# "School of Social Sciences"

## Supply Chain Management

### Postgraduate Dissertation

Exploring the Implementation Status, Challenges and Enablers of the Electronic Freight Transport Information (eFTI) Regulation: The Greek Public Administration Perspective

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Patras, Greece, June 2024

# Exploring the Implementation Status, Challenges and Enablers of the Electronic Freight Transport Information (eFTI) Regulation: The Greek Public Administration Perspective

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Patras, Greece, June 2024

*In memory of the fifty seven decesead*
*in the passanger service and freight train crash*
*of the 28th February 2023*

# Abstract

EU member states have to comply with Regulation 2020/1056 of the European Parliament and of the Council of the European Union regarding electronic freight transport information (eFTI). The Regulation 2020/1056 encourages the digitization of freight transport and logistics, in order to reduce administrative costs, improve the enforcement capabilities of the competent authorities and enhance the efficiency and sustainability of transportation activities.

In this context, to provide a fully interoperable system - which enables cross-border control of digital transport documents- for the secure data exchange between businesses and authorities, the United Nations Convention for the Carriage of Goods (the Hamburg Rules) endorses the electronic consignment note (e-CMR).

Very recently, on the 28th September 2023, Greek authorities have ratified the implementation (L.5054/28.09.2023) (Ministry of Infrastructure and Transportation, 2023) of e-CMR enhancing the country's compliance with the EU Regulation 1056/2020 on eFTI, which is set into force in August 2024, according to initial plan.

The purpose of the study is to review the state of play with regards to the eFTI implementation in Greece from the competent authorities' ecosystem perspective, as well as to investigate the key challenges and enablers for the respective transition, in terms of regulatory requirements' conversion into operational specifications along with required organizational and regulatory intervention. The investigation is planned to be based on structured interviews and Ground Theory (GT) methodology for acquiring relevant insights.

The study's significance lays primarily on the timing, on the grounds of the very recent local regulation for the adoption of the e-CMR and the upcoming EU eFTI Regulation's entry into force. The review of the status as well as the insights on the implementation will provide valuable feedback for policy makers, decision makers and investment plans that enables decision making for the digital upgrade of the supply chain, while contributing in the eFTI literature gap.

**Keywords**

Freight Transport, eFTI , e- CMR, Public Administration, ground theory

# "Διευρεύνση της κατάστασης εφαρμογής, των προκλήσεων και διευκολυντών του ευρωπαϊκού κανονισμού για τις ηλεκτρονικές πληροφορίες των εμπορευματικών μεταφορών (eFTI): Η οπτική της ελληνικής Δημόσιας Διοίκησης

Κωνσταντίνα Τζωρτζακάκη

## Περίληψη

Τα κράτη μέλη της ΕΕ πρέπει να συμμορφώνονται με τον Κανονισμό 2020/1056 του Ευρωπαϊκού Κοινοβουλίου και του Συμβουλίου της Ευρωπαϊκής Ένωσης σχετικά με τις ηλεκτρονικές πληροφορίες εμπορευματικών μεταφορών (eFTI). Ο Κανονισμός 2020/1056 ενθαρρύνει την ψηφιοποίηση της μεταφοράς φορτίων και των λογιστικών, με σκοπό τη μείωση των διοικητικών εξόδων, τη βελτίωση των δυνατοτήτων ελέγχου από τις αρμόδιες αρχές καθώς και την αύξηση της αποτελεσματικότητας και της βιωσιμότητας των δραστηριοτήτων μεταφοράς.

Στο ίδιο συγκείμενο και για την παροχή ενός πλήρως συμβατικού συστήματος - το οποίο επιτρέπει τον διασυνοριακό έλεγχο των ψηφιακών εγγράφων μεταφοράς - για την ασφαλή ανταλλαγή δεδομένων μεταξύ επιχειρήσεων και αρχών, η Σύμβαση των Ηνωμένων Εθνών για τη Μεταφορά Εμπορευμάτων (Οι Κανόνες του Αμβούργου) υποστηρίζει την ηλεκτρονική συνοδευτική φορτωτική (e-CMR).

Πολύ πρόσφατα, στις 28 Σεπτεμβρίου 2023, οι ελληνικές αρχές επικύρωσαν την εφαρμογή (Ν.5054/28.09.2023) της e-CMR ενισχύοντας το πλαίσιο συμμόρφωσης της χώρας με τον Κανονισμό της ΕΕ 1056/2020 για τον κανονισμό eFTI, με αρχική πρόβλεψη ισχύος τον Αύγουστο 2024.

Ο σκοπός της μελέτης είναι να διερευνήσει την κατάσταση όσον αφορά την εφαρμογή eFTI στην Ελλάδα από την οπτική γωνία του οικοσυστήματος των αρμόδιων αρχών, καθώς και

να εξετάσει τις κύριες προκλήσεις και διευκολύνσεις για την αντίστοιχη μετάβαση, όσον αφορά τη μετατροπή των κανονιστικών απαιτήσεων σε λειτουργικές προδιαγραφές μαζί με την απαιτούμενη οργανωτική και θεσμική παρέμβαση. Η έρευνα προγραμματίζεται να βασίζεται σε δομημένες συνεντεύξεις και στη μεθοδολογία της Θεμελιώδους Θεωρίας (Ground Theory, GT) για την απόκτηση σχετικών αναλύσεων και διατύπωση θεωριών.

Η σημασία της μελέτης ερείδεται κυρίως στον χρονισμό της υλοποίησής της (επίκαιρη), με βάση το πολύ πρόσφατο τοπικό κανονισμό για την υιοθέτηση της e-CMR και την επερχόμενη είσοδο σε ισχύ του Κανονισμού της ΕΕ για την eFTI. Η επισκόπηση της κατάστασης καθώς και οι εισηγήσεις σχετικά με την υλοποίηση θα παράσχουν πολύτιμα σχόλια για τους συνεργαζόμενους φορείς και αρχές που συμμετέχουν στη λήψη αποφάσεων, στη διαμόρφωση πολιτικών και στην υλοποίηση επενδύσεων για την ψηφιακή αναβάθμιση της αλυσίδας εφοδιασμού, συμβάλλοντας παράλληλα και στην σχετική βιβλιογραφίας για τον κανονισμό eFTI.

**Λέξεις – Κλειδιά**

Ηλεκτρονικές Πληροφορίες Εμπορευματικών Μεταφορών, Ηλεκτρονική Φορτωτική, Εμπορευματικές Μεταφορές, Δημόσια Διοίκηση, Θεμελιώδης Θεωρία

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# List of Abbreviations & Acronyms

| | |
|---|---|
| 3PL | Third Party Logistics |
| AI | Artificial Inteligence |
| AR | Augmented Reality |
| B2A | Business to Administration |
| B2B | Business to Business |
| B2G | Business to Government |
| CCTV | Closed Circuit Television |
| CEF | Connecting Europe Facillity |
| e-CMR | electronic Consignment note for international transport |
| ECTA | European Chemicals Transport Association |
| EDMS | Electronic Document Management System |
| eFTI | electronic Freight Transport Information |
| E-procurement | Electronic Public Procurement System |
| GCR | General Commercial Registry |
| GPS | Global Positioning System |
| GT | Ground Theory |
| HCDB | Hellenic Customs Digital Borders |
| HFE | Hellenic Federation of Enterprises |
| HRMS | Human Resources Management System |
| IAPR | Independent Authority for Public Revenue |
| ICC | Infrustructure Control Center |
| ICT | Information and Communication Technologies |
| ID | Identifier |
| ID | Identifier |
| IoT | Internet of Things |
| IS | Information Systems |
| MDG | Ministry of Digital Governance |
| MDI | Ministry of Development and Investments |
| MEE | Ministry of Environment and Energy |
| MFA | Ministry of Foreign Affairs |
| MIT | Ministry of Infrastructure and Transport |
| MRDF | Ministry of Rural Development and Food |
| OCC | Operational Control Center |
| RFID | Radio-frequency identification |
| UID | Unique Identifier |
| UNECE | The United Nations Economic Commission for Europe |
| VAT | Value Added Tax |

# Introduction

The global interconnections of products, people and businesses along with the technology adavncements and innovation deployed by the market and supply chain actors lead to the emerging need of authorities' and Public Administrations' actors to update their procedures and practices in order to allow for effective information exchange and control. In this context, freight transpotartion has been addressed by the European Parliament and the Council of the European Union through the Regulation 2020/1056 . The specific initiative aims to promote the digitization of freight transport and logistics, with anticipated positive impact on reduction of administrative costs, improvement in the enforcement capabilities of the competent authorities and enhancement of the efficiency and sustainability of transportation activities. The member states will have to adopt the regulation entailing national preparedness and european centralized orchestration.

