

Article

Customs Agents Facing State-Driven Technological Changes: Perceptions of the Digitization of Goods Clearance in Chile

Miguel Muñoz ^{1,*} , Juan Felipe Espinosa-Cristia ²  and Raúl Carrasco ³ 

¹ Departamento de Economía, Recursos Naturales y Comercio Internacional, Facultad de Administración y Economía, Universidad Tecnológica Metropolitana, Santiago 7500998, Chile

² Facultad de Economía y Negocios, Universidad Andrés Bello, Viña del Mar 2531015, Chile; juan.espinosa@unab.cl

³ Departamento de Contabilidad y Gestión Financiera, Facultad de Administración y Economía, Universidad Tecnológica Metropolitana, Santiago 7500998, Chile; rcarrasco@utem.cl

* Correspondence: miguel.munoz@utem.cl

Abstract

Globally, states are incorporating various digital tools with the purpose of accelerating customs management of export and import goods. An example of this is the implementation of electronic single windows that seek to streamline the transmission of information on export and import operations by generating a single data entry point that can be accessed by different interconnected state and private entities. For customs clearance, some States require the collaboration of intermediaries known as customs agents: private actors who collaborate in the public function of customs control. Customs agents are licensed by the State to act as such, and are hired by exporters and importers to manage their operations with the customs authority. A digital reform of this type is a governance mechanism that involves coordination between institutions, interaction between the State and private actors, and the redefinition of the role of different actors. However, this can create tensions with actors who collaborate with the State. The objective of this study is to determine the perceptions of customs agents—as incumbent actors and collaborators of the State—regarding the implementation of new technologies by the State, through an analysis of the case of Chilean customs agents in the context of the implementation of a single window system for foreign trade by the Chilean customs authority. To this end, a qualitative study was conducted based on 15 semi-structured interviews with customs agents, including both current and former government officials. The data obtained were coded using MAXQDA software. The results show that the State has had to integrate customs agents into the implementation process, primarily due to their expert knowledge. On the other hand, some customs agents have viewed the implementation of the single window system with apprehension, while others have attempted to embrace the technological change since its inception, collaborating with the government. In order to protect their profession, the agents have sought opportunities for dialogue with the authorities and state agencies. Furthermore, customs agents and public officials agree that one of the system's main weaknesses is the lack of participation from other government agencies in the operation of the single window system, thus failing to meet the State's own established plans: the interconnection of different state agencies at a single point. This, in turn, reveals weaknesses in collaborative governance. In short, the implementation of a single window has been a major challenge for actors collaborating in the public customs function, producing tensions in its governance.



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1. Introduction

Technological changes affect public governance, both in its internal workings and in the relationships that government entities maintain with each other and with external actors (Di Giulio & Vecchi, 2023; Rodríguez Bolívar, 2026; Sienkiewicz-Małyjurek & Zyzak, 2025). This work focuses on the technological change implemented by the State and the perspective of external actors who relate collaboratively with it, particularly in the field of foreign trade.

One of the essential tasks in international trade is the customs clearance of goods. This is defined by the WCO (2024) as “The accomplishment of the Customs formalities necessary to allow goods to enter home use, to be exported or to be placed under another Customs procedure”. Customs clearance procedures are complex and therefore require a thorough understanding of the customs regulations of the country in question (Gwardzińska, 2014).

A customs agent is a professional who acts as an intermediary between customs authorities and exporters/importers (Medin, 2021). In certain contexts, they act as a collaborator in customs governance, since they work jointly with the relevant authority in decision-making processes and the application of policies to achieve public purposes (Ansell & Gash, 2008; Emerson et al., 2012). They have specialized customs expertise to facilitate the exchange of information between customs authorities and companies (WCO, 2016). Customs agents are responsible for assisting exporters, importers, and customs authorities in processing customs clearance for goods, ensuring their legal entry into or exit from the country (WCO, 2024).

Around the world, the hiring of customs agents by traders is not usually imposed as an obligation by governments. According to information from the WCO (2016), 74% of WCO member countries allow for the optional use of customs agents, while, in 9% of cases, their use is mandatory. On the other hand, 14% of members require the mandatory hiring of customs agents, with exceptions in certain cases, and 3% allow third parties to clear goods. Additionally, the vast majority of countries require compliance with specific requirements to operate as a customs agent.

Today, customs officials carry out their duties in a challenging environment, in which governments and multilateral organizations promote trade facilitation. The World Trade Organization (WTO) defines trade facilitation as “The simplification and harmonization of international trade procedures, including activities, practices, and formalities involved in collecting, presenting, communicating, and processing data required for the movement of goods in international trade” (WCO, 2024).

Facilitating trade involves, among other things, reducing the time and costs associated with the paperwork and procedures involved in customs clearance of goods (ECLAC, 2017; Grainger, 2011; OECD, 2018). The promotion of trade facilitation by international organizations dates back to the 1960s (Izam, 2001; World Trade Organization, 2026b). But it has intensified with the widespread adoption of new information technologies and the reduction of tariffs worldwide following the Cold War (ECLAC, 2017; OECD, 2018). One of the most widely promoted trade facilitation tools is the digitization of procedures—through the creation of single windows, for example—to minimize paper use, speed up operations, and reduce associated costs through the electronic interconnection of public entities (Lebid et al., 2024; Pius & Murugan, 2025; F. Wang, 2018). It is, therefore, a

digital reform implemented by the State that is, at the same time, a governance mechanism (Gasco-Hernandez et al., 2022; Ranerup, 2012; Stanojević et al., 2025).

This work addresses the question: what has been the perception of customs agents regarding the incorporation of relevant technological changes in their work, such as an electronic single window? Although a good part of the literature on trade facilitation delves into digitization tools and, particularly, the implementation of electronic single windows, the focus has been mainly on their technical characteristics and the impacts they have had on trade in terms of costs and times (Guilloux & Moreau, 2016; Tijan et al., 2019). Consequently, the perspectives of the actors involved have scarcely been addressed. Those studies that do address these characteristics, however, fail to consider the actors within a socio-technical framework or situate them within their collaborative relationship with the State (Pius & Murugan, 2025). This article aims to fill that gap.

Furthermore, it is interesting to explore the case of Chilean customs agents in particular, given that it has three characteristics that make it special: the single window system is driven by the State (SICEX, 2025); it is part of the 14% of countries that establish the obligation to hire customs agents, except in exceptional situations (WCO, 2016); the agents are licensed by the State to act as such, after a competitive process based on qualifications and knowledge (Servicio Nacional de Aduanas, 2026); its single window system is still being implemented (SICEX, 2025); and the agents operate in a country that has seen its trade multiply in recent decades, given that it is one of the countries with the largest number of trade agreements (WTO, 2026).

The objective of this research is to outline the perception of Chilean customs agents regarding the implementation of relevant technological changes in their work, with emphasis on the current implementation of a single window, in order to identify how they have faced the technological changes that have emerged. In this way, it sheds light on the reaction of private actors who collaborate with public governance to technological changes implemented by States.

2. Literature Review

This work seeks to contribute to the understanding of actors' perspectives on the dynamics of technological change in public management and, particularly, customs management. Within this framework, it bridges the gap that has kept the literature on technological change separate, from the perspectives of multilevel analysis of socio-technical transitions and collaborative governance. This allows us to understand, using a novel approach, how actors linked to states react to technological changes driven by the latter, something that has been scarcely explored in academic publications.

2.1. Understanding Socio-Technical Change in Public Management

Public management is frequently challenged by the arrival of new technologies: given that governments carry out their work in constant interaction with external actors, new technologies impact collaborative governance (Lee & Lio, 2016; Mutiarin et al., 2019; Oni, 2024). The modernization of states through the incorporation of new technologies is relevant because it contributes to improving decision-making and increasing efficiency, although it requires that organizations be prepared (Klievink et al., 2017); it also establishes new capabilities for sustained governance through institutional modernization (Zuiderwijk et al., 2021) and contributes to improving the efficiency and optimization of public services and processes (Latupeirissa et al., 2024; Rusu et al., 2023). An interesting case is the incorporation of information technologies, since, with them, knowledge is applied in devices that, in turn, generate more knowledge and process information (Castells, 2005). This change has affected the work of customs agents in foreign trade in their relationship with customs authorities.

The duties of a customs agent are part of a socio-technical system in which material aspects (technological devices such as computers, electronic connection networks, punch cards, etc.) are interwoven with social aspects (such as the interests of the agents, customs authorities, and other stakeholders, including institutions, political groups, and others) in a “seamless network” (T. Hughes, 1996; T. P. Hughes, 1986, 1993). However, the work of customs agents predates the emergence of new information technologies; therefore, these technologies represent a change in the socio-technical system in which they are embedded. The transformation of a socio-technical system, driven by the emergence of technological innovations, can be examined through a “multilevel perspective” (F. Geels, 2004, 2012). This framework provides a structure that helps us understand these changes—or “sociotechnical transitions”—by analyzing the interaction of three distinct levels. One of these is the “sociotechnical regime.” This refers to a domain in which various elements of a technology-based system (science, industries, rules, markets, users, etc.) maintain a certain coherence or alignment with one another, which endows the system with relative stability. This stability is achieved through “closures,” which act as barriers to the entry of innovations or new actors; these barriers may be established by interested parties to resist changes that threaten the system’s stability (F. W. Geels, 2019; Wesseling et al., 2022). Such threats originate from the other two levels: the “niche” and the “socio-technical landscape.” The niche is the level where radical innovations are born and nurtured, sheltered there until they break into the established system (Giganti & Falcone, 2021). As for the landscape, this refers to variables that change gradually—such as climatic or cultural shifts—or suddenly and with the potential to profoundly impact the regime, such as wars or economic crises (F. W. Geels, 2019; Liang et al., 2023). Ultimately, it is the interaction of these three levels that constitutes a sociotechnical transition.

This research focuses on the implementation of a technological change that involves modernizing public governance (Klievink et al., 2017), recognizing that this is a change in the socio-technical regime of Chilean foreign trade, in which various actors participate (including customs and customs agents), through the incorporation of digitalization and the pressures of a scenario that promotes this transition. In particular, it focuses on customs agents as actors embedded within the system. New technologies have disrupted the socio-technical regime, transforming it into a new socio-technical configuration based on the concept of “trade facilitation”, which is promoted by the States (Alfarajat & Masron, 2024). The new socio-technical configuration, in turn, appears to diminish the importance of customs agents within the system, judging by the policies of international organizations such as the WTO and WCO, which promote digitization and reduce the requirement to hire them (Juárez, 2022; WTO, 2014).

The multilevel analysis of sociotechnical transitions and collaborative governance frameworks are interwoven in this work, as they allow us to situate the technological change that digitalization implies in customs management and understand the dynamics that drive this change in which various actors participate. Collaborative governance allows us to understand the relationship between the State and internal and external actors—such as customs agents—who collaborate in ensuring compliance with customs regulations. Customs agents, therefore, are collaborators from the perspective of their relationship with the State, but they are also stakeholders from the perspective of technological change because they have a vested interest in the changes that the sociotechnical system undergoes, as will be discussed in the following subsection.

2.2. Customs Agents as Collaborators of the State and Incumbents

From a governance perspective of public management, customs agents are collaborating actors, understood as organizations or individuals (from the public, private, or civil

society sectors) who actively participate in decision-making, interacting with governments in pursuit of a common goal (Ansell & Gash, 2008; Emerson et al., 2012). Meanwhile, the incorporation of new technologies creates tensions in collaborative governance, which are supported by various arguments addressed in the literature. For example, these tensions arise from the competition for resources and power exhibited by the actors involved (H. Wang & Ran, 2023) or because the unequal distribution of power among the actors limits collaboration (Lehtonen & Uusikylä, 2021; Ran & Qi, 2018). Other phenomena that strain collaborative governance are based on the natural resistance to change (Plotnikof & Pedersen, 2019) and on trust issues, which make building collaborative processes challenging (D.-Y. Kim, 2014; Waardenburg et al., 2020). As a result, customs agents could see their role and relationship with government entities redefined (Abuljadail et al., 2023; Di Giulio & Vecchi, 2023; Tassabehji et al., 2016).

