profit from open data produced by public institutions, while data and knowledge generated by users but processed by corporations become proprietary. (...) Once again, ‘open’ and ‘public’ are not the same things”.

4.2 Lattes components

The Lattes Platform is divided into three sub platforms, as described in table 2: i) Directory of Institutions and Research Infrastructure (Diretório de Instituições e Infraestruturas de Pesquisa – DIIP); ii) Directory of Research Groups (Diretório de Grupos de Pesquisa – DGP); and iii) Lattes Curricula (CV-Lattes).

17. This information was obtained under the rule of Law No. 12,527, called Brazilian Access to Information Law, which provides access to public information. Under Protocol No. 01217.001918/2021-36, we had access to all meeting minutes organized by Comlattes from July 2019 to October 2020. CNPq did not provide the meeting records from 2005 to 2019.

TABLE 2
Lattes Platform and its sub platforms

Platform	Sub platform	Acronym	Objectives
Lattes	Directory of Institutions and Research Infrastructure	DIIP	Monitor and evaluate public policies to promote the national S&T infrastructure, constituting an information system about organizations and their research infrastructures.
	Directory of Research Groups	DGP	Allow information exchange among researchers. Monitor and evaluate public policies, constituting an information system about S&T production and interactions among research groups and the productive sector.
	Lattes Curricula	CV-Lattes	Allow scholars and researchers to create a professional profile adding information about their scientific achievements. Monitor and evaluate public policies, constituting an information system about S&T production and investment allocation.

Authors' elaboration.

The DIIP was designed to gather information on research infrastructure available in Brazilian institutions and to provide info for comprehensive diagnosis of their conditions.¹⁸ One of its main objectives was to build a dynamic database that allows systematic monitoring and the production of periodic reports on the national research infrastructure; however, the information was gathered only in 2012 and only a report was publicly available (De Negri et al., 2013) and a few studies used the dataset (Caliari, Rapini and Chiarini, 2020; De Negri and Squeff, 2016). It is noteworthy that DIIP gathers information about 1,760 scientific infrastructures including laboratories; research ships or floating labs; and plants or pilot plants.

The DGP was developed to gather information about active research groups,¹⁹ and has an increasing registration number, reaching more than 37 thousand groups spread nationwide (figure 2). It includes data about researchers, students, technicians, research streams in progress, and the scientific, technological, and artistic production generated by each group. It automatically provided a few aggregated metrics regarding research groups' characteristics and scientific and technological production; however, it was discontinued in 2010. Notwithstanding that, it still allows XML microdata extraction²⁰ from the 2000 to 2016 Census. DGP data has been increasing

18. Available at: <<https://bit.ly/3OpL77B>>. Accessed on: June 1, 2021.

19. Available at: <<https://bit.ly/387595Y>>. Accessed on: June 1, 2021.

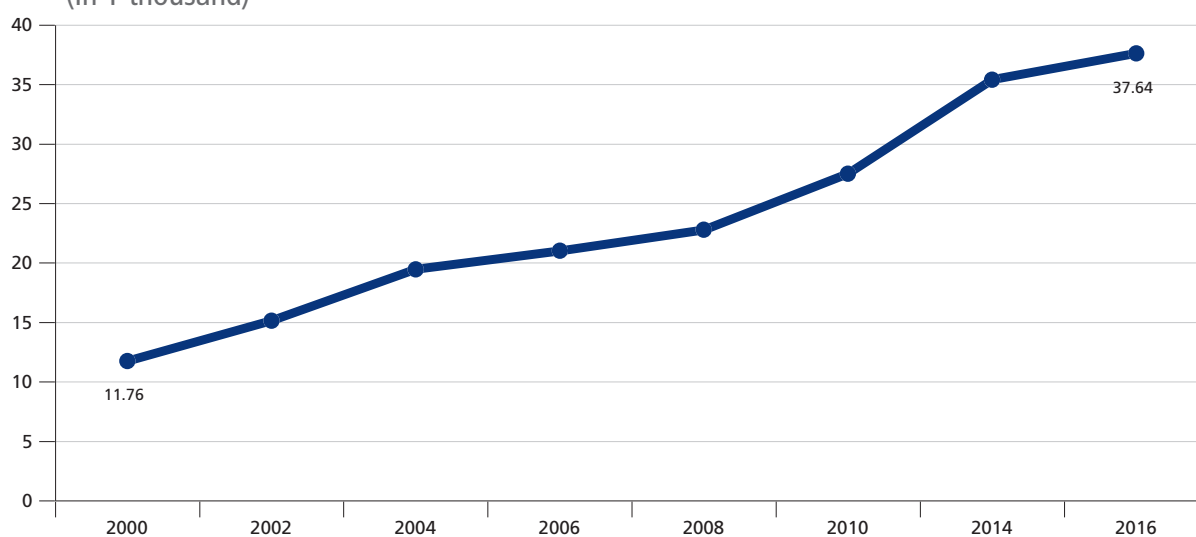
20. Available at: <<https://bit.ly/3Oqq2de>>. Accessed on: June 1, 2021.

over the years (from a little more than 4 thousand groups in 1993 to over 37 thousand in 2016), and it can be assumed that it is representative of the national scientific community. Many studies build on DGP microdata to describe university-industry interactions through different perspectives (Fernandes et al., 2010; Garcia, Rapini and Cario, 2018; Rapini, 2007; Rapini et al., 2019; Suzigan et al., 2009; Suzigan, Albuquerque and Cario, 2011).

FIGURE 2

Number of research groups registered at DRG

(In 1 thousand)



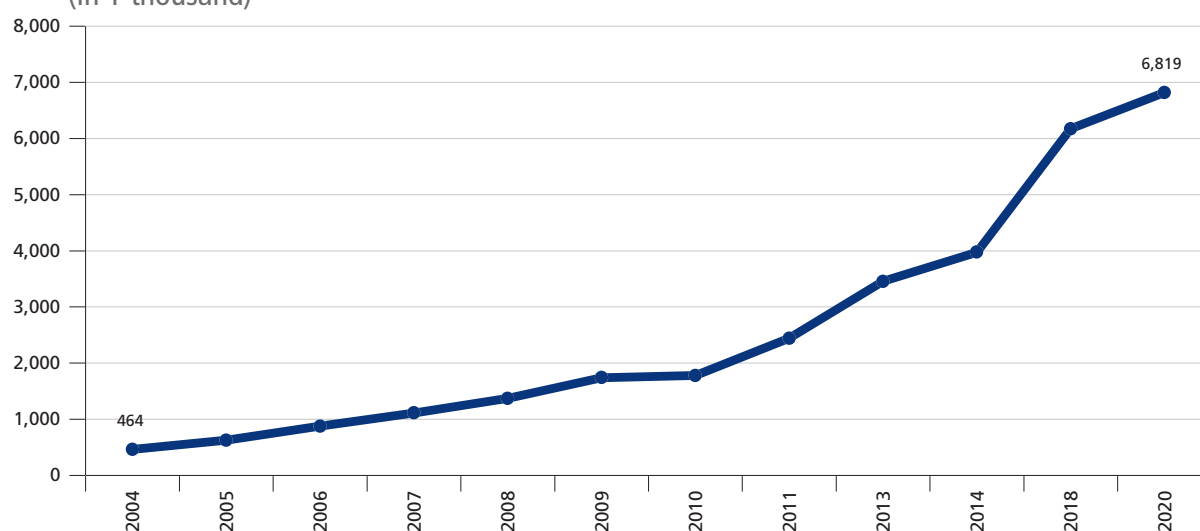
Source: CNPq. Available at: <<https://bit.ly/3Mk5iC1>>.

Authors' elaboration.

Obs.: The last census was done in 2016.

Finally, the Lattes Curricula sub-platform gathers public information individually available for each scholar with information about his/her lines of research, projects, and scientific and technological production. Registration with CV-Lattes is voluntary and spontaneous, although scholars are highly stimulated to participate, mainly because having updated curricula is a precondition for accessing public funding and scientific research. Probably, CV-Lattes is the most used sub-platform provided by Lattes and we can define it as an outlet of scholarly work, as checking one's CV-Lattes is a current practice among scholars. It gathers now over 6 million *résumés* (figure 3).

FIGURE 3
Number of scholars registered at CV-Lattes
(In 1 thousand)



Source: *Relatórios de Gestão*. Available at: <<https://bit.ly/3Evi5ir>>.

Authors' elaboration.

Obs.: For the years 2012, 2015-2017 and 2019, information about updated numbers is not available publicly.

Lattes Curricula does not provide automatically reports and metrics of scientific productions; however, it allows the free use of the "Lattes Extractor"²¹ tool to mine data. Many inventors have also developed software for extracting information and big data mining from CV-Lattes as registered at the Brazilian National Institute of Industrial Property (Instituto Nacional de Propriedade Industrial – INPI) using different languages like Java, Python, and R (section 4.3.2). There is also open-source software like ScriptLattes²² – designed and implemented to create academic reports based on Lattes Database (Mena-Chalco and Cesar Junior, 2009) – and e-Lattes²³ – which uses the R language (Sampaio, 2018).