Therefore, the purpose of the study is to review the state of play with regards to the eFTI implementation in Greece from the Public Administration and competent authorities' ecosystem perspective. In the first part of the study a map of preparedness is reflected in national legislation, assigned responsibilities, national strategic actions and investment projects on the eFTI objective todate. To further generate insights, after descirpion of the methodology in the second chapter, the factors which impact the respective transition are demonstrated in the third chapter as key findings of the research. The findings are used for the formation of the theory, describing key challenges and enablers in order to support conversion of stakeholders' capability intto capacity through strategic initiatives , technical measures and policies along with required organizational and regulatory intervention.

The methodology that has been used for the research is qualitative analysis, by means of combination of structured interviews with and Ground Theory (GT) deployment for acquiring relevant insights. We have prepared four open-ended questions with the objective of investigating challenges, enablers and experiences from the implementation of eFTI and eCMR covering for general, organizational, regulatory, technological and policy concearns. The questions have been addressed to four subject matter experts in order to allow for structured interviews. The answers collected have been processed according the GT flow to allow for qualitative analysis of the transcripts, based on GT coding, both axial and

sellective that ultimately provided thematic axes and patterns of the insights. The selective coding has been provided by the author, on the grounds of underlying pespetions on megatrends highlighted by the literature and overall scope of public administration. The transcripts' analysis has been performed with the language modeling tool , GPT4.0. The same tool has been used for comparison of interviews against similar literature, to identify similarity and differences. The results of the analysis have been used to construct the theories and assessed by interviews' agreement level.

The key findings indicate that the successful implementation of eFTI and e-CMR systems in the road freight transport sector is contingent upon addressing significant challenges such as scheduling delays, high costs, data security concerns, and integration issues. Robust regulatory and organizational support, characterized by clear regulations, legal enforcement, and coordinated efforts among key entities, is essential. Digital transformation offers numerous benefits but necessitates substantial investments and standardization efforts. The impact on SMEs and the need for stakeholder coordination and public-private partnerships are vital considerations. Leveraging enablers such as European Commission support, simplification of processes, and investment in technological infrastructure can facilitate the adoption and effective implementation of these systems. Effective coordination among stakeholders, supported by robust organizational structures and legal enforcement, will facilitate successful digital transformation and improve the efficiency, transparency, and sustainability of logistics operations.

Potential limitations of the study lay on a limited number of participants in the interviews, on the grounds that the level of exposure to the eFTI regulation is still low and to new organizational announcement and replacements, stressed the proximity and availability of the experts. In this context, potential limited participation may reflect subjectivity or biases on the conclusions, as well as a less rounded overview. The level of familiarity with the detailed objectives of eFTI and e-CMR, may introduce imbalanced or generalization in the answers as well. Finally, the GT theory depends on the interpretation of results by the researcher implying subjectivity, while there is a potential inaccuracy risk when broad conclusions derive from complex context and dynamics.

Finally, the study's significance lays primarily on the timing, on the grounds of the very recent local regulation for the adoption of the e-CMR and the upcoming EU eFTI

Regulation's entry into force. The review of the status as well as the insights on the implementation will provide valuable feedback for policy makers that enables decision making for the digital upgrade of the supply chain, while contributing in the eFTI literature. Further studies may include either a broader experts ecosystem research, or deep dives into impacting factors and respective actions, while the technical features of the implementation will provide valuable insights for the architecture of the systems.

# 1. Implementation of the Electronic Freight Transport Infromation

The digitization of documents in the movement of goods provides reliability, speed, and flexibility in the implementation of the required transformation of supply chains. Moreover, it plays an instrumental role in increasing authorities' controls and confronting illicit trade and cabotage.

The digitization of supply chain respective documents, namely dispatch note, invoice or transport permit along the movement of goods on national road, by rail, as well as sea and costal transport strengthens the global business environment and local enterpreneual ecosystem. From economy perspective, it enhances the competitiveness of companies, while from operational perspective it accelerates the exchange of information between companies and agencies. Moreover, it facilitates the processing of hazardous goods declarations with the competent authorities, promotes the integrated multimodal transport, and introduces the results of research and innovation in the sector through education and training. Third-party logistics (3PL) companies tend to adhere to digitization by developing in-house or adopting information systems (IS) that register and issue appropriate documentation for the movement of goods. Therefore, the collaboration with states, will provide the opportunity to further optimize cargo insurance, confidentiality and digital certification of transport documents.

In this context, emphasis lays on linking the digitization of transport documents with the e-CMR (consignment note for international transport). The paper form of CMR represents a common supply chain document exposed to forgery, enabling illegal cabotage in a the countries.

To embrace the digitization of supply chain the European Parliament and the Council of the European Union (EU) have regulated the electronic freight transport information (eFTI), which aims to encourage the digitization of freight transport and logistics, in order to reduce administrative costs, improve the enforcement capabilities of the competent authorities, and enhance the efficiency and sustainability of transportation activities.

## 1.1 The Digitalization of Supply Chain

### 1.1.1 The technological quantum leap

The use of digital technology in every aspect of the economy and the society is emerging in an unprecented speed, justifying the entering to a new era of the fourth industrial revolution, under the term of Industry 4.0. It reflects the gradual transformation of all the conventional practices applied for production and industry, by means of adopting new technologies, namely the Internet of Things (IoT) , machine learning and artificial intelligence (AI), use of robotics and big data analystics, as well as operations over cloud computing along with the increasing mega trend of Cybersecurity (Calza et al, 2023).

Industry 4.0 technology has unlocked the potential of supply chains in gaining competitive advantage through digitization by improving productivity, efficiency and responsiveness while designing and managing their operations (McKinsey and Company, 2016) (Doug and Laaper, 2016) (Hahn G., 2021).

In addition, Risk management capability has been challenged over the disruption caused by Covid-19 pandemic (Ravindran et al, 2023), which ultimately indicated the need of supply chains' capacity building in resilience by use of digital technology (Gaur, 2021), (Florent, 2022).

The supply chain literature and studies strive to keep pace with the emerging reality of supply chain practices in the market and indicate a series of applied techonology, in terms of Blockchain technology (Queiroz et al., 2020), Artificial intelligence (AI) and Robotics, Cloud computing, 3D printing, Advanced analytics, Augmented Reality (AR), Radio-frequency identification (RFID), Internet of Things (IoT) and Cloud Technology (Mohsen , 2020), Cybersecurity (Cheung et al, 2021), PUF-based authentication systems (Hassija et al, 2021), as well as 5G (Lanire and Himanshu, 2021) and the recent advancements in Digital Twins (Gharaibeh et al, 2024).

Moreover, the adoption of the technology trends are pivotal for the management of the levers of supply chain in the dimension of capital, cost, service and agility (McKinsey and Company, 2016), while balancing the environmental and resource management aspects,

under the emerging trends of the green (Feng, 2022) and the circular economy (Mastos et al, 2021).

The upcoming supply chain strategies (Gartner Press Release, 2023) as well as policy and regulation should aim at adhering to these key trends of the digital supply chain, where the digitization of the documentation reflects the linkage of a digital supply chain between the market, the authorities and the policy makers.

### 1.1.2 Digital Supply Chain impact on market and Public Administration

In the case of policy formation in Greece, the study and proposals of the Hellenic Federation of Enterprises (HFE), demonstrate a number of use cases to underline the importance of deploying advanced technologies in supply chain network (HFE, 2021) .

More specifically, in terms of Inventory Management, it is stated that a company producing industrial equipment with a large network of representatives managing its inventory leveraged the benefits of analytics by integrating data from various sources to improve real-time monitoring of its overall inventory, reduce delivery times, and optimize inventory management and tracking. As regards, to the monitoring of the Status of Vulnerable Products, a company operating in the retail food sector utilized technologies such as RFID and cloud-based analytics, resulting in a significant reduction in product spoilage in warehouses or during transportation, thanks to improved visibility and control across the entire supply chain. In the case of Dynamic Delivery Routing (Outbound Logistics), development of artificial intelligence solutions for intelligent heuristic solutions and implementation of a dynamic routing program, a retail company managed to reduce its delivery costs by 25%, achieving simultaneous improvement in the utilization of its transportation means and customer service levels. With respects to Fleet Management via IoT-connected Devices, a company in the freight transport sector achieved more effective fleet management and reduced accidents by activating and deploying IoT data transmission devices in its vehicles.

From buseness point of view, according to the HFE study issued in 2021, the use of new digital technologies and solutions helps address the challenges faced by businesses in the

supply chain with significant benefits, with approximate results of 15-25% reduction in finished product inventory, along with capital savings and required storage space, 25% reduction in outbound logistics costs and a 44% improvement in the efficiency of transportation means and fixed asset utilization through dynamic routing. In addition, it is expected to have an impact of 20-30% improvement in raw material availability and inventory retention and 40% increase in picking accuracy and reduction in error correction costs through the integration of augmented reality technologies. While the use of robots enables 24-hour operation of distribution centers without interruptions an 100% increase potential in transportation network capacity unlocked. In addition, a 9%-17% reduction in fleet operating costs may occur through fuel consumption reduction, reduction of vehicle and driver idle time, and improved procurement practices related to fleet operation (HFE, 2021).