Regarding its contextualization within a socio-technical transition, customs agents are incumbent actors: actors who typically reproduce, maintain, and improve the socio-technical system through actions guided by the shared rules and institutions that define it (F. W. Geels, 2014). Incumbent actors create barriers that, while providing stability to the system, make it difficult for new entrants to break into the market. These actors include users, companies, politicians, and interest groups (F. W. Geels, 2014). But just as they can put mechanisms in place to shut things down, they can also adopt an attitude of embracing technological change (F. W. Geels, 2019) or reorient themselves to varying degrees by forming partnerships with new entrants, for example (F. Geels et al., 2016). Resistance, meanwhile, can take many forms. For example, they can engage in political activism to help mitigate the threats posed by newcomers (Ford & Newell, 2021) or they can use discourses to oppose the socio-technical transition (Lowes et al., 2020). The reactions of incumbents have also been examined in various analyses of specific cases, such as in the fields of electromobility and energy (Ford & Newell, 2021; Jano-Ito & Crawford-Brown, 2016; Kanger & Sovacool, 2022; Liu & Chao, 2022; Morgunova, 2021; Valta et al., 2022), the shipping industry (Stalmokaite & Yliskylä-Peuralahti, 2019), urban water resource management (Quezada et al., 2016), and innovations in the field of cooperative investment (Gismondi et al., 2015).

Despite their role in foreign trade, few publications have focused on customs agents. Some of them emphasize their importance in customs clearance procedures (Juárez, 2022; Llanto et al., 2013) and the safeguards they provide, through their work, for biosecurity (Bondarenko & Tkachyk, 2017). There are also publications on their implementation in environments characterized by a high degree of institutional informality (Cantens et al., 2014). Some studies point to a decline in their relevance: Llanto et al. (2013) and Riga (2016) focused on the Philippine context to demonstrate that their influence is waning amid customs modernization, where computerization is replacing agents' interactions with local customs officials, a development perceived as a threat by the agents. Additionally, regarding customs agents' perceptions of the technological changes involved in the digitization of cargo clearance, Pius and Murugan (2025) emphasized that customs agents remain indispensable for customs clearance in India due to their expertise in customs regulations and their ability to coordinate related tasks. Gwardzińska (2014) also describes this situation in the Polish case, but he further highlights the opportunities that arise for customs agents as a result of international standards on supply chain security. Finally, a study in Norway found that customs agencies, like other commercial intermediary services, reduce fixed costs for their users, since these agencies are primarily tasked with providing logistics services or other related services and, secondarily, clearing goods (Medin, 2021).

2.3. Single Windows and Their Impact on Foreign Trade

The focus of electronic single windows for foreign trade lies in establishing a platform where trade stakeholders—such as exporters and importers, customs authorities, customs agents, and government regulatory and certification agencies (e.g., health and phytosanitary agencies)—can collaborate by sharing information related to trade transactions (Widdowson et al., 2019). According to Tijan et al. (2019), the electronic single window is also important for connectivity among stakeholders in the transportation sector, which involves the electronic exchange of data within the port system.

The impact of single windows on foreign trade has received particular attention in recent years, particularly in terms of their technical aspects (Ahn et al., 2008; Dong et al., 2022; Guilloux & Moreau, 2016) as well as in terms of their implementation. In the latter case, we can identify studies that provide a regional overview, such as the case of ASEAN (Ming Chow, 2018; Weber, 2012), but also a review of specific applications in different countries (J. Kim et al., 2022; Melgar & De María, 2023; Nizeyimana & De Wulf, 2015; Peynirci, 2023; Tosevska-Trpcevska, 2014). In the case of Latin America, some studies have shown that electronic single windows help reduce the time and costs involved in carrying out various procedures in international trade (CEPAL, 2023; Tijan et al., 2019).

The literature still contains only a limited number of studies that have delved into the socio-technical analysis of technological change in the customs clearance process for goods. In this context, the work by Aryee et al. (2021) emphasizes that the digital transformation of freight forwarding in Ghana was driven by key stakeholders rather than by technological determinism. Additionally, Muñoz (2019) analyzed the pressures that technological change and trade liberalization exerted on the Chilean foreign trade system, but without delving into the reaction of incumbent actors.

While studies on the implementation of single windows as part of the digitization process are abundant, less attention has been paid to the reaction of the actors involved and those who, therefore, could see their participation in the socio-technical system affected. In this sense, it is valuable to examine the Chilean case, given that the digitization taking place there is driven by the State; customs agents are actors highly regulated by the State, and the country has faced exponential growth in its trade in recent decades. Therefore, this case sheds light on how the impetus of State-led technological change alters the perceptions of incumbent collaborators—such as customs agents—regarding their role and new technologies.

The literature on the modernization of Chilean customs operations is limited. The work of Muñoz (2019, 2021) stands out, regarding the incorporation of technologies for trade facilitation and the trade facilitation measures taken in that country, and in Peru, in response to the COVID-19 pandemic. Despite this, the Chilean case is useful for understanding how incumbent actors react to the implementation of a state-driven technological change that impacts their work.

The implementation of the electronic single window system occurs within the context of modernizing customs clearance through the integration of information technologies. Following the introduction of the first computer to support statistical management and customs procedures at Chilean customs in the 1960s, the State established the “principle of good faith” in the management of customs agents. This principle establishes that the Customs Service considers the information provided by these agents to be truthful. In the 1980s, the Customs Service promoted the electronic management of customs procedures through the implementation of a Comprehensive Foreign Trade System. From the mid-1990s onward, Electronic Data Interchange (EDI) began to be used, based on the United Nations standard (UN/EDIFACT) and the Value Added Network (VAN), and the documents required for customs procedures were simplified. This also allowed customs

agents to connect with the Customs Service using their own technological tools. In early 2000, the Internet Systems Integration Project for the Development of Customs Operations and Regulations was implemented, with the aim of processing various procedures (such as storage, transportation, and payment of duties, among others) through a single portal (Muñoz, 2019). Simultaneously, the country continued to implement a trade liberalization policy and increase its trade. The establishment of the electronic single window, SICEX, began in 2010 (SICEX, 2025) and, subsequently, in 2017, a law was passed that modernized customs legislation, incorporating, among other changes, the Authorized Economic Operator (AEO) designation (Ministerio de Hacienda, 2017). Subsequently, in January 2020, the National Customs Service formalized the “Electronic Dispatch Folder”, which seeks to strengthen the presentation and preservation of documents related to the dispatch of goods (Servicio Nacional de Aduanas, 2017).

In summary, this research presents the perspective of actors involved in public governance regarding technological innovations driven by states. To this end, it aims to determine how Chilean customs agents have perceived technological change, focusing on the implementation of a single window system. In doing so, it seeks to address the existing gap in the literature, which recognizes them as key players in international trade.

3. Chilean Customs Agents and the Single Window for Foreign Trade

In Chile, the National Customs Service is responsible for regulating the import and export of goods and services, in accordance with the Customs Ordinance (Ministerio de Hacienda, 2005). This, in turn, falls under the jurisdiction of the Ministry of Finance and, specifically, the Undersecretariat of Finance.

To carry out their export and import operations, companies require authorization from the National Customs Service. However, these parties cannot apply directly to customs; they must normally do so through a customs agent acting on their behalf (Ministerio de Hacienda, 2005).

In Chile, the regulations define a customs agent as “a professional who assists the customs service, whose license authorizes them to provide services to third parties as an agent in the clearance of goods” (Ministerio de Hacienda, 2005). Thus, the customs agent, acting on behalf of a trader, handles the relevant export or import information with the National Customs Service. Currently, there are 274 authorized customs agents in Chile (Servicio Nacional de Aduanas, 2026). It is, therefore, an incumbent actor that collaborates with the Chilean State.

The National Customs Service specifies and authorizes who may serve as customs agents: they must be Chilean citizens who have passed a competitive examination, which includes a background check and a knowledge assessment (Ministerio de Hacienda, 2005). Exporters and importers are required to use this service. However, there are some exceptions, notably the import of goods with an FOB value not exceeding USD 1000 and the export of goods with an FOB value of up to USD 2000 (Servicio Nacional de Aduanas, 2026). It is, therefore, a significant player in Chilean foreign trade, although one that has received little attention. The information that agents present to customs includes the details of the corresponding operation. Based on the supporting commercial documents provided by their client, the customs agent prepares a DIN (Import Declaration) for imports or a DUS (Export Declaration) for exports, summarizing the relevant data. They then submit this document—the DIN or DUS—to the National Customs Service electronically. To do so, customs agents use software interconnected with the customs authority. The most widely used is “SIGAD,” owned by the company EDITRADE; a smaller number use the “Aduananet” program. In operations other than exports or imports, the agent also assists

with the submission of information to the National Customs Service ([Servicio Nacional de Aduanas, 2026](#)).

In addition, agents typically handle the process of obtaining approval for the export or import of goods from other specialized government agencies, depending on the nature of the goods. However, this is a task that exporters and importers can perform themselves. For example, marine products require authorization from the National Fisheries and Aquaculture Service (SERNAPESCA), while agricultural products require authorization from the Agricultural and Livestock Service (SAG), among others ([Servicio Nacional de Aduanas, 2026](#)). The single window for foreign trade currently being established in Chile aims to integrate the various public agencies into a single point of contact for authorizations and other procedures.

Currently, there are two trade associations for customs agents: the Chilean Customs Chamber (CACH) and the National Association of Customs Agents (ANAGENA). The former was established in 1939 and has 48 member brokers, while the latter has 171 members and was founded in 1993 ([Asociación Nacional de Agentes de Aduana, 2025](#); [Cámara Aduanera de Chile, 2026](#)).

Recent years have presented a challenging socio-technical landscape for customs agents. A key factor is the exponential growth of Chilean trade, driven by the signing of trade agreements with more than 30 countries ([SUBREI, 2022](#)). Between 2003 and 2025, exports of goods grew from nearly USD 22 billion to USD 107 billion, while imports rose from USD 19 billion to USD 92 billion ([Banco Central de Chile, 2026](#)). In other words, the boom in Chilean foreign trade also poses a greater challenge in terms of the number of customs procedures required to clear goods.

Another important aspect is the rise of trade facilitation and digitalization on the international stage. International organizations such as the WTO and the WCO have promoted agreements on trade facilitation and the development of related measures. The WCO finalized the Revised Kyoto Convention in 1999, which established modern principles for streamlining customs clearance procedures while safeguarding the necessary customs control measures. It also encourages the use of electronic technologies as widely as possible in the customs clearance of goods, with the aim of streamlining procedures ([Juárez, 2022](#)).

On the other hand, in 2013, the WTO adopted the Agreement on Trade Facilitation. This agreement is particularly significant because, on the one hand, it requires countries to implement digitization (through the use of electronic means for document management, the payment of fees and duties, and electronic processing), and, on the other hand, it prohibits them from making the use of customs agents mandatory ([WTO, 2014](#)).

A significant portion of the tasks performed by customs agents—such as filling out and processing numerous documents (authorizations, certificates, permits, declarations, etc.)—used to be done manually and in person. The advent of new information technologies, however, has made it possible to streamline these processes through the digitization of information and the transmission of data via electronic networks. Document management for the clearance of goods can be carried out more efficiently through the use of information technology ([Corfmat & Castro, 2003](#)).

