Revista Ibero-Americana de Estratégia
Iberoamerican Journal of Strategic Management

C O P E
JM14473

OPEN ACCESS

e-ISSN: 2176-0756
https://doi.org/10.5585/2025.25866
Received: 15 Jan. 2024 / **Approved:** 25 Sept. 2024
Evaluation Process: Double Blind Review
Editor in Chief: Heidy Rodriguez Ramos
Co-editor: Ivano Ribeiro

Check for updates

Cyberspace as Asset Specificity

Marcia C. Rossi[1a] **Faïz Gallouj**[2b] **and Gilberto Perez**[3c]

[1,3] Universidade Presbiteriana Mackenzie, São Paulo, SP, Brazil

[2] Université de Lille - Lille, France

Summary

Objective: This article proposes cyberspace as the seventh asset specificity in Transaction Cost Theory. To support this view, this article aims to answer the following interconnected questions: (i) what are the characteristics of cyberspace? (ii) what possible forms can it take considering the convergence between asset specificities in the physical and digital environments?
Methodology: This article adopts theoretical and analytical methods, with an analysis of the literature dedicated to Transaction Costs and Cyberspace.
Originality: Cyberspace is proposed as the seventh asset specificity in Transaction Cost Theory, expanding the traditional framework to include digital environments. Unlike conventional assets, cyberspace introduces a triad of connectivity, interactivity, and visibility, serving as a medium and as asset specificity that influences business models. This new asset accentuates the role of cyberspace in transaction costs and managing uncertainty within increasingly digitalized economies.
Theoretical contributions: Cyberspace has the potential to integrate transaction cost theory, highlighting the management of specific assets - constituting a broad field for empirical research. In addition, it is proposed that cyberspace is correlated with the evolution of Service Innovation Theory, discussed in depth by Gallouj and Djellal (2010, 2018 and 2023).
Managerial contributions: The relevance of cyberspace as an asset specificity is emphasized, enabling managers to understand better and manage uncertainty when making specific investment decisions. These elements are essential for establishing unique characteristics, promoting efficiency, reducing transaction costs, and managing uncertainty.

Keywords: cyberspace, asset specificity, connectivity, interactivity, visibility

Authors' notes

Conflict of interest: The authors have not declared any potential conflicts of interest
Corresponding author: Marcia C. Rossi - contato@marciarossi.com

Cite as / Como citar

American Psychological Association (APA)

Rossi, M. C., Gallouj, F., & Perez, G. (2025, Jan./Apr.). Cyberspace as Asset Specificity. *Iberoamerican Journal of Strategic Management (IJSM)*, *24*(1), 1-38, e25866. https://doi.org/10.5585/2025.25866

(ABNT – NBR 6023/2018)

ROSSI, M. C.; GALLOUJ, F.; PEREZ, G. Cyberspace as Asset Specificity. *Iberoamerican Journal of Strategic Management (IJSM)*, v. 24, n. 1, p. 1-38, e25866, Jan./Apr. 2025. https://doi.org/10.5585/2025.25866

[a] PhD in Business Administration and Master in Business Controllership. Professor of Financial Controllership in the MBA programs at USP ESALQ, as well as in the MBA programs in Strategic Business Management and Valuation at FECAP and Mackenzie Presbyterian University
[b] PhD in Economic Sciences Professor of Economics (Exceptional Class) at the University of Lille and Director of the Master's Program in Management of Innovative Enterprises. He is a member of RESER (European Association for Research on Services) and editor-in-chief of the European Review of Service Economics and Management
[c] Associate Professor at the University of São Paulo. Adjunct Professor in the Stricto Sensu Graduate Program in Administration (PPGA) at Mackenzie Presbyterian University

Resumo

Ciberespaço como Especificidade de Ativos

Objetivo: Este artigo propõe o ciberespaço como a sétima especificidade de ativos na Teoria dos Custos de Transação. Para apoiar essa visão, este artigo visa responder às seguintes perguntas interconectadas: (i) quais são as características do ciberespaço, (ii) que formas possíveis ele pode assumir, considerando a convergência entre as especificidades de ativos nos ambientes físico e digital?
Metodologia: Este artigo adota métodos teóricos e analíticos, com uma análise da literatura dedicada aos Custos de Transação e ao Ciberespaço.
Originalidade: O ciberespaço é proposto como a sétima especificidade de ativo na Teoria dos Custos de Transação, expandindo a estrutura tradicional para incluir ambientes digitais. Diferentemente dos ativos convencionais, o ciberespaço introduz uma tríade de conectividade, interatividade e visibilidade, servindo como meio e como especificidade de ativo que influencia os modelos de negócios. Esse novo ativo acentua a função do ciberespaço nos custos de transação e na gestão da incerteza em economias cada vez mais digitalizadas.
Contribuições teóricas: O ciberespaço tem o potencial de integrar a teoria dos custos de transação, destacando a gestão de ativos específicos - constituindo um amplo campo para a pesquisa empírica. Além disso, propõe-se que o ciberespaço esteja correlacionado com a evolução da Teoria da Inovação em Serviços, discutida em profundidade por Gallouj e Djellal (2010, 2018 e 2023).
Contribuições gerenciais: Enfatiza-se a relevância do ciberespaço como uma especificidade de ativos, permitindo que os gerentes compreendam melhor e gerenciem a incerteza ao tomar decisões específicas de investimento. Esses elementos são essenciais para estabelecer características únicas, promover a eficiência, reduzir os custos de transação e gerenciar a incerteza.

Palavras-chave: ciberespaço, especificidade do ativo, conectividade, interatividade, visibilidade

Resumen

El ciberespacio como Especificidad de los Activos

Objetivo: Este artículo propone el ciberespacio como la séptima especificidad de los activos en la Teoría de los Costes de Transacción. Para apoyar esta opinión, este artículo pretende responder a las siguientes preguntas interconectadas: (i) ¿cuáles son las características del ciberespacio?; (ii) ¿qué posibles formas puede adoptar teniendo en cuenta la convergencia entre las especificidades de los activos en los entornos físico y digital?
Metodología: Este artículo adopta métodos teóricos y analíticos, con un análisis de la literatura dedicada a Costes de Transacción y Ciberespacio.
Originalidad: Se propone al ciberespacio como la séptima especificidad de activo en la Teoría de los Costes de Transacción, ampliando así el marco tradicional para incluir los entornos digitales. A diferencia de los activos convencionales, el ciberespacio introduce una tríada de conectividad, interactividad y visibilidad, actuando tanto como medio como especificidad de activo que influye en los modelos empresariales. Este nuevo activo resalta de manera significativa el papel fundamental del ciberespacio en la reducción de costes de transacción y en la gestión de la incertidumbre en economías cada vez más digitalizadas.
Aportaciones teóricas: El ciberespacio tiene el potencial de integrar la teoría de los costes de transacción, destacando la gestión de activos específicos - constituyendo un amplio campo para

la investigación empírica. Además, se propone que el ciberespacio está correlacionado con la evolución de la Teoría de la Innovación en Servicios, discutida en profundidad por Gallouj y Djellal (2010, 2018 y 2023).
Aportaciones gerenciales: Se destaca la relevancia del ciberespacio como especificidad de un activo, lo que permite a los gestores comprender mejor y gestionar la incertidumbre a la hora de tomar decisiones específicas de inversión. Estos elementos son esenciales para establecer características únicas, promover la eficiencia, reducir los costes de transacción y gestionar la incertidumbre.

Palabras clave: ciberespacio, especificidad activo, conectividad, interactividad, visibilidad

Introduction

Understanding how firms are being created and structured, and explaining their diversity, behavior, and limits has been an objective to reaching a coherent understanding of organizations in the economy. This search was initiated by Ronald Coase (1937) who asked the question “Why does the firm exist?”, a primary, simple and non-trivial question, which was later deepened by Williamson (1985). This question came to constitute a broad field of research triggered to reduce transaction costs.

Transaction Cost Theory (TCT) is gaining prominence due to the growing complexity and expansion of markets through cyberspace. Indeed, companies must seek compliance and quality in their processes, and their managers have realized that sustainability is a non-isolated action necessary to managing opportunities and mitigating risks, whether related to the business itself or arising from its value chain (Rayport & Sviokla, 1995).

Cyberspace is a complex socio-technical system that results from the interaction between humans and technologies. The growing complexity and non-linear behavior of this system increase the probability of uncertain events while businesses are launched and boosted. However, the literature does not yet have a complete understanding of how economic and political factors interact in this complex context (Dunn Cavelty & Wenger, 2022).

This new socio-technical environment encompasses a wide range of theories to be discussed, including e-business, non-fungible tokens (NFT), and the metaverse encapsulating the innovations emerging from this environment (Park & Kim, 2022). However, delimiting cyberspace is not a simple task. No theory or traditional management practice can thoroughly explain its potential.

Some studies have highlighted that the lack of clarity in the definition of terms related to operations in cyberspace, or even the lack of a straightforward terminological convention, is a barrier to economic, political, and social interoperability (Douzet, 2014; Janczewski et al., 2019). This terminological ambiguity can hinder international cooperation, compromise the effective formulation of laws and regulations, and delay the development of secure and effective technologies. In contrast, the ease of access and the wide variety of online resources have made cyberspace widely used for personal and business purposes.

Statistical data clearly illustrate the significant growth in online sales of products and services in international trade over the 2014-2023 period. This segment grew an average of 42% per year and is estimated to grow by 56%, reaching about 8.1 trillion dollars by 2026 (Statista, 2022).