With the development of extractors, it was possible to use Lattes Database to draw a bigger picture of the Brazilian Innovation System. Examples are snapshots of the scientific production (Dias and Moita, 2018), scientific regional distribution (Sidone, Haddad and Mena-Chalco, 2016; 2017), knowledge field particularities (Arruda et al., 2009; Hilário and Grácio, 2017; McManus and Neves, 2020), scientific collaboration and coauthorship networks (Fonseca, Fernandes and Fonseca, 2017; Mena-Chalco et al., 2014), gender inequality in scientific areas (Oliveira, Mello and Rigolin, 2020; Perlin et al., 2017; Santiago, Affonso and Dias, 2020), academic genealogy studies (Damaceno et al., 2019; Rossi, Damaceno

21. Available at: <<https://bit.ly/3OqExgX>>. Accessed on: June 1, 2021.

22. Available at: <<https://bit.ly/3vtLEwJ>>. Accessed on: June 1, 2021.

23. Available at: <<https://bit.ly/3rEH65g>>. Accessed on: June 1, 2021.

and Mena-Chalco, 2018), and other scientometric and network analysis such as the research output in response to the Zika Crisis (Sampaio et al., 2020) and tuberculosis (Fonseca et al., 2017), development of methods to assess researcher quality-oriented to specific purposes (Duarte, Weber and Pacheco, 2018), trust analysis in cooperation in research (Adamatti and Castelfranchi, 2015) and predatory publishing (Perlin, Imasato and Borenstein, 2018).

The Lattes Platform provides valuable data. The studies cited above highlight that Lattes provides value through open, comprehensive, high-quality, and structured data. These data are vital for science policy too as it is a process with many sources of uncertainty. As precisely mentioned by Thomas and Mohrman (2011, p. 261),

there are endless options for investment in science, each carrying varying levels and kinds of potential payoff and risk. Investment decisions and science policies are themselves hypotheses. They are based on incomplete knowledge of what avenues of science exploration are likely to yield useful knowledge, what areas of science will be adequately funded without policy intervention, and what dynamics will result from a policy and how they will impact science production and the linking of science to the larger innovation and mission system outcomes.

As a consequence, policymakers must deal with a very complex system and they have to combine their insights, ideologies, values, and judgements with data and analytics to guide the strategic and tactical decisions on science policy. Gathering and analysing data creates pieces of evidence to support policy options and their opportunities for impact (Thomas and Mohrman, 2011). Therefore, the creation of databases and the development of analytical and interpretive tools and methodologies are required to “support a robust, evidence-based science policy decision process” (Thomas and Mohrman, 2011, p. 268).

The Lattes Platform gathers substantial information on the stock of knowledge and, to a certain extent, on its flows regarding talent and capabilities (provided at CV-Lattes for example). Notwithstanding that, Lattes data is also an input to identify opportunities for any investment decision.

The questions, however, are: who will appropriate the value emerging from the Lattes Platform’s data? Is the open data strategy pursued enough to make the Lattes Platform catch up with the new generation of scientific platforms?

4.3 Lattes Platform multi-layered analysis

Manca's (2017) contribution was in proposing a multilayer approach for analysing ASN according to a networked socio-technical perspective into three levels: networked-scholar, techno-cultural and socio-economic. Notwithstanding that, we believe it is possible to improve her multilayers to analyse other scientific digital platforms such as the state-mandated Lattes Platform. The micro-level – the network-scholar layer – refers to affordances (Majchrzak and Markus, 2013), which are the action potential within reach of the platform user; the meso level – techno-cultural layer – concerns the platform controller's decisions about its dynamics, i.e., ability to integrate open innovation etc.; finally, the macro-level – socio-economic layer – contextualizes the entire platform ecosystem (users + platform) in terms of infrastructure characteristics and economic dynamics. In what follows, we apply an extended version of Manca's (2017) framework with new categories, starting from the micro level and going to the macro level.

4.3.1 Networked-scholar layer

Networking components

The Lattes Platform was established before the full development of technologies used in the most advanced ASN such as ResearchGate. Some scientific platforms whose primary focus was on posting and sharing academic-related content were able, subsequently, to add social networking capabilities, such as Mendeley (Jordan, 2019). That was not the case with the Lattes Platform so far: it has not included any network of feedback artifacts. The sub-platform DGP, for example, contained at its core a proposal for the visualization and formation of research networks, aiming

to boost the creation of knowledge and the innovation process resulting from the *exchange of information* and, above all, from the junction of competencies of groups that join efforts in the search for common goals, with or without sharing facilities. *Not to be confused with ASN* – which are not the target of DGP. These aim to meet the need for a specific environment that is specialized in a particular area of knowledge,

with possibilities for discussions, networking, purchase of inputs, dissemination, and marketing of research results and innovations^{24,25} (emphasis added).

In recent years, DGP has started to have many of its functionalities disabled, keeping only a history of data from research groups on its website for a consultation. It is possible though to use a parameterized query tool²⁶ to find research groups, being the way to allow users to monitor other research groups' activities. There is no other way to foster interaction with peers. In a public report, CNPq affirms that DGP was

defined as an inventory of active scientific and technological research groups in the country. Today, the DGP, despite some problems it has been passing through, continues to configure itself as an *instrument for information sharing and exchange*, allowing, accurately and quickly, to *identify and locate expertise* and their current occupation, in addition to recent production, such as the source of information for both scientific societies and the various instances of the political and administrative organization of the country, allowing the analysis of the state-of-the-art of Brazilian Science and Technology and helping to preserve the memory of the national scientific and technological activity²⁷ (CNPq, 2020, p. 17, emphasis added).

24. In the original: "*visam impulsionar a criação do conhecimento e o processo de inovação resultantes do intercâmbio de informações e, sobretudo, da junção de competências de grupos que unem esforços na busca de metas comuns, podendo ou não haver compartilhamento de instalações. Não confundir com redes sociais de pesquisa que não são o alvo do DGP. Estas visam suprir a necessidade de um ambiente próprio e especializado em uma determinada área do conhecimento, com possibilidades de discussões, networking, compras de insumos, divulgação e comercialização dos resultados de pesquisas e inovações*".

25. Available at: <<https://bit.ly/38jqb1u>>. Accessed on: Mar. 22, 2022.

26. Available at: <<https://bit.ly/37yushA>>. Accessed on: June 1, 2021.

27. In the original: "*é definido como 'inventário dos grupos de pesquisa científica e tecnológica em atividade no País'. Hoje, o DGP, não obstante alguns problemas porque tem passado, continua se configurando como instrumento para o intercâmbio e a troca de informações, permitindo, com precisão e rapidez, identificar e localizar expertises e sua ocupação atual, além da produção recente, como fonte de informação tanto para sociedades científicas como as várias instâncias de organização político-administrativa do país, permitindo a análise do estado da Ciência e Tecnologia brasileiras e ajudando a preservação da memória da atividade científico-tecnológica nacional*".

Knowledge sharing

Concerning knowledge sharing, the Lattes Platform, especially the CV-Lattes sub-platform, has since its inception adopted an open interface, in which users fill in relevant information about their scientific and academic activities. If, on the one hand, this reduces the costs of development and maintenance of the platform (and perhaps allows the insertion of idiosyncratic information), the lack of standardization and the total autonomy of the insertion of information hinder the recovery of this information. The exchange of knowledge is also affected by the absence of “a controlled vocabulary or a hierarchical tree of terms” (Silva and Smit, 2009, p. 86).

Identity

Concerning identity formation, as in ASN, the Lattes Platform allows users to shape their profiles, including a headline where scholars present their expertise and skills and they can present themselves; consequently, user identity is mostly conveyed through the profile. However, according to Silva and Smit (2009), the complete autonomy for generating profiles by such a heterogeneous group of users, more or less versed in communication and information tools, leads to a very large dispersion of profiles. Both CV-Lattes and DGP are user-generated contents (UGC) with low standardization (pre-determined categories for metadata).

CV-Lattes and DGP provide indicators of researchers’ scientific and technical production, but they are simple indicators that seem to contribute little to the formation of a user’s “reputation and trust as elements that shape academic personae” (Manca, 2017, p. 3), even if there are displays of research results and impacts (CV-Lattes proposes publication metrics based on Web of Science, Scopus and Scielo and JCR impact factor for indexed journals).

4.3.2 Techno-cultural layer

User/usage and content

As far as the techno-cultural level is concerned, CNPq implements features to spur users’ connectivity based on the stimuli to join all sub platforms. For instance, having updated information in CV-Lattes is a precondition for accessing public funding and scientific research. CV-Lattes’ homepage provides an outlet that allows users to monitor other scholars’ activities (main researches, publications, filiation etc.).