However, towards the conclusions made by the same study, not only the busineses benefit from a digitized supply chain network but also the Public Administration, managing a significant control workload and balancing the citizen's and consumer's benefits with a sustainable economic growth, over policy. In particular, the implementation and application of an electronic cargo monitoring system can be a useful tool for Public Administration, strengthening public finances by contributing to the fight against: VAT evasion, income concealment from sales, illicit trade, unfair competition practices, bureaucracy, reducing administrative costs for issuing, managing, and archiving accompanying shipping documents. An analysis driven for HFE (HFE, 2021) has indicated that combating tax evasion and illicit trade is mainly achieved by digitizing shipping documents throughout the supply chain, rather than by monitoring electronic invoices by tax authorities.

To strengthen the argument of digitizing the documentation, a use case of Electronic Information Exchange with Public Administration by The Hungarian Tax and Customs Authority is demonstrated. The respective authorities have been implementing a digital system since 2015, where companies are required to declare all B2B shipments made through the country's road network. For each shipment, an indicative number is assigned via the electronic platform, where Hungarian companies declare critical shipment details. The system has significantly contributed to combating illicit trade, consequently increasing

public revenues. VAT collection delays decreased from 18% in 2014 to 13% in 2016, as well as an increase in tax revenues by €1.7 billion in the first year of implementation.

Focusing in transportation, the movement of goods, including waste, is accompanied by a large volume of information and documents, which are still exchanged in paper form between businesses and between businesses and competent authorities. The use of printed documents represents a significant administrative burden and additional cost for logistics companies and related sectors (such as trade and manufacturing), especially for SMEs, while also having a negative impact on the environment.

International business practices are moving towards full digitization throughout supply chains (end-to-end solutions) and therefore the elimination of paper use. The traditional linear supply chain, as we know it today, is being transformed into a new, dynamic, flexible, and customizable model, where all parties, now digitally interconnected, can communicate and exchange information in real-time with the help of innovative technologies.

A digital network can immediately respond to unexpected changes in the external environment (suppliers, customers) and ensure access and visibility to information transmitted at any time from any part of the value chain. All processes are conducted electronically: receipt of goods, order management, tracking of shipments, warehouse operations, delivery to recipients, invoicing, etc.

As a conclusion, the study by the Hellenic Federation of Enterprises (HFE) highlights the critical role of advanced technologies in optimizing supply chain networks in Greec, which include inventory management, monitoring of products, dynaming routing and fleet management, application of scale and international practices along with administration and environmental efficiency. Finally, Public Administration enjoys the benefits of increased revenues and administrative costs. It is therefore underscored that the benefits of digital technologies in supply chain management, articulate cost reductions, improved efficiency, and enhanced regulatory compliance, promoting both business growth and public sector efficiency.

## 1.2 The electronic Freight Transport Information (eFTI)

In the light of the emerging need of digitizing supply chain documents, namely the Freight Transport Information, on July 15 of 2020, the European Parliament and European Council adopted the Regulation 2020/1056 on electronic Freight Transport Information (eFTI). This regulation aims to enhance the sustainability and efficiency of the transport sector while promoting the digitization of supply chains and freight transport. It establishes a legal framework for the electronic communication of regulatory information between economic operators, freight transport stakeholders, and public authorities regarding the transport of goods within the EU. The eFTI regulation will officially come into effect on August 21, 2024 (European Parliament and The Council of European Union, 2020), (Dasaklis et al, 2023) , leading to a start of obligation for authorities to accdept eFTI data from August 2025. However, there is a recent shift in the start date of the obligation to August 2026, according to the respective update of the implementation (Potec for DG MOVE, 22 November 2023).

The eFTI framework includes details on cargo, transport instructions, and various documents to be exchanged, aiming to improve efficiency and transparency through the quick and accurate exchange of information among all parties in the road freight transport ecosystem. The eFTI is expected to reduce errors, enhance security, and speed up freight transport processes. Implementing eFTI can also help reduce costs by automating processes, shortening processing times, and reducing reliance on paper-based documentation.

Key elements of this legal framework include ariculate the operational requirements for eFTI platforms, which economic operators must use to provide freight regulatory information to competent authorities electronically. This ensures that competent authorities are mandated to accept this information in electronic form. Although the mandatory implementation date for economic operators to use electronic documentation may be slightly extended (from 2025 to 2026, as demonstrated previously), the Regulation sets up a legal framework for electronic communication of regulatory information between economic operators and competent authorities concerning the transport of goods within the Union. It specifies the conditions under which competent authorities must accept regulatory information electronically provided by economic operators, and establishes rules for the services related to making this information available electronically.

EU member states, will have to comply with the Regulation 2020/1056 of the European Parliament and the Council of the European Union with reference to the eFTI by means of digitization of freight transport and logistics, in order to reduce administrative costs, improve the enforcement capabilities of the competent authorities, and enhance the efficiency and sustainability of transportation activities (European Parliament and The Council of European Union, 2020), while it is estimated by the European Commission that the investment of € 4.4 billion in administration will save € 20-27 billion in administrative cost as well as € 75-102 million work hours annually, while providing a more efficient and innovative logistics service. Moreover, both controls and statistics is anticipated to be improved, while the environmental benefit is estimated at more than 1300 tons of $CO_2$ emissions saving , while annualy a wide range from 180k to 900k trees is estimated to be saved (Potec for DG MOVE, 22 November 2023).

Taking a deeper look into the regulation, it applies to regulatory information requirements on the transport of goods set out in EU legal acts[1] and to regulatory information requirements laid down in delegated or implementing acts adopted by the European Commission in accordance with the legal acts referring to inland navigation, intermodal transport, international road haulage , waste shipments, inland transport of dangerous goods, interoperability of the rail system, civil aviation security. The regulation also applies to similar information requirements in relevant national laws.

On the grounds that eFTI involves electronically processed data elements for exchanging regulatory information among freight transport and logistics companies and between these operators and competent authorities, it regulates the procedures and linkages in requirement pillars, as illustrated below in Figure 1:

[1] EEC Council Regulation No 11 on **inland navigation** (summary); Council Directive 92/106/EEC on **intermodal transport** (summary), Regulation (EC) No 1072/2009 on **international road haulage** (summary), Regulation (EC) No 1013/2006 on **waste shipments** (summary), Directive 2008/68/EC on **inland transport of dangerous goods** (summary), Directive (EU) 2016/797 on the **interoperability of the rail system** (summary), Regulation (EC) No 300/2008 on **civil aviation security** (summary)

**Operator Requirements**

- Operators are not obligated to provide regulatory information electronically but must comply with specific requirements if they choose to do so:
- Use certified eFTI platforms and, if applicable, certified eFTI service providers.
- Provide data in a machine-readable format via a secure and authenticated connection.
- Communicate a unique identifying link to the data for inspection purposes.
- Present data in a human-readable format upon request by authorities.

**Authority Requirements**

- Accept regulatory information provided electronically by operators.
- Accept waste shipment information without requiring the agreement specified in Regulation (EC) No 1013/2006.
- Access and process eFTI data electronically.
- Provide electronic validation, such as stamps or certificates, when required.

**Confidentiality and Security**

- Authorities, service providers, and operators must maintain commercial information confidentiality and ensure it is accessed and processed only when authorized.

**eFTI Data Sets, Access Rules and Procedures**

- The European Commission must adopt delegated or implementing acts by February 21, 2023, to:
- Establish and update eFTI common data sets and subsets.
- Define and specify technical characteristics for each data element.
- Ensure interoperability with international data models.
- Create procedures and rules for authority access to eFTI platforms to enhance administrative efficiency and minimize compliance costs.

**eFTI Platform Requirements**

- Ensure compliance with data protection laws.
- Maintain commercial data confidentiality.
- Provide access and processing capabilities to competent authorities.
- Enable operators to share information with authorities.
- Establish a unique electronic link between shipments and data elements.
- Ensure authorized and authenticated data access.
- Record data processing in operation logs.
- Archive and secure data against corruption and theft.

**eFTI Service Provider Requirements**

- Authorize user data processing.
- Store and make data accessible according to EU and national law.
- Provide free and immediate access to regulatory information for competent authorities.
- Secure data against unauthorized processing, accidental loss, destruction, or damage.

**Certification**

- National accreditation bodies in EU Member States will certify eFTI platforms and service providers through accredited conformity assessment bodies.

**Figure 1 : Summary of eFTI regulation requirements (Author, 2024)**

As regards, to the timeline, it was stated by issue, that by August 21, 2023, the Commission would adopt the first implementing act to establish requirements for eFTI platforms and service providers. The plan is further shifted to July 2024 (Potec for DG MOVE, 22 November 2023) as demonstrated in Figure 2.