Given the evolution of business models and how transactions are carried out, identifying and understanding the specificities of the assets that permeate cyberspace can be challenging. Practical observations using Transactional Cost Theory (TCT) make it possible to guide the choice of effective governance control to minimize risks in these transactions. TCT offers three dimensions of analysis that identify the best governance controls for this purpose: asset specificity, uncertainty, and frequency (Williamson, 1979).

Regarding the specificity of assets, Williamson (1985) identified six types of asset specificity, including local, physical, human, dedicated, brand, and temporal specificity. Since then, asset specificity has been considered a key element of Transaction Cost Economics and it is frequently seen as a dominant theoretical element in explaining organizational boundary decisions (Geyskens et al., 2006).

Moreover, without specific assets, the world of contracts would be simplified, and TCT would lose most of its predictive power since there would be a decrease in risk, and many contractual incentives would lose their value (Williamson, 1985; Silva et al., 2017).

TCT aims to maximize results through efficiency, considering the behavior and coordination of those involved in transactions. However, cyberspace introduces complexity due to its interactive and dynamic nature (Rossi, 2023). Existing theories may need to fully capture how digital, virtual, and physical interplay affect governance decisions and cost structures.

Numerous studies have used TCT mainly as a framework for analyzing specific economic contexts, without offering any direct theoretical contribution to the development of the theory itself. Whether on topics related to logistics (Mou & Cheong, 2022), agribusiness (Mack et al., 2024), and digital services (Kerner & Kitsing, 2023) to blockchain (Yang et al.,

2023; Wang et al., 2024), authors often apply theory to practical realities, but fail integrate the nuances of these realities back into TCT with a view to its improvement and expansion.

Within this context, this article aims to address cyberspace as the seventh asset specificity in Transaction Cost Theory. To achieve this objective, this article explores the following interconnected questions: (i) What are the characteristics of cyberspace? and (ii) Which possible forms can it take, considering the convergence between asset specificities in physical and digital environments?

Considering that accessing cyberspace is not an action isolated from the real world, but an action necessary to coordinate any transactions arising from the business itself and its value chain, the aim is to build a model that can synthesize and disclose transaction costs linked to cyberspace. This can help managers and researchers in expanding their knowledge about fairer trading costs when they are aware of the opportunities and risks that arise from cyberspace.

In this research we adopted a systematic review methodology to investigate cyberspace as a possible new asset specificity in Transaction Cost Theory. The search was carried out using the Web of Science database, applying keywords such as “transaction costs,” “asset specificity,” “cyberspace,” and “service innovation.” The articles were selected to examine the characteristics of cyberspace and the possible forms of convergence between asset specificity in the physical and digital environments. There were no restrictions on the publication period, allowing for the inclusion of both seminal and recent literature.

As the literature on Transaction Costs and Cyberspace has expanded, the relevance of this study is evident as firms seek to enhance efficiency and productivity within the cyber environment. These factors influence business models and the management of assets across digital and physical spaces.

To address these topics, the study employed two primary strategies: first, we researched the diverse literature on transaction costs and cyberspace from different perspectives and theoretical approaches. Then, using an interpretative approach, we grounded the perspective of cyberspace as an asset specificity in Transaction Cost Theory.

This paper is organized into five sections. The first section is devoted to the exploration of the cyberspace concept, briefly addressing the historical context of cybernetics. The second and third sections present the transaction costs and the respective asset specificities to introduce and discuss the potential of cyberspace, exposing associations and distinctions regarding the other six specificities existing in the Transaction Cost Theory. In the fourth section, cyberspace is discussed as a seventh asset in transaction cost theory, exploring its characteristics through the triad of connectivity, interactivity, and visibility and how these characteristics combine.

Finally, in the last section, we offer the opportunity to understand the influence of transaction costs, adding cyberspace as an analysis of one of the types of transaction specificities and connection with the Theory of Innovation in Services.

1 From History to Practice: The Evolution of Cyberspace

Cyberspace is a space for interaction and communication that transcends physical barriers, allowing people to connect and share information from anywhere (Kim, 2004; Rossi, 2023). Although its prefix (cyber) is initially associated with the science of communication and control (Wiener, 1954), cyberspace has evolved to include various platforms and technologies, such as e-business, social networking, online gaming, and virtual reality. As a result, cyberspace now constitutes a fundamental element of business, with significant implications for the economy, politics, and society.

1.1 Historical Context of Cybernetics

Cybernetics has played an essential role in developing the concept of cyberspace, making it necessary to address its history. The tendency to create words based on the cybernetic root proved popular at the end of the 20th century, and many of these terms that use the prefix cyber are used in other areas such as cyberculture, cyborg, cyberpunk and cybersecurity, among others (Kim, 2004)

The birth of cybernetics has been called the Big Bang of the Information Age, which may make sense, considering the complexity and intensity of its eruption. Although cybernetics is an area of pluralistic and interdisciplinary scientific knowledge (Wiener, 1954; Beer, 2002; Kandjani et al., 2012; Schmidgen, 2020), the term came to prominence during work and experiences related to the Second World War, carried out by the mathematician Norbert Wiener, who published in 1948 a book entitled “Cybernetics: or the control and communication in the animal and in the machine”[d]. Having its origin in the Greek *kubernetes*, cybernetics properly means the art of the pilot, leading to the understanding of control and direction (Wiener, 1954; Abbagnano, 2007). In his book, Wiener develops and presents the hypotheses of this theme, arising from research and multidisciplinary interaction with other scientific groups formed by mathematicians, physicists, engineers, and social scientists.

[d] Wiener later discovered that Ampère had already used the same word in reference to the political science (Wiener, 1954).

In another book entitled “Cybernetics and Society: the human use of human beings” Wiener (1954) presents the purpose of cybernetics, exposing then, the science of communication and control between living beings and the machine, communication aiming to connect systems and control, in addition to regulating behavior. Wiener (1954, p. 16) defended the thesis that “the physical functioning of the living individual and that of some of the most recent communication machines are exactly parallel in the analogous effort to dominate control entropy (control) through feedback”.

Thus, control, feedback, and the relationship between machines and people constitute the triad of cybernetics. The entropy mentioned by Wiener is a term borrowed from thermodynamics. It is a measurement of disorder, uncertainty, and loss of information, the reversal of which requires control by a system over the environment, just as it occurs in physical systems (Abbagnano, 2007).

In this context, the development of cybernetics has led scientists to design new and complex mathematical models to expand the man-machine system, enabling the emergence of new terms “cyber” commonly used in contemporary times, which owe their origins to cybernetics, which inaugurated a new large number of developments (Kandjani et al., 2012), such as cyberspace.

1.2 The Cyberspace

One of the first concepts of cyberspace is attributed to the science fiction work “Neuromancer” (Gibson, 1984), where cyberspace is used to describe an immersive virtual environment accessed through computer networks. Emerging theories, such as cybernetics, influenced Gibson (Henthorne, 2011). However, beyond fiction, we see that many transactions now take place in cyberspace, including online shopping, electronic transfers, digital communication and file sharing, making it a practical field of action.

There is a consensus in the literature about the importance of connectivity and interactivity for digital operations (Kang, 1999; Ning et al., 2018; Lippert & Cloutier, 2021; Dunn Cavelty & Wenger, 2022). Regarding connectivity, cyberspace connects people, companies, and institutions through commercial and non-commercial transactions, going beyond it to encompass various physical, social, and even thought space aspects (Penttinen et al., 2018; Ning et al., 2018). In parallel, cyberspace presents itself as a new universe of architectures in which interactivity is increasingly attractive and diverse for business models.

In this environment, technologies and communication can enable social interaction between individuals who would not otherwise meet or engage in conversation in real space (Kang, 1999).

Connectivity and digital technology, developed in cyberspace, have profoundly transformed business models, labor markets, and governments, presenting new challenges and opportunities. Technological advances have been used to drive open innovation and collaboration between companies and institutions and contribute to developing digital tools that promote mass collaboration and co-creation between companies and individuals. So much so that some studies have presented how connectivity can be used to drive innovation (Chesbrough, 2003), collaboration (Tapscott & Williams, 2008), productivity in companies (Brynjolfsson & McAfee, 2014), digital tools such as the Internet of Things (Bunz & Meikle, 2017), blockchain (Hu et al., 2019), which are transforming cyberspace by connecting physical devices to digital networks.

Moreover, being an interactive environment, cyberspace constantly evolves beyond traditional forms of collaboration, such as the client-server model and peer-to-peer or web services. The co-creation of value by service providers can lead to greater interactivity and information sharing, reducing information asymmetry by allowing providers to tailor their services based on more accurate data. It has transformed traditional models of production, consumption, and collaboration (Benkler, 2006). In addition, it is self-organizing and has characteristics that distinguish it from other collaboration environments (Lévy, 1999; Janczewski et al., 2019).

Cyberspace, like cybernetics, is characterized by plurality and multidisciplinarity and stands out for its difference from classical media. Its interactivity and ability to adapt to users' demands drives innovation and network economic development (Castells, 1999). In this environment, each individual can become a broadcaster on an equal footing with print or television media. This leads to the understanding that cyberspace constitutes a product and a reproducer of physical space.

Despite the advances and business opportunities being explored in cyberspace, issues regarding challenges and risks deserve to be debated in light of socio-economic, ethical, and political implications. While there is an emphasis on political polarization and the manipulation of public opinion through social media, another challenge highlighted is the question of privacy and security of personal data, which is becoming increasingly important in an increasingly connected and interactive world (Castells, 2012; Cohen, 2013).

In regulatory contexts, governments have promulgated norms and policies related to cyberspace and created agencies and departments dedicated to cybersecurity and governance.

