

## ANALYSIS OF DIMENSIONS AND TRENDS IN THE DIGITAL TRANSFORMATION OF CUSTOMS SYSTEMS

RĂCĂȚĂIAN RALUCA IOANA

PHD STUDENT, DOCTORAL SCHOOL OF ECONOMICS AND BUSINESS ADMINISTRATION,  
WEST UNIVERSITY OF TIMISOARA, ROMANIA

e-mail: [raluca.racataian@e-uvt.ro](mailto:raluca.racataian@e-uvt.ro)

### Abstract

The present study aims to explore the impact of the implementation of information and communication technologies (ICT) in customs administrations, in the context of increasing the efficiency of the management of large volumes of data from various sources. The main objectives of research include assessing how ICT can improve the taxpayer experience and the internal efficiency of administration. The study will also focus on identifying the challenges associated with the lack of specialized workforce and the absence of a globally unified digital strategy in the public sector. A central aspect of the research is the analysis of the opportunities offered by ICT, such as the implementation of the "Single Window" for electronic filing of customs information, which facilitates interoperability between the automated customs systems of the member states of the European Union. In addition, it will investigate how digitization contributes to the effective use of data analysis, from descriptive to prescriptive models, to optimize tax collection and tax compliance. Next, the study will examine the implementation and strengthening of the Customs Integrated Information System (SIIV), which integrates various subsystems and improves data exchange, security and accessibility of information. It will also assess the long-term impact of digital transformation, including the adoption of emerging technologies such as blockchain and artificial intelligence, as well as aligning with the dynamics of changes in global trade, with the aim of effectively supporting international trade and ensuring its security.

**Keywords:** customs administration; Information and Communication Technologies (ICT); Customs Information System (SIV); Customs Integrated Information System (SIIV); big data; blockchain.

**Classification JEL:** F31; F42; H11; H21.

### 1. Introduction

The implementation of information and communication technology (ICT) in the public sector represents the extent to which the public system has to deal with ever-increasing amounts of data, resulting from a large number of new sources. The goal of public institutions is to learn how to effectively handle and implement these new data in specific activities (Matsudaira et al., 2022).

The adoption of ICT offers benefits for both taxpayers and public administration. On the one hand, it represents an improved experience for taxpayers, on the other hand, the implementation of ICT allows the public administration to model internal efficiency and accelerate the operation of the system. Another benefit that the use of ICT can generate is the voluntary compliance of taxpayers regarding the payment of taxes due, carried out by computer means.

Until now, the digital transformation of the public sector has been facing problems related to the lack and engagement of the workforce, the absence of a global digital strategy to enable the interconnection of data systems, as well as the low rate of electronic data submission. At the same time, without a complete and effective change management system it is unlikely that digital transformation will have a fully sustainable effect.

Digital transformation measures involve the automation or digitalization of public services to reduce the need for human intervention, with most European public sectors moving towards e-services, the use of big data sets and the use of artificial intelligence (Alvarenga et al., 2020).

The digital activity carried out by customs administrations is based on the collection of data and, finally, the assessment of tax collection based on the analysis of this data. The collection of this data has changed considerably in recent times, with an increasing number of data sets requiring conversion to digital form. The efficiency and effectiveness of these functions are constantly being developed by using and analyzing data to create models that meet the needs of taxpayers.

Another opportunity offered using ICT refers to the implementation of the Single Window that allows economic operators to submit in electronic format all the information required by customs legislation for the cross-border movement of goods within the European Union. Thus, the single windows will be connected to each other, with the data available to any customs administration, regardless of the Member State concerned, with the aim of improving effective cooperation between the automated customs systems of the Member States.

Although each process of digital transformation of the customs system has the same final objectives, it is carried out at different stages, usually using the same models of technology groups through which new technological opportunities are created.

The first model is related to the analysis of a large series of data (big data), through which customs administrations are competent to quickly examine trends and provide an answer to disagreements between forecasted and realized productivity (Matsudaira et al., 2022). The analysis of customs data represents their autonomous evaluation using sophisticated techniques but also methods that trigger future recommendations. There are four types of data analysis namely descriptive, diagnostic, predictive and prescriptive. Each model can support customs administration to produce more value from data sets, determine existing or future problems and reduce them in a short time.