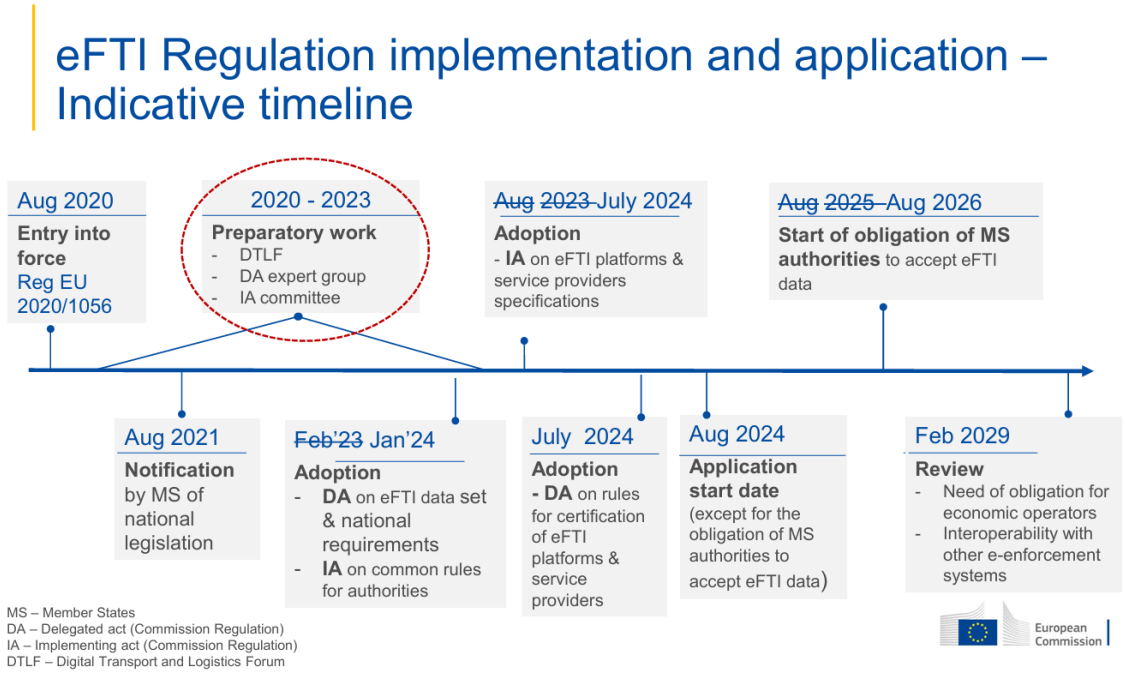


**Figure 2: Indicative timeline for eFTI implementation and application (Potec for DG MOVE, 22 November 2023)**

Furthermore, the eFTI implementation is envisiogned to be supported by an exchange environment which allows for information sharing between two main pools, a) the competent authorities ecosystem , that include the respective member-states' authorities and b) the B2B ecosystem, which reflects the information flow among the economic orperators.

These two pools are architecturaly linked over eFTI Gates (Varjas for DG Move, 2022) as demonstrated in Figure 3.

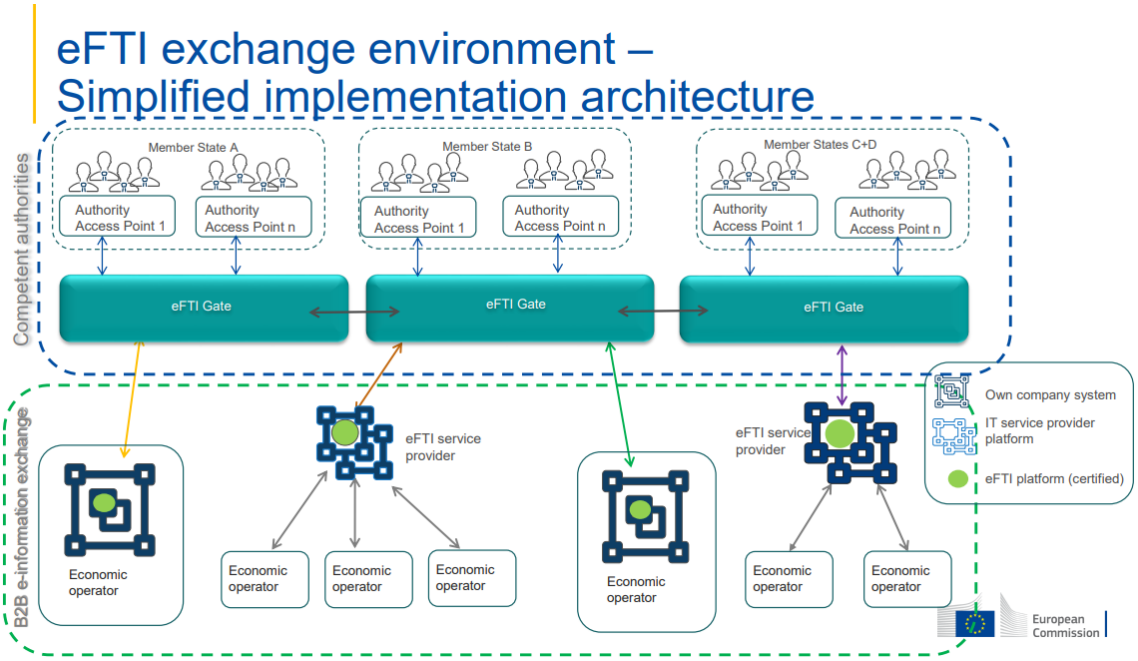


**Figure 3: Implementation architecture for eFTI implementation (Varjas for DG Move, 2022)**

In order to enable the exchange of information between member states competent authorities' and economic operators in a transnational level, it highly important to ensure semantic interoperability (Wout et al, 2022) of the information systems that is achieved through adoption of common data models, ontologies and respective data sets (Bouter et al, 2022). Moreover, harmonized procedures and rules (European Commission, 2023) will enable the regulatory level of interoperability and the horizontal technical specifications will enable the technical interoperability.

In this context, the vision is summarized in Figure 4 as the possibility of data of actual transports of goods over a unique identifier, will be shared in the B2B ecosystem of the economic operators, which will be linked to the eFTI gates allowing access to the competent and national authorities. Literature has soignalized blockchain as a suitable solution for the case (Bischoff and Gruchmann , 2021)

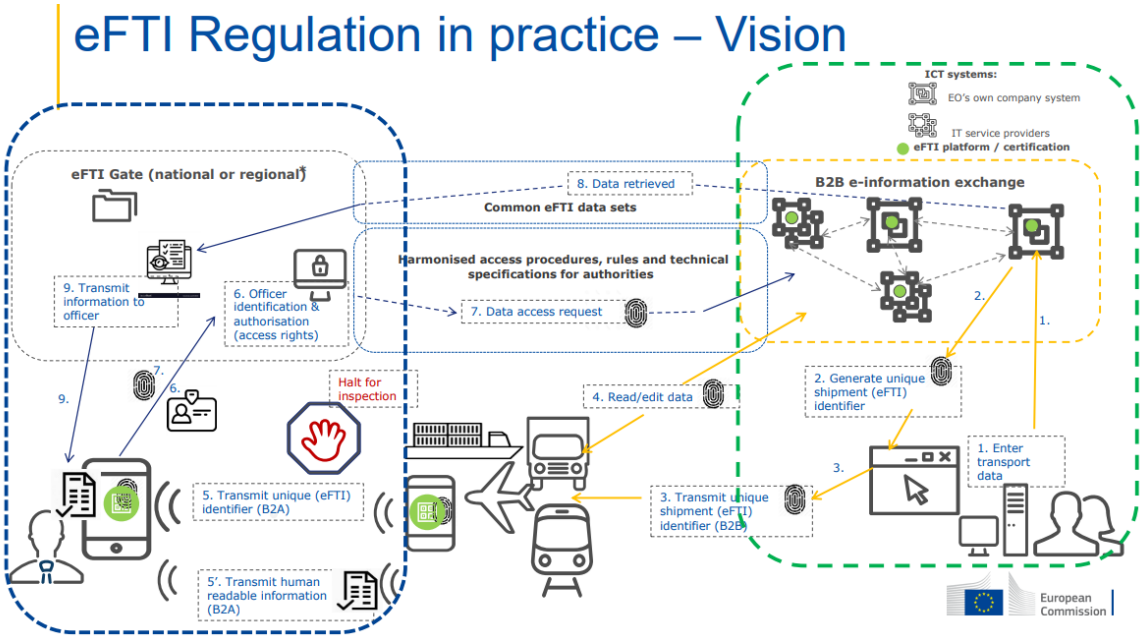


**Figure 4 : Vision of the eFTI in practice (Varjas for DG Move, 2022)**

### eFTI supporting initiatives

The eFTI implementation is supported by the program Connecting Europe Facillity (CEF) by means of the project eFTI4EU, starting from April 2023 up to April 2026, with the scope to provide studies, in terms of national and regional eFTI roadmaps, establish a pilot eFTI Gate and ultimately role out communication paths (European Commission, 2023). As regards to technical implementation, European Comission brings together both public and private stakeholders from logistics communities to enhance the technical assistance on the digital transformation of the logistics sector by the Digital Transport and Logistics Forum (DTLF), which contributes in the overall eFTI regulation and the data interoperability (European Commission, 2023).