In the context of this study, a new feature of the system is the promotion and implementation of the Integrated Foreign Trade System (SICEX), an electronic single window, by the Chilean government's Undersecretariat of Finance. This system was established in 2010 as a result of Supreme Decree 1049, which mandated the creation of a Presidential Advisory Commission for the establishment of an Integrated Foreign Trade System, chaired by the Undersecretary of Finance and comprising representatives from the Undersecretaries of Foreign Affairs, Economy and Small Businesses, Public Health, Agriculture, and, subsequently, Mining ([Ministerio de Hacienda, 2010](#)). SICEX operates through an online

electronic platform for exporting and importing goods and services. It is a single channel through which the procedures, certifications, and authorizations necessary for exports and imports can be managed. Therefore, various actors involved in these operations, such as customs, customs brokers, and other government agencies, interact within this platform. This makes it essential for all these actors to harmonize their processes, data, and platforms so that they can share information online (SICEX, 2025). It consists of two modules—export and import—and states that its objectives include: the digitization of logistics and foreign trade processes; the simplification of procedures to reduce operational costs and processing times; and the harmonization of customs information and procedures with entities in partner countries, among others. It is defined as “a single electronic channel for exporting and importing, which facilitates foreign trade by reducing processing times and costs.” This system “is interconnected and integrated with the platforms of all public services involved in foreign trade, which interoperate with one another.” Among the services mentioned are: National Customs Service, SAG, ISP, SERNAPESCA, SII, and TGR (SICEX, 2025).

The implementation of the single window for foreign trade has meant some changes for customs agents. For example, it has simplified the process for them to harmonize their platforms with the single window, enabling them to interconnect with it. Additionally, documentary procedures that exporters and importers usually delegated to customs agents for in-person processing can now be carried out through the electronic single window. Consequently, these procedures have resulted in greater efficiency in terms of time and costs for customs clearances (Garrido Hidalgo et al., 2026). Therefore, state-driven technological change includes replacing paper documents and face-to-face interaction with digital processing, centralizing certification requirements on one platform, and integrating information flows between government agencies. Specifically, SICEX has brought about a change in processes traditionally carried out by customs agents, presenting both potential threats and opportunities for their professional role in trade operations. For this reason, understanding their perceptions is particularly relevant.

The emergence of a single window system, coupled with international organizations' promotion of its non-mandatory nature, could pose complex challenges for the future of customs brokers. Chile's socio-technical trade regime is under pressure from the electronic single window and elements of the socio-technical landscape. Customs brokers are incumbent and collaborating actors in the midst of these changes, making it important to examine how they have responded to the emergence of new technologies, particularly from the point of view of collaborative governance management.

4. Materials and Methods

4.1. Research Design

This study adopts a qualitative–interpretive approach, as it is based on the analysis of non-standardized data that, by its very nature, requires interpretation. In this type of study, the validity of different interpretations is acknowledged, and the aim is to identify the personal or social meanings associated with certain phenomena (Schreier, 2012). The aim of this study is to examine how Chilean customs officials have responded to a current technological change (SICEX), and, to this end, it also gathers their perspectives on past changes and emerging technologies. Consequently, the study employs a longitudinal design, based on a retrospective and comparative analysis, supported by the current perceptions of the stakeholders interviewed (Hernández Sampieri et al., 2014).

4.2. Case Selection and Context

The case study, which focuses on Chilean customs agents, has certain distinctive features. First, in Chile, the clearance of imported and exported goods is handled by the National Customs Service and must be carried out through customs agents, although there are some exceptions. Second, the country is still in the process of implementing a single window system (SICEX). Finally, these are actors operating in an environment where foreign trade operations have increased steadily, based on the signing of trade agreements ([Banco Central de Chile, 2026](#); [World Trade Organization, 2026a](#)).

4.3. Sampling Strategy

The study gathered the perspectives of 10 customs agents and 5 current and former public officials involved in the customs clearance of goods. Customs agents were selected because they are actors involved and affected by the implementation of SICEX as a technological change in customs clearance. Since consulting the customs agents themselves might provide a biased perspective on their views regarding technological change, current and former public officials were also consulted in order to triangulate the data across different stakeholders and thereby strengthen the robustness of the results. The interviews with current and former representatives of the National Customs Service and other public agencies are necessary because these organizations are involved in Chilean foreign trade procedures, granting permits and authorizations; therefore, they have participated in SICEX since its inception. Furthermore, they interact with customs agents on an ongoing basis in the management of goods clearance: without the authorizations from the relevant agencies, export and import operations cannot be carried out. The interviews were conducted until a point of saturation was reached, that is, when the collection of new data ceased to offer new perspectives or topics ([Creswell & Creswell, 2023](#)). A combination of variation-based purposive sampling and snowball sampling was used. In the first case, this was done to ensure diversity ([Palinkas et al., 2015](#)) among the participants. In the second, it was done with the intention of expanding access to consulted actors ([Creswell & Creswell, 2023](#); [Palinkas et al., 2015](#)). Thus, the first interviewees were selected due to their high exposure to the digitization process. Subsequent interviewees were recruited through referrals, covering diverse professional experiences and membership in a trade association. Regarding the participation of members from the two existing associations, this allows for the inclusion of diverse opinions that their members might express, especially since CACH has a longer history than ANAGENA. Furthermore, their strategies for engaging in technological change may differ (for example, by showing greater or lesser reluctance to technological change), as may their relationships with the relevant authorities and government agencies. Due to the nature of this electronic single window, all customs agents interviewed are interconnected with it. All interviewees have or have had direct involvement in customs procedures and participate or have participated in the decision-making processes of their organizations, particularly regarding SICEX. This certainly includes current and former officials from government agencies consulted. Therefore, the interviewees represent different perspectives on customs management. Some details about the interviewees were intentionally omitted to protect their anonymity, as they operate within a specialized and limited professional sphere.

The characteristics of the customs agents interviewed are shown in Table 1.

As for current and former officials, they work or have worked in public agencies such as: the National Customs Service, the Undersecretariat of Finance, SERNAPESCA, ISP, and SAG. Table 2 below lists them.

Table 1. Customs agents interviewed.

Custom Agent	Trade Association	Experience as an Agent
Agent 1	ANAGENA	more than 30
Agent 2	ANAGENA	less than 10
Agent 3	ANAGENA	less than 10
Agent 4	CACH	more than 30
Agent 5	ANAGENA	between 21 and 30
Agent 6	CACH	between 10 and 20
Agent 7	ANAGENA	more than 30
Agent 8	ANAGENA	between 10 and 20
Agent 9	CACH	between 21 and 30
Agent 10	CACH	between 10 and 20

Table 2. Current and former government officials interviewed.

Actor	Agency
Official 1	Undersecretariat of Finance
Official 2	SERNAPESCA
Former official 1	ISP
Former official 2	National Customs Service
Former official 3	National Customs Service

4.4. Data Collection

Given the established objective, the research was based on the conduct and analysis of semi-structured interviews. This approach was chosen because it gives the interviewee greater control over the discussion, allowing their views to emerge more freely (Tracy, 2025). A total of 15 interviews were conducted, each lasting approximately 40 min. Regarding the format of the interviews, different strategies were employed in consultation with the interviewees, as shown in Table 3:

Table 3. Interview format.

Interview Format	Number	Type of Interviewee
In-person	5	3 customs agents/2 former government officials
Online (video call)	9	7 customs agents/2 government officials
Online (chat via app)	1	1 former government official

The online interviews via video calls were conducted using Microsoft Teams and Google Meet. The only online interview conducted via a mobile messaging app was carried out using WhatsApp.

The interviews took place on various dates agreed upon with the interviewees between 11 August 2025 and 26 January 2026. The general structure of the interviews included the following elements:

- Background of SICEX;
- Perception of SICEX and its impacts;
- Experience with previous technological changes;
- Emergence of new technologies for customs clearance.

These topics were generated with a temporal logic (past technological change, future technological change, and current technological change with SICEX) so that the opinions of customs agents about SICEX can be triangulated by comparing them with broader perceptions about technological changes from other times.

The interviews were recorded and saved in MP4 format. They were then transcribed into text files and saved for later analysis. All interviewees signed an informed consent form that clearly outlined how the information gathered during the interviews would be handled.

4.5. Temporal Analytical Framework

In addition to incorporating stakeholders' perceptions of SICEX, the study includes a retrospective analysis of previously implemented technologies, as well as forward-looking assessments of the potential for adopting emerging technologies in customs clearance, such as artificial intelligence and blockchain. This exercise allowed us to determine whether the perception of the technological change represented by SICEX corresponds to a continuous phenomenon or not, thereby helping to control for any bias that might be present in the agents' responses.

4.6. Data Analysis

Data analysis was conducted using inductive and axial coding; that is, codes were created as the data were reviewed. This made it possible to identify recurring experiences, concepts, and perceptions among the interviewees. The accumulation of codes was managed using a codebook, which allowed them to be organized into subcategories and categories (Saldaña, 2021) related to perceptions of previous technological changes, the implementation of the single window system, and emerging technologies. The codebook was continuously developed and refined throughout the analysis process to strengthen its consistency. The coding process began after the first interview was conducted, with the aim of identifying emerging themes. As more interviews were conducted, additional codes were identified, thereby increasing both their number and accuracy. MAXQDA version 24.9.1 was used for coding although it also helped in comparing the interviews to identify differences and similarities between the responses obtained. Figure 1 shows the main categories and subcategories.

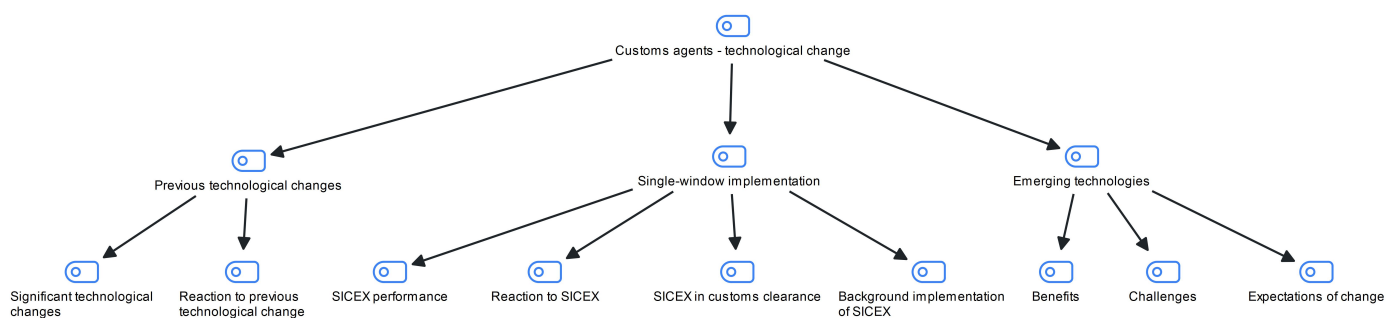


Figure 1. Hierarchical model of categories and subcategories.

4.7. Validity and Reliability

The study strengthened its credibility through stakeholder triangulation, with the aim of cross-checking the responses of customs agents against those provided by other stakeholders involved in customs clearance (current and former public officials). Additionally, temporal triangulation was incorporated by considering perceptions of technological changes in the past, present (SICEX), and future (emerging technologies). In this way, the study avoided capturing only isolated perceptions of SICEX, but rather viewed them as part of reactions to technological changes occurring at different times, thereby mitigating the potential bias that might arise.

Contextual background information was provided, covering the description of the Chilean customs system, the regulatory framework for customs agents, and the characteris-

tics of SICEX, with the aim of offering criteria for evaluating the applicability of the results in different contexts.