These actions have varied according to each country's different approaches and interests and often reflect the tensions between protecting national security and promoting freedom and civil rights (Johnson & Post, 1996; Dunn & Wenger, 2022). However, there needs to be a thorough understanding of how economic and political factors interact.

Furthermore, the relationship between cyberspace and global geopolitics has been discussed, emphasizing the importance of cyber security issues in the international arena. Nevertheless, geographic boundaries apply in a jurisdiction with national responsibilities (Douzet, 2014), going beyond business models. The United Nations (UN) have been dedicated to discussing issues related to cyberspace through several of its agencies, such as the International Telecommunication Union (ITU), the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2005), the Security Council, among others. In addition, other international organizations, such as the Organization for Economic Cooperation and Development (OECD) and the European Union (EU), have issued recommendations and guidelines for governance, security, privacy, and digital inclusion in cyberspace.

2 Transaction Costs

Adam Smith's work on the division of labor and the "invisible hand" theory has significant implications for transaction cost economics (Smith, 2013). Smith argued that the division of labor could lead to increased productivity and efficiency as individuals specialize in particular tasks and exchange the goods and services, they produce in a market economy. This exchange process involves transaction costs, such as negotiating, monitoring, and enforcing contracts, which can reduce the efficiency of markets.

In fact, Smith and the first economists sought to understand the dynamics of inventiveness and the increased productivity generated by the evolving economy (Nelson & Winter, 2002) and, more broadly, how technological, and innovative changes would drive the economic growth processes.

Later economists, such as Ronald Coase and Oliver Williamson, built on Smith's ideas by focusing on the role of transaction costs in shaping economic behavior and organizational structures. They argued that transaction costs can create inefficiencies and market failures, leading to the emergence of alternative forms of governance, such as firms and contracts, that can reduce these costs and improve economic performance.

The theory of the firm was established in 1937 with the publication of the book "The Nature of the Firm" by Ronald Coase and gained notoriety with the works of Williamson, who

followed Coase's premise and expanded the idea that the costs involved in a transaction are fundamental in a negotiation, culminating in the effective contract.

The theory is appropriate for understanding organizations, their monitoring coordination costs, control and transaction management, and their respective specificities. From the proposition that transaction costs are central to the study of economics, Williamson (1979) developed the critical dimensions to characterize transactions and described the main transaction governance structures, indicating how and why transactions can be combined with organizations in a discriminatory manner.

Subsequently, Williamson (1991, 1996) postulated that costs are produced from transaction dimensions (frequency, asset specificity, and uncertainty) in addition to behavioral assumptions (bounded rationality and opportunism), which together act through governance structures (market, hierarchical and hybrid) that incorporate a transaction as the unit of analysis.

Transactions differ from one another and have distinct attributes that are observable in practice, so much so that specificities assets, opportunism, and incompleteness of contracts make the investment subject to risks and adaptation problems, generating transaction costs. Gallouj & Djellal (2011) argue that the concept of transaction costs in the context of service innovation can be particularly high due to the uncertainty and ambiguity of many service innovations and the need to negotiate new and often complex service contracts.

However, increasingly, service innovation focuses on improving capabilities related to customers, their interactions and experiences (i.e., understanding needs, loyalty, complementary knowledge, tacit knowledge). Therefore, experience has been recognized as a critical element for service quality, which integrates a positive cost-benefit perception by customers (Pine et al., 1999; Espino-Rodríguez et al., 2008; Sundbo et al., 2022).

In this context, cyberspace has proven to be an enabling environment for service innovation, providing valuable resources and tools for co-creation, personalization, immediate feedback, data analysis, prototype testing, and access to resources. With these features, companies can develop and launch innovative services. Studies argue that value co-creation in services can help reduce transaction costs by facilitating communication, information sharing and collaboration among stakeholders. Indeed, value co-creation can help increase the efficiency and effectiveness of the service innovation process (Gallouj & Weinstein, 1997; Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2016).

The advantages of reduced transaction costs also include easier communication and information exchange between stakeholders, as well as the possibility of process automation and the use of digital technologies to improve efficiency and productivity. In addition, co-

creation of value in the digital environment can enable greater customization of services, or interactive or co-productive actions based on customer data and behavior, as well as rapid adaptation to changing customer needs and demands (Nagle et al., 2020; Rubalcaba, 2023).

The rapid adoption of cyberspace and its integration into the ecosystem have driven the emergence of a wide range of services, which progressively interconnect with the industry. This interconnection is considered both cause and effect of the complexification of economic systems, whose strategies enable new activities and services (Desmarchelier, 2019). Cyberspace stands out as a repository of service provision, offering various accessible, customizable, fast, and constantly evolving options.

Depending on how they are undertaken and coordinated, organizations seek to reduce transaction costs by achieving status and to maximize profits from transactions (Williamson, 1991; Ménard, et al. 2014). It will be up to the organization to stand out and differentiate itself due to the specificities of the assets it transacts concerning other organizations, including those that transact in cyberspace.

The central concept of TCE is asset specificity, which has been discussed as a dominant theoretical element in explaining organizational boundary decisions (Geyskens et al., 2006). When creating or managing a business model, it is essential to consider asset specificities as they affect the choice of business strategies and partnerships. The analysis of asset specificities is critical as it directly influences the transaction cost and efficiency of the firm's operations, identifying opportunities to reduce costs and increase competitive advantage (Lepak & Snell, 1999) and organizational capabilities (Teece, 2014).

Analyzing asset specificities can help the company identify how to reduce costs and increase its strategic flexibility. For example, if the company depends on a specific supplier to provide a specific asset, it may be forced to work exclusively with that supplier, which increases transaction costs (Williamson, 1991). However, if the firm can develop its capabilities to produce or procure specific assets, it can reduce transaction costs and increase its strategic flexibility. Thus, careful analysis of asset specificities can be critical to a company's bottom line.

Furthermore, North (1990) states that individuals or organizations incur adaptation costs to adjust to the new conditions imposed by changes in the economic environment. These costs may include the need to develop teams, invest in new technologies or reorganize the organization's activities (internal, external or hybrid), involving the analysis of the specific assets present in the business model.

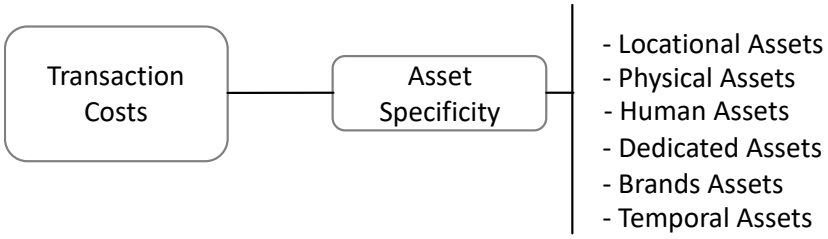
Asset specificity is a fundamental attribute in resource allocation, which refers to the degree of difficulty in transferring an asset to another user without significant loss of value (Saes et al., 1997). Furthermore, assets cannot be easily replaced or reused in other activities because their transfer may result in a loss of value. The Transaction Cost Theory, proposed by Williamson (1985, 1991), identifies six asset specificity types that affect economic transactions' efficiency. Next, these six types are presented to understand the relevance of the asset specificity concept for the economic theory and its implications for the business practice:

1) *Locational asset* refers to the specificity of assets tied to a specific geographic location, such as adjacent workstations that aim to save on inventory and transportation. This type of specificity can generate high transaction costs if the asset is difficult to transfer or reproduce in another geographic area.
2) *Physical asset* is related to specialized assets for a specific matrix, service, production process, or technology and can generate high transaction costs if the asset cannot be easily adapted or reused for other purposes.
3) *Human asset* arises from learning by doing, skills, or knowledge specific to a particular job, such as a teacher's experience, an accountant's expertise or a software engineer's knowledge. When these assets are considered essential to the company, they can generate high transaction costs if the professional is difficult to replace or his skills are not transferable to another business activity.
4) *Dedicated asset* refers to products and services tailor-made for a specific customer or intended for a specific transaction, such as a customized product or a specialized service. In addition to franchises, considered a classic example of dedicated asset, this includes long-term contracts and investments in technology. If the asset cannot be easily repurposed for other customers or transactions, this can lead to high transaction costs.
5) *Brand asset*, which represents brand capital, considers the value attributed to a brand or its reputation, which can be specific to a particular product or service. Brand specificity results in high transaction costs when a company's reputation is difficult to replicate or when customers have strong loyalty for a particular brand.
6) *Temporal asset* is a type of asset that has a defined expiration date, such as service contracts or leases. It may refer to assets with a limited life span or with a different value at different times. In addition, time specificity can relate to seasonal or needed

assets only in specific periods, which can also create high transaction costs if the asset cannot be easily replaced or reused.

Figure 1

Assets Specificities



Source: Based on Williamson (1985, 1991)

Understanding the type and degree of asset specificity is a prerequisite for determining the ideal governance structure for a transaction or relationship. A higher degree of asset specificity usually requires a higher level of coordination and investment in governance mechanisms to reduce transaction costs.

In the "physical" environment, if an organization needs a certain equipment to produce a specific service, the availability of that equipment is an important asset specificity. If the company does not have the equipment, it may have to look for an external supplier to acquire it. In this case, the availability of other specific assets, such as the skill and knowledge needed to operate the equipment and the human asset, also becomes critical.

However, the interdependence is a relevant characteristic of asset specificities, considered valuable for a given transaction (Williamson, 1985; Milgrom & Roberts, 1992). The specificity of assets can influence each other and create an interdependence that affects the behavior of the parties in a transaction. This is because specific assets are often complementary and necessary for carrying out the activities required to complete a transaction.