Finally, the increasing need for cross-border public services in Europe due to the growing mobility of citizens and businesses, as demonstrated by the eFTI regulation is addressed by complementary actions by the European Commission. The importance of interoperability in Public Administrations, which enables seamless data exchange across borders, sectors, and organizational boundaries is hight on the European agenda. The European Commission has promoted interoperability through various programs since 1995, leading to the development of the Interoperable Europe Act, adopted in April 2024. This Act aims to enhance

cooperation on interoperability among EU Public Administrations, providing significant benefits by reducing costs, time, and bureaucratic burdens for citizens and businesses. The Act includes measures to support policy implementation, encourage innovation, and establish a European network for cross-border interoperability. More specifically, it includes services that require cross-border exchange of data, such as: mutual recognition of academic diplomas or professional qualifications, digital driving licenses and exchanges of vehicle data for road safety, access to social security and health data, the exchange of information related to taxation and customs, public tender accreditation and commercial registers (European Commission, 2024). The adoption of the Act marks a crucial step towards its implementation which will be instrumental for initiatives such as eFTI regulation.

## 1.3 The e-CMR

### 1.3.1 Overview

The international transport of goods by road networks is governed by a special United Nations Convention, namely the Convention for the International Carriage of Goods by Road. This Convention is referred to internationally as the **CMR**. The purpose of the Convention is to regulate the contractual relations between the sender, the carrier, the recipient in a uniform way to remove the differences between the legal systems of the states.

The CMR Convention has been regulated more than 65 years ago. It was signed in Geneva on May 19th, in 1956 and has been ratified by the majority of the European states. In this application, freight companies, drivers and those who receive consignments of goods by road use a standardized CMR delivery note, which presents information about the goods, the transport parties and the collection points, information which is exchanged between various parts of the private and the public sector. The CMR form consists of mandatory fields to be filled in, it is copied and printed several times for each individual cargo transport.

On the 20th of February 2008, in Geneva, the Additional Protocol to the Convention was adopted (THE CONVENTION ON THE CONTRACT FOR THE INTERNATIONAL CARRIAGE OF GOODS BY ROAD (CMR), 2008), providing for the possibility of drafting an electronic bill of lading (e-CMR) utilizing the technological advancements of electronic recording and data management. However, the protocol was applied for the first

time in January 2017, in a cross-border transaction between Spain and France, transporting oranges for 1300km (Poliak and Tomicova, 2020) . Moreover, according to UNECE the protocol is ratified by 32 countries by now, among which, Greece in 2023 (UNECE, 2023). Furthermore, the first e-CMR in Greece has been created in 2019, on behalf of Hermes Agencies SA, as part of a conference organized by the Hellenic Truck Drivers' Federation, in collaboration with the International Road Transport Union (IRU) and under the auspices of the Ministry of Infrastructure and Transportation (supply-chain.gr, 2019) .

According to the new structure, the trasport companies or carriers are enabled to prepare the electronic bill of lading by filling in the respective form using a digital platform. The cooperating parties will be receiving a notification for the new registrated form and will be able to enter information until the bill of lading is issued. Moreover, should additional data or variances occur, modifications of the registered form are enabled at an even later stage through the digital application. The accecibility of the digital application allows for a multichannel integration through a variety of devices, namely smartphones, tablets, personal computers or laptops. Finally, the users are not limited to the transactional stakeholders, but also the control authorities are provided with respective visibility.

The Protocol requires the identification and statement of the of the electronic bill of lading, namely the shipper, the carrier and the consignee, through an electronic signature and the interface with the respective shipments. The electronic bill of lading mandates identical content to the conventional one, in paper form. Although there is no international regulation for a standardized form, the data included in the form, mandatory information include the

Date and place of issuance, Names and addresses of the consignor, carrier, and consignee, Places and dates of receipt and delivery, Description and packaging details of goods, including special details for dangerous goods, Number of packages, their marks, and numbers, Gross mass or quantity of goods, Transport charges and additional costs, Instructions for customs and other formalities, Statement confirming the shipment is subject to the CMR Convention. If this declaration is omitted, the carrier bears liability for any resulting expenses, losses, or damages. If the carrier cannot verify the details like the number of packages, they must note reservations on the consignment note, which the consignor must acknowledge and sign. Although the consignment note is not a document of ownership, it establishes legal rights and obligations, therefore when applying the electronic form it is

crucial that the information system ensures compliance with the CMR Convention (Poliak and Tomicova, 2020).

According to the procedural design of the operational implementation of the e-CMR, the process starts with entering the data of the transportation. The transport data is used to generate a unique cargo identifier (ID) via e-CMR (digital waybill) and the identifier is then shared over a notification center between businesses (B2B) in order to aknowlwdge or process, according to the operational requirements. As a next step, the identifier is also forwarded to the relevant control authorities (B2A) on request along with the necessary information. Moving forward to potential controls, the appropriate employee using their authorized identification and rights to request access to the data, access the system, which further retrieves the relevant data and allows visibility to the employee, completing the process. A comprehensive step-by-step description of the overall process is drafted in Figure 5.

The steps mentioned, require a number of clarifications in order to be adoptes, as indicated by the continuous efforts of the United Nations Econimic and Social Council and collaboration with working parties on read transport, in order to further support standards and solutions for the operationalization of the e-CMR with key focus areas the authentication of the users, the electroinic signatures, the IT solutions and the national validation body, the safe storage of data, cyber security , back ups, fallbacks and architecture procedure (Economic Commission for Europe, Inland Transport Committee, 2023).

Finally, the thematic of eCMR appears also in the agenda of member states, like the case of Estonia, where applying the initiative over pilots have been investigated (Taavi et al, 2021). A pilot has been also run in Belgium and Luxemburg (GS1, 2022). It's implamentation has been investigated by specialized transport assosiations, as the European Chemical Transport Association (ECTA) for applying digital accompanying documents (ECTA, 2021).

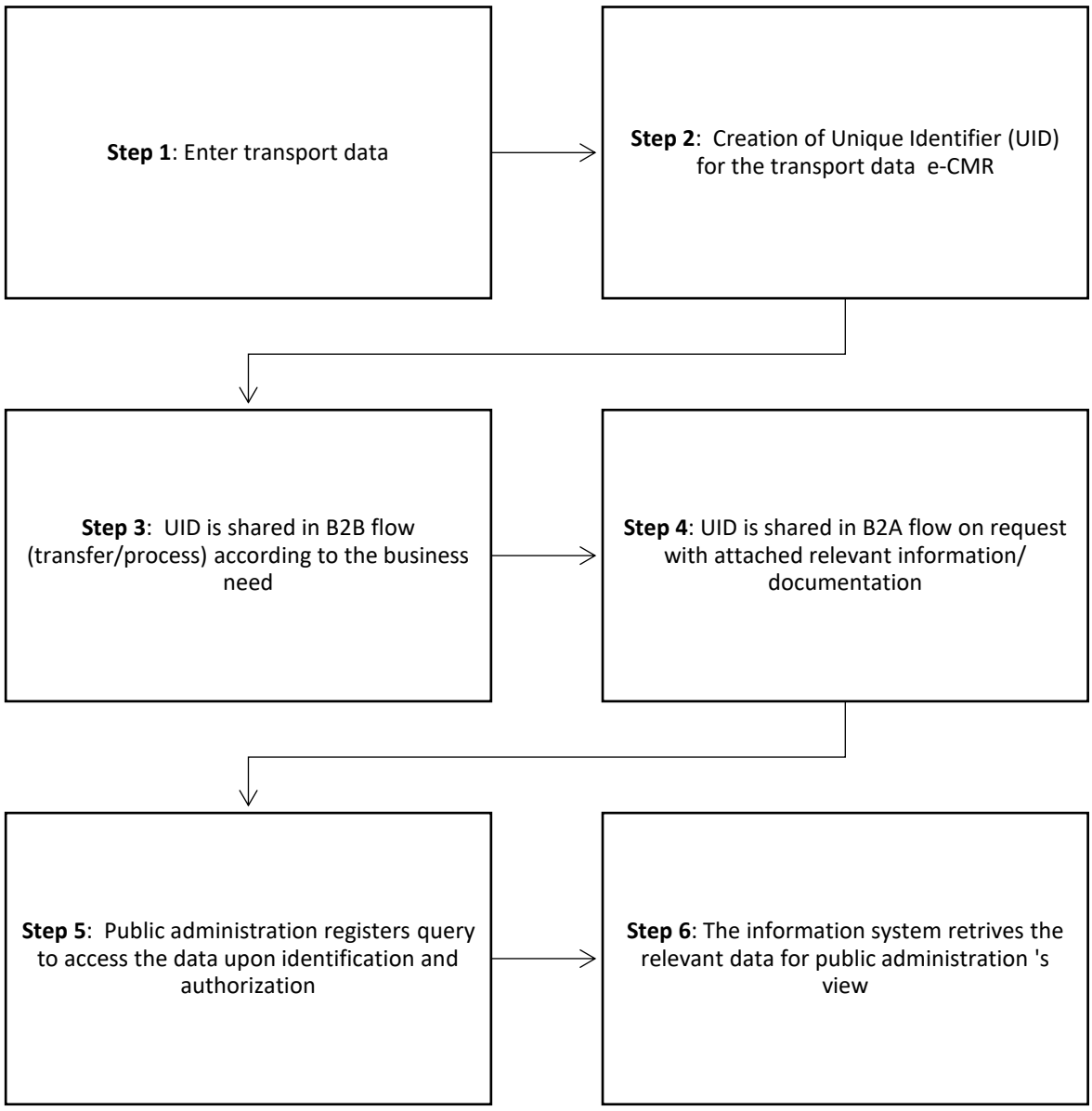


**Figure 5 : e-CMR flow (Author, 2024)**

### 1.3.2 Expected benefits

Transitioning from printed to electronic CMR consignment notes offers numerous benefits, mainly through reducing administrative costs and enhancing communication transparency among the sender, recipient, and carrier. Carriers can better forecast demand and optimize planning, improving the utilization of transport infrastructure and managing traffic congestion, thereby positively impacting the environment by reducing traffic congestion.