The study's reliability was ensured by following guidelines for conducting semi-structured interviews, which were consistently applied to all participants. The data were systematically coded. This coding and management were performed using specialized software, thereby ensuring the transparency and traceability of the analyses.

By using direct quotations, comparing accounts, and drawing on the author's own experience, this study sought to ensure the neutrality of its interpretations. For example, categories were compared with alternative explanations. Indeed, as a researcher, the author of this publication holds an undergraduate degree in international trade and therefore has knowledge of how Chilean customs clearance operates. However, he has not worked professionally in governmental or private organizations directly related to the customs clearance of goods.

Ethical Considerations in Research

The interviews were conducted in accordance with the approval of the Scientific Ethics Committee of the Universidad Tecnológica Metropolitana. Each participant signed an informed consent form in which the processing of their responses was explained and the protection of their identity was guaranteed.

5. Results: Opposing Perceptions of Customs Agents Regarding Technological Change and Weakness of Collaborative Governance

This section presents the research findings regarding customs agents' characterization of a single window system, their own role in goods clearance, their perceptions of its implementation, and their reactions to past and emerging technological changes. While the initial results help to understand how agents have faced the challenge of state-driven digitalization and the challenges to collaborative governance, the latter demonstrates the intertemporal consistency of the findings.

5.1. A Relevant Tool, with Implementation Problems

The following results offer the characterization of the single window system by customs agents, as a technological tool, as well as the factors that, in their opinion, are behind its implementation. In this way, their interpretation of the reasons for the technological change driven by the State and the status of their participation—as incumbent actors—can be understood, serving as input for identifying potential weaknesses in collaborative governance.

5.1.1. SICEX: A Challenge for Government Agencies That Did Not Include Customs Agents

When the single window system was first launched, only government agencies were invited to participate by the Undersecretary of Finance.

Customs brokers recognize the fundamental purpose of the tool. As part of their work, they must obtain authorizations from various public agencies, depending on the type of goods and transaction they are handling, such as health, fisheries, agricultural, or other authorities. Through the single window, therefore, they can manage the various permits virtually, entering the detailed information about the transaction just once. In general, they emphasize that the single window would allow for the consolidation of procedures into a single point. "Essentially, the government wanted to establish a single hub where all the necessary procedures for foreign trade could be concentrated" (Agent 5). "SICEX is a very broad project that effectively seeks to involve many more actors throughout the entire supply chain, which, at least for us—I don't know about the rest of the agents (...)—would be essential" (Agent 8).

However, they note that they were not included in the initial phase of the project's implementation; there was no specific module on the platform for them to log in:

So, of course, when they started rolling out the system, people began asking, “Wait, what login credentials does the customs agent use? What are their roles?” (...) And the trade associations got involved, the Customs Chamber got involved, and they began to see the need to include the customs agent among the stakeholders. (Agent 10)

The agents acknowledge that the goal of establishing SICEX requires a significant coordination effort among government agencies, which are accustomed to operating according to their own routines and systems: “(...) because SICEX was also a tremendous challenge for the public sector—that is, in terms of adapting all customs processes or the processes they were responsible for” (Agent 10).

But they also agree on the importance of incorporating the single window system in the context of Chile’s growing trade “(...) because foreign trade operations have been increasing steadily over time, but with e-commerce, they have skyrocketed” (Agent 2). In fact, they say the idea was “quite good” because it allows them to deliver information to different government agencies by filling out a single form (Agent 5).

However, there are significant challenges in its implementation. The most significant of these relates to the government’s inability to ensure interoperability among the IT systems of various public agencies. As a result, the single window fails to fully fulfill its purpose:

In my opinion, based on my many years of experience dealing with the SICEX system, the challenge has been that it has been very difficult to implement. It has been very difficult to get all stakeholders—especially government agencies—on board so that it functions properly as a single window, rather than requiring stakeholders to navigate a maze of government agencies. (Agent 8)

Customs agents recognize the purpose of the single window as a tool for processing procedures with public agencies in the context of customs administration. However, they were not involved in its implementation from the outset. While they emphasize the importance of implementing a single window for trade, they maintain that its implementation has faced difficulties due to the lack of integration among the public agencies involved in the system.

5.1.2. Trade Liberalization and Foreign Best Practices: Factors Behind the Incorporation of the Single Window

Customs agents were asked about the factors that they believed had contributed to the creation of Chile’s single window system. In this regard, they highlighted two types: international and domestic. Regarding international factors, they cited Chile’s trade liberalization policy, the traceability of trade operations, and the adoption of international best practices. As for domestic factors, they highlighted the need to modernize government procedures to increase competitiveness.

The agents noted that trade agreements have been significant in this regard “because we are so open to the economy, with all countries, and increasingly so” (Agent 4). Closely linked to these agreements is the issue of traceability, since trade agreements establish standards regarding control:

(...) such as those with the European Union—and the requirements are very strict in that they mandate a health certificate that must provide flawless and complete traceability all the way to the destination. (Agent 10)

In fact, the implementation of a single window that links public agencies means that “we can track processes much more clearly to identify where bottlenecks might occur, and so on” (Agent 8).

Others highlight the relevance of practices in other countries as a factor: “I believe they influenced some international decisions because other countries had implemented

them or were in the process of doing so. Colombia was implementing a single window. Peru was implementing a single window” (Agent 7).

With regard to the modernization of the state, one of the stakeholders notes that

It stems from a competitive drive. At one point, President Piñera’s administration said we needed to improve the country’s productivity. What obstacles can we address? How does the permitting process work? How can we make it more efficient? I believe that was the original idea behind this initiative. And the task was assigned to staff at the Ministry of Finance. (Agent 5)

However, one official also argues that the views of private-sector stakeholders—including the officials themselves—also influenced the implementation of the single window:

(...) one could ultimately say that private entities and customs agents—and perhaps some others as well—pressed for the establishment of a mechanism like this, but the Undersecretary of Finance has been leading the program. (Agent 10)

Therefore, customs agents perceive the influence of both international and domestic factors behind the creation and implementation of SICEX in Chilean foreign trade, highlighting Chile’s trade liberalization and international practices.

Interviews conducted with current and former officials from public agencies involved in customs clearance of goods show a certain consistency with the views of customs agents reviewed above.

Regarding the purpose of the single window, one interviewee noted that it is

To facilitate trade, which meant reducing costs, time, and expenses for exporters and importers and, consequently, becoming a more productive country—that is, fostering collaboration and increasing competitiveness and productivity (...) Initially, the goal was simply to streamline customs procedures and other processes related to the export and import of public and documentary services. (Official 1)

The aim was thus to streamline trade by digitizing detailed information on transactions, thereby eliminating the need to “(...) gather paperwork from all over and then take it to customs to complete the formalities there (...)” (Former Official 2).

Customs agents, in fact, were not included at the outset of the implementation process, which affected its progress:

(...) in the end we had to bring them on board, and we started working with the customs agents’ technology providers. Why? Because what wasn’t anticipated—since private sector entities weren’t included in the design—was that the customs agents had their own systems connected to Customs. (Official 1)

With regard to the difficulties encountered during implementation, it is also acknowledged that there are shortcomings in the integration of certain elements into the single window system, particularly regarding approvals from public agencies that have not yet fully integrated with SICEX: “(...) what we know is that we are behind on approvals from some public services for imports, since everyone wants that, but there is a government-wide difficulty there” (Official 1). “(...) And the truth is that it has been a challenge for the government to ensure that other government agencies are up to the task (...)” (Official 2).

Regarding the factors that drove the implementation of SICEX in Chile, both international factors (a surge in trade agreements signed by the country and foreign best practices) and domestic factors related to the modernization of the State are highlighted:

The large number of international treaties Chile signed (...) was one of the main incentives for seeking ways to modernize the government through information technology (...) The country is defined by its openness and the reduction of tariffs; therefore, anything

that would streamline import (...) and export (...) processes were factors that compelled the country to make these kinds of advances. (Former Official 1)

With regard to best practices,

SICEX was conceived based on international best practices originating in Asia—specifically Korea and Japan—and dating back to the 1980s. The goal was to replicate that model here using technology to facilitate trade. (Official 1)

“In this way, the single window also addresses the ‘concept of trade facilitation and efficient logistics—something no one used to talk about’”. (Official 1)

Finally, regarding local factors, one interviewee noted that during the period when SICEX implementation began, “there was (...) great interest in integrating public services and incorporating information technologies (...) there was a push (...) to streamline processes by applying information technologies” (Former Official 1).

When comparing the perceptions expressed by the agents with those of current and former officials from government agencies, it is possible to note consistency in aspects such as the purpose pursued by the technology, the lack of involvement of customs agents at the outset, and implementation difficulties stemming from challenges in engaging public agencies. Similarly, regarding the factors driving the technology, there are international factors, such as the country’s trade liberalization and international best practices, and national factors, such as the modernization of the state.

5.2. Deficiencies in Government Agencies’ Collaboration and Opposing Perceptions About the Single Window Among Customs Agents

These results shed light on the weaknesses and strengths that customs agents observe in the implementation of the single window system. They also delve into their role as incumbents within the socio-technical system being transformed by the state’s push for digitalization. Furthermore, they explore their reactions to the incorporation of the new technology, specifically how they have perceived it and whether this perception has been inconsistent.

5.2.1. Some Strengths in a Context of Conflicting Opinions and Disappointment over the Weak Linkage of Government Agencies

An important factor in gaining a comprehensive understanding of customs agents’ perspectives on the implementation of new technology is assessing its impact on the tasks they perform. In this regard, opinions vary. Several respondents agree that SICEX has had no impact on their operations. They note that they do not see any significant difference between working with or without SICEX.

I think, from our perspective, nothing. I couldn’t say it’s zero, but something very close to zero. Something very close to zero. (...) we, as users, are actually doing practically everything the same way we did before SICEX. There’s no major difference. (Agent 5)

Basically, SICEX is seen merely as a “transit point” for information, with little impact on operations: “Not today; it’s just a place you pass through” (Agent 9). However, other agents point out the opposite: they have noticed a beneficial impact on their operations, especially in processing the DUS: “(...) it has had a positive impact because the truth is that it’s almost perfect. I’d say that if we could get imports in Chile to be handled under the same conditions, we’d gain a lot” (Agent 4).

Regardless of how they assess SICEX’s impact, agents handling customs clearance for fishery products acknowledge that SICEX’s interoperability with the SERNAPESCA system has improved process efficiency: “It has made the clearance process for goods of

marine origin more efficient. Basically, everything related to SERNAPESCA. Since we are fully integrated with that public service" (Agent 3).

The integration of the various public sector actors is one of the weaknesses most frequently cited by customs agents. This, combined with certain operational shortcomings, has led to disappointment: initially, there were high expectations regarding the system's potential, which were later unmet. One agent notes that he still has to go in person to complete procedures at one of the government agencies that should be connected to SICEX:

[SICEX] aims to create a unique interaction, so to speak (...), and that is something we are working on, but it doesn't work right now—the other stakeholders aren't participating (...). We, for example, have to go through the Regional Ministerial Secretariat of Health; I can't do it through SICEX, when logically it should be a major e-commerce platform. (Agent 8)

This lack of coordination, according to agents, could be explained by the fact that foreign trade is not a primary concern for the other government agencies, even though goods cannot be cleared for shipment without their approval:

At the Ministry of Agriculture, their focus is on protecting wildlife and flora. Foreign trade is just an afterthought for them (...). If we don't have their approval, we can't get the goods out or ship them. (Agent 1)

Some agents have also pointed out that the SICEX service often has some shortcomings, such as glitches that must be resolved by contacting the platform's technical staff: "It doesn't happen often, but I have four such cases a year where I have to call SICEX. Or send an email" (Agent 6).

