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# GOVTECH ECOSYSTEM: A THEORETICAL-CONCEPTUAL FRAMEWORK

## *Ecossistema de GovTech: Um marco teórico e conceitual*

## *Ecosistema GovTech: Un marco teórico-conceptual*

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## ABSTRACT

The growing interest in GovTech ecosystems reveals theoretical and methodological gaps. This study aims to advance the theoretical understanding of GovTech ecosystems by proposing a theoretical-conceptual framework. Methodologically, it relies on a systematic literature review covering the period from 2014 to 2024, conducted following the PRISMA protocol and supported by AI-assisted screening tools. GovTech ecosystems are viewed as collaborative socio-technical systems that involve actors, resources, and coordination mechanisms to generate public value. As a result, the study presents a framework connecting three design dimensions of the GovTech ecosystem: the engagement of actors, including their skills, preferences, and interaction modes; the means for developing GovTech solutions, encompassing material transformation, information and intellectual processing, and relational services; and the nature of GovTech innovations and their contribution to public value creation. This framework provides an analytical basis for future empirical research and policy-oriented analysis.
**Keywords:** innovation ecosystem, GovTech, GovTech ecosystem, systematic literature review, artificial intelligence.

## *RESUMO*

O crescente interesse pelos ecossistemas de GovTech revela lacunas teóricas e metodológicas. Este estudo tem como objetivo avançar a compreensão teórica dos ecossistemas de GovTech por meio da proposição de um *framework* teórico e conceitual. Metodologicamente, a pesquisa baseia-se em uma revisão sistemática da literatura, abrangendo o período de 2014 a 2024, conduzida de acordo com o protocolo Prisma e apoiada por ferramentas de triagem assistidas por inteligência artificial. Os ecossistemas de GovTech são conceituados como sistemas sociotécnicos colaborativos que mobilizam atores, recursos e mecanismos de coordenação para a geração de valor público. Como resultado, o estudo desenvolve um *framework* que articula três dimensões de *design* do ecossistema de GovTech: o engajamento dos atores, incluindo competências, preferências e modos de interação; os meios para o desenvolvimento de soluções GovTech, abrangendo transformação material, processamento da informação,

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processamento intelectual e serviços relacionais; e a natureza das inovações GovTech e sua contribuição para a criação de valor público. O *framework* sobre ecossistema de GovTech fornece uma base analítica para pesquisas empíricas futuras e análises orientadas a políticas públicas.
**Palavras-chave:** ecossistema de inovação, GovTech, ecossistema GovTech, revisão sistemática da literatura, inteligência artificial.

***RESUMEN***
El creciente interés en los ecosistemas GovTech revela brechas teóricas y metodológicas. Este estudio tiene como objetivo avanzar en la comprensión teórica de los ecosistemas GovTech mediante la proposición de un marco teórico y conceptual. Metodológicamente, la investigación se basa en una revisión sistemática de la literatura que abarca el período de 2014 a 2024, realizada de acuerdo con el protocolo PRISMA y apoyada por herramientas de selección asistidas por Inteligencia Artificial. Los ecosistemas GovTech se conceptualizan como sistemas sociotécnicos colaborativos que movilizan actores, recursos y mecanismos de coordinación para la generación de valor público. Como resultado, el estudio desarrolla un *framework* que articula tres dimensiones de diseño del ecosistema GovTech: el involucramiento de los actores, incluyendo competencias, preferencias y modos de interacción; los medios para el desarrollo de soluciones GovTech, que abarcan la transformación material, el procesamiento de la información, el procesamiento intelectual y los servicios relacionales; y la naturaleza de las innovaciones GovTech y su contribución a la creación de valor público. El framework sobre ecosistemas GovTech proporciona una base analítica para futuras investigaciones empíricas y análisis orientados a políticas públicas.
**Palabras clave:** ecosistema de innovación, GovTech, ecosistema GovTech, revisión sistemática de la literatura, inteligencia artificial.

## INTRODUCTION

The discussion about the innovation ecosystem phenomenon has gained popularity over the last 15 years, becoming part of the routine of many researchers, people, media, professionals, and institutions involved with entrepreneurship, technology, and innovation projects and activities (Gomes et al., 2018; Silva et al., 2024; Yang et al., 2021). This scenario reflects the growing importance attributed to the phenomenon, which can be defined as an evolving set of actors, activities, artifacts, institutions, and relationships relevant to the innovative performance of an actor or a group of actors (Granstrand & Holgersson, 2020). Given their importance, the World Economic Forum recommends using innovation ecosystems as essential policies to enhance innovation in both developed and developing countries (Russell & Smorodinskaya, 2018).

In parallel, the perennial advancement of Information and Communication Technologies (ICTs), and the rapid evolution of computing power are among the key factors for the government restructuring. Governments seek to develop and implement new solutions for the daily lives of organizations and citizens (Criado et al., 2023). In other words, the use of these ICTs aims to deliver better services effectively and transparently, while generating and acquiring new knowledge to add value and strengthen relationships between governments, citizens, and other actors (Almaiah et al., 2020). This is how the GovTech phenomenon arises (Santos et al., 2025), which relies on strategies aimed at

modernizing the public sector and increasing efficiency through the adoption of new ICTs and the development of solutions that create and provide public services in new formats or models (Davydova, 2022; Santiso, 2022; Yoshida & Thammetar, 2021).

It is important to note that e-government, digital government, and government technologies (or GovTech) share similarities, but each term encompasses different concepts and implications within the fields of Public Administration and technology. In other words, they are related but distinct stages in the digitalization of the public sector (Güler & Büyüközkan, 2023; Liva et al., 2020; Organisation for Economic Co-operation and Development [OECD], 2016), and understanding their definitions clarifies how they are connected.