Manca (2017, p. 3) presents the technology of a platform as “services that help encode activities into a computational architecture that steers user behavior”. In this sense, CV-Lattes users have the option of including its ORCID ID through an application programming interface (API). Although the

Lattes Platform created its identification number many years before, the inclusion of ORCID ID indicates its consolidation in the Brazilian scientific community and its increase in popularity as presented in figure 4. Bello and Galindo-Rueda (2020) demonstrated how ORCID ID has taken the lead²⁸ as the most pervasive standard for the unique and digital identification of researchers in the world. Also, concerning technology, more specifically the interface, CV-Lattes users can register information in seven modules: General data, Education, Performance, Projects, Production, Education, and Popularization of S&T and Events. Each of these modules also opens up other different categories, for example, the production module unfolds into bibliographic, technical, and artistic/cultural production.

This user-generated content (UGC) is also related to what Manca (2017) calls “content”: standards of content and delivery of products. There are three levels of user autonomy when filling fields in the platform: with full autonomy, partial autonomy, or without autonomy. As most fields have total or partial autonomy, the system “allows the filling of fields to be carried out at the mercy of the perception that feeder users have of its operation or of the objectives pursued when filling out the Lattes Platform” (Silva and Smit, 2009, p. 85). This opening allowed by the interface leads to a lower economic cost, but to greater difficulty in standardizing and retrieving information in the system, as previously mentioned in section 4.3.1.

Technological components and open innovation mechanisms

Technological components present in the Lattes Platform, despite marginal improvements, maintain the main architecture used when it was developed: XML (extendable markup language) and three sets of information sources: i) operational bases; ii) warehouse bases; and iii) web information repositories. The operational bases are structured (relational) bases resulting from transactions with the different users of the Platform. Warehouse bases include both text bases generated from operational bases (for indexing and searching) such as the data marts produced for the different information units and their domains (Pacheco, 2003;²⁹ Pacheco and Kern, 2001; 2003).

In section 4.1, it was argued that the Lattes Platform’s maintainers allow third parties to recombine data aiming at generating new products and services. Not only did the open innovation mechanism result in open source software such as ScriptLattes (Mena-Chalco and Cesar Junior, 2009) and e-Lattes (Sampaio, 2018), but also in new technologies filed at INPI (table 3).

28. “The ‘Open Researcher and Contributor Identifier’ (ORCID), promoted by the namesake international non-profit organization, appears to have become the prevailing global standard as it is the most diffused type of identifier used by scientific authors worldwide (more than 60 percent)” (Bello and Galindo-Rueda, 2020, p. 29).

29. Available at: <<https://bit.ly/3LoUeU7>>. Accessed on: Mar. 26, 2022.

TABLE 3
Application filed of computer software at INPI related to Lattes Platform

Code number	Year of deposit	Title	Owner	Main language	Type of program
BR 51 5051 001146 5	2021	LLattes ProdPPT – Gerador de Relatórios Padrão Lattes da Produção Técnica	Márcio Carneiro dos Santos	Python, XML	DS07, GI04
BR 51 2021 001145 7	2021	LLattesPBiblio – Gerador de Relatórios Padrão Lattes da Produção Bibliográfica	Márcio Carneiro dos Santos	Python, XML	DS07, GI04
BR 51 2020 002612 5	2020	Extract Lattes	Universidade Estadual de Montes Claros (Unimontes)	Django, Python	AP02, AV01, GI04, IA01
BR 51 2020 002538 2	2020	Extrator Lattes	Fabiano Peruzzo Schwartz	R	AP03, AV01, GI04
BR 51 2017 001622 4	2017	Intelligentia Lattes Extractor	Instituto Stela	Java	CD01, GI01, GI06, GI08, S007
BR 51 2017 001621 6	2017	Intelligentia Lattes Annotator	Instituto Stela	Java	CD01, GI01, GI06, GI08
BR 51 2017 001619 4	2017	Intelligentia Lattes Cube	Instituto Stela	Java	CD01, GI01, GI06, GI08
BR 51 2017 001618 6	2017	Intelligentia Lattes Intellectus	Instituto Stela	Java	CD01, GI01, GI06, GI08
BR 51 2017 001617 8	2017	Intelligentia Lattes Viewer	Instituto Stela	Java	CD01, GI01, GI06, GI08
BR 51 2017 001616 0	2017	Intelligentia Lattes Service	Instituto Stela	Java	CD01, GI01, GI06, GI08
BR 51 2016 001291 9	2016	SILQ – Sistema de integração Lattes-Qualis	Universidade Federal de Santa Catarina (UFSC)	Java	GI01, GI04, GI08, S002
BR 51 2014 000516 0	2014	NILREP	Universidade Federal do Rio Grande do Sul (UFRGS)	Python	GI04
10918-5	2010	SISLattes – Sistema Extrator Lattes	Universidade Estadual do Oeste do Paraná (Unioeste)	Java	GI01, GI08

Source: INPI.

Obs.: ¹ Search String: “Plataforma Lattes” and “Lattes”.

² DS07 – documentation support; GI04 – report generator; AP02 – planning; AV01 – performance evaluation; IA01 – artificial intelligence; AP03 – controlling; CD01 – data communication; GI01 – information management; GI06 – data entry and validation; GI08 – data recovery; S007 – process controlling; S002 – input and output interface.

4.3.3 Socio-economic layer

Ownership and governance

The Lattes Platform is a non-profit scientific digital platform belonging to CNPq. The governance component is mostly managed through the Terms of Service – ToS (Termo de Adesão e de Condições de Uso), which was defined after 2004. The term stipulates that, in what regards CV-Lattes, CNPq collects and stores users' personal information for supporting policy making and evaluation, sharing data with third parties except for personal data.

CNPq, through CV-Lattes, collects and stores curricular information from users, necessary to fulfil its institutional mission: To promote and foster the country's scientific and technological development and contribute to the formulation of national S&T policies. Such information is used to assess the competence of candidates to obtain scholarships and grants; in the selection of consultants, committee members, and advisory groups; in supporting the evaluation of Brazilian research and graduate studies, and in the construction of other databases that support the drafting of indicators and studies of interest to ST&I (...). All curricular information sent to CNPq may be made available for internal access or displayed on the Agency's internal network. They may also be disclosed to the external public, through the Internet or other means, except for the following information regarding user's identification data, by which CNPq undertakes not to publicly disclose it: a) residential address; b) home telephone; c) affiliation; d) year of birth; e) CPF; f) gender; g) colour or race; h) identity; i) passport and j) e-mail addresses.^{30,31}

30. In the original: "*O CNPq, através do Sistema de Currículos Lattes, coleta e armazena informações curriculares dos usuários, necessárias ao cumprimento de sua missão institucional: Promover e fomentar o desenvolvimento científico e tecnológico do país e contribuir na formulação das políticas nacionais de C&T. Tais informações são utilizadas na avaliação da competência de candidatos à obtenção de bolsas e auxílios; na seleção de consultores, de membros de comitês e de grupos de assessoramento; no subsídio à avaliação da pesquisa e da pós-graduação brasileiras e na construção de outras bases de dados que subsidiam a elaboração de indicadores e estudos de interesse da CT&I. (...) Todas as informações curriculares enviadas ao CNPq poderão ser por este disponibilizadas para acesso interno ou exibidas na rede interna da Agência. Poderão também ser divulgadas para o público externo, através da Internet ou de outros meios, exceto as seguintes informações relativas aos dados de identificação do usuário, pelas quais o CNPq se compromete à sua não divulgação pública: a) endereço residencial; b) telefone residencial; c) filiação; d) ano de nascimento; e) CPF; f) sexo; g) cor ou raça; h) identidade; i) passaporte e j) endereços eletrônicos".*

31. Available at: <<https://bit.ly/38jqb1u>>. Accessed on: Mar. 22, 2022.

Lattes' Terms and Conditions seem to be partially following the Brazilian General Personal Data Protection Law³² (Brasil, 2018), which states that the processing of personal data can be carried out by the public administration for the processing and shared use of data necessary for the execution of public policies and by research institutes to carry out studies, ensuring, whenever possible, the anonymization of personal data.³³ However, as Lattes' data "may also be disclosed to the external public, through the Internet or other means", how can data holders avoid improper use of their data? According to LGPD, the holder has the right to easily access the information about the processing of their data, which must be made available in a clear, adequate, and ostensible way about, for example, the specific purpose of the data processing and responsibilities of the agents who will carry out that processing.³⁴ This information is not available at Lattes' ToS.

In addition, the Lattes Platform does not comply with a recently published Bill that provides principles, rules, and instruments for Digital Government (Brasil, 2021a), which states that e-gov platforms must have transparency and control tools for the processing of personal data that are clear and easily accessible and that allow the citizens to exercise their privacy right.

Business model and market scope

The business model is based on public funding, as the Lattes Platform offers free-of-charge services and there are no other supplementary services. Even if the Platform was freely licensed to other countries in the scope of ScienTI Network in the early 2000s and most recently CNPq's Information Technology Master Plan (Plano Diretor de TI) the expansion of its use by other countries was plotted in a SWOT Matrix³⁵ as an opportunity (CNPQ, 2014a). There is no public evidence demonstrating that CNPq has a well-developed strategy to internationalize the artifact, as in its most recent Strategic Plan there is no mention about the Lattes Platform at all (CNPQ, 2014b). Its market scope is national.