The highlighted weaknesses have caused disappointment among agents, especially those who joined the single window from the very beginning: "I think we've gone in circles. I don't know how many hours have been wasted, and we're still in the same situation" (Agent 5).

Therefore, in that sense, given our proximity to the public sector, we are often cautious about getting our hopes up too much when there is an announcement like this, because we know that the processes are not as fast as even the authorities themselves would sometimes like them to be (...) it still does not meet the objective they likely set for themselves, which was to be a platform, a single window as expected. (Agent 8)

However, when asked about the strengths, some noted that the "single window" concept has the potential to streamline the clearance of goods: "I mean, if this could be implemented as a single platform for international trade, it would be wonderful, because all countries would essentially be speaking the same language" (Agent 3).

Other agents highlight the advantages it offers in terms of speed, control, and the robustness of the service:

First, all transactions are thoroughly recorded. Second, shipments are approved very quickly—much faster, for example, than a standard export or import transaction. There are no system crashes; the system doesn't go down. In other words, it's secure. It's very robust; we don't have that problem. And (...) it facilitates the second message, but there's also very good communication. In other words, when there's a problem, it gets solved. (Agent 4)

In summary, customs agents have mixed views on its impact. While some noted that SICEX has had no impact on their operations, others highlighted its impact on certain tasks. The main weakness cited is the lack of interoperability among public agencies that should already be connected to the single window, which has led to disappointment. On the other

hand, they highlight strengths related to the tool's potential, emphasizing the speed and robustness of the service, as well as the control it offers over the processing.

5.2.2. Opposing Perceptions Among Customs Agents and the Search for Instances of Influence

By comparing their role in customs clearance with the contribution of electronic single-window technologies, customs brokers have a clear understanding of how their profession continues to contribute to trade. In fact, Chilean regulations mandate the use of these systems, albeit with some exceptions. But that is not the only reason; there are other factors that determine the essential role of the customs agent: "(...) because there is a barrier to entry that is simply a matter of information, which is very important" (Agent 2).

(...) As agents, we have a great deal of information from both sides; we have a great deal of information on how the public sector operates in this area, how the regulated private sector operates (shipping companies, ports, port terminals, airports, etc.). And, of course, we have a deep understanding of the views held by the vast majority of the country's importers and exporters. (Agent 8)

But they also argue that even though they are currently responsible for many procedures that could be handled without their involvement, exporters and importers would still need to rely on their services by outsourcing those tasks so as not to have to deal with local customs procedures: "(...) Many exporters would tell me, 'I'd rather pay your fee, but I don't want to have anything to do with it. If there's a problem, customs comes to you, not me'" (Agent 7).

Regarding how other customs agents perceived the early stages of the single window's implementation in the country, the agents note the existence of two camps: those who opposed it (the majority) and those who decided to join in. "(...) For these purposes, you can divide them into two groups. There are some who are very opposed to any kind of change, so to speak. Anything scares them, or they don't like it (...) there are others who join in (...) (Agent 5). "(...) There were both. There were agencies that joined the project, others that were more reluctant. Today, you have to process everything through SICEX, so they're all integrated, but those were the feelings" (Agent 3).

Those who were most reluctant to change did so out of a fear of being replaced by new technologies: "Everyone thinks that a single window could eventually eliminate the customs agency in the future" (Agent 9). "So there was this whole issue of bias, in the sense that there were people who said no, that this is practically going to replace us" (Agent 10).

This fear has been heightened by three developments. First, customs procedures can be carried out digitally. Second, when the Undersecretary of Finance announced the project, customs agents were not consulted. Third, the National Customs Service issued a Resolution ([Servicio Nacional de Aduanas, 2024](#)) that removed the requirement to hire customs brokers for service export procedures. As a result, some agents remain concerned.

The bottom line is (...) if you simplify foreign trade procedures and make them all available on a single portal, and on top of that streamline the clearance process, the existence of a customs agency firm becomes superfluous or unnecessary (...) Customs agency firms exist because there is a law that requires you to work with customs agents. It's always understood that this is being called into question. (Agent 2)

(...) everyone initially thought that SICEX was going to replace customs agents. I believe that there may have been something like that in the intention (...) this is somewhat confirmed by the fact of the export of services. (Agent 7)

Beyond the fear displayed by some, other customs agents decided to join the project. This was due both to a desire to comply with or support the State's requirements and to

support the adoption of new technologies that would strengthen foreign trade performance: “(...) We are very interested in the hope that these technologies will be developed much more (...) and that customs will advance much faster in that sense (...)” (Agent 8).

(...) We at this agency generally try to move forward quickly (...) because ultimately, if you know the State wants to implement this, your responsibility is to collaborate with the State, rather than obstruct it. (Agent 10)

Customs agents use third-party software programs that allow them to manage customs clearances by transmitting information to the National Customs Service. Most agents use SIGAD (provided by the company EDITRADE), which appeared in the early 2000s. Once SICEX was established, this program was interconnected with SIGAD, so that virtual transactions go through SICEX: “(...) we are somewhat dependent on SIGAD for the connection with customs. So, we are also subject to what EDITRADE decides” (Agent 5).

Customs agents are organizing themselves in response to changes in the environment in order to protect the profession. To this end, they are forging connections with various actors within the country’s political institutions.

(...) One is to protect the quality of the customs agent. And that is done through intervention with customs, with the Minister of Finance, with different authorities to clarify the role that the customs agency fulfills. (Agent 2)

They organize their representation through the professional associations to which they belong: CACH and ANAGENA. These associations create opportunities for dialogue with state actors, such as ministries, undersecretaries, members of the Chamber of Deputies and the Senate, the National Customs Service, and other state agencies. With these actors, “what we have done (together with the Customs Chamber) is basically to protect the profession” (Agent 1). “Yes, we have been in the Senate Finance Committee, defending our profession” (Agent 1).

Furthermore, they have sought to influence SICEX by creating “opportunities to submit and contribute background information to SICEX. In other words, there were many messages: “Hey, what can we contribute... ideas...?” It’s always like that” (Agent 6).

(...) the trade associations contribute through every possible channel to influence, participate in, and improve all these proposals. I also know that at least the entire structure of the Undersecretariat of Finance, which is where SICEX falls under, is also very close to the agents’ sector. (Agent 8)

In summary, regarding the reaction of customs agents to the implementation of the single window for foreign trade, it can be stated that they are clear about their contribution to the clearance of goods in an environment of technological change. This is based on two foundations: the regulations that establish the mandatory nature of their services and their high level of knowledge of complex customs matters, which leads companies to prefer their services. However, they also note that information technologies, such as SICEX, could eventually make their role unnecessary. Consequently, the agents themselves observe two types of reactions to the implementation of SICEX: the majority reacted with apprehension, while a smaller number preferred to embrace the change immediately. Those who reacted reluctantly out of apprehension did so because they perceive the possibility of being replaced by new technologies, a feeling that has been reinforced by some measures implemented by the State and the potential of these new technologies. Those who, on the other hand, claim to have joined immediately, did so to comply with and support the State’s requirements, to support the incorporation of new technologies, and to strengthen foreign trade. To address technological changes, they seek to protect the profession through their two professional associations (CACH and ANAGENA), which participate in dialogue with political actors and technical organizations.

To a large extent, the views expressed by customs agents are consistent with those of current and former officials. These officials emphasize the importance of the customs agent's role, beyond the incorporation of technology. As the agents themselves point out, their knowledge of customs regulations and other specific aspects of trade demonstrates that "customs agents play a relevant role because they add more value to the service (...) Yes, they do a job that is relevant, and that one couldn't do if one wanted to export" (Official 1).

(...) In other words, the essence of a customs agent is knowledge, the handling of customs nomenclature, what in customs technique is called merchandise knowledge, that is the added value that this merchandise knowledge has, it is not sold on the street (...) it is a natural monopoly, basically due to knowledge. (Former Official 2)

For this reason, during the implementation of SICEX, state authorities had to modify the single window system as previously planned to incorporate customs agents: "And we looked at what the benefit could be for customs agents. For public services as well" (Official 1). "The system had to undergo design modifications to integrate the customs agents' technological systems and adapt them (...) so that they could operate from their own systems, and so that these would interoperate with SICEX" (Former Official 1).

Regarding weaknesses, current and former officials agree with the customs agents: they report outstanding issues in the implementation of SICEX. The main one is the incorporation of the various state agencies due to existing resistance within these agencies and the complex adaptation of their technical systems.

I believe there was some resistance from the public services themselves at the beginning. It was difficult to form a team (...) We all struggle to change our way of working (...) and it's difficult to get people to agree to comply (...) At first, I would say the most difficult thing was harmonizing the procedures. (Former Official 1)

But the fact that the import module was only recently consolidated is also a weakness: "Well, imports are there too, but we only started recently, about a year ago, and we're still waiting on some approvals" (Official 1).

A public official maintains that SICEX has the strength of providing faster support and greater traceability in operations, as customs agents have suggested. Regarding the agents who dared to join when its implementation began, he notes that "some of them really saw the benefit, well, the speed. The speed was the most noticeable thing (...) The speed of the transactions and the responses" (Official 1). Additionally,

The other benefit they saw was having SERNAPESCA's approval already in place, without having to request it through the office. (...) and the traceability also interested customs agents because many times they didn't know what was happening with the cargo when it entered the port. (Official 1)

In this case, there is some tension regarding the position taken by some agents, who, while appreciating the speed the system provides, maintain that its impact is negligible.

The customs agents reacted, for the most part, by opposing the single window system, although a few were willing to join the initiative immediately. "Some customs agencies were more participative than others, which were more reluctant" (Official 2).

Those who found it most difficult were the customs agents. Now, there are some customs agents (...) who were very willing to contribute their experience, to cooperate in creating this single window system... But the vast majority were very hesitant, because they were wary, I think, afraid that they would cease to be relevant players in foreign trade, and that they would no longer be mandatory (...). (Former Official 1)

However, “(...) later they jumped on the bandwagon. There are some who are still always paying attention to what we’re doing (...)” (Official 1).

One official interviewed maintains, in fact, a difference in the reaction among the trade associations. ANAGENA “was more receptive to the idea of SICEX, and among the agents, they were the first to start, that is, to dare to use SICEX” (Official 1).

Regarding the evaluation of SICEX’s performance and the agents’ reaction to its implementation, there is agreement between what current and former public officials and customs agents say. Certainly, the agents’ role appears to be important, even though they were not included immediately. Officials and former officials agree that one of the system’s main weaknesses is the lack of integration with public services, which would allow for the approval of operations. Meanwhile, among its strengths, they also highlight its speed and traceability. However, there is tension regarding the perceived impact on customs agents: some maintain it has been negligible, others that it has been positive, while other stakeholders (not customs agents) assert that agents have indeed perceived improvements in some aspects, such as speed. This tension likely reflects a lack of trust among the stakeholders, hindering the reciprocal exchange of information about their opinions (Gil-Garcia & Sayogo, 2016; Waardenburg et al., 2020). This could be further supported by the disappointment customs agents have expressed regarding the technology implementation process. Regarding customs agents’ perceptions, current and former officials also identified two groups that reacted differently: a majority expressing fear and another group actively participating. This fear stems from a perceived threat that their profession will be displaced by technology.

5.3. Past and Emerging Technological Changes from the Perspective of Customs Agents

The perceptions of customs agents regarding the implementation of a single window system, gathered in the preceding subsections, can be contrasted with their reactions to past technological changes and the emergence of new technologies. These results lend consistency to the previous findings concerning their reaction, as incumbent actors and collaborators, to technological changes driven by the State.