3 Introducing Cyberspace into the Specificities of Assets

Introducing cyberspace into the light of asset specificities, involve specific investments for creating and maintaining online platforms and systems that may or may not be highly specific to the transactions and interactions that take place in this environment. For example, a company that invests significant resources to develop an e-commerce platform must be able to process payments, manage inventory, serve, manage, and protect customer information and

data. This platform, being highly specific to the company and its customers, cannot be easily replaced or replicated if there is a breach in the contractual relationship.

When analyzing specific assets in the cyber environment, one realizes that cyberspace is constantly evolving and transforming with the advent of new technologies and innovations. The Internet, in particular, is an abundant source of information, which can increase complexity and make it challenging to predict behaviors and outcomes. This scenario is conducive to generating uncertainty and transaction costs, including information search and evaluation costs, adaptation costs to changes, and monitoring and quality assurance costs (Alchian & Demsetz, 1972; Barzel, 1982; Rossi, 2023). These costs occur in companies of all sizes and segments, although it is especially relevant for those operating in markets characterized by high uncertainty, complexity, and low predictive ability (Stiglitz, 1988; North, 1990).

Rindfleisch (2020) examines technology in distinct periods: in the past, Coase (1937) did not emphasize the role of technology in his original theory. Williamson (1993) acknowledges the role of technology but argues that "the choice between firm and market organization is neither given nor determined by technology," reflecting an ambivalent position. For the future, Benkler (2006; 2017) states technology as an enabling factor that changes the dynamics of economic transactions, allowing forms of collaboration and production that were previously impractical.

This context suggests to consider cyberspace as the seventh type of specificity for transaction cost analysis. The cyberspace can constitute an asset that influences and is influenced by the other six asset specificities that are interdependent, mutually influential, and overlapping in different business contexts:

Locational. Although cyberspace is, by definition, a virtual space, it can also have a local dimension. For example, geolocation services can use a device's GPS data to provide information about nearby locations. In addition, websites can adapt their content to reflect the user's geographic location. Moreover, "phygital" is a recent term created and used by businesses to describe the blending of physical and digital experiences for customers (Piccioni, 2023).

Another way to demonstrate how the physical environment affects the digital and vice versa is through technologies such as augmented reality and virtual reality, whether for commercial, educational, development of scientific (e.g., clinical areas) or entertainment applications (Yim et al., 2017; Cipresso et al., 2018; Rosenbaum & Germán, 2023) These technologies allow customers to view and interact with products digitally, but with an experience closer to what it would be in the physical environment, as is the case with digital

books and digital reviews in libraries. Cyberspace can occur in the individual's relationship and with other technologies, such as digital, virtual, and remote, especially when it comes to service innovations in which physical presence becomes a secondary factor.

Physical. The physical dimension of cyberspace includes the infrastructure needed to connect people and machines to the network. Building servers and laying fiber optic cables exemplify how the physical dimension integrates cyberspace. Due to their high interactivity between machines and people, investments in e-commerce and digital banking can be classified as specialized physical investments. This interactivity is a reflection of the figure of the cyberbody, which represents the projection of the body or a person in a hypertextualized form. The concept of the "cyberbody", proposed by Lévy (1996), involves various forms of media, including videos, photos, writing, and images, and has been expanded with the emergence of Non-Fungible Token (NFT).

Human. The specificity of human assets refers to the skills, knowledge, and experience that are unique to each individual and cannot be easily transferred or replicated. The human dimension of cyberspace includes interaction between users, whether through messaging, gaming, videoconferencing, or other forms of online communication.

Considering the physical asset, there is not necessarily full employment of human capital or even the need for the direct and physical presence of the employee. However, robotization and automation are examples of processes built and parameterized by humans in cyberspace. The specificity of the human asset can have several repercussions for cyberspace, affecting the demand for ICTs talent, the costs of training and developing people, cybersecurity, and the ability of companies to compete in the marketplace.

Dedicated. Dedicated assets in cyberspace, such as servers, virtual private networks (VPNs), and firewalls, can significantly influence the security and efficiency of an organization's online operations (Kreutz et al., 2014). The network of relationships in the digital environment is an intangible asset that refers to the set of relationships that a company or individual has with other companies, customers, suppliers, and employees. There are commercial models where face-to-face communication consumes only additional resources, and cyberspace can favor a plurality of commercial partners.

Brand. This asset specificity refers to the unique value that a brand possesses, and other brands cannot easily replicate that. It is necessary to point out that cyberspace can affect the specificity of the brand asset. The brand is not always built with "organizational effort". A new business model typical of cyberspace is the influencers in social networks that advertise and sell products, behaviors, and fashion, constituting an environment of dissemination and

potential performance for companies. Considering the speed and access to information on the web, it is also necessary to consider the "deconstruction" of the brand in the same environment.

Temporal. Although the question of time is an unchanged aspect, cybernetic time can be considered in the cybernetic environment, which is the intermediary between absolute and digital time. Wiener (2017, p. 67) would classify it as a "consecutive relationship of input-output in time", in which statistics constitute a sensitive measurement factor. Depending on the nature of the transaction, asset specificities concerning locational, physical, human, dedicated, brand, and temporal aspects will depend on and impact each other. It would be no different regarding cyberspace, as the asset specificity would also depend on and mutually impact these existing specificities.

Several business models on the market were created in the digital world and would not exist without them. It can be challenging to imagine today's market without the digital environment, as technology and the internet have become essential parts of most business models: companies would need to rely on traditional means of communication such as telephone, mail, and fax to communicate with their customers, suppliers, and business partners. In addition, print, radio, and television advertising to promote and sell their products and services through physical stores, catalogs, and telephone sales. Without digital technology, internal business processes would be more manual, and companies would remain dependent on "traditional" methods.

The convergence between the specificities of assets in the physical and digital environment is increasingly present, prompted by using technologies such as augmented and virtual reality. These tools allow consumers to interact in a more immersive and experiential way with products, even while shopping online. This has created new opportunities for companies to stand out in the market through service innovation (Gallouj & Weinstein, 1997; Djellal & Gallouj, 2007), offering experiences that differentiate them from the competition and, consequently, generate competitive advantage (Wernerfelt,1984; Barney, 1991; Teece et al., 1997).

The greater the specificity, the greater the risks and the greater the adaptation problems and, consequently, the more significant transaction costs (Williamson, 1985; Farina et al., 1997). Therefore, structuring activities will depend on the company's assessment of the costs involved. Revenues and costs pile up on both sides of a platform embedded in cyberspace, driving larger companies to pursue interoperability, scale, and network effects (Mancini, 2021). However, this can limit managers' view of the positive effects of the platform, especially if they see it in the same way as traditional processes. On the other hand, smaller companies value

local use efficiency, user-friendliness, and cost concerns (Eisenmann et al., 2008; Pentinnen et al., 2018).

However, cyber-attack is a recent topic of scientific discussion (Strupczewski, 2021; Matthijsse et al., 2023). At the same time, its diversity and complexity have characterized an exponential change in cybersecurity and cyber threats, permeating companies of all segments and sizes. It has even gained focus from the accelerated digitization of the economy and social relations.

4 Cyberspace as Asset Specificity

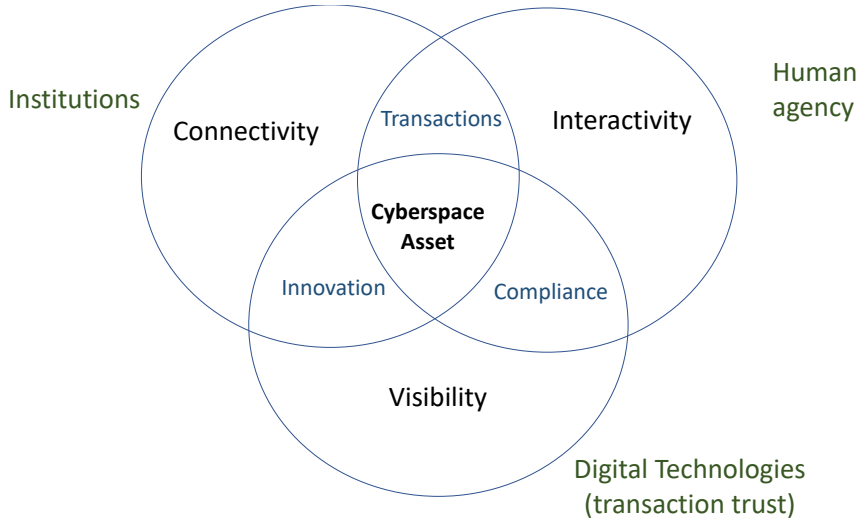
Understanding the type and degree of asset specificity is essential in determining the optimal governance structure for a given transaction or relationship. A greater degree of asset specificity typically requires a greater level of coordination and investment in governance mechanisms to reduce transaction costs (Coase, 1937; Williamson, 1985; 1991; North, 1990; Tirole, 2010). This reinforces the understanding that specific assets are specialized or unique to a particular transaction or use and have limited value outside of that transaction.

Cyberspace presents itself as the production and distribution of decentralized and collaborative goods and services, with the participation of a large number of individuals, artefacts, and institutions in a network, constituting a new economy in cyberspace (Benkler, 2006). The physical and the digital coexist in a complex configuration of cyberspace where connectivity, interactivity, and visibility exist. Industrial and technological structures are being replaced and complemented by codified technologies capable of reducing distance and time, while expanding opportunities in terms of control and command of the physical world.