Electronic government, or E-Government, is defined as the use of ICTs by government agencies to provide public services, disseminate information, and facilitate democratic processes (Kononenko, 2022). Digital government is a broad framework that integrates various digital tools and strategies to fundamentally change how public services are designed, delivered, and used, prioritizing user experience and data-driven decision-making (Silve & Moszoro, 2023). On the other hand, GovTech is an emerging concept gaining momentum in both the public and private sectors. It aims to improve public services through human-centered socio-technical solutions and data-driven processes, using emerging digital technologies and collaboration among various actors (e.g. government, startups, scaleups, Micro, Small, and Medium-Sized Enterprises, civil society, academia, and non-profit sector) to create public value that complements state capacity, prioritizing agility, user centricity, and efficiency (Amaglobeli et al., 2023; Bharosa, 2022; OECD, 2024; Santiso, 2022; Santos et al., 2025; Silve & Moszoro, 2023). GovTech also involves the development of emerging digital technologies, which are often created by organizations outside the public sector (Hoekstra et al., 2023). This distinguishes it from earlier e-government initiatives by emphasizing a more dynamic, market-driven approach to public sector innovation (Bharosa, 2022).

Academic research on GovTech is still in its early stages, with limited conceptual clarity, few empirical studies, and a lack of unified definitions or frameworks (Bharosa, 2022). Most literature (Bharosa & Janowski, 2024; Hoekstra et al., 2023; Labanava et al., 2023; OECD, 2024; Yoshida & Thammetar, 2021) indicates that GovTech has only recently entered mainstream academic discussions, leaving significant gaps in theory, design knowledge, and systematic analysis of its impact and business models. The field is characterized by fragmented constructs and a need for foundational research to support both public and private sector innovation.

In this context, this research is justified by the specific nature of public value generation through socio-technical solutions in GovTech (Hoekstra et al., 2023). Although the concept of an innovation ecosystem spans various sectors, the GovTech ecosystem is unique in that it focuses specifically on partnerships between the public sector and other actors to develop technologies that address essential social needs, such as healthcare, education, and security (Svahn et al., 2023; Yoshida & Thammetar, 2021). As highlighted by international studies (OECD, 2024), GovTech investment requires a deep understanding of how multi-sector collaboration can be structured to optimize public sector innovation.


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This involves not only the use of digital technologies, but also the mobilization of dynamic public sector capabilities to interact with external partners (Santos et al., 2025).

While the concept of innovation ecosystems is supported by a relatively consolidated and diverse body of literature, GovTech remains an emerging field, characterized by fragmented definitions, predominantly descriptive approaches, and limited conceptual systematization. Although increasingly prominent in practice and public policy discourse, GovTech lacks analytically robust and systematically derived frameworks, particularly from an ecosystem perspective. A PRISMA-based systematic literature review reveals not only the dispersion of conceptual approaches, but also the absence of integrative analytical models capable of capturing the constitutive dimensions and relational dynamics specific to GovTech ecosystems. This theoretical asymmetry and lack of synthesis constitute the central research gap this study addresses.

The research question guiding this investigation is: Based on the literature on innovation ecosystems and GovTech, which constitutive dimensions of GovTech ecosystems support the development of a conceptual analytical framework? Thus, the article aims to develop a conceptual framework for understanding GovTech ecosystems, grounded in a systematic literature review for the period 2014 to 2024. The review adopts the PRISMA methodology and leverages an Artificial Intelligence (AI) based tool to enhance the collection, screening, and analysis of relevant academic publications.

The main contribution of this research is a systematic, transparent, and replicable review strategy to integrate the consolidated literature on innovation ecosystems with still-emerging GovTech research. Building on prior contributions, including Bharosa (2022) and Carneiro et al. (2023), it systematically examines the scope, limitations, and points of convergence through structured evidence synthesis. This process enables the identification and refinement of constitutive dimensions that reflect the distinctive characteristics of GovTech ecosystems, such as the centrality of public and private actors, hybrid sociotechnical arrangements, and institutional and regulatory constraints. The resulting conceptual analytical framework represents a foundational contribution, supporting cumulative theory building and providing a coherent basis for future empirical research and policy design on the GovTech phenomenon.

In addition to this introduction, this study includes the theoretical framework in the next section, followed by the methodological procedures, and results and discussion, culminating in the presentation of the GovTech Ecosystem framework. The last section provides the final considerations.

## THEORETICAL FRAMEWORK

### Innovation ecosystem

The concept of an ecosystem originates in biology (Moore, 1999), defined as a community of organisms, living or nonliving, that inhabit an environment in a process of mutual interaction. Inspired by the concept developed in biology, Moore (1993) proposed the concept of business ecosystem, defined

as a network of organizations comprising a mutual support system and jointly evolving around an innovation, focused on the cooperation between different actors that guarantee support for a new product.

According to Gratacap et al. (2018), the context in which this definition arises is that a company is not limited to its sector. It evolves in a business ecosystem that transcends traditional industrial boundaries. Actors with diverse skills and members of a business ecosystem are all, to varying degrees, motivated by innovation or interested in the flow of innovations that irrigate the business ecosystem (intentionality). Business ecosystems, in turn, are structures dedicated to collective innovation (purpose), generally structured around one or more specific companies (governance structure), where the role is to orchestrate the dynamics of collective innovation (co-value creation) across geographic borders (internationalization).