5.3.1. Similarly to the Single Window: Opposing Perceptions Regarding Past Technological Changes

How have customs agents reacted to past technological changes? Customs agents identified the establishment of technologies for electronic data transmission, such as the Internet and VAN (Value Added Network), and for electronic payments as relevant technological changes in the past.

Thus, one agent commented on the establishment of the VAN in the mid-1990s, stating, (...) that allowed you to have a declaration approved in seconds, which could previously take hours or days” (Agent 5).

With the arrival of the internet, procedures became even faster: “I think the most important challenge was eliminating manual submissions and using the internet as a means of transmission and connection with customs, which at first was through a VAN” (Agent 7).

Electronic payments were highlighted by the agents as a change that streamlined not precisely the customs procedures, but the payments of duties and taxes that had to be made.

The agents’ reaction to these technological changes was similar to the current implementation of SICEX: widespread aversion to what was perceived as a threat to the role of customs agents in foreign trade. “There was a lot of fear among the more senior agents” (Agent 10). “From what I’ve heard, there was probably some degree of fear among some of them (...)” (Agent 8).

Among the former officials consulted, two distinct groups emerged: some who strongly supported the transmission technologies and others who emphasized the opposition of certain agents. Regarding the CACH's position, one former official stated that it supported the National Customs Service in providing information for the implementation of electronic transmission systems and also requested training on the matter.

(...) We had a lot of support. On the one hand, they agreed with all the changes in the Chilean Customs Chamber, and many customs agents because, in essence, they were helped to gain a perspective from the point of view of customs clearance. (Former Official 3)

However, another former official points out that the CACH “had the most reluctant agents. ANAGENA, where there were smaller agents, was more modern. But the Customs Chamber was the slowest, the most traditional” (Former Official 2). Thus, there was resistance from some agents, although some also saw its potential benefits:

(...) in terms of electronic processing at the beginning (...) there was some resistance from customs agents regarding electronic processing (...) Because [they assumed] “in the end they are going to displace us”, because “they are going to allow importers to process directly with customs without the need for a customs agent”. (Former Official 2)

In contrast, others understood the possibilities it opened up “from the perspective of the objective of better leveraging trade integration and saw it as a tool for improving productivity” (Former Official 2). The adoption of electronic transmission was therefore gradual, given the agents' apprehension: “(...) So, their growing conviction was gradual” (Former Official 2). In short, customs agents and former officials emphasize the significance of the technological shift that electronic transmission entailed. Likewise, they acknowledge mostly oppositional reactions from agents due to fear of being displaced.

5.3.2. Emerging Technologies: Between the Fear of Being Replaced and the Visualization of Opportunities

The emerging technologies are seen by customs agents as unavoidable challenges. Technologies like blockchain and artificial intelligence will contribute to the efficiency of customs clearance to such an extent that customs agents risk becoming unnecessary. “I am convinced that it is very likely that in a few years, for example, customs agents will no longer be necessary” (Agent 6). “And ultimately, they are going to eliminate all intermediaries” (Agent 2).

But because of this, they maintain that they must embrace the need to adapt to technological change: “In the case of customs agents, let's say, the issue of information and all that has to be incorporated into the new technologies” (Agent 6).

Another significant challenge perceived by the agents involves changes in the company that provides the software that most of them use: EDITRADE, the creator of the SIGAD software. This company was acquired by an Australian firm, which will likely seek to incorporate new technologies and procedures into the supply chain, which could also affect the agents' work: “SIGAD was sold to an Australian company. So we have serious problems today with that service as well” (Agent 6).

And what this company seems to be trying to do is set up the entire chain, so that the data is entered from one end to the other. And that would obviously eliminate or remove the intervention of customs agents. (Agent 2)

But other agents are more optimistic, and place the customs agent fulfilling some challenges in greater depth: ensuring the logistics and information chain, as well as traceability.

So, where will the role of the customs agent lie, whether it remains institutionally the same as it is now, or if the regulations change? I believe we will have a much greater

role in ensuring compliance with the regulations and preventing our clients from falling into regulatory violations. This includes everything related to compliance, information security, (...) ensuring the traceability of operations. (Agent 5)

However, the agents also recognize the opportunities presented by new technologies (such as blockchain and artificial intelligence). They believe that these technologies are beneficial because they will bring greater efficiency and traceability to the process. In fact, some indicate that they are already implementing them in internal procedures: “I think they make the process much more efficient” (Agent 8). “(...) We have to get on board no matter what” (Agent 4).

We, in particular, at least, are working on developing artificial intelligence and other technologies for our internal processes and the relationship between our internal processes and our clients and Customs (...) But in terms of the industry as a whole and at a central level, it would be ideal if this type of technology were developed further (...) (Agent 8).

Emerging technologies also have the potential to impact product traceability, enabling greater security in information management, as the agents point out: “Blockchain technology allows you to be certain that what originated or the information at the source is exactly the same as what arrives at the destination” (Agent 5).

(...) They can make trade much safer in the future, they can also make cargo control and inspection strategies much more effective by likely being accompanied by risk management (...). (Agent 8)

In short, customs agents acknowledge that previous technological changes, such as those related to electronic transmission, have been significant and generated concern among many of them regarding the future of their profession. That is corroborated by the former public officials consulted. On the other hand, while agents also tend to question the status of their profession in the face of emerging technological changes, they maintain that these will bring greater benefits to the development of foreign trade, primarily in the areas of efficiency and traceability of operations.

6. Discussion

From the perspective of customs agents, SICEX aims to streamline customs procedures related to approvals obtained from government agencies prior to exports and imports. To achieve this, it is essential that these agencies have integrated their information systems with SICEX. These streamlining initiatives have been implemented as part of ongoing efforts to facilitate international trade (Alfarajat & Masron, 2024; Masood & Martínez-Zarzoso, 2024). However, despite the importance of their role in the clearance of goods, they were not considered from the outset by government authorities. In fact, SICEX has faced difficulties in its implementation. The main one is that the interconnection of all public agencies has not been achieved. This highlights a certain weakness in collaborative governance and tensions arising from it, consistent with the studies by Hanisch et al. (2026); Wouters et al. (2020, 2023).

The assessment of SICEX's performance is mixed. The customs agents consulted primarily indicate that the tool has had very little impact on their operations. However, they emphasize that the system has potential for development, is fast and robust, and therefore facilitates information control. Its main weakness, they point out, is precisely the fact that the interconnections between public agencies have not yet been finalized, a situation that has caused disappointment.

Beyond their assessment, the agents have reacted in defense of the profession. They are aware of the advantages of technological change for foreign trade, are familiar with examples abroad, and understand that the international context is pushing for the implementation of single windows and other trade facilitation measures. Although from the

outset of SICEX, a majority reacted reluctantly and with apprehension, a group immediately joined the initiative. These “early adopters” (Carter & Salimath, 2019) perceive themselves as having the capacity to exploit new technologies. The fact that it is possible to distinguish between two different positions among agents supports the view that incumbent actors can respond to technological change by seeking to adapt, rather than merely resisting it (F. W. Geels, 2019). The agents demonstrate an awareness that the electronic single window could be detrimental to their profession, at the very least by reducing their market share or forcing them to reorient their careers, that is, redefine their professional jurisdiction (Kronblad & Jensen, 2023). They justify their fear with clear facts: they were not considered at the beginning of the program, and, recently, their hiring by service exporters ceased to be mandatory. However, they also generally know that they have the advantage of detailed knowledge of customs regulations and trade processes, which is a pillar on which they rely for their continued participation in the system. This is consistent with the findings of Pius and Murugan (2025), who argue that, in the Indian case, customs agents retain strategic importance in customs clearance, despite digitalization. However, unlike this work, this one does not contrast the opinion of customs agents with that of other actors or with views on technological changes at other times. Given the privileged treatment that customs agents receive, having a state license to be hired and operate in customs clearance on a mandatory basis, and be collaborators of the State, these are actors threatened by technological change (van Mossel et al., 2018). Therefore, beyond its relevance, its role in Chilean foreign trade could be altered, which constitutes an additional element of tension. This coincides with the findings of Di Giulio and Vecchi (2023) who emphasize that digitalization reconfigures the relationships between actors, forcing them to modify their behaviour.

To address the challenge of the single window system, as incumbent actors, the agents have resorted to institutional dialogue through the two trade associations that represent them: CACH and ANAGENA. These associations maintain ongoing interaction with specialized government agencies and also frequently seek contact with political representatives in the National Congress, exploring opportunities to exert influence within institutions that establish SICEX systems through alliances (Suddaby & Viale, 2011). In this way, they make efforts to redirect technological change projects and align them with their interests (Späth et al., 2016).

As Aryee et al. (2021) suggest regarding technologies in import clearance, the single window, like other customs clearance technologies, is embedded in a society, so the actors involved contribute to determining and influencing its characteristics. This poses significant challenges to the established socio-technical framework, as various elements within it (such as institutions, users, related organizations, values, and others) are altered. Customs agents, as both collaborators and incumbents, are certainly affected by these changes. This situation presents, above all, challenges to collaborative governance.

7. Conclusions

This study sought to determine the perceptions of customs agents, as incumbent actors, regarding the technological change involved in establishing a single window system, that is, a technological change driven by the State. To illustrate this, the case of Chilean customs agents and the electronic single window system was used. A qualitative study was conducted, based on interviews with customs agents. To triangulate these results, interviews were also carried out with current and former public officials from institutions involved in customs clearance. Additionally, the agents’ perceptions of the implementation of the contemporary single window system were compared with their perceptions of previous technological changes and emerging technological changes.

The agents' perceptions of SICEX are not new when compared to their reactions to past and emerging technological changes: they know they can continue to play a relevant role, but that it will entail changes in their profession. Therefore, they are also aware that technological change could replace them if they do not adapt. In general, some are more proactive in incorporating the technological change, while others (the majority) have viewed it with apprehension and have adopted it more slowly. In any case, they resort to dialogue with authorities and political actors in order to influence decisions regarding SICEX.

Emerging technologies, which will likely continue to gain traction in the socio-technical landscape of international trade (blockchain and artificial intelligence, for example) appear among customs agents in the same way as the single window system: for some, as challenges to their professional work; for others, as opportunities to improve their management.

In short, state-driven technological change has posed challenges to public administration, straining the collaborative governance of Chilean foreign trade, as evidenced by the aforementioned perceptions of customs agents. These agents have had to promote dialogue and participation to mitigate the impact of technological change on their role as collaborators.

7.1. Limitations

One limitation of the study is its retrospective descriptions, based on the accounts of the consulted actors, which may reduce the precision of the results. Therefore, triangulation strategies were employed. Since the work is not based on quantitative research and is a case study, its results are not statistically generalizable.

7.2. Further Research

This research highlights the need for further investigation into the public administration sector regarding the governance challenges of technological change. Interoperability between government agencies, and between these agencies and external actors, not only presents technical obstacles but also governance challenges that require high-level political coordination.

Similarly, it is suggested that future research delve deeper into the perceptions of other incumbent actors, particularly highly regulated professionals, who face the challenge of state-promoted digitalization.

Further research could explore customs agents' perceptions of other technological changes or the perceptions of others collaborating with the State, such as technology companies, with the aim of gaining a clearer understanding of the socio-technical transition under study and its implications for collaborative governance.