In Figure 2, transactions result from the integration between connectivity and interactivity. The combination of connectivity and viability promotes the creation of Innovation. Moreover, compliance can be produced by the fusion of interactivity and visibility. Therefore, connectivity, interactivity, and visibility have exclusive and distinct characteristics, but when combined, they create additional attributes that allow delineating cyberspace as an asset specificity.

Figure 2

Cyberspace Assets



Source: authors (2024)

Cyberspace can be considered a specific asset that neither replaces nor isolates itself from other specific assets related to transaction costs. Considering the three elements that make up the specificity of cyberspace assets, connectivity is the first element for their functionality and existence. Cyberspace is a digital space built from the interconnection of computer networks, which allows communication and information exchange between people and geographically distributed systems (Ning et al., 2018; Lippert & Cloutier, 2021; Dunn Cavelty & Wenger, 2022).

Understanding the influence of social institutions on the economy is still an evolving field which requires further analysis (Williamson, 2000; Aoki, 2007). In this context, institutions can promote business connectivity by investing in ICT infrastructure, implementing public policies, and creating a regulatory environment conducive to innovation and competition (European Commission, 2021).

Connectivity is also a contributing factor to the expansion of cyberspace as new networks are created and connected to the global network. In fact, a lack of connectivity can lead to digital exclusion and limit people's access to cyberspace and its possibilities. When the cost of interaction is low, there is more likely to be an increase in connectivity, while when the cost is high, interaction is limited (G20, 2019).

The literature highlights how connectivity can foster innovation, collaboration, and productivity in companies through digital tools, while also addressing the challenges and transformations that this connectivity brings to the business world (Angelopulo, 2014;

Werbach, 2020; Luo, 2022). From this perspective, connectivity is closely linked to the interaction between social agents, which occurs when connected by a network. Thus, connectivity is the basis of cyberspace, allowing information to flow through the network and users to access and interact with each other.

Interactivity in cyberspace and co-creation are closely linked, since cyberspace provides an ideal environment for collaboration and idea sharing between individuals around the world. Similarly, Lévy (2003) explored the relationship between a beehive and cyberspace to talk about collective intelligence, suggesting that cyberspace can be seen as a "digital hive" where people interact to create and share knowledge.

Interactivity is feature of the digital economy, allowing companies to innovate and thrive in a highly competitive environment. Tapscott and Williams (2008) define interactivity as a process in which users actively participate in the creation of new products and services, allowing companies to benefit from ideas and perspectives from a broad user community.

In addition, interactivity also constitutes a specific feature of new forms of digital narrative, allowing users to experience stories in innovative ways and create new forms of narratives (Murray, 2017) or even recognition of programming as the new digital age literacy arising from interactivity and connectivity (Rushkoff, 2010). Through dynamic relationships between the user and technology, it is possible to explore and experience new forms of interaction (Rajala et al., 2016; Montfort & Bogost, 2020).

Conceptually, the visibility refers to the ability of an object, phenomenon, or process to be perceived or observed by one or more observers. It is an indispensable property in many fields, such as technology, social sciences, and others. In the context of cyberspace, visibility can be understood as the ability of an user to perceive the actions of other users in real-time, enabling a greater sense of proximity and interaction in the virtual environment. In an online game, whether entertainment or educational, for example, visibility allows players to perceive the movements of other players, making the experience more immersive and engaging (Jenkins, 2015).

The combination of visibility and interactivity in cyberspace is a vital element in enabling secure and reliable transactions among users, providing transparency and control over their actions and interactions, resulting in trustworthy transactions, as noted by Head and Hassanein (2002).

In the current context of the digital economy, where commercial and financial transactions are increasingly taking place through online platforms and applications, security and trust are critical aspects to ensure the integrity and privacy of users' information (Sharma

et al., 2019; Urena et al., 2019). In this sense, visibility (i.e., the ability to monitor and track users' actions) and interactivity (i.e., the possibility of communicating and negotiating in real-time) are elements to establish a secure and trustworthy virtual environment.

Some studies have highlighted the importance of interactivity and visibility as factors that influence users' perception of security and trust in virtual environments (e.g., Pavlou & Gefen, 2004; Wu & Wang, 2005; Pang et al. 2024). In addition, it is also pertinent to consider other aspects related to data protection, such as encryption, authentication, and digital certification, to ensure the integrity and authenticity of online transactions (Swan, 2015; Werbach, 2018; Zhang et al., 2022).

It is worth highlighting that the token economy has enabled the development of other business models, such as decentralized crowdsourcing, as well as business relationships generating greater visibility of business processes while "transferring ownership of physical or digital assets using tokens" (Sunyaev et al., 2021, p. 458).

In terms of trust transactions, studies have investigated the development of trust in several areas, including banking transactions (DeYoung, 2015), e-commerce platforms (Resnick & Zeckhauser, 2002; Al-Debei et al., 2015), digital health services (Adjekum et al., 2018), cryptocurrencies (Böhme et al., 2015; Werbach, 2018) and blockchain (Beck et al., 2018; Werbach, 2018; Brookbanks & Parry, 2022). The trust embedded in the visibility of transactions is intrinsically linked to the trust deposited by people in commercial and financial transactions, such as purchases, sales, loans, and investments. Transaction trust is critical for the proper functioning of the economy in general, as it allows people (human agency) to transact in cyberspace.

The visibility associated with connectivity expands the innovation capacity in the development and availability of new products and services. When combined, visibility and connectivity allow information management data to be made available in an open and understandable way to individuals through public services, such as institutions that make sectoral data, political activities, legislation, and norms available. These social innovations are perceived by Djellal et al. (2013, p. 7) as "electronic village halls[e]". It also creates other possibilities in which individuals take an active role in developing norms and policies through their participation in public consultations, hearings, and other channels.

Services can be developed and transacted in the cyber environment due to the geographical reach, real-time interactivity, accessibility, and credibility when promoting

[e] *Electronic Village Halls* are community spaces that provide information technology resources, such as computers and the internet, intending to promote digital inclusion.

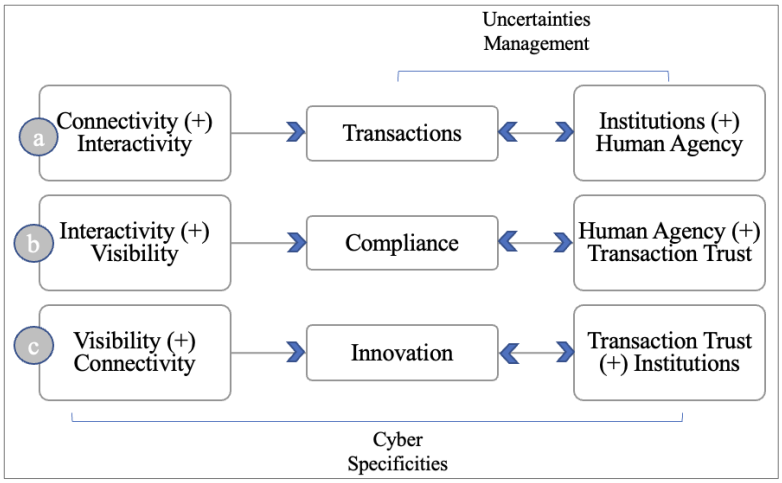
reliable transactions. Also, connectivity allows the creation of new services such as e-books, online courses, games and applications, and social media with long-term effects (Benoit, 2023), whose visibility is presented as an accessible service shelf and can be monetized or non-monetized.

From the perspective of the specificities of cyberspace and uncertainty management, Figure 3 illustrates cyberspace assets. Starting from the triad of connectivity, interactivity, and visibility, the integration among them is represented by transactions, compliance, and innovation, which are critical factors in defining the specifics to bring efficiency, reduce transaction costs and manage uncertainty.

Uncertainty management is developed, implemented, monitored, and enhanced by institutions, human agencies, and transaction trusts that act and influence transactions, compliance, and innovation in cyberspace.

Figure 3

Cyber specificities and uncertainties management



Source: authors (2024)

Imagine contracting a loan that needs to be made simple and secure, using the cyber environment. For this, we will consider (a), (b), and (c) in Figure 3 to support visualize cyberspace as a specificity asset.

Item (a)

Connectivity + Interactivity: refer to the format in which transactions occur. They are necessary for the customer to access the financial institution's platform, conduct the

negotiation, provide and receive documentation, and finally, contract the service in real-time and with immediate feedback.

Transactions: are related to contracting the bank loan and receiving the loan amount. Also, other adjacent financial transactions may occur, such as an insurance contract related to the loan.

Institutions + Human Agency: are interested parties and can perform the role of facilitators in the transactions carried out, reinforcing the characterization of interactivity. Furthermore, the transaction may involve more than one institution, depending on regulatory agencies and credit agencies that will be part of the ecosystem of validation and formalization of contracts, standards and rules with the customers.

Item (b)

Interactivity + Visibility: Interactivity is responsible for enabling the customer to take a more active role in developing and purchasing a product or service. A global survey conducted by Sinch (2022) identified that one in three people over 40 switched financial institutions for a better mobile experience. The result points to a trend of users increasingly exploring the applications to perform services previously offered at the branches. In the case of a loan contract, it is expected that the customer will be able to perform all his actions, without the need to contact the call center, for example. Visibility goes beyond the user-friendly online transaction - it involves the security, transparency, and compliance that the platform offers.

Compliance: involves creating a culture of accountability in which a company's actions are documented and monitored to ensure reliability. Companies that invest in effective and consistent compliance programs demonstrate a commitment to ethics, integrity, and transparency (IBGC, 2021). This can help build a solid and trusted reputation and contribute to building transaction trust by improving compliance with laws and regulations.