Economic effects

The value generation dynamic takes place in the platform's interaction with its user community and third parties, that is, with its ecosystem. The mechanism that defines the generation of value through this interaction is network effects. Network effects are characterized by the increase in the value perceived by the user as new users join the network/platform in question. These effects

32. Lei Geral de Proteção de Dados (LGPD).

33. Law No. 13,709/2018, Article 7, items III and IV.

34. Law No. 13,709/2018, Article 9.

35. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats.

occur both directly and indirectly. In the case of the CV-Lattes, the direct network effect occurs when scholars understand that the entire research community uses the Lattes portfolio as a standard to register their scientific and academic activities. This effect is based on the very essence of the research community: by sharing values, norms, and practices, the community spreads certain conventions over time. Following these conventions creates value for network participants as they are shared by all other members. While there were few researchers with their CV registered on the Lattes Platform, this practice did not seem to have been institutionalized by the community; today, with over six million résumés registered (figure 4), there has been a “naturalization” of the Lattes Platform as the unquestionable mechanism of the individual research portfolio. In other words, as the number of subscribers to the platform grew, the greater the importance that new members gave to this practice.

The network effect is also present indirectly. As more researchers use the platform to register their portfolios, it becomes more important for S&T institutions to use the Lattes Platform as the source of information about researchers for granting scholarships, offering jobs etc. The same is true for researchers: the more institutions requesting the CV-Lattes, the greater the value associated with having an up-to-date profile.

While the Lattes Platform has been successful in leveraging network effects, the same cannot be said about feedback effects. The success of machine learning techniques over the last decade has enabled a new way to improve products and services. Services offered via ML-based systems collect user data and digital traces of their use and enhance the service itself based on these inputs. According to Mayer-Schönberger and Ramge (2018, p. 127), “it feels strangely alchemistic: turning a by-product of usage into the raw material of improvement, like converting lead into gold”. Feedback effects are at the heart of a new generation of science platforms, as we can see from the following excerpt, taken from the ResearchGate ToS.³⁶

The Service also provides you with functionalities that support your scientific work, your professional life, and your development. To be as helpful as possible, the Service takes information about you as a Member, your Member Submissions, and your activity on the Service into account in emerging content and providing other aspects of the Service. This way we can make recommendations for connections, content, and features that may be useful to you. Keeping your profile information

36. Available at: <<https://bit.ly/3MhC5ro>>. Accessed on: June 1, 2021.

accurate and up-to-date helps us to make these recommendations more accurate and relevant.

The improvement of services based on feedback effects appears as a new dynamic of digital innovation: the transformation of the service occurring almost automatically and at increasingly lower costs as the pool of captured data grows *pari passu* with the increase of the user base (Mayer-Schönberger and Ramge, 2018). Although the Lattes Platform can make use of user data internally, it does not mobilize this data to improve its service.

Infrastructure

Regarding the infrastructural role played by the Lattes Platform, according to Günther et al. (2020, p. 111), “Brazilian graduate programmes make use of CV-Lattes to mediate their bureaucratic processes. It is an information flow channel that enables social relations, as it organizes bureaucracy, standardizes information, and fosters a collaborative scientific network that uses its information in an operational and strategic way.” According to Ramos et al. (2017), the Lattes platform is a strategic tool for the formulation of public policies; in addition, the CV-Lattes component is used as an evaluation criterion by “institutions such as Capes and other research bodies; selection of students and candidates for scholarships and grants; evaluation of courses in Postgraduate; selection of faculty in selection processes; monitoring of national scientific and technological production, among other attributions of the kind. Finally, to Silveira (2020) “a scientist in the country who does not have his or her *vitae* in it practically does not exist for peers and funding agencies”.

Two current examples demonstrate how the Lattes Platform has become the standard for the country’s S&T agencies. For instance, the CNPQ Call 05/2021 – which provides granting for Senior Researchers – requires candidates to have their *résumés* registered in the Lattes Platform and they must be updated until the deadline for proposal submission. The public notice released by FAPESP, another S&T funding agency, establishes a calendar for submissions of proposals from Research, Innovation, and Dissemination Centres and declares that “CV-Lattes [of the proponents] must be up to date” (Fapesp, 2021a).

The above evidence strengthens the idea of the criticality of the Lattes Platform in the Brazilian S&T system, a trait of infrastructure platforms. Another way to capture its criticality is through the

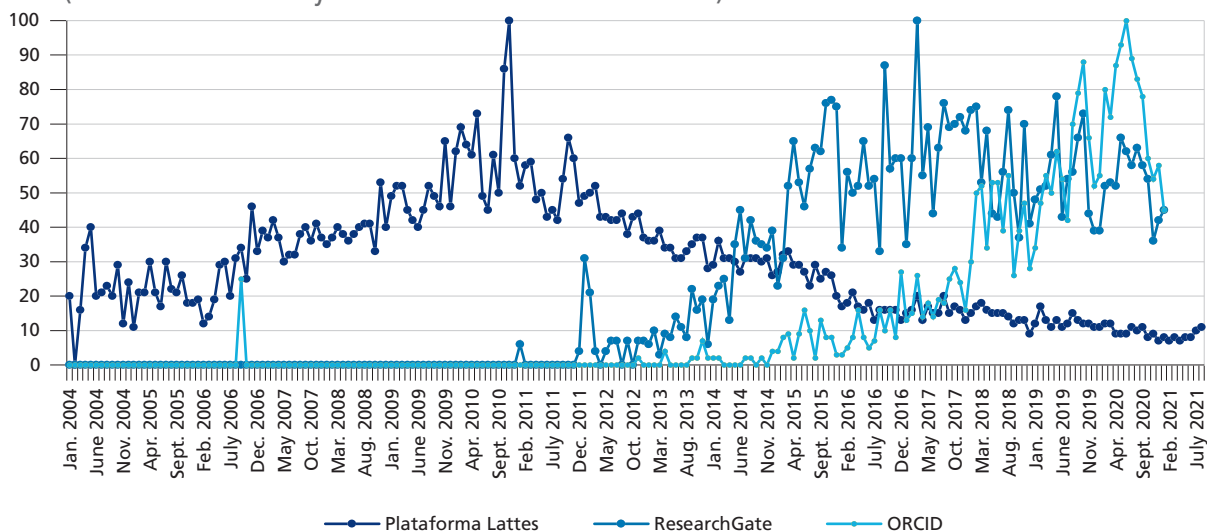
public's interests, concerns, or intentions on the Lattes Platform over time, using "Google Trends" tools,³⁷ which provides data on Google Search usage.³⁸

In Google Trends the results are returned on a scale ranging from 0 to 100, with 100 representing the highest proportion for the terms queried and zero the lowest. In a search for the terms "Plataforma Lattes" across Brazil month by month from January 2004 to August 2021, Trends assign the highest value (100) to the month with the highest volume (i.e., November 2010 as depicted in figure 4). All other months are then represented as a fraction of that maximum.

FIGURE 4

Interest over time (Jan. 2004-Aug. 2021)

(In scores awarded by trends on the interest over time)



Source: Google Trends. Available at: <<https://bit.ly/3v2wek6>>.

Obs.: 1. Search String: Plataforma Lattes; ResearchGate and ORCID.

2. Parameters used for the search were: i) selected region: Brazil; b) time frame: Jan. 2004 to Jan. 2021. Scores are based on the absolute search volume for each term separately, relative to the number of searches received by Google for each term separately.

The above process also applies to queries that contain other terms, which is the case in figure 4. So, as seen in that figure, "ResearchGate" and "ORCID" are in a query separately, therefore, 100

37. For the limitations to the use of Google Trends, see Jun, Yoo, and Choi (2018).

38. "Google Trends is useful to promptly detect a certain phenomenon and is, therefore, an excellent monitoring tool" (Jun, Yoo and Choi, 2018, p. 71). It aggregates data that can be useful in shedding light on Google Search usage as a proxy for the public's interests, concerns, or intentions about a specific theme. It has been used to analyse many variables in a wide range of areas, including IT, communications, medicine, health, business, and economics (Jun, Yoo and Choi, 2018).

is assigned to that highest month for each one of them respectively (i.e., April 2018 and August 2020) and then all results across those terms are proportional to those points. Consequently, in interpreting results, we bear in mind that we can make evaluations about the rate of change and comparisons among the same term; however, we are not able to assess the total number of searches for any term, nor compare them directly as they were in a query separately. The idea is to show their usage tendency.

From figure 4, we can notice that in search engine tendency, Plataforma Lattes is decreasing with time starting from 2010. It is also interesting to note that other players like ResearchGate and ORCID have gained more popularity over time in Brazil.

Another typical trait of infrastructures is their invisibility, or the “visibility upon breakdown” (Star, 1999). Since they become essential utilities for social actors’ activities, they blend into their daily lives and are only perceived when they fail to deliver their critical services. This has been the case with the recent Lattes “blackout” (Rocha, 2021) and in July-August 2021 we can notice a relative increase of Plataforma Lattes in Google search.