Implementing digital technology for predictive data can help customs inspectors investigate customs fraud and assess risks. At the same time, the benefits of using digital technology include the ability to create a multi-dimensional profile of taxpayers, using and combining high-volume data sets to anticipate unreported income, identify customs fraud based on taxpayer data, through correlation with digital network analysis, and ability to detect and resolve customs duty filing and compliance errors.

Information processing components are another benefit of using customs ICT technology, which allows data stored in various forms to be included in a uniform format for further use. Thus, the data reported by the taxpayer through documents in XLS format can be configured with the transactional procedures of voluntary compliance in a pre-filled customs form.

Customs administrations must respond to changing technological waves to meet citizens' expectations. There are three technological waves that will affect customs administration in the process of implementing ICT technology, respectively basic, consolidated and optimized.

The first wave includes basic digitization technologies, which implemented the conversion from paper-based processes to the storage of customs information in a digital manner. The second technological wave is one of consolidation and represents a rapid transition from traditional customs administration processes to the development and implementation of new technologies, through which opportunities for customs data analysis are realized. Thanks to this technological step, there have been significant increases in efficiency and speed in terms of customs activity. The last wave, of optimization, is characterized by the abandonment of physical control and direct intervention of customs personnel in customs control and the use of new modern technologies, such as blockchain and artificial intelligence. With self-optimizing technologies, customs administrations should develop processes to store and optimize data flow and with the help of computers develop their own customs systems and procedures (Alvarenga et al., 2020).

Among the opportunities offered by information and communication technology are cloud platforms that are designed to be flexible and allow customs authorities to collect huge volumes of data in different formats. The use of cloud platforms allows customs administrations to provide cloud software as a service to taxpayers and allow all interested parties access to information held online.

## **2. Considerations regarding the customs integrated it system and accessibility in the system**

With the aim of modernizing the specific activities of customs administrations, in 1998 the European Council established the Customs Information System (SIV) whose objective was to

prevent, investigate and track operations that represent a violation of customs legislation, by increasing the efficiency of customs procedures cooperation and control of customs administrations.

According to the Regulation of the European Council no. 515 of March 13, 1997<sup>1</sup>, the customs information system consists of a centralized database that can be accessed by each member state and contains data, including personal data, necessary to fulfill its objective. The elements included in the customs information system refer to the personal data of the taxpayer (respectively name and surname, date of birth, nationality, gender) and data about the customs action to be carried out, respectively the registration number of the means of transport, the proposed actions, the reason for entering the data. In the case of personal data, their processing is carried out in compliance with the relevant legal provisions. Also, in the case of specific actions, additional data can be entered, namely the objects transported, the passengers of the means of transport used, the place, time and reason for the check, etc.

Duval et al. (2024) states that, globally, the implementation of paperless trade and the operability of customs IT systems would save millions of tons of paper, thus contributing to the protection of the environment and society. The use of customs information systems and electronic processes can also have benefits in terms of the growth and development of international trade. Related to this aspect, even the partial implementation of paperless cross-border trade measures through digital customs data exchanges could see an increase in exports and the time needed to export could decrease considerably. Through the customs computer system, several types of commercial documents necessary for the customs clearance procedure can be digitized.

The complexity of customs IT systems has become evident due to the challenge of harmonizing data sets obtained by customs administrations from economic operators. At the same time, it is important to ensure the interoperability of electronic systems and the uniform application of legislative provisions at the level of the European Union, an aspect that can lead to a complete reprogramming of the total implementation of some of the existing electronic systems, an aspect due to investments both related to the financial part and and the time factor.

In order to modernize the Customs Union, the Customs Integrated Information System (SIIV) was designed, which represents an update of the Customs Information System. It consolidates the information subsystems interconnected by logical connections and data exchange designed for the operation, management of information processed using information technology tools, as well as the infrastructure necessary to fulfill the functions of customs administrations. This new system consolidates all existing customs systems into a modern, robust and more efficient system built on the latest technology (Denysenko, 2020).