Immediate data access for control authorities, such as police and customs, enhances inspection effectiveness. Each e-CMR document's uniqueness, ensured by a unique QR code, and its interoperability with other applications, can significantly prevent accidents and ensure timely intervention by authorities (HFE, 2021). Additionally, e-CMR provides crucial information on multimodal transport, traffic conditions, safe goods transport, and secure parking reservations for professional vehicles. Key benefits may be classified as follows:

**Cost Reductions**: The traditional CMR consignment note involves printing at least four copies, with additional costs for sending and archiving. Issuing paper consignment notes is time-consuming and often requires direct delivery from the shipper to the driver. Digital CMR enhances administrative efficiency, leading to substantial sector-wide savings.

**Environmental Impact**: A significant reduction in paper usage benefits the environment. In the EU alone, approximately 377 million CMR consignment notes are used annually for cross-border transport (Poliak and Tomicova, 2020). The shift to digital documentation substantially reduces this paper consumption.

**Health and Safety**: Amidst the pandemic, e-CMR reduces the need for physical paper exchanges, lowering the risk of virus transmission, as paper can harbor the virus for extended periods (Poliak and Tomicova, 2020).

**Visibility and Efficiency**: Digital e-CMR allows real-time shipment tracking throughout the supply chain. Once a shipment is completed, the e-CMR is instantly accessible to all parties, allowing for immediate invoicing and eliminating delays waiting for the driver to return with a paper note.

**Process Acceleration**: The e-CMR can expedite the invoicing process by weeks, improving companies' financial health. Real-time damage reporting and photo attachments within the platform reduce dispute resolution times and accelerate claims processing.

**Integration with Customs Systems**: Enables real-time checking and reporting of the current customs status of transported goods, improving compliance and efficiency.

**Collaboration with Industrial Services**: Facilitates cooperation with services such as fleet management, enhancing overall logistics operations.

**Enhanced Road Safety**: Supports automatic emergency calls for trucks, improving response times and safety. Interoperability with other applications, providing multiplied benefits for preventing the consequences of various accidents and the timely intervention of Authorities where needed. In addition, provides information for the safe transport of goods, data, and reservations for secure parking spaces for professional vehicles.

**Increased Transport Efficiency**: Improves the economic competitiveness of the transport industry and the countries that are signatories to the Additional Protocol to the CMR Convention. Also, reduces the time needed to resolve disputes and accelerates claims processing.

**Unified Supply Management Platform**: The implementation of e-CMR fosters a unified supply management platform that interconnects vehicles, buildings, and applications. This digital integration connects previously isolated objects with logistics systems, creating significant possibilities for businesses through improved decision-making speed and accuracy via digital information analysis. It also benefits the State by enabling real-time monitoring and data utilization for implementing the National Logistics Strategy and updating the National Action Plan, namely the eFTI Rroadmap.

Overall, adopting e-CMR results in resource savings and environmental compliance, offering comprehensive advantages to the logistics sector, businesses, and public authorities.

## 1.4 The Digital Supply Chain Ecosystem in Greek Public Administration

As reviewed so far the eFTI regulation holds strong linkage to the e-CMR adoption, in terms of digitizing the supply chain streams. As regards to the actions taken by the Public Administration in Greece in order to enable compliance to the eFTI and e-CMR regulation and their context, there has been an investigation into the regulatory roles and responsibilities, in order to identify the key actors and their initiatives.

The mapping of the stakeholders, will support the policy identification as well the projects in plan or in progress that reflect the status of digital supply chain.

### 1.4.1 Public Administration Stakeholders

According to the White Paper on eFTI (Chountalas et al, 2023) prepared for the awareness and dissemination portal eFTI.gr the primary stakeholders of the eFTI system include the entities that mandate the shipment, the service providers of all coordination of movements, transport and information technology, as well as Public Administration by means of customs and regulatory controllers. In eFTI architecture terms, the entities servicing the chain from shipment to delivery are serviced by the B2B stakeholder stream, while the Public Administration is serviced by the B2A stream, all of which by deploying the technology services.

Starting form the Shippers, they provide critical information such as the type, value, and destination of goods within the eFTI system, on the grounds that they own the goods to be transported. Moreover, the Logistics Providers and the Forwarders, manage and coordinate the transportation of goods and therefore, they play a vital role in the eFTI system by supplying and receiving electronic information. Furthermore, the Carriers, that physically transport goods are essential to the eFTI system, since they provide real-time updates on the location and status of shipments.

From Public Administration perspective, the Customs and Border Protection Agencies: have to ensure that goods comply with laws and regulations when entering or leaving a

country and therefore their role in the eFTI system involves granting clearance for goods. Additional Government Agencies, are responsible bodies for setting and enforcing regulations related to freight transport as well as providing the infrastructure and funding for the eFTI system.

Finally, the Technology Providers are the companies supplying the technology and software necessary for the eFTI system and they ensure that the system is reliable, secure, and user-friendly.

In the following chapter the national Public Administration bodies are investigated in order to focus on mapping the eFTI stakeholders in the Greece implementation use case. It is important to mention that focus is laid out in central administration authority on the grounds that they hold the responsibility of issuing the legislation and the indepentdant authority that holds the regulating responsibility.

### I. Logistics Department of the Ministry of Infrastructure and Transport (MIT)

Special mention should be made of the Ministry of Infrastructure and Transport, particularly the Logistics Department, whose responsibilities focus exclusively on logistics matters.

The Logistics Department falls under the Directorate of Transport Development of the Ministry of Infrastructure and Transport. According to Article 66 of Presidential Decree 123/2017 (Government Gazette A'151/12-10-2017), the following responsibilities are subject to adherence:

a. The processing, recommendation, and monitoring of the regulatory framework for Freight Centers and Storage and Distribution Centers, within its scope of authority.
b. The processing, development, and implementation of the National Logistics Strategy, as well as the evaluation, promotion, and application of related actions, within its scope of authority.
c. The recording, monitoring, and processing of critical performance indicators (KPIs) of the logistics sector.
d. The recommendation of measures to boost competitiveness and support professionals in the logistics sector.

e. The monitoring and continuous updating on European and international developments in the aforementioned areas, at both regulatory and technological levels.
f. The support of the Ministry's representation at transnational, European, and international levels on logistics issues.

## II. The Supply Chain Development Service of the Ministry of Development and Investments (MDI)

The Supply Chain Development Service is a department-level unit, which reports directly to the Minister and its objective include the staff coordination of the implementation of the institutional framework for the supply chain, and in particular of Law 4302/2014 (A'225) .

According to Article 17 of Presidential Decree 5/4-2-2022, its responsibilities include:

a. The coordination of all services, bodies, and actions for the planning, development, and monitoring of the country's supply network, as well as supporting the provision of related services and information.
b. The study and recommendation of measures concerning the modernization and simplification of the regulatory framework of the supply chain, particularly Law 4302/2014, following the opinion of the involved services and bodies.
c. The recommendation of policies and measures for the integration of logistics functions into the internal operations of public bodies, especially concerning procurement and inventory management, to make value chains efficient.
d. The supervision and evaluation of policies and measures related to the development of the national supply network.
e. The support of the operation of the Development and Competitiveness Council of the Article 7 of Law 4302/2014 and the Government Committee for the Development of the Supply Chain of PYS 20/2020, as well as the recommendation for the establishment of collective bodies in the logistics sector, and the relevant updating of the Coordination Service.