Based on Moore's (1993) definition, other concepts have emerged linking ecosystems to specific topics in management areas (Cobben et al., 2022), including the innovation ecosystem, whose definition still lacks consensus among researchers (Akberdina & Vasilenko, 2021), despite the growing number of studies published in the area (Gomes et al., 2018). Given the diversity of conceptualizations in the literature, Table 1 uses a concept-centric approach to synthesize the main definitions and analytical perspectives on innovation ecosystems published over the last decade. Rather than aiming for an exhaustive list of authors, the table consolidates influential and recurrent conceptual contributions that capture the core dimensions and theoretical foundations of the field, thereby providing a structured overview of the current literature and supporting the study's analytical foundation.

**Table 1** – Systematization of definitions and approaches to the innovation ecosystem from 2014 to 2024

| REFERENCES | CONCEPTS AND APPROACHES |
|---|---|
| (Autio & Thomas, 2014) | Interconnected organizations centered around a platform to co-create value through innovation. |
| (Gratacap et al., 2018) | Dynamic inter-organizational structures with heterogeneous actors and emergent properties (coevolution, etc.). |
| (Carayannis et al., 2018) | Fractal and helical innovation system involving five helices (government, university, industry, society, environment). |
| (Gomes et al., 2018) | Value co-creation with interdependent actors that evolve through cooperation and competition. |
| (Bogers et al., 2019) | Network of interdependent, self-interested actors focused on joint value creation. |
| (Granstrand & Holgersson, 2020) | Set of actors, institutions, and artifacts influencing innovation performance. |

(continue)

(conclusion)

**Table 1** – Systematization of definitions and approaches to the innovation ecosystem from 2014 to 2024

| REFERENCES | CONCEPTS AND APPROACHES |
|---|---|
| (Carayannis et al., 2021) | Quadruple/quintuple helix model for social innovation and sustainable development. |
| (Youtie et al., 2023) | Firm-centered networks influenced by regional/sectoral actors and institutional structures. |
| (Jalilian & Zanjirchi, 2023) | Categorization into four systems: national, regional, sectoral, and innovation ecosystem. |
| (Carneiro et al., 2023) | Public sector innovation ecosystem is a system that mobilizes actors, components, and resources to collaboratively create and implement innovations that generate public value for society and public organizations. |
| (Silva et al., 2024) | Theoretical model emphasizing innovation process orchestration by organizations in ecosystems. |

Note: Elaborated by authors.

By analyzing the studies presented in Table 1 and considering the aim of this research, the definition of "public innovation ecosystem" was adopted. It is defined as "a system that mobilizes a set of actors, components, and resources for the creation and implementation, collaboratively, of innovations that generate value for society and public organizations" (Carneiro et al., 2023). Based on this definition, it is possible to identify and describe these actors, components, and resources related to the execution of innovation projects within the government, working collaboratively and effectively to generate public value in the public sector. Considering these findings, this choice is therefore based on the complementarity between the concepts of innovation ecosystems and GovTech, a topic that will be addressed in the next section.

## GovTech

In the logic of digitalizing public services, GovTech originates from combining technology and government concepts, considering the latter's function of providing public services (Davydova, 2022). However, it remains an embryonic term without a consolidated universal definition (Bharosa, 2022). The literature presents different ways of conceptualizing the phenomenon, which address diverse aspects related to GovTech, as shown in Table 2. This table includes all studies on GovTech identified and retained according to the criteria of the Systematic Literature Review.

**Table 2** – Systematization of GovTech concepts

| AUTHORS | CONCEPTS |
|---|---|
| (Engin & Treleaven, 2019) | It represents the "smartification" of public services. |
| (Stevens & Haines, 2020) | Government technological solution tools that can positively or negatively affect civic behavior. |
| (Yoshida & Thammetar, 2021) | Strategy for administrative efficiency through digitalization and technology; aims for simple, affordable, and efficient government. |
| (Bharosa, 2022) | Socio-technical solutions co-developed by private and public sectors to improve government service delivery. |
| (Davydova, 2022) | Tech-based public services to optimize management and foster innovation, participation, and flexibility. |
| (Santiso, 2022) | Technology-driven modernization to improve governance and combat corruption, especially in core public functions. |
| (OECD & Development Bank of Latin America and the Caribbean [CAF], 2023) | For OECD, GovTech refers to public sector collaboration with an ecosystem of start-ups, innovators and intrapreneurs to implement digital government solutions that complement existing public sector abilities for agile, user-centric, responsive and cost-effective public processes and services. |

Note: Elaborated by authors.

Davydova (2022) examines the use of intelligent regulatory tools in electoral law, emphasizing GovTech's relevance in strengthening citizen–state relationships and enhancing electoral processes. Santiso (2022) analyzes how GovTech-driven digital reforms contribute to anti-corruption efforts, stressing that data integrity and process automation are effective when led by technologically skilled actors.

Huang et al. (2020) approached GovTech from the perspective of tracking the COVID-19 transmission route in Singapore. They compared the performance of two tools, TraceTogether, a smartphone application, and a wearable tag-based real-time localization system (RTLS). The goal was to validate these tools against electronic medical records from the National Center for Infectious Diseases (NCID), the country's national reference center for COVID-19 screening.

Engin and Treleaven (2019) analyze GovTech as a driver of the "smartification" of public services, enabled by data science technologies such as AI, IoT, big data, and blockchain, and fostering a new generation of startups. Similarly, Stevens and Haines (2020) emphasize the technological nature of GovTech but highlight the importance of establishing clear parameters before implementation to prevent unintended consequences.