**Table no. 1 Transport documents that can be digitized**

Document type	Examples
Documents related to goods	Documents proving the origin of the goods Universal certificate of origin Health certificate for live animal products Sanitary and Phytosanitary certificate Inspection certificate for organic products Dangerous goods documentation
Movement of goods (import, export, transit)	Import/export declaration Import/export license for controlled goods Safety and security statement TIR carnet (transit)

<sup>1</sup><https://eur-lex.europa.eu/legal-content/RO/TXT/PDF/?uri=CELEX:31997R0515>

Documents related to payments	Commercial invoices Letters of credit Bills Tickets on order Cargo insurance certificate Deposit slips Marine insurance policy Payment confirmations
Documents related to Transport and logistics	Product packing list Export freight instructions Standard delivery note Railway consignment note (CIM) Road transport note (CMR) Sea Waybills Air freight invoices

Source: own processing,  
after [https://www.wto.org/english/res\\_e/publications\\_e/paperlesstrade2022\\_e.htm](https://www.wto.org/english/res_e/publications_e/paperlesstrade2022_e.htm)

The accessibility of the Customs Integrated Information System is an important element for the efficient and safe improvement of customs procedures. The implications arising from access to the SIIV relate to the unrestricted access of customs administrations, economic operators and other enterprises to electronic information, as well as to the simplification of the technical requirements for the use of the system, so as to allow users to access and use it simply and easily. At the same time, SIIV has devices for authentication and authorization of the parties involved, to provide protection for sensitive data and prevent unauthorized access to customs data. The system must be implemented and developed in accordance with the national and international regulations specific to the customs field, an aspect that contributes to the respect and compliance of users with the imposed customs formalities.

SIIV provides essential benefits for all parties involved in the trade chain. Customs administrations benefit from quick and viable access to information about goods, customs declarations and other related documents, which contributes to the improvement of customs control and continuous surveillance of transhipped goods. At the same time, the system identifies any incidents that may occur during the movement of goods and their remedy by customs administrations in a timely manner and in accordance with customs regulations. This benefit offered by SIIV leads to the prevention of illegal actions, fraud and customs smuggling, monitored through technological components.

At the same time, SIIV offers the possibility of accessing the dedicated database to economic operators or other companies involved in the commercial chain. By implementing the system, economic operators can submit customs declarations in electronic format, thus eliminating the manual procedure on paper, simplifying customs procedures and reducing the time required for processing. Also, economic operators can follow in real time the stages of the processing of the registered customs declaration, have access to the customs tariffs imposed by the administrations and the legislative provisions in customs matters. Therefore, the accessibility of the SIIV by the parties involved leads to the efficient planning of the customs control but also of the supply chain, the real-time monitoring of the fulfillment of the customs procedure through the unlimited access of the parties as well as guaranteeing the protection of sensitive data.

Access to the SIIV is also guaranteed to other economic operators, namely commercial banks, transporters or distributors, giving them access to the regulations specific to the activities carried out, the status of goods or information related to transport and related customs tariffs, contributing to operational efficiency and the optimization of trade operations.

### 3. Developments and trends generated by the new computerized transit system. The impact of digitalization

Beyond the simple implementation of new components and technologies, the digital transformation of the customs sector also involves the complete process of changing legislative and institutional provisions. This digitization process includes all the necessary adaptations to traditional operational models to achieve long-term and sustainable efficiency, to offer new consolidated services to taxpayers but also to implement new capacities in key areas, namely, submitting the customs declaration by electronic means, digital invoicing, digital payments, advanced data analysis, etc. Such changes allow customs administrations to process large data sets and considerably increase the reliability, accuracy and timeliness of the processed information, which leads to the reduction of administration costs.

The development of internal resources has become an objective on the list of the strategies for the development and modernization of customs administration. Also, the information systems of the economic operators can lead to the reduction of the interaction with the customs staff. If the relationship between the economic operators and the customs authorities is constantly carried out through physical interaction, the natural element of deterrence in terms of the digitalization of the customs system is indicated.

Varela et al., (2022) states that the success factors of a digital transformation include establishing the transformation strategy and vision, achieving the ideal organizational structure, ensuring that the digital transformation is driven by a strategy, a transformational roadmap and a precise action plan but a strong team to support the process. Recognizing the importance of the human factor and addressing the fragmentation, structure and quality of systems and data, as well as promoting user adoption and trust through a change management program, are key factors in the process of digitizing a system.

The European Commission's initiative on the Electronic Customs (E-Customs) project is designed to replace customs procedures that are based on paper form with electronic operations and to create a more efficient form and a modern environment for the customs administrations of the EU Member States. The e-Customs project involves the use of digital systems, collection of customs duties, control of the flow of goods and dangerous articles, and security against crime at state borders. In practice, this aspect represents the provision to the competent customs authorities of information specific to goods transactions in electronic format, through electronic customs declarations, and involves the use of digital systems to ensure and carry out the collection of customs duties as well as the effective control of goods to and from EU member states .