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References

- Abuljadail, M., Khalil, A., Talwar, S., & Kaur, P. (2023). Big data analytics and e-governance: Actors, opportunities, tensions, and applications. *Technological Forecasting and Social Change*, 193, 122612. [CrossRef]
- Ahn, K., Park, S., & Chung, J. (2008). The study of the UNeDocs support system for maritime transport business's single window. In *Proceedings of the 2008 international conference on e-learning, e-business, enterprise information systems, and e-government, EEE 2008* (pp. 449–454). CSREA Press.
- Alfarajat, M. H., & Masron, T. A. (2024). The effect of trade facilitation measures on import in developing countries. *Applied Economics*, 56(52), 6547–6563. [CrossRef]
- Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, 18(4), 543–571. [CrossRef]
- Aryee, J., Andersen, C., & Hansen, A. S. (2021). The social-political embeddedness of import clearance: 20 years of digital transformation at Tema, Ghana. *World Customs Journal*, 15(1), 3–14. [CrossRef]
- Asociación Nacional de Agentes de Aduana. (2025, March). *Quiénes Somos: Somos una asociación que representa a los Agentes de Aduana de Chile, defendiendo su labor y aportando al desarrollo del comercio exterior*. Asociación Nacional de Agentes de Aduana. Available online: <https://anagena.cl/quienes-somos/> (accessed on 31 March 2026).
- Banco Central de Chile. (2026, March). *Monitor comercio exterior de bienes*. Available online: <https://www.bcentral.cl/areas/estadisticas/comercio-exterior-de-bienes/monitor-comercio-exterior> (accessed on 31 March 2026).
- Bondarenko, E. P., & Tkachyk, F. P. (2017). Customs mediation in foreign trade: Scientific and practical aspects. *Journal of Tax Reform*, 3(3), 170–181. [CrossRef]
- Cantens, T., Kaminski, J., Raballand, G., & Tchapa, T. (2014). *Customs, brokers, and informal sectors: A cameroon case study*. The World Bank. [CrossRef]
- Carter, W. R., & Salimath, M. S. (2019). Diving into strange waters: Incumbent adoption of emerging radical technology. *International Journal of Business Innovation and Research*, 18(3), 346–368. [CrossRef]
- Castells, M. (2005). *La era de la información: Economía, sociedad y cultura* (Quinta ed., Vol. 1). Alianza Editorial.
- Cámara Aduanera de Chile. (2026, March). *Nosotros. Cámara aduanera de Chile*. Available online: <https://caduanera.cl/nosotros/> (accessed on 12 February 2026).
- CEPAL. (2023). *Análisis comparativo de cinco ventanillas únicas de comercio exterior de América Latina: Chile, Costa Rica, México, Perú y Uruguay* (Tech. Rep.). CEPAL.
- Corfmat, F., & Castro, P. (2003). Computerization of customs procedures. In *Changing customs: Challenges and strategies for the reform of customs administration* (p. 201). International Monetary Fund. [CrossRef]
- Creswell, J. W., & Creswell, J. D. (2023). *Research design. Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications Inc.
- Di Giulio, M., & Vecchi, G. (2023). Implementing digitalization in the public sector. Technologies, agency, and governance. *Public Policy and Administration*, 38(2), 133–158. [CrossRef]
- Dong, L., Zhao, J., Chen, T., Yu, Y., Duan, Z., & Zhu, J. (2022). The secure data sharing and interchange model based on blockchain for single window in trade facilitation. In *Proceedings—2022 international conference on blockchain technology and information security, ICBCTIS 2022* (pp. 138–146). IEEE. [CrossRef]
- ECLAC. (2017). *Trade facilitation and paperless trade implementation in Latin America and the Caribbean* (Tech. Rep. No. Regional Report 2017). ECLAC.
- Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory*, 22(1), 1–29. [CrossRef]
- Ford, A., & Newell, P. (2021). Regime resistance and accommodation: Toward a neo-Gramscian perspective on energy transitions. *Energy Research & Social Science*, 79, 102163. [CrossRef]
- Garrido Hidalgo, R., Isa Valencia, P., & Rojas Rivera, P. (2026). *Identificación, Cuantificación y Valorización Económica de los Beneficios del Sistema Integrado de Comercio Exterior de Chile—SICEX Chile* (F. Herrera Castillo, B. Vásquez Iba, M. Apablaza Riquelme, & L. Silva, Eds.). SICEX Chile.
- Gasco-Hernandez, M., Gil-Garcia, J. R., & Luna-Reyes, L. F. (2022). Unpacking the role of technology, leadership, governance and collaborative capacities in inter-agency collaborations. *Government Information Quarterly*, 39(3), 101710. [CrossRef]

- Geels, F. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6–7), 897–920. [CrossRef]
- Geels, F. (2012). A socio-technical analysis of low-carbon transitions: Introducing the multi-level perspective into transport studies. *Journal of Transport Geography*, 24, 471–482. [CrossRef]
- Geels, F., Kernb, F., Fuchs, G., Hindere, N., Kungl, G., Mylana, J., Neukirchc, M., & Wassermann, S. (2016). The enactment of socio-technical transition pathways: A reformulated typology and a comparative multi-level analysis of the German and UK low-carbon electricity transitions (1990–2014). *Research Policy*, 45(4), 896–913. [CrossRef]
- Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society*, 31(5), 21–40. [CrossRef]
- Geels, F. W. (2019). Socio-technical transitions to sustainability: A review of criticisms and elaborations of the Multi-Level Perspective. *Current Opinion in Environmental Sustainability*, 39, 187–201. [CrossRef]
- Giganti, P., & Falcone, P. M. (2021). Socio-technical transitions and innovation niches: The case of the virtual and augmented reality in Europe. *AIMS Energy*, 9(4), 755–774. [CrossRef]
- Gil-Garcia, J. R., & Sayogo, D. S. (2016). Government inter-organizational information sharing initiatives: Understanding the main determinants of success. *Government Information Quarterly*, 33(3), 572–582. [CrossRef]
- Gismondi, M., Marois, J., & Straith, D. (2015). ‘Unleashing Local Capital’: Scaling cooperative local investing practices. In *Putting sustainability into practice* (pp. 204–228). Edward Elgar Publishing. [CrossRef]
- Grainger, A. (2011). Trade facilitation: A conceptual review. *Journal of World Trade*, 45, 39–62. [CrossRef]
- Guilloux, V., & Moreau, O. (2016). The end of frontiers between ICT4D and ICT with ICT4TF&D? An illustration with the Benin port single window. In *21st symposium of the association information and management 2016, AIM 2016*. Association Information and Management.
- Gwardzińska, E. (2014). The role of customs brokers in facilitating international trade. *World Customs Journal*, 8(1), 63–70. [CrossRef]
- Hanisch, M., Roozen, P., & Theodosiadis, V. (2026). Success and failure in blockchain-based interorganizational ecosystems: A governance perspective. *Journal of Management*, 01492063261420752. [CrossRef]
- Hernández Sampieri, R., Fernández Collado, C., & Baptista Lucio, P. (2014). *Metodología de la investigación* (6th ed.). McGraw-Hill Interamericana Editores, S.A. de C.V.
- Hughes, T. (1996). *El impulso tecnológico* (M. R. Smith, L. Marx, & E. Rabasco, Eds.). Alianza Editorial.
- Hughes, T. P. (1986). The seamless web: Technology, science, etcetera, etcetera. *Social Studies of Science*, 16(2), 281–292. [CrossRef]
- Hughes, T. P. (1993). *Networks of power: Electrification in western society, 1880–1930*. Johns Hopkins University Press.
- Izam, M. (2001). *Facilitación del comercio: Un concepto urgente para un tema recurrente* (Tech. Rep.). Naciones Unidas Comisión Económica para América Latina y el Caribe (CEPAL).
- Jano-Ito, M., & Crawford-Brown, D. (2016). Socio-technical analysis of the electricity sector of Mexico: Its historical evolution and implications for a transition towards low-carbon development—ScienceDirect. *Renewable and Sustainable Energy Reviews*, 55, 567–590. [CrossRef]
- Juárez, H. (2022). *The world customs organization: Past, present and future*. Springer. [CrossRef]
- Kanger, L., & Sovacool, B. K. (2022). Towards a multi-scalar and multi-horizon framework of energy injustice: A whole systems analysis of Estonian energy transition. *Political Geography*, 93, 102544. [CrossRef]
- Kim, D.-Y. (2014). Transformation of countervailing power in collaborative governance: A case study of the Shi-Hwa sustainable development committee. *Korean Journal of Policy Studies*, 29(3), 53–77. [CrossRef]
- Kim, J., Paek, B., & Lee, H. (2022). Exploring innovation ecosystem of incumbents in the face of technological discontinuities: Automobile firms. *Sustainability*, 14(3), 1606. [CrossRef]
- Klievink, B., Romijn, B.-J., Cunningham, S., & de Bruijn, H. (2017). Big data in the public sector: Uncertainties and readiness. *Information Systems Frontiers*, 19(2), 267–283. [CrossRef]
- Kronblad, C., & Jensen, S. H. (2023). ‘Being a professional is not the same as acting professionally’—How digital technologies have empowered the creation and enactment of a new professional identity in law. *Journal of Professions and Organization*, 10(2), 99–119. [CrossRef]
- Latupeirissa, J. J. P., Dewi, N. L. Y., Prayana, I. K. R., Srikandi, M. B., Ramadiansyah, S. A., & Pramana, I. B. G. A. Y. (2024). Transforming public service delivery: A comprehensive review of digitization initiatives. *Sustainability*, 16(7), 2818. [CrossRef]
- Lebid, I., Luzhanska, N., & Lebid, I. (2024). Efficiency improvement of customs formalities during international road transport. In *Transport means—proceedings of the international conference* (Vol. 2024–Octob, pp. 840–845). Kauno Technologijos Universitetas. [CrossRef]
- Lee, M.-H., & Lio, M.-C. (2016). The impact of information and communication technology on public governance and corruption in China. *Information Development*, 32(2), 127–141. [CrossRef]
- Lehtonen, K., & Uusikylä, P. (2021). How do networks reflect collaborative governance? The case of a sport policy program. *International Journal of Environmental Research and Public Health*, 18(14), 7229. <https://doi.org/10.3390/ijerph18147229>.