Human Agency + Transaction Trust: Although the concept is commonly used in finance, particularly in structured finance and securitization transactions, trust transactions are also built through technological tools in commercial transactions, which use the financial system to transact (Kowalski et al., 2021). E-commerce has become an indispensable part of the global retail business that offers bank loans to its customers as a complementary activity to its core business.

Cyberspace has been conducive to the development of peripheral services, which constitute support for businesses, although not essential to the provision of the core service, which improves accessibility and quality (Djellal & Gallouj, 2023) and can reduce transaction

costs. Concerning trust relationships, the individual (human agency) will always be subject to errors, intentionally or not (Williamson, 1993). Moreover, that can explain why security system developers have dedicated efforts to keep up with and respond quickly to cybercriminals' evolving strategies or systemic failures.

Item (c)

Visibility + Connectivity: Visibility emphasizes transparency and trust in lending, and connectivity represents a key element in connecting customers to an organization. This combination can enable operational efficiency and cost reduction while providing convenience and customer experiences.

Innovation: Innovation introduces innovative technologies and practices that advance as business models are created or adapted, contributing to a "permanent innovation economy" (Djellal et al., 2023, p. 183). In a bank loan transaction, contracting brings authentication processes, security keys, cryptography, smart contracts, and payment solutions developed and maintained through technology and innovation (Werbach, 2020; Natanelov et al., 2022; Yang et al., 2023). For example, a blockchain has represented a viable tool for recording and tracking transactions through a public and immutable record.

Transaction Trust + Institutions: **Trust is essential for the proper functioning of the economy since it allows individuals to make transactions safely. In one of the stages of contracting a bank loan, it is necessary to provide sensitive data, such as the customer's financial situation, which is mandatory information for credit analysis and approval.** Institutions are central to building trust and transparency in transactions through digital technologies, laws, and regulations. Trust reduces transaction costs and can be an essential source of competitive advantage (Dyer & Chu, 2003; Brookbanks, & Parry, 2022).

5 Final Remarks

The primary purpose of this article was to investigate and answer these questions addressed to broaden the understanding of cyberspace as the seventh asset specificity and to support future research. Cyberspace serves as the base environment of physical and digital (phygital) businesses. Depending on the business model, it can constitute a highly specificity asset. This is because its nature is highly technical, considering the investments required to involve technical tools and resources that are not easily replicable in any business model - whether to maintain, develop or upgrade the systems that operate in cyberspace.

Another aspect that contributes to the specificity of cyberspace focuses on customers satisfaction and their participation, which may also involve specific technologies to customize or adjust to their needs, as well as to keep the organization at a good competitive advantage in front of its players, while ensuring security and trust for all involved, i.e., institutions, and individuals.

The characteristics of cyberspace, shown in Figures 2 and 3, emphasize the importance of connectivity, interactivity, and visibility in transactions, integrating with organizations' traditional operating models. Connectivity enables communication and information exchange between distributed networks, promoting innovation and productivity. Interactivity enables co-creation and the active participation of users in the creation of new products and services, while visibility ensures that actions are perceived in real time, guaranteeing transparency and security in transactions.

Figure 3 illustrates how these elements combine to facilitate transactions, regulatory compliance, and innovation. In the example of a bank loan agreement, connectivity, and interactivity enable real-time negotiations and document processing, while visibility ensures transparency and security of transactions. In this way, cyberspace complements and extends the specificities of traditional assets, providing new dimensions of operation and control.

We have described the forms that have emerged in the convergence of cyberspace assets with asset specificities. These forms are widely recognized as local, physical, dedicated, human, brand, and temporal. It should be noted that certain types of services rely exclusively on physical assets. Examples include cloud storage services and online gaming, which depend on digital technologies and the Internet infrastructure for their operation.

Furthermore, the combinations revealed between connectivity, interactivity, and visibility have made it possible to present the following cores: transactions, compliance, and innovation, which can be similarly considered a “digital solder” as each of these cores constitute a process that links the two elements (connectivity and interactivity, interactivity and visibility, and visibility and connectivity) to the point of fusion.

In the cores, digital technology tools are highlighted that support transaction reliability through data protection, immutable and decentralized records, automated contract enforcement, and the authentication of digital identities. In addition, compliance, through auditing and monitoring, is critical to ensure the transparency and security of transactions between individuals and organizations. Moreover, finally the third and last core is innovation, which drives companies forward through differentiation, competitiveness, and adding value to society.

As concluding remarks, it should be emphasized that cyberspace is connected not only to Transaction Cost Theory but also to Service Innovation Theory, widely discussed by Gallouj and Djellal (2010; 2018; 2023), concerning the evolution of service sectors, the development of service innovation models, and the interaction between services and industries. This is mainly because, in cyberspace, there is a diffusion of goods and services, in which services are an intermediate activity for the delivery of physical products and an end activity for intangible deliverables.

Although cyberspace demonstrates the potential for innovation and efficiency in commercial transactions, its dynamic and technically complex nature can pose significant challenges to Transaction Cost Theory (TCT), which aims to minimize these costs. The interaction between emerging technologies and economic factors in cyberspace can introduce new forms of transaction costs, such as monitoring costs and technological adaptation. This perspective suggests that cyberspace can hinder investments instead of simplifying and reducing costs due to its constant evolution and uncertainty.

As recommendations for future studies, it is proposed to identify the governance structure and the dimensions of transaction costs (asset specificity, uncertainty, and frequency) of particular companies or sectors that transact services by hiring or providing services.

References

Abbagnano, N. (2007). *Dicionário de Filosofia*. Martins Fontes.

Adjekum, A., Blasimme, A., & Vayena, E. (2018). Elements of trust in digital health systems: scoping review. *Journal of Medical Internet Research, 20*(12), e11254. https://doi.org/10.2196/11254

Alchian, A. A., & Demsetz, H. (1972). Production, information costs, and economic organization. *The American Economic Review, 62*(5), 777-795.

Angelopulo, A. (2014). Connectivity, Communication. *Communicatio, 40*(3), 209-222. https://doi.org/10.1080/02500167.2014.953561

Aoki, M. (2007). Endogenizing institutions and institutional changes. *Journal of Institutional Economics, 3*(1), 1-31. https://doi.org/10.1017/S1744137406000531

Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99-120. https://doi.org/10.1177/014920639101700108

Barzel, Y. (1982). Measurement cost and the organization of markets. *The Journal of Law and Economics, 25*(1), 27-48. https://doi.org/10.1086/467005

Beck, R., Müller-Bloch, C., & King, J. L. (2018). Governance in the blockchain economy: A framework and research agenda. *Journal of the Association for Information Systems, 19*(10), Article 1 - https://doi.org/10.17705/1jais.00518

Beer, S. (2002). What is cybernetics? *Kybernetes, 31*(2), 209-219. https://doi.org/10.1108/03684920210417283

Benkler, Y. (2006). *The Wealth of Networks: How Social Production Transforms* Markets and Freedom. Yale University Press. Social Science Computer Review, 26(2), 259-261. https://doi.org/10.1177/1084713807301373

Benkler, Y, Y. (2017). Peer production, the commons and the future of the firm. *Strategic Organization*., 15(2), 264–274.

Benoit, S. (2023). Characteristics of services. In F. Gallouj, C. Gallouj, M. C. Monnoyer, & L. Rubalcaba (Eds.), *Elgar Encyclopedia of Services* (pp. 5-7). Edward Elgar Publishing.

Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015). Bitcoin: Economics, technology, and governance. *Journal of Economic Perspectives, 29*(2), 213-238. https://doi.org/10.1257/jep.29.2.213

Brookbanks, M., & Parry, G. (2022). The impact of a blockchain platform on trust in established relationships: a case study of wine supply chains. *Supply Chain Management: An International Journal*. https://doi.org/10.1108/SCM-05-2021-0227

Brynjolfsson, E., & McAfee, A. (2014). *The Second Machine Age: Work, Progress, and* Prosperity *in a Time of Brilliant Technologies*. W.W. Norton & Company.

Bunz, M., & Meikle, G. (2017). *The Internet of Things*. John Wiley & Sons.

Castells, M. (1999). *Information technology, globalization and social development* (Vol. 114). Geneva: UNRISD.

Castells, M. (2012). *Redes de indignação e esperança: movimentos sociais na era da internet*. (C. A. Medeiros, Trans.). Rio de Janeiro: Zahar.

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.

Cipresso, P., Giglioli, I. A. C., Raya, M. A., & Riva, G. (2018). The past, present, and future of virtual and augmented reality research: A network and cluster analysis of the literature. *Frontiers in Psychology, 9*, Article 2086. https://doi.org/10.3389/fpsyg.2018.02086

Coase, R. H. (1937). The nature of the firm. *Economica, 4*(16), 386-405

Cohen, J. E. (2013). What privacy is for. *Harvard Law Review, 126*(7), 1904-1933.

Djellal, F., & Gallouj, F. (2007). Innovation in services and entrepreneurship: From theories to practices. In *A Handbook of Research in Entrepreneurship and Innovation, 2*, 303-328.

Djellal, F., Gallouj, F., & Miles, I. (2013). Two decades of research on innovation in services: Which place for public services? *Structural Change and Economic Dynamics, 27*, 98-117. https://doi.org/10.1016/j.strueco.2013.06.005

Djellal, F., & Gallouj, C. (2023). Core Services and Peripheral Services. In F. Gallouj, C. Gallouj, M. C. Monnoyer, & L. Rubalcaba (Eds.), *Elgar Encyclopedia of Services* (pp. 157-158). Edward Elgar Publishing.