Yoshida and Thammetar (2021) approach GovTech from the strategic point of view of government supported by the digitalization of processes and the development of new technologies to modernize the provision of public services. This supports the neologism proposed by Engin and Treleaven (2019),

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who introduce the term "smartification" of public services as a new panorama to which government services must parameterize and adapt. Bharosa (2022) proposes a conceptual framework for examining GovTech, including a research agenda inspired by theory and practice. The author presents a conceptual model that connects four interrelated areas of GovTech design: institutional, governance, technical, and person-centered.

Based on the presented perspectives and given the undefined concept in the literature, this study proposes and adopts the following definition of GovTech: a sociotechnical innovation solution developed through collaboration between public and private organizations to generate public value.

It is important to note that for GovTech to effectively increase the efficiency, transparency, and inclusivity of the public sector, its design and implementation must align private sector interests with the fundamental objective of achieving a "citizen-oriented" digital transformation (Santos et al., 2025). However, given the frequently adversarial nature of the interests held by the state and private sector providers, the generation of social benefits derived from GovTech depends on establishing a suitable market framework. This requires enforcing appropriate property rights and robust regulatory oversight (Silve & Moszoro, 2023).

Govtech is related to public sector innovation, particularly in enhancing service delivery and responsiveness to citizens' needs (Boiko, 2024). The theoretical integration of innovation ecosystems and GovTech ecosystems is predicated on the state's role as an orchestrator of mission-driven innovation activities (Misuraca & Viscusi, 2015). Recent research demonstrates that public sector innovation emerges through multi-stakeholder interactions where governments simultaneously perform demand-shaping, regulatory, and enabling functions to direct technological solutions toward societal challenges (Carneiro et al., 2023; Mazzucato et al., 2020). In GovTech ecosystems, this interdependence between institutional capacities, entrepreneurial actors, and digital infrastructure creates sociotechnical arrangements focused on generating public value (OECD, 2024). Crucially, these ecosystems constitute specialized innovation configurations distinguished by their explicit public-purpose orientation, co-creative governance mechanisms, and institutional embeddedness – thereby substantiating their conceptual alignment with broader innovation frameworks (Ansell & Torfing, 2021; World Bank, 2022).

## METHODOLOGICAL ASPECTS

We used the PRISMA 2020 statement (Page et al., 2021) to develop the systematic literature review. It allows the identification, selection, evaluation, and transparent synthesis of the studies that comprise the sample analyzed through different items. The PRISMA framework includes an item checklist and a flow diagram.

We selected the Web of Science (WOS), Scielo, Science Direct, and Spell databases to collect articles. The selection of databases was guided by their relevance and comprehensiveness, which bring together peer-reviewed scientific publications with recognized impact and validity in the field of study. They were chosen to ensure the quality and reliability of the sources used.


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In addition, we used the paid version of the AI-based SciSpace tool to explore studies not found through traditional searches in academic databases. According to Jain et al. (2024) and Nikolic et al. (2024), SciSpace is a multifaceted solution to streamline literature and document review processes. Using technologies such as vector-based search, reranking, and large language models, the tool offers customizable results, AI assistant integration, multilingual support, and key article insights. These features help meet researchers' needs and accelerate literature exploration. In addition, sharing and documentation features optimize the reach and depth of research. The platform also enabled efficient identification of relevant articles, especially the most recent ones, and offers intelligent summarization and paraphrasing tools.

After defining the databases, we established the following descriptors to conduct the searches: (1) "*ecossistema de inovação*" OR "innovation ecosystem" and (2) "GovTech.". The term "innovation ecosystem" was incorporated to underscore the early state of research on the GovTech phenomenon. Although the search for "GovTech" was conducted separately for methodological reasons, this did not imply conceptual isolation. The term was searched independently only to identify studies that explicitly use this label. Given its emerging nature, GovTech must still be understood within the broader systemic context in which it develops — the innovation ecosystem. However, based on the adopted search criteria, no studies were identified that address innovation ecosystems and GovTech jointly. Within the scope defined by the selected databases, keywords, and inclusion criteria, the two topics appear in the literature as analytically separate streams. This conceptual framing enables a more comprehensive analysis of the interdependencies, institutional arrangements, and multi-actor dynamics that shape the design, implementation, and scaling of GovTech solutions. We conducted the searches in March 2024 considering the following operationalization criteria: (a) the defined descriptors should appear in the title, abstract, and/or keywords; (b) only articles published in peer-reviewed scientific journals would be included; (c) the works should be published between 2014 and 2024, ensuring coverage of the most recent and relevant developments on the topic; and (d) books, dissertations, and theses were excluded. Using these criteria, we found 1,610 articles on "*ecossistema de inovação*" and "innovation ecosystem" and 17 on "GovTech."

We exported records of search results from databases and Scispace as .RIS format file to the Mendeley manager, which made it possible to identify and manage duplicates. After removing duplicates, the sample was reduced to 1,084 works related to the innovation ecosystem topic and seven on GovTech. Table 3 summarizes the results.

**Table 3** – Number of articles found in each database

| DATABASE / DESCRIPTOR | ECOSSISTEMA DE INOVAÇÃO/ INNOVATION ECOSYSTEM | GOVTECH |
|---|---|---|
| WOS | 1,102 | 10 |
| Scielo | 17 | 1 |
| Science direct | 311 | 1 |
| Spell | 90 | 0 |
| SciSpace | 90 | 5 |
| Total | 1,610 | 17 |
| Selected after eliminating duplicates | 1,084 | 7 |
| Selected after reading title, abstract, and keywords | 1,024 | 7 |
| Selected after pertinence analysis | 117 | 7 |

Note: Elaborated by authors.