Pavlova and Smolina, (2020) consider that, from the perspective of the information system, a common information model for e-commerce is the foundation of ensuring from a technical point of view the interoperable exchange of documents between different electronic customs applications. The basic premise in achieving this objective is the application of interoperability at the European level, through common understanding and mutual agreement from a technical, procedural and organizational point of view between the private sector and governments, as well as between the governmental authorities of the different member states.

The first important step towards an electronic custom and implicitly towards the electronic exchange of customs declarations at the level of the European Union was made in 1997, through the computerized system called the New Computerized Transit System (NCTS).

By European Council Decision no. 210 of December 19, 1996<sup>2</sup>, the New Computerized Transit System was considered an essential condition in the process of computerization of community transit. As a result of this fact, by Decision no. 105 of December 17, 1999<sup>3</sup>, adopted by the European Parliament and the Council, it was decided that the new transit system should be implemented as soon as possible, setting the date of June 30, 2003.

---

<sup>2</sup> [https://data.europa.eu/eli/dec/1997/210\(1\)/oj](https://data.europa.eu/eli/dec/1997/210(1)/oj)

<sup>3</sup> <https://eur-lex.europa.eu/legal-content/RO/TXT/PDF/?uri=OJC:2007:044:FULL>

Currently, the New Computerized Transit System is used in 27 EU member states, 4 member states of the European Free Trade Association - EFTA (Norway, Switzerland, Iceland, Liechtenstein), Turkey, Serbia, Macedonia, Great Britain, Ireland and Ukraine.

NCTS was implemented to modernize and digitize the transit process as well as replace paper-based customs documents with an automated system that allows for real-time surveillance of the movement of goods, thus contributing to the minimization of fraud risks and the efficiency of customs procedures.

By fully digitizing transit processes, NCTS contributes to reducing the time and risks associated with transit operations, enhancing the security and transparency of customs procedures. Thus, the NCTS allows goods in transit to move freely between member states and participating states, without the need to complete additional customs formalities at each border point. Starting from the point of departure to the final destination, the system allows the monitoring of the movement of goods, ensuring full transparency on the transit operation and preventing theft or loss of goods.

The main effect of the digitization of the new computerized transit system is the electronic processing of customs transit procedures to efficiently execute and control the customs process by competent customs personnel. In this sense, the system involves the exchange of information between the customs authorities of all EU member states, as well as other state institutions that are involved in the procedures for customs clearance and control of goods, regardless of the mode of transport. The exchange of information involves transmitting information between the customs points involved in a short time, thus facilitating the rapid movement of goods in transit.

Also, the digitization of the computerized transit system has led to simplifying the procedure for declaring shipment of goods in transit for consignors and approved consignees. Consignors and authorized consignees benefit from the simplified procedure due to the fact that they are authorized to use the global guarantee and access to the NCTS but also because they regularly use the common or Community transit regime (Yereshko et al., 2024).

The digitization of the NCTS also influences the optimization of resources and the reduction of operational costs. Thus, by eliminating paper documents, the system contributes to the considerable reduction of costs related to paper printing, logistics and paper storage. Thanks to the use of digital technologies, the need for customs personnel engaged in the procedure of administration and processing of paper documents is significantly reduced. This measure allows customs administrations to allocate resources towards other strategic operations, thus increasing the operational efficiency of the customs sector.

We appreciate the effects of the digitization of the new computerized transit system as positive, in the sense that it contributes to the efficiency of customs processes, the intensification of security and the reduction of operational costs. However, in the case of full implementation of the NCTS, periodic adaptations to modern and operational technologies, as well as the development of technical skills of customs personnel are necessary. As trade becomes more extensive, digitization and the use of paperless systems such as NCTS will continue to play a critical role in supporting and securing the international transit of goods.

#### **4. Conclusions**

Based on what was previously synthesized, we appreciate that investments in the digital infrastructure of customs administrations, by implementing modern IT systems that provide automation and digitalization of customs processes, are important factors in facilitating the rapid exchange of information between customs administrations. To this we add the need for continuous training of customs staff to deal with new technologies, thus developing the effectiveness of customs checks, through the rapid adoption of advanced technological components (container scanners, GPS tracking systems, etc.) and, above all, through the use of algorithms artificial

intelligence, which helps ensure the security of the trade flow and the prevention of fraud and smuggling.