## III. Independent Authority for Public Revenue (IAPR)

In power of the Law 4389/2016, the Authority' s main mission is to monitoring and control the collection of public revenues and ensure the application of existing legislation for their collection. In addition, the Authority is responsible for the :

a. implementation of Measures: Taking and implementing necessary measures for the effective operation of tax, customs, and other services, targeting tax evasion, smuggling, tax fraud, and the informal economy. This includes applying tax and customs laws and improving public revenue collection.
b. Issuing Regulations and Guidance: Issuing regulatory decisions, circulars, instructions, and other administrative documents for interpreting and applying tax, customs, and related legislation.
c. Service Organization: Issuing administrative documents related to the organization of services and management of resources.
d. Public Health and Consumer Protection: Taking measures to protect public health, the environment, and consumer interests, while supporting market function, competitiveness, and innovation in the chemical industry. Providing scientific support to judicial, police, and other state authorities.
e. Strategic Planning: Developing strategic and operational plans for all services, setting targets, and performance indicators.
f. Operational Plans for Inspections: Preparing detailed operational plans for tax, customs, and other inspections, scheduling checks to ensure compliance with tax and customs laws, and evaluating and prioritizing inspection requests from other entities.
g. Detection of Illegal Activities: Identifying instances of tax evasion, smuggling, tax fraud, illicit trade, and the informal economy, and assessing the resulting tax liabilities.
h. Corruption and Inefficiency Detection: Identifying corruption, opaque procedures, inefficiency, low productivity and quality of services, and non-compliance with legality within tax, customs, and other services.
i. Supervision and Coordination: Supervising and coordinating tax, customs, and other services, evaluating their performance against set objectives based on operational planning and action programs.

j. Legislative Proposals: Recommending legislative measures to enhance tax and customs compliance and improve the efficiency of public revenue collection.
k. Advisory Opinions: Providing opinions on draft laws related to its responsibilities.
l. Coordination with Other Entities: Coordinating and collaborating with other entities and authorities in exercising its duties.
m. Software and IT Systems Management: Developing, updating, maintaining, operating, and using application software for its information systems. This is crucial for carrying out its duties effectively and ensuring data security and management, especially for supporting the core functions of tax, customs services, and the State General Laboratory.
n. Electronic Services: Providing and supporting electronic services to citizens, businesses, and public sector entities to facilitate transactions, reduce bureaucracy, simplify procedures, and achieve tax justice and transparency.
o. Technological Strategy: Defining its technological strategy for the design and development of applications and e-Government services.

On the grounds of the complexity of the logistics sector, additional entities from of the Public Administration are involved in the digitalization of supply chain.

## IV. Additional Public Administration Authorities

To narrow down the interelations, the Ministry of **Maritime Affairs and Insular Policy** (MMAIP) holds the responsibility of merchant shipping and its connection with the national economy, as well as the protection of the natural and marine environment. In more specific, the MMAIP has included the e-CMR in its recent legislation and according to Ar.288 Law 5020/2023 , joint decision by the Ministers of Digital Governance and the Minister of MMAIP and will specify a) The process for issuing the electronic bill of lading and its transfer to a new carrier, b) the terms for ensuring the authenticity and integrity of the document, c) the means of proving the delivery of the document to the holder and verifying the holder's identity, d) the procedure for verifying the commencement and cessation of the electronic document's validity and any replacement by a paper document, e) The method for returning the electronic bill of lading to the carrier in the event of cargo delivery to the holder, f) Any other necessary details, as well as specifics regarding the electronic unloading

bill and the combined transport bill of lading and those related to the electronic issuance and management of sea waybill.

Moreover, the **Ministry of Rural Development and Food** (MRDF) as well as the **Ministry of Environment and Energy** (MEE) share an important role in the food and health safety as regards to the safety and quality aspects of the supply chain, along with the environmental impact of logistics, the waste management and reverse logistics regulated and controlled by the respective authorities.

Finally, the digital supply chain in Public Administration ecosystem includes the **Ministry of Digital Governance** and the General Secretariat of Information Systems and Digital Governance, with repects to design, development, operations, and utilization of Information and Communication Technologies (ICT) in public services, operates the Interoperability Center, hosts the systems of the Independent Authority for Public Revenue, in accordance with Article 37 of Law 4389/2016 (A' 94), as well as other Public Administration entities in collaboration with them. Additionally, it ensures the smooth and uninterrupted operation of the electronic services provided to citizens, businesses, and Public Administration through its central, regional, and backup computing infrastructures and applications, and implements the necessary authorization, security measures to protect infrastructures, software, and data from malicious attacks.

The ecosystem that engages in the digitization of the supply chain may be reflected in the following scheme in Figure 6.

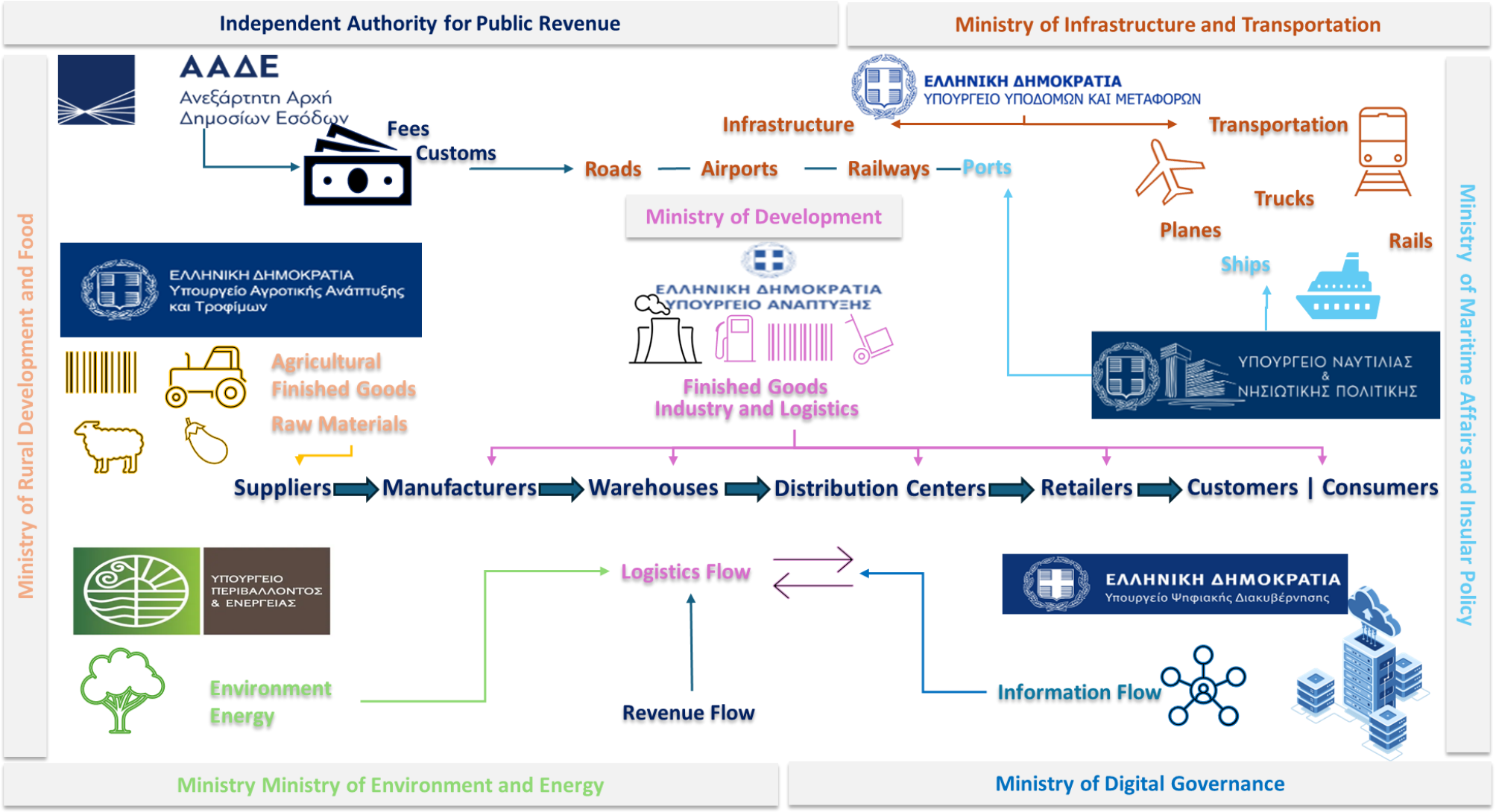


**Figure 6 : The Greek Public Administration ecosystem for Supply Chain (Author, 2024)**

### 1.4.2 Public Administration Strategic Projects

The Public Administration Strategic Projects signalize the maturity of the implementation status of the eFTI initiatives and relevant regulation enforcement. In addition, although the initiaves in terms of legislation and regulation ensure the roll out and the compliance to European and international legislation, it is the secondary legislation and regulation that mandates the implementation, while the the investment in transformational projects, in this case digitization, indicates the actual adoption of a regulation. In this context, the key projects in the Agenda are displayed.

#### 1.4.1.1 The Trade Facilitation Roadmap 2022-2026 – Action 12 of the National Action Plan

The integration of e-CMR into national strategic actions underlines the commitment to advancing the digital transformation of logistics and transport, ensuring compliance with international standards, and enhancing efficiency and transparency in supply chain operations.