After screening for duplicate works, we thoroughly analyzed titles, abstracts, and keywords to identify articles with "innovation ecosystem" and "GovTech" as their central themes. At this stage, a triangulation process was conducted among four researchers to enhance the rigor and reliability of the review. We analyzed the selected articles independently using Rayyan, a specialized platform that facilitates collaboration and streamlines the screening process in systematic literature reviews. The use of the platform aimed to avoid any bias in the selection since more than one researcher scrutinized the texts. Of the articles selected for analysis, we chose 1,024 articles on the innovation ecosystem and seven articles on GovTech for a complete reading. In the final selection stage, the inclusion criterion required that the study substantively address one or both central themes — the innovation ecosystem and GovTech. Studies that did not align with the research scope were excluded, as well as those that discussed innovation without establishing a direct connection to the innovation ecosystem or GovTech. From these, we included only 117 articles on the innovation ecosystem in the systematic review. Considering the small number of works on GovTech, we selected all studies for the final sample.

We used the following tools to conduct the analyses: a Google Docs spreadsheet, where aspects relevant to each topic were listed and recorded and the Scispace platform, to assist in analyzing related topics. Each author was responsible for investigating each topic within a specific set of articles and registering the results in the spreadsheet. In parallel, we conducted manual analyses to investigate flaws and correct results yielded by Scispace that were not trustworthy.

To support the GovTech ecosystem framework proposal, we conducted a qualitative Content Analysis following Saldaña's (2021) coding protocol, encompassing data familiarization, first- and second-cycle coding, categorization, and analytic synthesis. The screening and coding of the selected

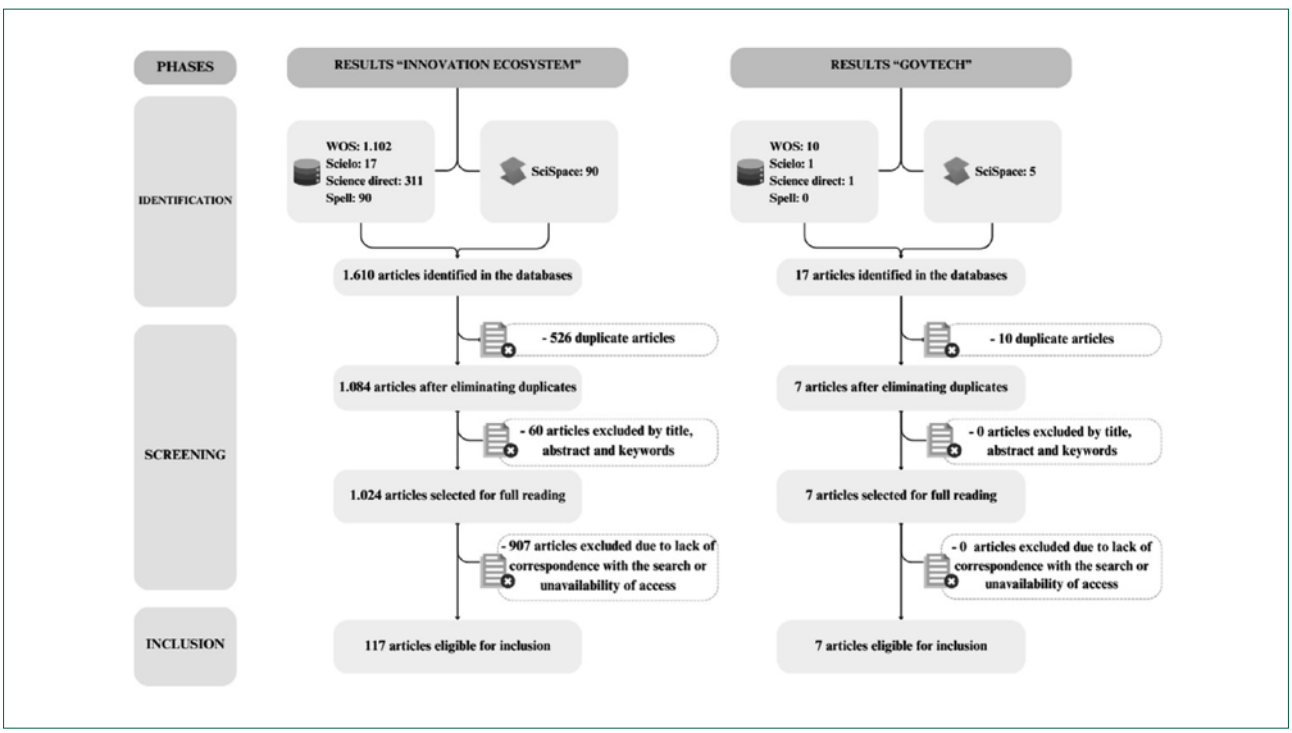
articles were supported by the AI-assisted platform Rayyan, which enabled the systematic identification of recurrent patterns, analytical emphases, and conceptual convergence across the corpus.

The analysis was guided by theoretically informed dimensions derived from the literature: (i) GovTech categories (Bharosa, 2022; Davydova, 2022; Santiso, 2022); (ii) actors involved (Carneiro et al., 2023; Carayannis et al., 2018; Gomes et al., 2018), including their skills and preferences (Carneiro et al., 2023); (iii) interaction modes within the ecosystem (Carneiro et al., 2023); (iv) means for developing GovTech solutions, such as instruments, mechanisms, and policy tools (Bharosa, 2022; Carneiro et al., 2023); and (v) public value generation associated with GovTech initiatives (Bharosa, 2022; Carneiro et al., 2023).