4.3.4 Path dependent dynamics

The lock-in concept applies especially in the context of technologies that generate positive network effects. ICTs, for example, are more valuable the more people use them. This externality puts pressure on the system towards non-coordinated standardization among several competing technologies. Another element that reinforces the lock-in is switching costs: in the emblematic case of the Qwerty keyboard (David, 1985), typists needed to invest in alternative typing training if they were looking to switch to machines with other designs. The lock-in concept cannot be directly translated into the case of the Lattes Platform, given its public character, as it did not compete directly with other technologies to be established as the main artifact. It was defined by CNPq as the standard and gradually accepted by the two main groups that use it: researchers and scientific and research institutes. However, the analogy is valid for thinking about the future of the Platform.

The Lattes Platform is a digital system composed of its controller (CNPq) and two groups of users, who benefit from network effects as presented before. Directly, the more researchers have a CV-Lattes, the more it establishes itself as the *de facto* standard in the national scientific portfolio, increasing the value for the researcher who has it. Indirectly, for scientific and research institutes, the more researchers registered, the more it makes sense to use it as a source of information for the most diverse processes, from the formation of talent banks to the granting of scholarships and financing. Also indirectly, the more scientific and research institutes use the Platform, the greater the value for the researcher who owns it.

The switching cost, in its turn, is related to the potential of multihoming, that is, the development or consumption of products/services on more than one platform. In the case of Plataforma Lattes, there is currently no platform that is a perfect substitute for its services. Thus, at the moment, multihoming is possible not because of the cost, but because of the lack of reasonable alternatives.

The two elements that guarantee users' lock-in into the Lattes Platform are under transformation. The platformization of science advances with the establishment of new digital platforms dedicated to different phases of scientific activity. Academia.edu, ResearchGate, and Orcid already have millions of users in the whole world and are more and more searched for in Brazil (figure 4); it seems reasonable to assume that shortly the possibility of multihoming will be real and Lattes Platform users will be able to migrate to these new intermediaries.

Once an eventual migration process starts, negative network effects come into play. Assuming that a large number of researchers started to adopt another platform, or that scientific and research institutes with weight in the national S&T system turn to other solutions, a dynamic of negative network effects would be set in motion. For instance, recently, Fundação de Amparo à Pesquisa de São Paulo (Fapesp) declared that ORCID ID will be mandatory for all researchers and it is going to be used to monitor their scientific production and research results (Fapesp adotará..., 2021). Fewer scientific and research institutes requesting the CV-Lattes would discourage researchers from owning/updating their registration. The negative spiral could, in theory, occur at an accelerated speed. The user ecosystem built over two decades could be lost.

5 FINAL COMMENTS

The Lattes Platform is crucial for the S&T community in Brazil. Its importance goes beyond *vitae* showcases of Brazilian scholars, as we have exemplified through the multilevel analysis synthesized in table 4 and through the many studies that used its data to provide a big picture of the Brazilian National Innovation System.

TABLE 4
Multilevel analysis of Lattes Platform

Layer	Component	Description
Socio-economic	Ownership	Governmental
	Governance	Managed through the "Terms and Conditions", which stipulate that the company collects and stores personal information from users to be used for supporting policy making and evaluation, sharing data with third parties except for personal data
	Business model	Public funding
	Market scope	National
	Economic effect	Network effect
	Infrastructure	Criticality and invisibility
	Path dependence dynamics	Lock-in effect
Techno-cultural	Technological components	Protocols; operational bases; warehouse bases; and web information repositories
	User/usage	Based on the stimuli to join the platform, mainly because having updated information is a precondition for accessing public funding and scientific research
	Content	UGC (user-generated content) with low standardization (pre-determined categories for metadata)
	Open innovation mechanism	Open data
	Networking components	Absent
Networked-scholar	Knowledge sharing	Based on the free access to scholars' curricula vitae (e.g., DOI for publication) and Research Groups' information; search mechanism based solely on research name
	Identity	User identity is conveyed through the profile and there are indirect reputation indexes (e.g, productivity grants, citations, impact factor etc.)

Source: Manca (2017).
 Authors' elaboration.

Lattes is also a relevant source of information for policy decision-making based on pieces of evidence as argued; however, despite its originality and criticality, it seems that CNPq was not able to keep pace with the technological development of the new generation of platforms, such as the inclusion of advanced machine-learning algorithms to generate feedback effects and dashboards of analyses that could be automated, integrating data about talent, capabilities, and opportunities to enable real-time strategic decision-making. It seems that the Lattes Platform is trapped in a

less dynamic and less promising technological trajectory and with constant budgetary constraints it will hardly be able to escape from the trap. Below, we comment on both the path dependence and the budgetary constraint effects and finally, we bring some points to reflect on the crossroads that lie in the future path of the Lattes Platform envisioning three possible scenarios.

5.1 Path dependence

The Lattes Platform maintains its infrastructural characteristic in the Brazilian context due to its criticality. However, launching only the open data strategy hindered the platform, for example, from providing research IDs (already occupied by ORCID), communication functionalities (taken over by ASN such as ResearchGate or even more conventional social network as LinkedIn), or even new useful functions within the restricted e-portfolio proposal. The Lattes Platform fulfilled its function of providing information about scholars and the scientific communities to the government and S&T institutions. It became a critical platform for all Brazilian scholars, who registered and showcased their e-portfolios. Its success, however, could be the reason for its stagnation (lock-in!). Lattes was an early adopter of a new generation of technologies and organizational models but it was not prepared for the digital transformation that has accelerated since the 2010s, with the explosion of big data, the use of algorithms to order this same data, and the formation of collaborative platform ecosystems.

5.2 Budgetary constraints

The Lattes Platform's business model is based on public funding as it offers free-of-charge services. After it was launched, there were drastic budget reductions – the average expected budget for 2000-2003 was BRL 4.29 million and for 2017-2019, it was five times less – and this reduction tendency was worsened from 2016, probably as a result of the approval of the Constitutional Amendment (95A), capping public spending for 20 years. There is no public evidence demonstrating that CNPq has a well-developed strategy to maintain and upgrade the Lattes Platform, as in its most recent Strategic Plan there is no mention about the platform at all.

In 2019, in a conference to celebrate the Lattes Platform's 20th anniversary, the then CNPq President mentioned that:

There is a series of improvements happening (...). The serious thing to mention about Lattes [Platform] and Carlos Chagas Platform (...) is that we need to reformulate both of them. The decision we took at the beginning of this year is that in

2019 we are going to invest in Carlos Chagas Platform because it is more urgent (...) and the expectation, and I am afraid to make forecasts as the crystal ball can be a little cloudy, but the expectation until mid-2020 is that we will make these overall [changes] of Carlos Chagas and then we will start to do the same process for Lattes [Platform]. Of course, marginal changes will still happen³⁹ (Azevedo, 2019, 1h45).

Indeed, his crystal ball was cloudy. No extra budget was allocated for the Lattes Platform; rather, it was reduced. The National Strategy of Innovation published in 2020 by the Presidential Office (Brasil, 2020) and approved in 2021 (Brasil, 2021b) allocated BRL 485,000 for implementing a new platform substituting Carlos Chagas Platform⁴⁰ for 2021. There are no mentions of the Lattes Platform in that plan.

5.3 Crossroads

Overcoming the budgetary constraints and dealing with technological modernization to escape path dependence are the challenges facing the Lattes Platform directly. These two obstacles stand in the way of the platform and need to be overcome so that it redefines its new trajectory in the reality of the infrastructuralization of platforms. As it is currently a critical infrastructure, the Lattes Platform would have to be updated to stop relying solely on its enforcement power and, let's say, win over users (scholars and S&T agencies) for the service it provides. We do not believe that this necessarily implies transforming the Lattes Platform into an ASN; rather it needs to be updated and incorporate new tools that allow, for example, feedback mechanisms for users (complying with LGPD, not for surveillance purposes). There are studies on Lattes Platform usability concerned with the aspects of user performance and satisfaction which show that system inconsistencies affect users' experiences (Ramos et al., 2017); also, Google Trends data presented show that more and more ASN are being searched in Brazil.

39. In the original: "*há uma série de aprimoramentos que estão acontecendo (...). A coisa séria de se falar sobre Lattes e Carlos Chagas (...) é que precisamos renovar as duas. A decisão que a gente tomou no início desse ano foi de que, nesse ano, nós vamos investir na Carlos Chagas porque ela é mais urgente (...) e a expectativa, e eu morro de medo de fazer essas previsões porque a bola de cristal pode estar meio nebulosa, mas a expectativa é que até o meio do ano que vem a gente vai fazer todo esse overall, não é, da Carlos Chagas e aí a gente vai começar a fazer o mesmo tipo de coisa com o Lattes. Claro, as mudanças incrementais vão continuar acontecendo*".