Djellal, F. (2023). Innovation in Services. Services in Innovation. In F. Gallouj, C. Gallouj, M. C. Monnoyer, & L. Rubalcaba (Eds.), *Elgar Encyclopedia of Services* (pp. 322-325, 338-339, 346-347). Edward Elgar Publishing.

Djellal F., Gallouj, C., & Gallouj, F. (2023). Service innovation: Some arguments in favor of services and innovation in services. In A. Rehn & A. Örtenblad (Eds.), *Debating Innovation: Perspectives and Paradoxes of an Idealized Concept*(pp. 183-202). Springer Nature.

Desmarchelier, B. (2019). Service Economies and Complexity. In *Handbook of Service Science, Volume II* (pp. 711-728). Springer, Cham.

Douzet, F. (2014). La géopolitique pour comprendre le cyberespace. *Hérodote, 152-153*(1), 3-21. https://doi.org/10.3917/her.152.0003

Dunn Cavelty, M., & Wenger, A. (2022). *Cyber Security Politics: Socio-Technological Transformations and Political Fragmentation*. Taylor & Francis, New York, NY.

Dyer, J. H., & Chu, W. (2003). The role of trustworthiness in reducing transaction costs and improving performance: Empirical evidence from the United States, Japan, and Korea. *Organization Science, 14*(1), 57-68. https://doi.org/10.1287/orsc.14.1.57.12806

Eisenmann, T., Parker, G., & Van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard Business Review, 84*(10), 92. https://hbr.org/2006/10/strategies-for-two-sided-markets

Espino-Rodríguez, T. F., Lai, P.-C., & Baum, T. (2008). Asset specificity in make or buy decisions for service operations. *International Journal of Service Industry Management, 19*(1), 111-133. https://doi.org/10.1108/09564230810855734

European Commission. (2021). Europe's Digital Decade: Digital targets for 2030. Retrieved March 5, 2023, from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

Farina, E. M. M., Saes, M. S. M., & Azevedo, P. F. (1997). *Competitividade: Mercado, estado e organizações*. São Paulo: Singular.

Gallouj, F. (2023). Innovation in services. Services in innovation. In F. Gallouj, C. Gallouj, M. C. Monnoyer, & L. Rubalcaba (Eds.), *Elgar Encyclopedia of Services* (pp. 331-333, 336-338). Edward Elgar Publishing.

Gallouj, F., Gallouj, C., Monnoyer, M. C., & Rubalcaba, L. (Eds.). (2023). *Elgar Encyclopedia of Services*. Edward Elgar Publishing.

Gallouj, F., & Weinstein, O. (1997). Innovation in services. *Research Policy, 26*(4-5), 537-556. https://doi.org/10.1016/S0048-7333(97)00030-9

Gallouj, F., & Djellal, F. (Eds.). (2010). *The Handbook of Innovation and Services: A Multi-disciplinary Perspective*. Edward Elgar Publishing.

Gallouj, F., & Djellal, F. (Eds.). (2018). *A Research Agenda for Service Innovation*. Edward Elgar Publishing.

Geyskens, I., Steenkamp, J. B. E., & Kumar, N. (2006). Make, buy, or ally: A transaction cost theory meta-analysis. *Academy of Management Journal, 49*(3), 519-543. https://doi.org/10.5465/amj.2006.21794670

Gibson, W. (1984). Neuromancer. In *Crime and Media* (pp. 86-94). Routledge.

G20. (2019). Background-Paper-Infrastructure-Connectivity. Japan G20 Development Working Group January, Japan. https://g20.utoronto.ca/c20/2019-Japan-C20.pdf

Head, M. M., & Hassanein, K. (2002). Trust in e-commerce: Evaluating the impact of third-party seals. *Quarterly Journal of Electronic Commerce, 3*, 307-326. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=2d5c02b2b85b67fd9c32e5357b97a983a2baec26

Henthorne, T. (2011). *William Gibson: A Literary Companion*. McFarland & Company.

Hu, Y., Manzoor, A., Ekparinya, P., Liyanage, M., Thilakarathna, K., Jourjon, G., & Seneviratne, A. (2019). A delay-tolerant payment scheme based on the Ethereum blockchain. *IEEE Access, 7*, 33159-33172.https://doi.org/10.48550/arXiv.1801.10295

Instituto Brasileiro de Governança Corporativa (IBGC). (2021). Compliance à Luz da Governança Corporativa. Conhecimento IBGC. https://conhecimento.ibgc.org.br/Paginas/Publicacao.aspx?PubId=23486

Janczewski, R., Pilarski, G., & Marczyk, M. (2019). Terminology as a Barrier to NATO's Interoperability in Cyberspace Operations. In International Conference, 25(3), 31-35. DOI:10.2478/kbo-2019-0113

Johnson, D. R., & Post, D. (1996). Law and borders: The rise of law in cyberspace. Stanford Law Review, 48(5), 1367-1402. https://doi.org/10.2307/1229390

Kandjani, H., Wen, L., & Bernus, P. (2012). Enterprise architecture cybernetics for collaborative networks: Reducing the structural complexity and transaction cost via virtual brokerage. IFAC Proceedings Volumes, 45(6), 1233-1239. https://doi.org/10.3182/20120523-3-RO-2023.00162

Kerner, R., & Kitsing, M. (2023). Small is beautiful and important: economies and firms trading in digital services. *Journal of Business Economics and Management*, *24*(1), 93-111. https://doi.org/10.3846/jbem.2023.18585

Kreutz, D., Ramos, F. M., Verissimo, P. E., Rothenberg, C. E., Azodolmolky, S., & Uhlig, S. (2014). Software-defined networking: A comprehensive survey. *Proceedings of the IEEE*, *103*(1), 14-76. https://doi.org/10.1109/JPROC.2014.2371999

Lévy, P. (1996). *O que é virtual?* Editora 34.

Lévy, P. (1999). *Cibercultura*. Editora 34.

Lévy, P. (2003). *A inteligência coletiva: por uma antropologia do ciberespaço* (4th ed.). Loyola.

Lippert, K. J., & Cloutier, R. (2021). Cyberspace: a digital ecosystem. *Systems, 9*(3), 48. https://doi.org/10.3390/systems9030048

Luo, Y. (2022). New connectivity in the fragmented world. *Journal of International Business Studies, 53*(5), 962-980. DOI: 10.1057/s41267-022-00530-w

Kang, J. (1999). Cyber-race. *Harvard Law Review, 113*, 1130. DOI:10.2307/1342340

Kim, J. H. (2004). Cibernética, ciborgues e ciberespaço: notas sobre as origens da cibernética e sua reinvenção cultural. *Horizontes Antropológicos, 10*, 199-219.

Kowalski, M., Lee, Z. W., & Chan, T. K. (2021). Blockchain technology and trust relationships in trade finance. *Technological Forecasting and Social Change*, 166, 12064. https://doi.org/10.1016/j.techfore.2021.120641

Mack, G., Ritzel, C., Ammann, J., & El Benni, N. (2024). Improving the understanding of farmers' non-compliance with agricultural policy regulations. *Journal of Rural Studies*, 106, 103190. https://doi.org/10.1016/j.jrurstud.2023.103190

Mancini, J. (2021). Data Portability, Interoperability and Digital Platform Competition: OECD Background Paper (June 8, 2021). https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/10/data-portability-interoperability-and-competition_f09a402e/73a083a9-en.pdf

Matthijsse, S. R., van't Hoff-de Goede, M., & Leukfeldt, E. R. (2023). Your files have been encrypted: a crime script analysis of ransomware attacks. Trends in Organized Crime, 1-27. DOI:10.1007/s12117-023-09496-z

Ménard, C., Saes, M. S. M., Silva, V. L. D. S., & Raynaud, E. (2014). *Economia das organizações:* Formas plurais e desafios. São Paulo: Atlas.

Milgrom, P., & Roberts, J. (1992). Economics, Organization and Management, Pren, tice Hall. Inc., Englewood Cliffs, New Jersey.

Montfort, N., & Bogost, I. (2020). *Racing the beam: The Atari video computer system*. Mit Press.

Mou, J., & Cheong, I. (2022). The vertical boundary for cross-border e-tailers' logistics operations considering transaction costs. International Journal of Logistics Research and Applications, 1-16. DOI:10.1080/13675567.2022.2156987

Mulligan, D., & Levi, M. (2020). Prevalence of Cyber Crime and its Effect on Economy. *Idosr Journal of Arts and Management*, *5*(1). https://www.idosr.org/wp-content/uploads/2020/04/IDOSR-JAM-51-64-69-2020.P2.pdf

Murray, J. H. (2017). *Hamlet on the Holodeck, updated edition: The Future of Narrative in Cyberspace*. MIT press.

Nagle, F., Seamans, R., & Tadelis, S. (2020). Transaction cost economics in the digital economy: A research agenda. *Harvard Business School Strategy Unit Working Paper*, (21-009). https://www.hbs.edu/ris/Publication%20Files/21-009_93af5aea-aa7e-4985-8d7a-7cb65cb51c7a.pdf

Natanelov, V., Cao, S., Foth, M., & Dulleck, U. (2022). Blockchain smart contracts for supply chain finance: Mapping the innovation potential in Australia-China beef supply chains. *Journal of Industrial Information Integration*, *30*, 100389. https://doi.org/10.1016/j.jii.2022.100389

Nelson, R. R., & Winter, S. G. (2002). Evolutionary theorizing in economics. *Journal of economic perspectives*, *16*(2), 23-46. DOI: 10.1257/0895330027247

Ning, H., Ye, X., Bouras, M. A., Wei, D., & Daneshmand, M. (2018). General cyberspace: Cyberspace and cyber-enabled spaces. *IEEE Internet of Things Journal*, 5(3), 1843-1856. **DOI:** 10.1109/JIOT.2018.2815535

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press (cap. 1- 4).