In parallel, the coding process allowed for the identification of the theoretical models with the highest analytical adherence to the GovTech ecosystem phenomenon. Among the reviewed studies, the conceptual frameworks proposed by Bharosa (2022) and Carneiro et al. (2023) emerged as the most integrative, providing the clearest explanatory alignment with the dimensions identified in the literature. We systematized the coded data in structured spreadsheets and subsequently analyzed to assess frequency, co-occurrence, and theoretical coherence, supporting the selection of these frameworks as the primary analytical references for the proposed GovTech Ecosystem framework.

To facilitate visualization of the results achieved, we created tables, graphs, and images. Figure 1 summarizes the steps and results of the literature selection process.

**Figure 1** – PRISMA 2020 flow diagram to present the study selection process




Note: Adapted from Galvão et al., 2022.

Section 4 presents and analyzes the results of the systematic review and presents the conceptual framework of the GovTech ecosystem.

## RESULTS PRESENTATION AND ANALYSIS

### GovTech and innovation ecosystem: Proposition of a conceptual framework

The systematic review demonstrated that, in addition to the predominant technological character related to the discussion on innovation ecosystems and GovTech, we observed the need for a holistic and social perspective (Bharosa, 2022). This perspective explains the complexity of the system and consolidates the most relevant issues related to the GovTech ecosystem.

Therefore, to explain the phenomenon, we identified that the ecosystem aims to provide GovTech solutions by integrating different actors, such as government, startups, S&IT institutions, investors, and citizens, among others (Jalilian & Zanjirchi, 2023; Yoshida & Thammetar, 2021). As this is technological innovation within the public sector, governments must act as facilitators and regulators of GovTech by developing policies, regulatory frameworks, and infrastructures that promote it (Santiso, 2022). For this ecosystem to function effectively, it is necessary to mobilize human, technological, financial, and information resources (Janowski et al., 2018), as well as promote a culture of collaboration and sharing of resources and information among stakeholders (Bharosa & Janowski, 2024; Silva et al., 2024). This results in a synergy among these elements that is essential for promoting innovation in the public sector and delivering tangible public value for society (Gomes et al., 2018; Bogers et al., 2019).

Table 4 summarizes the primary dimensions, categories, and theoretical references identified in the literature as a result of the Content Analysis: GovTech categories, actors involved in the respective ecosystem, the skills and preferences they use, interaction modes and means used by these stakeholders and the public value generated by GovTech solutions.

**Table 4** – Dimensions and categories related to the GovTech ecosystem

| DIMENSIONS | CATEGORIES | REFERENCES |
|---|---|---|
| **GovTech categories** Bharosa (2022) | **Public service delivery** (e.g., digital public services); **Digital transformation and decision automation** (e.g., AI in process automation, open government platforms); **B2G partnerships** (e.g., GovTech startups co-developing solutions); **Data-driven policy-making** (e.g., use of open data and analytics for public decisions); **Intelligent monitoring and anti-corruption** (e.g., digital audit systems, real-time supervision tools). | Bharosa (2022); Davydova (2022); Santiso (2022). |

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**Table 4** – Dimensions and categories related to the GovTech ecosystem

| DIMENSIONS | CATEGORIES | REFERENCES |
|---|---|---|
| **Actors involved (competencies and preferences)** Carneiro et al. (2023) | Public sector; Private sector; Third sector; Society. | Bharosa (2022); Carneiro et al. (2023); Autio and Thomas (2014); Gratacap et al. (2018); Carayannis et al. (2018); Gomes et al. (2018). |
| Interaction modes Carneiro et al. (2023) | Information providers; Co-developers; Developers; Networks; Stakeholders; Collaboration and competition between actors. | Carneiro et al. (2023); Autio and Thomas (2014); Gratacap et al. (2018); Carayannis et al. (2018); Gomes et al. (2018); Bogers et al. (2019); Granstrand and Holgersson (2020). |
| **Means for developing GovTech solutions** Bharosa (2022); Carneiro et al. (2023) | **Information processing** (e.g., AI chatbots, robo-advisors, blockchain for public record security and smart contracts, digital platforms, value-sensitive design); **Knowledge processing** (e.g., design thinking, user journey mapping, audit schemes, regulatory frameworks, standardization); | Engin and Treleaven (2019); Granstrand and Holgersson (2020); Bharosa (2022); Carneiro et al. (2023). |
| **Public value Generation** Bharosa (2022); Carneiro et al. (2023) | **Outcome dimensions** such as **user satisfaction, quality, efficiency, efficacy, transparency, trust, sustainability, and social impact**, supported by policies (e.g., innovation acquisition, GovTech acceptance), and tools (e.g., apps, APIs, digital wallets, services). | Carneiro et al. (2023); Bharosa (2022); Autio and Thomas (2014); Gomes et al. (2018); Bogers et al. (2019). |

Note: Elaborated by authors.

The theoretical foundation defined in the previous sections suggests that the constructs "Innovation ecosystem" and "GovTech" are characterized by diversity and conceptual ambiguity, explaining a research gap in their interrelationship (Bharosa, 2022). To fill this gap, in this research, we define the "GovTech ecosystem" as the system that collaboratively mobilizes a set of actors, components, and resources to develop socio-technical innovations that generate public value.

Concerning the interaction between the two topics, this article proposes a new conceptual model based on the research selected and displayed in Table 4, as they present greater adherence to explaining the GovTech ecosystem phenomenon. The Content Analysis carried out showed that the approach taken by Carneiro et al. (2023) presents a proposal for conceptual and applied representation through the matrix framework of the public innovation ecosystem, comprised of seven main dimensions: ecosystem

actors; nature or role of the actor in the ecosystem; skills and preferences of multiple actors; means for innovation; nature of innovation; and the public value added with innovation, as shown in Table 5.