40. Available at: <<https://bit.ly/3KrbfvP>>. Accessed on: June 1, 2021.

What the Lattes Platform seems to confirm is that we are witnessing a historic moment in which public infrastructures fragment and are complemented or supplanted by private infrastructures (Plantin et al., 2018; Plantin, Lagoze and Edwards, 2018). Van Dijck (2020) highlights how private intermediary platforms push upwards to occupy sectoral platforms, and downwards, to occupy the space of flows in the infrastructural layers of platforms. Due to this pattern of expansion, one might consider Dai, Shin and Smith (2018, p. 23) warning:

at the present stage, online platforms mainly target different stages of the scientific process, e.g. providing services for data analysis, publishing, or evaluation. As technologies, standards and protocols develop an integrated online platform that provides services across the whole scientific process (...) or integrates various other platform services (...) can be envisioned. This raises important policy questions related to the ownership, control, and access to such platforms.

On other occasions, private platforms feed on data produced on public platforms, which leads the author to consider that civil-democratic principles are being disrespected.⁴¹ Taken together, the evidence presented leads us to question whether the Lattes Platform is on an irreversible trajectory of obsolescence or whether there will be a space for it in the future configuration of digital platforms for science.

5.4 Possible scenarios?

Although it is reasonable to celebrate the Lattes Platform as a Brazilian heritage for science and technology, the combination of the lock-in effect and the budget cuts for its maintenance and modernization jeopardize the Platform. From that, we envision three possible scenarios.

In the first one, without adequate investment for its modernization and inclusion of new functionalities, users would start to overcome the lock-in through migration to other new platforms with better services offer. Little by little, the platform would lose relevance and wither away.

In another negative scenario, even with inadequate investments, CNPq would be able to maintain the mandatory use of the Lattes Platform. However, given the predictable low cost for users of having more than one platform, multihoming would be established: this way, users would use

41. "Is the incorporation of data flows generated in public sectors (e.g. schools, hospitals) permitted when they can be connected to data flows outside the public realm?" (van Dijck, 2020, p. 16). The same reasoning would apply to the GaaP practices presented in this article for the Lattes Platform.

Lattes due to its enforcement and would adopt other platforms for their value/convenience. In this scenario, the Lattes Platform would become a sort of “zombie”: dead for users and live for CNPq.

Finally, in a more positive scenario, with adequate budget and investments, Lattes Platform would be modernized and would start to attract all groups towards its ecosystem for the value it delivers.

REFERENCES

20 ANOS de Plataforma Lattes. [S.l.]: [s.n.], 2019. 1 vídeo (5 min). Publicado pelo canal CNPq Oficial. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3vFm2Nr>>.

ADAMATTI, D. F.; CASTELFRANCHI, C. A trust metric to Lattes curriculum data. **Artificial Intelligence and Applications**, p. 1-10, June 2015.

FAPESP ADOITARÁ registro ORCID ID na submissão de propostas. **Agência Fapesp**, 16 ago. 2021. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3OCT09K>>.

ARRUDA, D. et al. Brazilian computer science research: gender and regional distributions. **Scientometrics**, v. 79, p. 651-665, Jan 2009. Retrieved Mar. 2022, from: <<https://bit.ly/3xSjH4z>>.

AZEVEDO, J. L. F. Mecanismos de fomento para CT&I do CNPq e os 20 anos da Plataforma Lattes. In: REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA PARA O PROGRESSO DA CIÊNCIA, 71., 2019, Campo Grande, Mato Grosso do Sul. **Proceedings**... Campo Grande: SBPC, 2009. Retrieved from: <<https://bit.ly/3Lf3MAV>>.

BELLO, M.; GALINDO-RUEDA, F. **Charting the digital transformation of science**. Paris: OECD Publishing, 2020. (OECD Science, Technology and Industry Working Papers, n. 2020/03). Retrieved Mar. 28, 2022, from: <<https://bit.ly/3vbMIGC>>.

BORGMAN, C. L. (Ed.). **Scholarship in the digital age: information, infrastructure, and the internet**. Cambridge, United States: MIT University Press, 2007.

BRASIL. Lei nº 13.709, de 14 de agosto de 2018. Dispõe sobre a proteção de dados pessoais e altera a Lei nº 12.965, de 23 de abril de 2014 (Marco Civil da Internet). **Diário Oficial da União**, Brasília, 15 ago. 2018. Retrieved Mar. 22, 2022, from: <<https://bit.ly/3EOxsTm>>.

_____. Decreto nº 10.534, de 28 de outubro de 2020. Institui a Política Nacional de Inovação e dispõe sua governança. **Diário Oficial da União**, Brasília, v. 208, p. 5, 29 out. 2020. Seção 1. Retrieved Mar. 29, 2022, from: <<https://bit.ly/3Mt6H>>.

_____. Lei nº 14.129, de 29 de março de 2021. Dispõe sobre princípios, regras e instrumentos para o Governo Digital e para o aumento da eficiência pública. **Diário Oficial da União**, Brasília, v. 60, p. 3, 30 mar. 2021a. Seção 1. Retrieved Mar. 29, 2022, from: <<https://bit.ly/3kib8YJ>>.

_____. Resolução CI nº 1, de 23 de julho de 2021. Aprova a Estratégia Nacional de Inovação e os Planos de Ação para os Eixos de Fomento, Base Tecnológica, Cultura de Inovação, Mercado para Produtos e Serviços Inovadores e Sistemas Educacionais. **Diário Oficial da União**, Brasília, v. 139, p. 27, 26 jul. 2021b. Seção 1. Retrieved Mar. 26, 2022, from: <<https://bit.ly/399EK89>>.

BUSCH, C. et al. **Uncovering blindspots in the policy debate on platform power**. [S.l.]: European Commission, 2021. Retrieved Mar. 22, 2022, from: <<https://bit.ly/3kcRMnU>>.

CALIARI, T.; RAPINI, M. S.; CHIARINI, T. A cooperação com empresas aumenta a geração de tecnologia nas universidades? análise a partir do diretório dos grupos de pesquisa no Brasil do CNPq. **Parcerias Estratégicas**, v. 23, n. 47, p. 9-28, 2018.

_____. Research infrastructures in less developed countries: the Brazilian case. **Scientometrics**, v. 122, n. 1, p. 451-475, 2020.

CHEN, J. Y.; QIU, J. L. Digital utility: datafication, regulation, labor, and DiDi's platformization of urban transport in China. **Chinese Journal of Communication**, v. 12, n. 3, p. 274-289, 2019. Retrieved Mar. 22, 2022, from: <<https://bit.ly/3vArIbu>>.

CHIARINI, T. et al. The political economy of innovation why is Brazil stuck in the technology ladder? **Brazilian Political Science Review**, v. 14, n. 2, p. 1-39. Retrieved Mar. 22, 2022, from: <<https://bit.ly/3vdF4vd>>.

CNPQ – CONSELHO NACIONAL DE DESENVOLVIMENTO CIENTÍFICO E TECNOLÓGICO. **Plano diretor de tecnologia da informação (PDTI 2014-2016)**. Brasília: CNPq, 2014a. Retrieved Mar. 28, 2022, from: <<https://bit.ly/39hs3bC>>.

_____. **Plano estratégico 2025**. Brasília: CNPq, dez. 2014b. Retrieved Mar. 28, 2022, from: <<https://bit.ly/3k8rcfu>>.

_____. **Relatório de gestão 2020**. Brasília: CNPq, 2020. Retrieved from: <<https://bit.ly/3kXj81D>>.

COZMA, R.; DIMITROVA, D. Research gate or revolving door? Uses and gratifications of academic social media among communication scholars. **Journalism & Mass Communication Educator**, v. 76, n. 3, p. 282-296, Sept. 2021.

D'ONOFRIO, M. G. The public CV database of Argentine researchers and the "CV-minimum" Latin-American model of standardization of CV information for R&D evaluation and policy-making. **Research Evaluation**, v. 18, n. 2, p. 95-103, June 2009.

DAI, Q.; SHIN, E.; SMITH, C. **Open and inclusive collaboration in science**: a framework. Paris: OECD Publishing, 2018. (OECD Science, Technology and Industry Working Papers, n. 2018/07).

DAMACENO, R. J. P. et al. The Brazilian academic genealogy: evidence of advisor–advisee relationships through quantitative analysis. **Scientometrics**, v. 119, n. 1, p. 303-333, 2019. Retrieved Oct. 30, 2020, from: <<https://bit.ly/37M5j2V>>.

DAVID, P. A. Clio and the Economics of Qwerty. **The American Economic Review**, v. 75, n. 2, p. 332-337, May 1985. Retrieved Mar. 28, 2022, from: <<https://bit.ly/3Myky1>>.

DE NEGRI, F. et al. **Mapeamento da infraestrutura laboratorial das instituições de pesquisa do MCTI**. Brasília: MCTI, 2013. Retrieved Mar. 29, 2022, from: <<https://bit.ly/36Rb5A2>>.

DE NEGRI, F.; SQUEFF, F. de H. S. (Ed.). **Sistemas setoriais de inovação e infraestrutura de pesquisa no Brasil**. Brasília: Ipea; Finep; CNPq, 2016.