The implementation of blockchain technology in customs systems also contributes to changing the way international trade is conducted, by developing the transparency, security, and efficiency of customs procedures. Through this technology, customs administrations can quickly and securely examine the origin of goods, certifying that they comply with the rules on tariff preferences and standards of origin. Blockchain also allows the establishment of a database in which all related information is transparently recorded of a flow of goods, ensuring the continuous monitoring of the flow of goods and the fulfillment of customs formalities as well as reducing the risk of fraud.

The increase in the performance of the digitized customs sector combined with the decrease in administrative costs represents a benefit for this sector, thus contributing to the increase of collected revenues and the compliance of economic operators. By transforming customs procedures with the help of information and communication technology, all the functions of economic operators are provided and processed automatically by the IT system, and with the help of the risk management system, errors related to customs overvaluations and undervaluations are reduced, thus increasing the confidence of economic operators in customs administrations and processes.

We believe that the customs-integrated IT system has interactive capabilities that will eliminate unnecessary processes, automate manual processes, and embed robust management in all customs transactions. Also, the new customs IT system comes with best practice features including automatic data upload chain of goods import to detect falsification of import goods, automatic data exchange to counter non-compliant economic operators, and a virtual e-auction platform to make the carriage of customs goods accessible to all stakeholders.

Furthermore, this level of improvement in customs processes and procedures can create significant environmental benefits, given that global supply chains typically involve printing, shipping, processing, exchanging and ultimately disposing of large quantities of paper documents.

For the study objective pursued in this paper, our conclusion is that by implementing the components of the Customs Integrated Information System, customs administrations can better manage risks, ensure compliance with the legislative provisions established at the international level, and contribute to the development of trade at the global level. Furthermore, digitization through the computerized transit system NCTS optimizes customs processes, strengthening security and reducing operational costs. However, the success of the full implementation of NCTS requires regular updates to new technologies and the development of technical skills of customs personnel. As trade expands, the use of digital systems and the elimination of paper are becoming crucial to making the international transit of goods more efficient and secure.

## 6. Bibliography

- [1] Alvarenga, A., Matos, F., Godina, R. and Joao, M. C.O. Digital transformation and knowledge management in the public sector. *Sustainability*, 2020, 12(14), 5824, <https://doi.org/10.3390/su12145824>;
- [2] Denysenko, M.P. Management Technologies for Enhancing Integrated Processes in the custom and logistic services sector. *Bulletin of the Kyiv National University of Technologies and Design*, 2020, 147(3), <https://doi.org/10.30857/2413-0117.2020.3.5>;
- [3] Duval, Y., Prince, N., Utoktham, C. Trade Digitalization Index: A new tool for assessing the global state of play in the digitalization of trade procedures. *Trade Investment and Innovation-Economic and Social Commission for Asia and the Pacific*, 2024, pp. 1-31, <https://hdl.handle.net/20.500.12870/6754>;

- [4] Matsudaira, T., Azcarraga, A.A.P., Rentier, G.M., Nagy, J. and Clark, R.J. Customs Matters. Strengthening Customs Administration in a Changing World. International Monetary Fund, 2022;
- [5] Pavlova, K.S. and Smolina, E.S. Digitalization of tax and customs control of foreign trade operations. Economic systems in the new area: stable systems in a unsustainable world, 2020, vol. 160, pp. 684-691, [https://link.springer.com/chapter/10.1007/978-3-030-60929-0\\_88](https://link.springer.com/chapter/10.1007/978-3-030-60929-0_88);
- [6] Varela Junquera, R.F., Lucas, C.O., Krsul, I., Calderon Yksic, V.O. and Rodriguez, A.P. Digital Transformation Of Tax and Customs Administrations. Equitable Growth, Finance and Institutions Insight Washington DC, World Bank Group, 2022, <https://openknowledge.worldbank.org/>;
- [7] Yereshko, K., Khoma, O. and Plysytsia, A. Digitalization of Customs Procedures: Current State and Prospects. Journal of Vasyl Stefanyk Precarpathian National University. 2024, 11 (2), pp.103–115. DOI:<https://doi.org/10.15330/jpnu.11.2.103-15>.