**Table 5** – Conceptual framework of the public innovation ecosystem

| ECOSYSTEM ACTORS | NATURE OF THE ACTOR | COMPETENCIES | PREFERENCES | MEANS FOR INNOVATION | | | | NATURE OF INNOVATION | PUBLIC VALUE GENERATION |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Material transformation | Information processing | Intellectual knowledge processing | Contact or relational service | | |
| Organization 1 (reference) | S1<br>S2<br>[...] | | | | | | | | |
| Organization 2 (another public, private, or non-profit organization) | S1<br>[...] | | | | | | | | |
| Organization 3 | S1<br>S2<br>[...] | | | | | | | | |
| Other actors [...] | | | | | | | | | |

Note: Adapted from Carneiro et al., 2023.

Table 5 presents the convergences that provide opportunities for theoretical-conceptual integration with the primary common elements we need to consider when analyzing innovation ecosystems in the governmental context to generate public value for society, as proposed by Carneiro et al. (2023). The matrix reflects public innovation as a product of a dynamic and collaborative system of multiple public agents and organizations: resources and organizational capabilities for innovation related to structures and mechanisms to coordinate efforts for innovation, defined as means for innovation (operations, functions, and technologies associated with the services); preferences, skills, and modes of interaction of the multiple actors who innovate in this context; attributes of the innovation generated, called the nature of innovation; and finally, public value generation, which translates into the desired results with innovation development and implementation.

Bharosa's (2022) conceptual framework stands out for indicating the four areas of GovTech design: governance, institutional, technological, and people-centered, as summarized in Table 6.

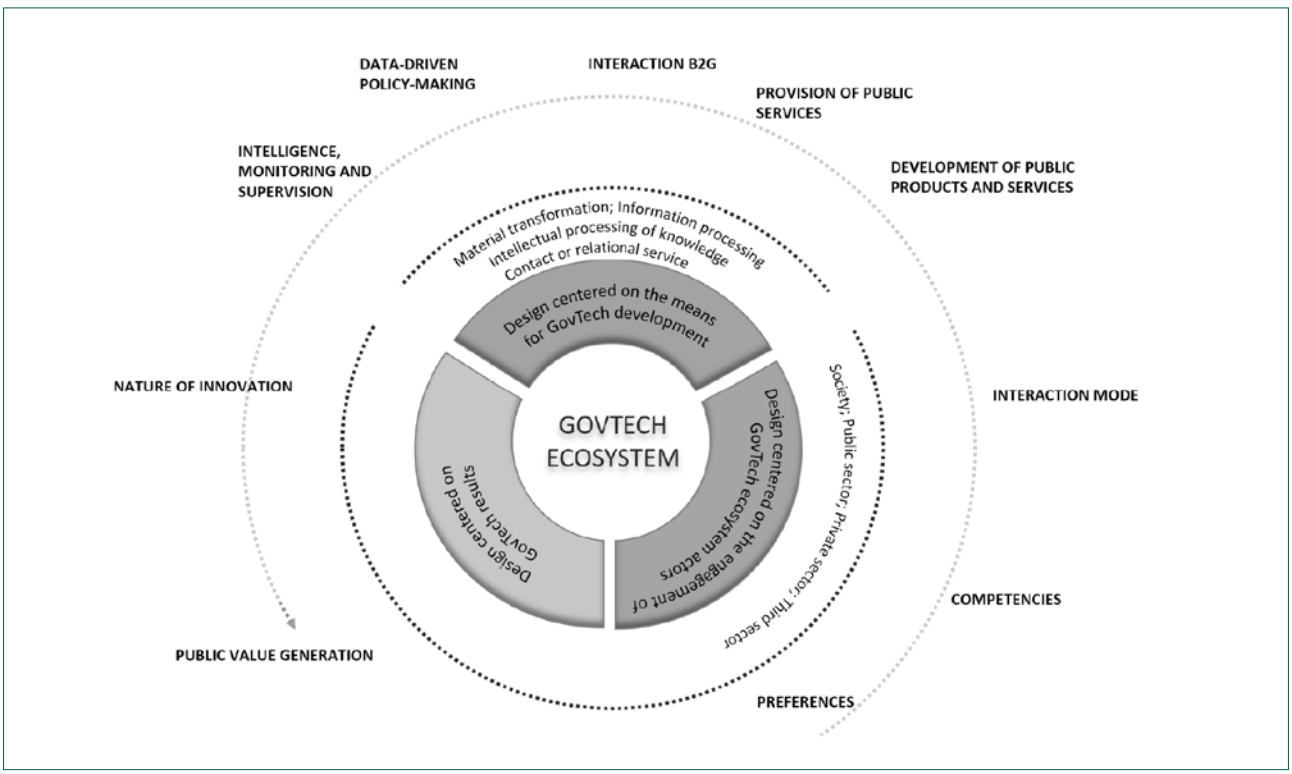
**Table 6** – Conceptual framework for GovTech design and governance

| AREAS | OBJECTIVES | OUTPUTS |
|---|---|---|
| Governance design | To collectively shape decision-making structures, departments, and mandates for GovTech co-creation and transition. | Innovation coalitions, agreements, governance, and business models. |
| Institutional design | To define or develop legal and policy arrangements that legitimize and regulate GovTech design, procurement, and delivery. | Trust frameworks, acceptance policies, audit schemes, certification programs, and innovation procurement policies. |
| Technological design | To develop interoperable digital components aligned with other design areas. | Architectures, APIs, algorithms, applications, digital wallets, services, and distributed ledgers. |
| People-centered design | To understand user needs, ensure ethical design, and involve users in GovTech development. | Empathy maps, user journey models, value hierarchies, design standards, and harm-prevention guidelines. |

Note: Adapted from Bharosa, 2022.