DIAS, T.; MOITA, F. Um retrato da produção científica brasileira baseado em dados da plataforma LATTES. **Brazilian Journal of Information Studies: Research Trends**, v. 12, n. 4, p. 62-74, 2018. Retrieved Mar. 28, 2022, from: <<https://bit.ly/3LhOjA2>>.

DI VAIO, A.; VARRIALE, L. Digitalization in the sea-land supply chain: experiences from Italy in rethinking the port operations within inter-organizational relationships. **Production Planning & Control**, v. 31, n. 2-3, p. 220-232, 2020. Retrieved Mar. 28, 2022, from: <<https://bit.ly/3EJBrAi>>.

DUARTE, K. B.; WEBER, R. O.; PACHECO, R. C. S. Um método orientado a propósito aplicado ao currículo Lattes para fins de concessão de fomento a pesquisadores em grupos colaborativos. **Parcerias Estratégicas**, v. 23, n. 47, p. 181-196, 2018.

FAPESP – FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO. **Edital CEPID 2021**. São Paulo: Fapesp, 2021a. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3EKH01k>>.

FERNANDES, A. C. et al. Academy–industry links in Brazil: evidence about channels and benefits for firms and researchers. **Science and Public Policy**, v. 37, n. 7, p. 485-498, Aug. 2010.

FONSECA, B. de P. F. Network analysis for science and technology management: evidence from tuberculosis research in Fiocruz, Brazil. **Plos One**, v. 12, n. 8, p. 1-17, 2017. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3va6bY5>>.

FONSECA, B. P. F.; FERNANDES, E.; FONSECA, M. V. A. Collaboration in science and technology organizations of the public sector: a network perspective. **Science and Public Policy**, v. 44, n. 1, p. 37-49, 2017.

GARCIA, R.; RAPINI, M. S.; CARIO, S. (Ed.). Estudos de caso da interação universidade-empresa no Brasil. Belo Horizonte: Cedeplar; UFMG, 2018.

GUIDINI, M. B. et al. PPSUS/RS: um estudo sobre avaliação de impacto usando abordagem quase-experimental. **Parcerias Estratégicas**, v. 23, n. 47, p. 165-180, 2018.

GÜNTHER, L. L. et al. Análise do sistema de currículo LATTES segundo modelo CESM: perspectivas para um sistema de informação para a E-science. **Perspectivas em Gestão & Conhecimento**, João Pessoa, v. 10, n. 1, p. 107-130, jan.-abr. 2020. Retrieved Mar. 29, 2022, from: <<https://bit.ly/3venNSP>>.

HILÁRIO, C. M.; GRÁCIO, M. C. C. Scientific collaboration in Brazilian researches: a comparative study in the information science, mathematics and dentistry fields. **Scientometrics**, v. 113, n. 2, p. 929-950, 2017. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3MoOv0w>>.

HILL, K. I tried to live without the tech giants. It was impossible. **The New York Times**, New York, 31 July 2020. Retrieved Mar. 29, 2022, from: <<https://nyti.ms/3MoOM3y>>.

JORDAN, K. From social networks to publishing platforms: a review of the history and scholarship of academic social network sites. **Frontiers in Digital Humanities**, v. 6, n. 5, p. 1-53, Mar. 2019. Retrieved Mar. 25, 2022, from: <<https://bit.ly/38lLxvk>>.

JUN, S.-P.; YOO, H. S.; CHOI, S. Ten years of research change using Google Trends: from the perspective of big data utilizations and applications. **Technological Forecasting and Social Change**, v. 130, p. 69-87, May 2018. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3LgQdRE>>.

KENNEY, M.; ZYSMAN, J. The rise of the platform economy. **Issues in Science and Technology**, v. 32, n. 3, p. 62-69, 2016.

LEITE, D. et al. Publish or perish? Avaliação de redes de pesquisa e colaboração com RNPE. **Parcerias Estratégicas**, Brasília, v. 23, n. 47, p. 83-102, jul.-dez. 2018.

MAJCHRZAK, A.; MARKUS, M. L. Technology affordance and constraints in management information system. In: KESSLER, E. H. (Ed.). **Encyclopedia in management theory**. London: Sage Publications Inc., 2013. p. 832-834. Retrieved Mar. 29, 2022, from: <<https://bit.ly/3rQsrnQ>>.

MANCA, S. An analysis of ResearchGate and Academia.edu as socio-technical systems for scholars' networked learning: a multilevel framework proposal. **Italian Journal of Educational Technology**, v. 25, n. 3, p. 20-34, Dec. 2017

_____. Adoption and usage of academic social networks: a Japan case study. **Scientometrics**, v. 122, n. 3, p. 1751-1767, 2020. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3OucU6O>>.

MAYER-SCHÖNBERGER, V.; RAMGE, T. (Ed.). **Reinventing capitalism in the age of big data**. New York: Basic Books, 2018.

MCMANUS, C.; NEVES, A. A. B. Production profiles in Brazilian science, with special attention to social sciences and humanities. **Scientometrics**, v. 126, n. 3, p. 1-23, 2020. Retrieved Mar. 25, 2022, from: <<https://bit.ly/3vKmCtc>>.

MCQUIRE, S. One map to rule them all? Google Maps as digital technical object. **Communication and the Public**, v. 4, n. 2, p. 150-165, June 2019. Retrieved 25 Mar, 2022, from: <<https://bit.ly/3MoMeCC>>.

MENA-CHALCO, J. P.; CESAR JUNIOR, R. M. ScriptLattes: an open-source knowledge extraction system from the Lattes Platform. **Journal of the Brazilian Computer Society**, v. 15, n. 4, p. 31-39, 2009. Retrieved Mar. 26, 2022, from: <<https://bit.ly/36NLLlg>>.

MENA-CHALCO, J. P. et al. Brazilian bibliometric coauthorship networks. **Journal of the Association for Information Science and Technology**, v. 65, n. 7, p. 1424-1445, July 2014. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3w1K1qr>>.

MILLER, P.; ROSE, N. (Ed.). **Governing the present: administering economic, social and personal life**. Cambridge: Polity Press, 2008.

MONTERO, J. J.; FINGER, M. Platformed! network industries and the new digital paradigm. **Competition and Regulation in Network Industries**, v. 18, n. 3-4, p. 217-239, 2017.

MOSCO, V. (Ed.). **Becoming digital: toward a post-internet society**. Bingley: Emerald Publishing Limited, 2017.

MUKHERJEE, R. Jio sparks disruption 2.0: infrastructural imaginaries and platform ecosystems in "Digital India". **Media, Culture & Society**, v. 41, n. 2, p. 175-195, 2019.

NASCIMENTO, M. On the "missing letter" to Lattes and the Nobel Prize in Physics. **Ciência e Sociedade**, v. 3, n. 2, p. 35-42, 2015. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3vgM8ao>>.

NECHUSHTAI, E. Could digital platforms capture the media through infrastructure? **Journalism**, v. 19, n. 8, p. 1043-1058, 2018. Retrieved Mar. 26, 2022, from: <<https://bit.ly/39kh7Kn>>.

OLIVEIRA, J. R. de; MELLO, L. C.; RIGOLIN, C. C. D. Participação feminina na pesquisa sobre tecnologia da informação no Brasil: grupos de pesquisa e produção científica de teses e dissertações. **Cadernos Pagu**, v. 58, p. 1-51, 2020. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3xU3AmN>>.

O'REILLY, T. Government as a platform. In: LATHROP, D.; RUMA, L. (Ed.). **Open government: collaboration, transparency, and participation in practice**. Sebastopol: O'Reilly Media, 2010. p. 11-50. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3ENIWay>>.

ORDUNA-MALEA, E. et al. Do ResearchGate scores create ghost academic reputations? **Scientometrics**, v. 112, n. 1, p. 443-460, 2017. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3Kg30lZ>>.

PACHECO, R.; KERN, V. Arquitetura conceitual e resultados da integração de sistemas de informação e gestão da ciência e tecnologia. **DataGramZero – Revista de Ciência da Informação**, v. 4, n. 2, p. 1-10, 2003. Retrieved Mar. 26, 2022, from: <<https://bit.ly/37EDnyc>>.

_____. Uma ontologia comum para a integração de bases de informações e conhecimento sobre ciência e tecnologia. **Ciência da Informação**, Brasília, v. 30, n. 3, p. 56-63, set./dez. 2001. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3vJBjwK>>.

PERLIN, M. S. et al. The Brazilian scientific output published in journals: a study based on a large CV database. **Journal of Informetrics**, v. 11, n. 1, p. 18-31, 2017. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3rTSAIA>>.

PERLIN, M. S.; IMASATO, T.; BORENSTEIN, D. Is predatory publishing a real threat? evidence from a large database study. **Scientometrics**, v. 116, n. 1, p. 255-273, 2018. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3rTuveF>>.