- Liang, T., Mao, H., Tan, Y., & Sun, B. (2023). How does socio-technical landscape affect the formation of technical standards? *Sage Open*, 13(4), 21582440231216009. [CrossRef]
- Liu, J. C.-E., & Chao, C.-W. (2022). Equal rights for gasoline and electricity? The dismantling of fossil fuel vehicle phase-out policy in Taiwan. *Energy Research & Social Science*, 89, 102571. [CrossRef]
- Llanto, G. M., Navarro, A. M., Detros, K. C., & Ortiz, M. K. P. (2013). *Customs brokerage services and trade facilitation: A review of regulatory coherence* (p. 27). PIDS Discussion Paper Series 2013-48. Philippine Institute for Development Studies (PIDS).
- Lowes, R., Woodman, B., & Speirs, J. (2020). Heating in Great Britain: An incumbent discourse coalition resists an electrifying future. *Environmental Innovation and Societal Transitions*, 37, 1–17. [CrossRef]
- Masood, A., & Martínez-Zarzoso, I. (2024). Trade effects of trade facilitation revisited. *Economics Letters*, 234, 111477. [CrossRef]
- Medin, H. (2021). Customs brokers as intermediaries in international trade. *Review of World Economics*, 157(2), 295–322. [CrossRef]
- Melgar, N., & De María, N. (2023). Digitalization in Mercosur trade facilitation: The case of the Single Window of Foreign Trade in Uruguay countries. *Brazilian Journal of International Law*, 20, 103–117. <https://doi.org/10.5102/rdi.v20i2.9114>.
- Ming Chow, N. Z. (2018). The single window and the TFA: ASEAN's best chance at a common rule of law. *Asian Journal of Law and Economics*, 9(2), 1–11. [CrossRef]
- Ministerio de Hacienda. (2005, March). DFL 30. *Aprueba el texto refundido, coordinado y sistematizado del decreto con fuerza de ley de Hacienda N°213, de 1953, sobre Ordenanza de Aduanas*. Available online: <https://www.bcn.cl/leychile/navegar?idNorma=238919&idParte=9779807&idVersion=2017-03-13> (accessed on 27 March 2026).
- Ministerio de Hacienda. (2010). *Decreto 1049. Crea comisión asesora del Presidente de la República para el establecimiento de un Sistema Integrado de Comercio Exterior*. Available online: <https://www.bcn.cl/leychile/navegar?idNorma=1019087> (accessed on 19 March 2026).
- Ministerio de Hacienda. (2017). *Ley N° 20.997. Moderniza la legislación aduanera*. Available online: <https://www.bcn.cl/leychile/navegar?idNorma=1100901> (accessed on 8 June 2026).
- Morgunova, M. (2021). The role of the socio-technical regime in the sustainable energy transition: A case of the Eurasian Arctic. *The Extractive Industries and Society*, 8(3), 100939. [CrossRef]
- Muñoz, M. A. (2019). Establecimiento de un Régimen de Facilitación del Comercio en Chile: Estudio del Comercio Internacional desde la Perspectiva de las Transiciones Socio-técnicas. *Información Tecnológica*, 30(6), 233–242. [CrossRef]
- Muñoz, M. A. (2021). El desafío de la pandemia por COVID-19 para la facilitación del comercio en Chile y Perú. *Revista de Estudios Políticos y Estratégicos*, 9(2), 41–70.
- Mutiarin, D., Moner, Y., Yakin, N., & Nurmandi, A. (2019). The adoption of Information and communication technologies in human resource management in the era of public governance. *Public Policy and Administration*, 18(2), 346–362. [CrossRef]
- Nizeyimana, C., & De Wulf, L. (2015). Rwanda electronic single window supports trade facilitation. *World Customs Journal*, 9(2), 73–84.
- OECD. (2018). *Trade facilitation and the global economy*. OECD. [CrossRef]
- Oni, O. (2024). Stakeholder perspectives on blockchain technology adoption for public governance in Nigeria—A qualitative study. *Edelweiss Applied Science and Technology*, 8(6), 342–355. [CrossRef]
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42, 533–544. [CrossRef] [PubMed]
- Peynirci, E. (2023). The rise of emerging technologies: A quantitative-based research on “maritime single window” in Turkey. *Research in Transportation Business and Management*, 46, 100770. [CrossRef]
- Pius, J., & Murugan, S. (2025). Critical analysis of customs digitalization-customs broker perspective. *Journal of Vasyl Stefanyk Precarpathian National University*, 12(2), 65–79. [CrossRef]
- Plotnikof, M., & Pedersen, A. R. (2019). Exploring resistance in collaborative forms of governance: Meaning negotiations and counter-narratives in a case from the Danish education sector. *Scandinavian Journal of Management*, 35(4), 101061. [CrossRef]
- Quezada, G., Walton, A., & Sharma, A. (2016). Risks and tensions in water industry innovation: Understanding adoption of decentralised water systems from a socio-technical transitions perspective. *Journal of Cleaner Production*, 113, 263–273. [CrossRef]
- Ran, B., & Qi, H. (2018). Contingencies of power sharing in collaborative governance. *The American Review of Public Administration*, 48(8), 836–851. [CrossRef]
- Ranerup, A. (2012). The socio-material pragmatics of e-governance mobilization. *Government Information Quarterly*, 29(3), 413–423. [CrossRef]
- Riga, R. L. (2016). The filipino customs brokers' perception on the proposed customs modernization and tariff act (CMTA) of the Philippines. *Advances in Economics and Business*, 4(4), 149–156. [CrossRef]
- Rodríguez Bolívar, M. P. (2026). Advancing public administration research: Integrating digital governance, institutional resilience, and participatory pathways for public value. *International Review of Administrative Sciences*, 92(2), 167–195. [CrossRef]
- Rusu, E. C., Hyams-Ssekasi, D., Onofrei, M., Vatamanu, A. F., & Bercu, A.-M. (2023). Innovation and digital transformation in local communities. *European Journal of Public Administration Research*, 2023, 53–61. [CrossRef]

- Saldaña, J. (2021). *The coding manual for qualitative researchers*. SAGE Publications Ltd.
- Schreier, M. (2012). *Qualitative content analysis in practice*. SAGE Publications Ltd.
- Servicio Nacional de Aduanas. (2017). *Resolución exenta N° 487. De 31.01.2020. Del Director Nacional de Aduanas, que establece el marco normativo de la Carpeta de Despacho Electrónica*. Available online: https://www.aduana.cl/aduana/site/docs/20200103/20200103160956/resol_n_487_31_01_2020.pdf (accessed on 8 March 2026).
- Servicio Nacional de Aduanas. (2024, May). *Resolución 1931 exenta. Modifica compendio de normas aduaneras*. Available online: https://www.aduana.cl/aduana/site/docs/20240104/20240104160340/resolucion_exenta_n_1931_de_16_05_2024_de_la_directora_nacional_de_aduanas_s_.pdf (accessed on 8 March 2026).
- Servicio Nacional de Aduanas. (2026, March). *Compendio de normas aduaneras*. Available online: <https://www.aduana.cl/aduana/site/edic/base/port/normativas.html?filtro=20190107224337> (accessed on 30 March 2026).
- SICEX. (2025, August). *Qué es SICEX*. Available online: <https://sicexchile.cl/-que-es-sicex-> (accessed on 8 May 2026).
- Sienkiewicz-Małjurek, K., & Zyzak, B. (2025). Digital technologies in public administration networks: Systematic literature review and research avenues. *Administration & Society*, 57(8–9), 1051–1087. [CrossRef]
- Späth, P., Rohrer, H., & Von Radecki, A. (2016). Incumbent actors as niche agents: The German car industry and the taming of the “Stuttgart E-Mobility Region”. *Sustainability*, 8(3), 252. [CrossRef]
- Stalmokaite, I., & Yliskylä-Peuralahti, J. (2019). Sustainability transitions in Baltic Sea shipping: Exploring the responses of firms to regulatory changes. *Sustainability*, 11(7), 1916. [CrossRef]
- Stanojević, A., Goossens, J., & Keymolen, E. (2025). Governance by technology, governance of technology: The quest for public values, trust, and regulatory compliance. In J. Goossens, E. Keymolen, & A. Stanojević (Eds.), *Public governance and emerging technologies: Values, trust, and regulatory compliance* (pp. 1–15). Springer Nature. [CrossRef]
- SUBREI. (2022). *Impacto de los tratados de libre comercio. Hacia una política comercial inclusiva* (3rd ed., Tech. Rep.). Subsecretaría de Relaciones Económicas Internacionales.
- Suddaby, R., & Viale, T. (2011). Professionals and field-level change: Institutional work and the professional project. *Current Sociology*, 59(4), 423–442. [CrossRef]
- Tassabehji, R., Hackney, R., & Popovič, A. (2016). Emergent digital era governance: Enacting the role of the ‘institutional entrepreneur’ in transformational change. *Government Information Quarterly*, 33(2), 223–236. [CrossRef]
- Tijan, E., Agatić, A., Jović, M., & Aksentijević, S. (2019). Maritime national single window—A prerequisite for sustainable seaport business. *Sustainability*, 11(17), 4570. [CrossRef]
- Tijan, E., Jović, M., Jardas, M., & Gulić, M. (2019). The single window concept in international trade, transport and seaports. *Pomorstvo*, 33(2), 130–139. [CrossRef]
- Tosevska-Irpcevska, K. (2014). Effects of the implementation of single window and simplified customs procedures in the Republic of Macedonia. *World Customs Journal*, 8(1), 51–62. [CrossRef]
- Tracy, S. J. (2025). *Qualitative research methods. Collecting evidence, crafting analysis, communicating impact* (3rd ed.). Wiley Blackwell.
- Valta, J., Mäkinen, S. J., & Kirjavainen, J. (2022). Dialectic tensions driving niche creation—A case study of a local energy system. *Environmental Innovation and Societal Transitions*, 42, 99–111. [CrossRef]
- van Mossel, A., van Rijnsoever, F. J., & Hekkert, M. P. (2018). Navigators through the storm: A review of organization theories and the behavior of incumbent firms during transitions. *Environmental Innovation and Societal Transitions*, 26, 44–63. [CrossRef]
- Waardenburg, M., Groenleer, M., de Jong, J., & Keijser, B. (2020). Paradoxes of collaborative governance: Investigating the real-life dynamics of multi-agency collaborations using a quasi-experimental action-research approach. *Public Management Review*, 22(3), 386–407. [CrossRef]
- Wang, F. (2018). Interagency coordination in the implementation of single window: Lessons and good practice from Korea. *World Customs Journal*, 12(1), 49–68. [CrossRef]
- Wang, H., & Ran, B. (2023). Network governance and collaborative governance: A thematic analysis on their similarities, differences, and entanglements. *Public Management Review*, 25(6), 1187–1211. [CrossRef]
- WCO. (2016). *WCO study report on customs brokers* (Tech. Rep.). World Customs Organization.
- WCO. (2024). *Glossary of international customs terms* (Tech. Rep.). World Customs Organization.
- Weber, R. H. (2012). Legal framework for the single window concept in ASEAN: A successful movement towards trade facilitation in East Asian countries. *Asian Journal of Law and Economics*, 2(4), 1–24. [CrossRef]
- Wesseling, J., Kieft, A., Fuenfschilling, L., & Hekkert, M. (2022). How socio-technical regimes affect low-carbon innovation: Global pressures inhibiting industrial heat pumps in the Netherlands. *Energy Research & Social Science*, 89, 102674. [CrossRef]
- Widdowson, D., Blegen, B., Short, G., Lewis, G., Garcia-Godos, E., & Kashubsky, M. (2019). Single window in the context of the WTO Trade Facilitation Agreement. *World Customs Journal*, 13(1), 101–128. [CrossRef]
- World Trade Organization. (2026a, March). *Regional trade agreements database*. World Trade Organization. Available online: <https://rtais.wto.org/UI/PublicMaintainRTAHome.aspx> (accessed on 4 March 2026).

- World Trade Organization. (2026b, March). *Trade facilitation work undertaken by intergovernmental organizations*. World Trade Organization. Available online: https://www.wto.org/english/tratop_e/tradfa_e/intergov_e.htm (accessed on 6 March 2026).
- Wouters, S., Janssen, M., & Crompvoets, J. (2020). Governance challenges of inter-organizational digital public services provisioning: A case study on digital invoicing services in Belgium. In G. Viale Pereira, M. Janssen, H. Lee, I. Lindgren, M. P. Rodríguez Bolívar, H. J. Scholl, & A. Zuiderwijk (Eds.), *Electronic government* (Vol. 12219, pp. 223–235). Springer International Publishing. [CrossRef]
- Wouters, S., Janssen, M., Lember, V., & Crompvoets, J. (2023). Strategies to advance the dream of integrated digital public service delivery in inter-organizational collaboration networks. *Government Information Quarterly*, 40(1), 101779. [CrossRef]
- WTO. (2014). *Protocol amending the Marrakesh agreement establishing the World Trade Organization* (Tech. Rep. No. WT/L/940). World Customs Organization.
- WTO. (2026). *Trade facilitation agreement database: Ratifications*. WTO. Available online: <https://tfadatabase.org/en/ratifications> (accessed on 28 January 2026).
- Zuiderwijk, A., Chen, Y.-C., & Salem, F. (2021). Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda. *Government Information Quarterly*, 38(3), 101577. [CrossRef]

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