Pang, H., Ruan, Y., & Zhang, K. (2024). Deciphering technological contributions of visibility and interactivity to website atmospheric and customer stickiness in AI-driven

websites: The pivotal function of online flow state. *Journal of Retailing and Consumer Services*, *78*, 103795. DOI: 10.1016/j.jretconser.2024.103795

Park, S. M., & Kim, Y. G. (2022). A metaverse: Taxonomy, components, applications, and open challenges. *IEEE access*, *10*, 4209-4251. **DOI:** 10.1109/ACCESS.2021.3140175

Pavlou, P. A., & Gefen, D. (2004). Building effective online marketplaces with institution-based trust. *Information systems research*, 15(1), 37-59. https://doi.org/10.1287/isre.1040.0015

Penttinen, E., Halme, M., Lyytinen, K., & Myllynen, N. (2018). What influences choice of business-to-business connectivity platforms? *International Journal of Electronic Commerce*, 22(4), 479-509. DOI:10.1080/10864415.2018.1485083

Piccioni, N. (2023) From physical to metaversal events: An exploratory study. *Ital. J.* Mark. 119–134 (2023). https://doi.org/10.1007/s43039-023-00068-1https://doi.org/10.1007/s43039-023-00068-1.

Pine, B. J., & Gilmore, J. H. (2013). The experience economy: past, present and future. In *Handbook on the experience economy* (pp. 21-44). Edward Elgar Publishing.

Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of interactive marketing*, 18(3), 5-14. https://doi.org/10.1002/dir.20015

Rayport, J. F., & Sviokla, J. J. (1995). Exploiting the virtual value chain. *Harvard business review*, 73(6), 75-85. https://hbr.org/1995/11/exploiting-the-virtual-value-chain

Rajala, R., Gallouj, F., & Toivonen, M. (2016). Introduction to the special issue on multiactor value creation in service innovation: Collaborative value creation in service. *Service Science*, *8*(3), iii-viii. https://doi.org/10.1287/serv.2016.0157

Resnick, P., & Zeckhauser, R. (2002). Trust among strangers in Internet transactions: Empirical analysis of eBay's reputation system. In *The Economics of the Internet and E-commerce* (Vol. 11, pp. 127-157). Emerald Group Publishing Limited.

Rindfleisch, A. (2020). Transaction cost theory: past, present and future. *AMS Review, 10*(1), 85-97.

Rossi, M. C. (2023). *Effects of governance structure on mitigation of cyber risks in services* [Doctoral dissertation, Universidade Presbiteriana Mackenzie]. https://dspace.mackenzie.br/items/b61c9abd-2dee-4fb4-a307-d7802be57dd2

Rosenbaum, M. S., & Contreras Ramírez, G. (2023). E-servicescape/Cyberscape. In F. Gallouj, C. Gallouj, M. C. Monnoyer, & L. Rubalcaba (Eds.), *Elgar Encyclopedia of Services* (p. 221). Edward Elgar Publishing.

Rubalcaba, L. (2023). Service Definition. In F. Gallouj, C. Gallouj, M. C. Monnoyer, & L. Rubalcaba (Eds.), *Elgar Encyclopedia of Services* (p. 18). Edward Elgar Publishing.

Rushkoff, D. (2010). *Program or be programmed: Ten commands for a digital age*. Or Books.

Sharma, S., Menard, P., & Mutchler, L. A. (2019). Who to trust? Applying trust to social commerce. *Journal of Computer Information Systems*, 59(1), 32-42. DOI:10.1080/08874417.2017.1289356

Schmidgen, H. (2020). Cybernetic times: Norbert Wiener, John Stroud, and the ‘brain clock’hypothesis. History of the Human Sciences, 33(1), 80-108. https://doi.org/10.1177/09526951198806

Da Silva, A. A., Bataglia, W., Klement, C. F., Sanches, J. Y. L., & Da Silva, A. C. (2017). *A eficácia da especificidade dos ativos, da incerteza e da frequência das transações como proxy de custos de transações*. Universidade Mackenzie.

Sinch (2022). Relatório CX Financeiro: Oportunidades para o Setor Financeiro no Brasil. *Financial CX Report: Opportunities for the Financial Sector in Brazil*. Retrieved from https://v.fastcdn.co/u/a11f3035/62330448-0-PT-cx-report-finance.pdf

Smith, A. (2013). *A mão invisível*. Editora Companhia das Letras.

Statista. (2022). Worldwide retail e-commerce sales from 2014 to 2024 (in billion U.S. dollars).https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/.

Swan, M. (2015). Blockchain: Blueprint for a new economy. " O'Reilly Media, Inc.".

Sundbo, J., Rubalcaba, L., & Gallouj, F. (2022). Servitization in the creative and cultural industries. *International Journal of Quality and Service Sciences*, 14(1), 65-85. DOI: 10.1108/IJQSS-01-2021-0017

Sunyaev, A., Kannengießer, N., Beck, R., Treiblmaier, H., Lacity, M., Kranz, J., ... & Luckow, A. (2021). *Token economy. Business & Information Systems Engineerin*g, 63(4), 457-478. DOI: 10.1007/s12599-021-00684-1

Tapscott, D., & Williams, A. D. (2008). *Wikinomics: How mass collaboration changes everything*. Penguin.London, England.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. Strategic management journal, 18(7), 509-533. https://doi.org/10.1002/(SICI)1097 0266(199708)18:7<509::AIDSMJ882>3.0.CO;2-Z

Teece, D. J. (2014). *A dynamic capabilities-based entrepreneurial theory of the multinational enterprise*. Journal of international business studies, 45, 8-37. https://doi.org/10.1057/jibs.2013.54

Tirole, J. (2010). The theory of corporate finance. Princeton university press.

UNESCO. (n.d.). Internet Governance Glossary - 1. Internet governance general. https://en.unesco.org/glossaries/igg/groups/1.%20Internet%20governance%20general

Urena, R., Kou, G., Dong, Y., Chiclana, F., & Herrera-Viedma, E. (2019). A review on trust propagation and opinion dynamics in social networks and group decision making frameworks. *Information Sciences*, 478, 461-475. https://doi.org/10.1016/j.ins.2018.11.037

Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: an extension and update of service-dominant logic. *Journal of the Academy of marketing Science*, 44, 5-23. https://doi.org/10.1007/s11747-015-0456-3

Yang, Y. C., Shieh, W. S., & Lin, C. Y. (2023). Applying the Fuzzy BWM to Determine the Cryptocurrency Trading System under Uncertain Decision Process. *Axioms*, *12*(2), 209. https://doi.org/10.3390/axioms12020209

Yim, M. Y. C., Chu, S. C., & Sauer, P. L. (2017). Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective. *Journal of interactive marketing*, *39*(1), 89-103. https://doi.org/10.1016/j.intmar.2017.04.001

Wang, L., Wang, H., Huang, M., & Dai, W. (2024). The impacts of blockchain adoption in fourth party logistics service quality management. *International Journal of Industrial Engineering Computations*. Recuperado de http://www.GrowingScience.com/ijiec

Werbach, K. (2018). *The blockchain and the new architecture of trust*. Mit Press.

Werbach, K.. (2020). Introduction: An Endless Spiral of Connectivity? *After the Digital Tornado: Networks, Algorithms, Humanity* (pp. 1-10). Cambridge: Cambridge University Press. https://doi.org/10.1017/9781108610018

Wernerfelt, B. (1984). A resource-based view of the firm. Strategic management journal, 5(2), 171-180. https://doi.org/10.1002/smj.4250050207

Wiener, N. (2017). Cibernética ou controle e comunicação no animal e na máquina. Tradução Gita K. Guinsburgl. – 1ed – São Paulo. Ed. Perspectiva.

Wiener, N. (1954). Cibernética e sociedade: o uso humano de seres humanos. São Paulo: Cultrix, 1984.

Williamson, O. E. (1975). Markets and hierarchies: analysis and antitrust implications: a study in the economics of internal organization. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.

Williamson, O. E. (1979). *Transaction-cost economics: the governance of contractual relations*. The journal of Law and Economics, 22(2), 233-261. https://doi.org/10.1086/466942

Williamson, O. E. (1985) *Transaction cost economics*: The governance of contractual arrangements.

Williamson, O. E. (1991). *Comparative economic organization: The analysis of discrete structural alternatives*. Administrative science quarterly, p. 269-296, 1991. https://doi.org/10.2307/2393356

Williamson, O. E. (1993). Opportunism and its critics. *Managerial and decision economics*, 97-107. https://doi.org/10.1002/mde.4090140203

Williamson, O. E. (1996). The mechanisms of governance. Oxford University Press.

Williamson, O. E. (1998). The institutions of governance. The American Economic Review, 88(2), 75-79. http://www.jstor.org/stable/116896

Williamson, O. E. (2000). The new institutional economics: taking stock, looking ahead. *Journal of economic literature*, 38(3), 595-613. https://doi.org/10.1257/jel.38.3.595

Wu, J. H., & Wang, S. C. (2005). What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model. *Information & management*, *42*(5), 719-729. https://doi.org/10.1016/j.im.2004.07.001

Zhang, X., Song, Z., Moshayedi, A. J., & IEEE Member. (2022). Security scheduling and transaction mechanism of virtual power plants based on dual blockchains. Journal of Cloud Computing, 11(1), 4. https://doi.org/10.1186/s13677-021-00273-3