PLANTIN, J.-C.; DE SETA, G. WeChat as Infrastructure: the techno-nationalist shaping of Chinese digital platforms. **Chinese Journal of Communication**, v. 12, n. 3, p. 257-273, 2019. Retrieved Mar. 26, 2022, from: <<https://bit.ly/3F3l2WJ>>.

PLANTIN, J.-C. et al. Infrastructure studies meet platform studies in the age of Google and Facebook. **New Media & Society**, v. 20, n. 1, p. 293-310, 2018. Retrieved Mar. 27, 2022, from: <<https://bit.ly/38q7YQ3>>.

PLANTIN, J.-C.; LAGOZE, C.; EDWARDS, P. N. Re-integrating scholarly infrastructure: the ambiguous role of data sharing platforms. **Big Data & Society**, v. 5, n. 1, p. 1-14, Jan.-June, 2018. Retrieved Sept. 29, 2019, from: <<https://bit.ly/3LnDyqw>>.

PLANTIN, J.-C.; PUNATHAMBEKAR, A. Digital media infrastructures: pipes, platforms, and politics. **Media, Culture & Society**, v. 41, n. 2, p. 163-174, 2019. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3rTWgno>>.

POELL, T. Three challenges for media studies in the age of platforms. **Television & New Media**, v. 21, n. 6, p. 650-657, 2020. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3rSfvOo>>.

POELL, T.; NIEBORG, D.; VAN DIJCK, J. Platformisation. **Internet Policy Review**, v. 8, n. 4, p. 1-13, Nov. 2019. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3LlaFAU>>.

RAMOS, C. et al. Usabilidade de plataforma Lattes apresenta níveis inadequados de desempenho e satisfação do usuário. **Ergodesign & HCI**, v. 5, p. 153-165, 2017. Retrieved Mar. 27, 2022, from: <<https://bit.ly/38rRfeT>>.

RAPINI, M. S. Interação universidade-empresa no Brasil: evidências do diretório dos grupos de pesquisa do CNPq. **Estudos Econômicos**, São Paulo, v. 37, n. 1, p. 211-233, 2007. Retrieved Mar. 22, 2022, from: <<https://bit.ly/3vDsMew>>.

RAPINI, M. S. et al. The intensity of private funding and the results of university? firm interactions: the case of Brazil. **Innovation & Management Review**, v. 16, n. 2, p. 161-184, 2019. Retrieved Mar. 22, 2022, from: <<https://bit.ly/38kxrdv>>.

ROCHA, R. Lattes fora do ar pode gerar uma tragédia para a ciência, aponta pesquisadora. **CNN Brasil**, Rio de Janeiro, 28 jul. 2021. Retrieved Mar. 27, 2022, from: <<https://bit.ly/30Bn7OV>>.

RODIMA-TAYLOR, D.; GRIMES, W. W. International remittance rails as infrastructures: embeddedness, innovation and financial access in developing economies. **Review of International Political Economy**, v. 26, n. 5, p. 839-862, 2019. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3EOD27X>>.

ROSSI, L.; DAMACENO, J. P.; MENA-CHALCO, J. P. Genealogia acadêmica: um novo olhar sobre impacto acadêmico de pesquisadores. **Parcerias Estratégicas**, v. 23, n. 47, p. 197-212, 2018. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3vJRIkS>>.

ROSSI, P.; DWECK, E. Impacts of the new fiscal regime on health and education. **Reports in Public Health**, v. 32, n. 12, n. 1-5, 2016. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3MxNkfr>>.

SAMPAIO, R. B. E-Lattes: um novo arcabouço em linguagem R para análise do Currículo Lattes. **Medium**, 24 Feb. 2018. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3Mo214K>>.

SAMPAIO, R. B. et al. Scientometric analysis of research output from Brazil in response to the zika crisis using e-Lattes. **Journal of Data and Information Science**, v. 5, n. 4, p. 137-146, 2020. Retrieved Mar. 27, 2022, from: <<https://bit.ly/37G0vwf>>.

SANTIAGO, M. de O.; AFFONSO, F.; DIAS, T. M. R. Scientific production of women in Brazil. **Transinformação**, Campinas, v. 32, p. 1-11, 2020.

SELLAR, S.; GULSON, K. N. Becoming information centric: the emergence of new cognitive infrastructures in education policy. **Journal of Education Policy**, v. 36, n. 3, p. 309-326, Mar. 2019. Retrieved Mar. 27, 2022, from: <<https://bit.ly/30EhAHd>>.

SIDONE, O. J. G.; HADDAD, E. A.; MENA-CHALCO, J. P. A ciência nas regiões brasileiras: evolução da produção e das redes de colaboração científica. **TransInformação**, Campinas, v. 28, n. 1, p. 15-31, jan.-abr. 2016. Retrieved Nov. 23, 2020, from: <<https://bit.ly/3kgmYIX>>.

_____. Scholarly publication and collaboration in Brazil: the role of geography. **Journal of the Association for Information Science and Technology**, v. 68, n. 1, p. 243-258, Jan. 2017. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3MvZ8Ph>>.

SILVA, F. M.; SMIT, J. W. Organização da informação em sistemas eletrônicos abertos de informação científica & tecnológica: análise da plataforma Lattes. **Perspectivas em Ciência da Informação**, v. 14, n. 1, p. 77-98, abr. 2009. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3kfeRX6>>.

SILVA, V. J.; BONACELLI, M. B. M.; PACHECO, C. A. O sistema tecnológico digital: inteligência artificial, computação em nuvem e big data. **Revista Brasileira de Inovação**, v. 19, p. 1-31. 2020. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3vjAkEg>>.

SILVEIRA, E. da. A face perversa da plataforma Lattes. **Revista Questão de Ciência**, 27 nov. 2020. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3y0k653>>.

SRNICEK, N. (Ed.). **Platform capitalism**. Cambridge, United Kingdom; Malden: Polity Press, 2017.

STAR, S. L. The ethnography of infrastructure. **American Behavioral Scientist**, v. 43, n. 3, p. 377-391, Nov. 1999. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3vFJVEy>>.

SUZIGAN, W. et al. University and industry linkages in Brazil: some preliminary and descriptive results. **Seoul Journal of Economics**, v. 22, n. 4, p. 569-611, 2009.

SUZIGAN, W.; ALBUQUERQUE, E. da M.; CARIO, S. **Em busca da inovação**: interação universidade-empresa no Brasil. Belo Horizonte: Autêntica Editora, 2011.

TAHA, N. et al. (Ed.). **Social media shaping e-publishing and academia**. Cham: Springer International Publishing, 2017.

THELWALL, M.; KOUSHA, K. ResearchGate: disseminating, communicating, and measuring scholarship? **Journal of the Association for Information Science and Technology**, v. 66, n. 5, p. 876-889, May 2015. Retrieved Mar. 27, 2022, from: <<https://bit.ly/37G5YDh>>.

THOMAS, J.; MOHRMAN, S. A. A vision of data and analytics for the science of science policy. In: FEALING, K. H. et al. (Ed.). **The science of science policy**: a handbook. Stanford: Stanford University Press, 2011. p. 258-281.

TORRES, J. A. La gestión de la información como herramienta de planificación y toma de decisiones. In: COLOTTA, M.; DABREINCHE, S.; PRESA, A. M. (Ed.). **Políticas universitarias para el siglo**

XXI: perspectivas y temas de agenda. [S.l.]: Teseo, 2019. p. 349-366. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3vMjmgR>>.

VAN DIJCK, J. (Ed.). **The culture of connectivity**: a critical history of social media. New York: Oxford University Press, 2013.

_____. Seeing the forest for the trees: visualizing platformization and its governance. **New Media & Society**, v. 23, n. 9, p. 1-19, July 2020. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3EMSsd7>>.

VAN DIJCK, J.; POELL, T.; WAAL, M. D. (Ed.). **The platform society**: public values in a connective world. Kettering: Oxford University Press, 2018.

VELETSIANOS, G. (Ed.). **Social media in academia**: networked scholars. New York: Routledge, 2016.

VELETSIANOS, G.; JOHNSON, N.; BELIKOV, O. Academics' social media use over time is associated with individual, relational, cultural and political factors. **British Journal of Educational Technology**, v. 50, n. 4, p. 1713-1728, July 2019. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3LirKvh>>.

VELETSIANOS, G.; KIMMONS, R. Networked participatory scholarship: emergent techno-cultural pressures toward open and digital scholarship in online networks. **Computers & Education**, v. 58, n. 2, p. 766-774, Feb. 2012. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3klpLdz>>.

WELLER, M. J. (Ed.). **The digital scholar**: how technology is transforming scholarly practice. London: Bloomsbury Academic, 2011.

ZHAO, Y. et al. The evolution of platform business models: exploring competitive battles in the world of platforms. **Long Range Planning**, v. 53, n. 4, p. 101892. Retrieved Mar. 27, 2022, from: <<https://bit.ly/3klqlrL>>.

COMPLEMENTARY BIBLIOGRAPHY

GLOSSÁRIO. **Lattes**, 2022. Retrieved Mar. 22, 2022, from: <<https://bit.ly/3LgXTlp>>.

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