Considering the theoretical frameworks of Carneiro et al. (2023) and Bharosa (2022), Figure 2 presents the conceptual framework for analyzing the GovTech ecosystem, designed to highlight the interconnections of the concepts under analysis and provide a comprehensive view of the phenomenon.

**Figure 2** – Conceptual framework of the GovTech ecosystem




Note: Research results.

To provide a holistic view of the dynamics involved in the development and implementation of innovative socio-technical solutions in the government context, the GovTech ecosystem conceptual framework (Figure 2) establishes three macro dimensions arising from content analysis of the models by Bharosa (2022) and Carneiro et al. (2023): i) Design centered on the engagement of ecosystem actors; ii) Design centered on the means for GovTech development; and, iii) Design centered on GovTech results.

The macro dimension "Design centered on the engagement of ecosystem actors" covers the categories of actors (public sector, private sector, third sector, and society) that can be involved in GovTech projects. In addition to these categories of actors, the framework presents related dimensions: (a) skills, which relate the knowledge, abilities, and attitudes of those involved with the phenomenon; (b) preferences, which translate into individual, contextual, and organizational factors that motivate actors' engagement; and (c) interaction mode, which presents the primary roles and conditions of their relationship.

The macro dimension "Design centered on the means for GovTech development" (such as operations, functions, interactions, and technologies associated with products and services) involves the functioning and resources of the ecosystem. It comprises four groups of operations (Carneiro et al., 2023): (a) Material transformation, which regards material and logistic modification; (b) Information processing, associated with retaining and processing information in a coded format; (c) Intellectual processing of knowledge, which corresponds to processing knowledge through standardized routines and methods; and (d) Contact or relational service, through which relationships are established with multiple actors and means of contact, among which collaboration aspects stand out.

The macro dimension "Design centered on GovTech" lists the primary characteristics of innovative socio-technical GovTech solutions, which translate into the dimensions Nature of innovation and Public value generation derived from developing these solutions through ecosystem actors.

Based on the framework and concepts presented, we conclude that the GovTech ecosystem comprises a set of macro dimensions and characteristics intrinsic to each, essential to the configuration and achievement of the objectives established for this context. Therefore, these ecosystems should be analyzed broadly and holistically, as proposed here, before and during the planning and implementation of initiatives. This approach enables innovative GovTech solutions to become a solid pillar for constantly improving public services systematically and the continuous generation of public value for society.

## FINAL CONSIDERATIONS

This study aimed to answer the central question: Based on the literature on innovation ecosystems and GovTech, which constitutive dimensions of GovTech ecosystems support the development of a conceptual analytical framework? To address this question, we conducted a systematic literature review supported by the PRISMA protocol and SciSpace tools, ensuring methodological transparency and analytical rigor, which resulted in the development of an analytical framework for examining GovTech ecosystems.

Our findings revealed a multiplicity of perspectives and overlapping definitions concerning both the innovation ecosystem and GovTech phenomena. For innovation ecosystems, we adopted Carneiro et al.'s (2023) definition of the public innovation ecosystem as it aligns with the object of study. For GovTech, we proposed a synthesized definition derived from recurrent elements identified in the literature, framing it as a socio-technical innovation solution developed collaboratively by public and private organizations to generate public value (Bharosa, 2022; Davydova, 2022). Based on this conceptualization and the theoretical and methodological gaps identified, we defined the GovTech ecosystem as the system that mobilizes a set of actors, components, and resources, collaboratively, to develop socio-technical innovations that generate public value.

Regarding the research question, the literature review enabled a deeper analysis of the intersections between innovation ecosystem theories and the emerging body of work on GovTech. The frameworks developed by Carneiro et al. (2023) and Bharosa (2022) served as conceptual anchors for the framework proposed in this article. As a result, we developed a model outlining three design dimensions of the GovTech ecosystem: the engagement of actors (including skills, preferences, and interaction modes), the means for developing GovTech solutions (material transformation, information processing, intellectual processing, and relational service), and the nature of GovTech innovations and their contribution to public value creation. The framework offers a structured analytical tool that can support academic inquiry and inform public policies aimed at fostering innovation.

Despite its contributions, the study has limitations. The systematic review relied on specific databases and search strategies, which may not capture all relevant publications in a field characterized by terminological diversity and conceptual overlap with digital government, public innovation, and civic technology. Furthermore, the framework proposed here is primarily theoretical and requires empirical validation. Finally, given the rapid evolution of GovTech practices and narratives, conceptual definitions and ecosystem configurations may change over time, warranting ongoing refinement.

Therefore, future research should apply the proposed framework to empirical cases using qualitative, quantitative, or mixed-methods approaches to verify, adjust, or expand its dimensions and variables. Comparative analyses across national and regional contexts also represent promising avenues for understanding how institutional capacities, policy instruments, and innovation cultures influence the development of GovTech ecosystems. Such efforts can help consolidate GovTech as a robust field of theoretical and empirical inquiry.

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## CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

## DATA AVAILABILITY

The entire anonymized dataset supporting the findings of this study has been made available on SciELO Data and can be accessed at https://doi.org/10.48331/SCIELODATA.C1LGQ4.

## AUTHORS' CONTRIBUTION

Nathália de Melo Santos: Conceptualization; Data curation; Formal analysis; funding acquisition; Investigation; Methodology; Project administration; Supervision; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.

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Mauro Célio Araújo dos Reis: Data curation; Formal analysis; Investigation; Methodology; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.

Darlla Layse Torres de Lima: Data curation; Formal analysis; Investigation; Methodology; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.


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