The Trade Facilitation Roadmap 2022-2026 (Greek Republic, Government, 2022) is structured around four main pillars:

1. Institutional governance of trade facilitation

2. Simplification and digitization of pre-customs procedures

3. Implementation of the digital single window for foreign trade

4. Enhancement of Greece's connectivity with neighboring countries

The implementation of the e-CMR demonstrates synergy with the actions of the National Action Plan initiated by the Ministry of Foreign Affairs (MFA).

The following Table 1_summarizes the action details, the involved authorities, and the milestones as outlined in the Roadmap:

**Table 1: Trade Facilitation Roadmap :Action on e-CMR (Greek Republic, Government, 2023)**

| Action | Description | Initiating and Competent authorities | Milestone |
|---|---|---|---|
| Enhancement of the flow of electronic information related to logistics and transport, e-CMR | Electronic submission and verification of the CMR (international consignment note for road transport) via a certified platform. The e-CMR platform service providers are approved by the national authorities, which are obligated to accept the electronic information contained in the e-CMR | MIT<br>MFA | (a) ratification of the Additional Protocol on the International Carriage of Goods by Road (CMR) on the electronic Bill of Lading (e-CMR) |
| | | MIT<br>MDG | (b) implementation |

The action of enhancing the flow of electronic information related to logistics and transport, e-CMR , is the manifestation of the adoption of e-CMR as an enhancer of the foreign trade. The first milestone has been already achieved with the ratification of Law 5054/2023 (Government Gazette 159 A'/ 28.09.2023) titled "Ratification of the Additional Protocol to the Convention on the Contract for the International Carriage of Goods by Road (CMR) concerning the Electronic Consignment Note," whereas Greece officially adopts the Additional Protocol to the United Nations Convention, which provides for the possibility of issuing an electronic consignment note (e-CMR).

The Additional Protocol to the Convention on the Contract for the International Carriage of Goods by Road (CMR) concerning the electronic consignment note aims to resolve legal issues related to the introduction of the electronic consignment note, without modifying the provisions of the Convention.

The second milestone refers to the electronic submission and verification of the CMR through a certified platform. In this context, the e-CMR platform service providers should be approved by national authorities, which are ultimately required to accept the electronic information contained in the e-CMR. The approval process of the e-CMR providers by the

MIT is supported by an Agreement between the Ministry of Digital Governance and the Ministry of Infrastructure and Transport, as part of the National Simplification Program for the simplification and digitization of its administrative services, signed on January 14, 2020.

National authorities are obligated to approve e-CMR service providers and ensure that control and other authorities have access to the required information, which is available electronically. To implement the introduction of the electronic consignment note in Greece, respective legislative and technical project should be initiated, in order to verify that e-CMR service providers meet the technical requirements in accordance with the safeguards required by the Protocol (such as electronic signature, data retention, ensuring the accessibility of control authorities, etc.) in order for the MIT to proceed with the certification of e-CMR providers.

#### 1.4.1.2 The e- dispatch note

The pivotal legislative intervention by the IAPR is also in progress, indicated by the proposed provisions submitted to the Parliament, inb order to provide for the digital issuance of documents required by legislation for Greek auditing standards for the movement of goods and their transmission to the IAPR. The aim is to facilitate both businesses in documenting and monitoring their transactions and the Tax Administration in conducting relevant verifications within the framework of the conducted audits.

The evaluated regulation addresses the issue of how to document the movement of goods, aiming to facilitate businesses in documenting the movement of their goods and assisting the auditing services of the IAPR in the context of the verifications and cross-checks of the goods moved by businesses. The proposed provisions intervene in Law 4308/2014 (Government Gazette A'251) currently under consultation (IARP, 2024). It is notworthy that the main intervenetions articulate the digital forms as well as the secondary regulation that will define the specifics , in order to regulate the issue of digital goods transportation documents :

*"For the fulfillment of the obligations of goods movement, the relevant documents are issued digitally, bear specific specifications and markings, and are transmitted directly to the Independent Authority for Public Revenue (IAPR).*

*By joint decision of the Minister of Finance and the Governor of IAPR, the scope of application is specified, and the time of transmission, exceptions, and the commencement of the obligations are determined.*

*By decision of the Governor of AADE, the specific obligations of the the specifications, content, and format of the digital transportation documents, the method and channels of their transmission to IAPG, as well as the procedures and details for the implementation of the obligations are determined."*

The above mentioned initiative which released for public consultation to submit comments and proposals from the market (still under legislative process), stipulates that the data of digital monitoring of goods circulation will be transmitted in real-time prior to the uploading and circulation in the myDATA platform, and the "cycle" closes with the receipt of the products by the entity that placed the order.

Digital transportation documents receive a Unique Registration Number for each valid transmission to the myDATA platform, incorporate a QR Code, and specify that the circulation date cannot exceed five days from the date of issue of the transportation document.

In this context, IAPR will be able to trace every good being circulated at any given time, from the moment it leaves the merchant's warehouse or field, significantly simpligying the inspection, until the goods reach their final recipient, while ensuring visibility of the possible intermediate docks. Moreover, the electronic dispatch notes are planed to be mandatory, as of 2025 (IARP, 2024).

The Digital dispatch note application field refers to a wide range of physical and commercial goods transaction, namely wholesale and retail, domestic and foreign transactions, sales, sales on behalf of third parties and credit invoices. Indicative data displayed on the digital dispatch notes as per Table 2 : e- dispatch note fields' provisions based on Table 2.

**Table 2 : e- dispatch note fields' provisions based on (IARP, 2024)**

| R/N | Field | R/N | Field |
|---|---|---|---|
| 1 | Issuer's VAT Number | 14 | Purpose of Circulation (sale, purchase, sale on behalf of third parties, free disposal, sampling, exhibition, warranty, consignment, storage at third parties, return, recycling, destruction of waste material, intra-circulation, transportation, express transportation, circulation without transportation means, other circulations) |
| 2 | Issuer's Full Name/Company Name | | |
| 3 | Issuer's Country | | |
| 4 | Recipient's VAT Number | 15 | Vehicle Number |
| 5 | Recipient's Full Name/Company Name | 16 | Item Code |
| 6 | Recipient's Country | 17 | Type |
| 7 | Document Type | 18 | Unit of Measurement (pieces, kilograms, liters, meters, square meters, cubic meters) |
| 8 | Document Series and Number | 19 | Quantity |
| 9 | Document Date of Issue | 20 | Recipient Installation Address |
| 10 | Dispatch Start Date | 21 | Transaction Completion Installation/Delivery Location |
| 11 | Dispatch Start Time | 22 | Related Documents (circulation-cancellation) |
| 12 | Issuer and Recipient Installation Address | 23 | Sequence of annotations and indications such as other transportation means registration number, date and time of loading, etc. |

| | | |
|---|---|---|
| 13 | Transaction Start Installation/Loading Location | |

The content information of the e- dispatch note is aligned with the data included in the e-CMR, while covering a wider range of data that allow for deployment by an eFTI oriented platform.

#### 1.4.1.3 Monitoring System for Commercial Vehicles and Freight Containers

The Monitoring System for Commercial Vehicles and Freight Containers (Greek Republic, Government, 2023) is included in the National Recovery and Resilience Plan "Greece 2.0," under Action 16291 - "Digital Transformation of Tax and Customs Authorities" / Axis 4.1.

The project's objective is the implementation of an integrated system for the control and recording of trucks and freight containers' entering and exiting land border points and port customs, as well as the digital monitoring of their movement within Greek territory (Integrated Digital System for the Management of Vehicle and Freight Container Monitoring). The Project Manager is the Information Society S.A. (IS.SA) while the owner of the project is the Independent Authority for Public Revenue (IAPR) as the Contracting Authority. Starting in January 2024, the ambitius milestone for the completion of the implementation of the monitoring system for the movement of commercial vehicles and freight containers is set for December 2025.

This initiative constitutes by an Integrated Information System, under the name Hellenic Customs Digital Borders (HCDB) (Information Society, 2023), which aims to enhance customs control efficiency, combat smuggling and tax evasion, and improve the overall security and transparency of commercial vehicle and freight container movements within Greek territory.

The system consists of an Operational Control Center (OCC) and an Infrustructure Control Center (ICC). The OCC uses data generated by the system for control purposes. It is linked to Executive Customs Control Service, with the capability to create clones of the Center in

other organizational or mobile units. The Center is planed to receive information from peripheral systems, process it, and make decisions. Real-time (online) data from the technological equipment installed at control points and transport vehicles (such as license plate recognition/recording cameras, reading equipment, surveillance cameras, x-rays, scales, truck tracking technology, etc.) will be transmitted to the OCC. It monitors the flow of trucks and containers and coordinates the actions of the relevant control authorities to carry out inspections. The staff of the OCC will receive the necessary training to use the equipment and process the data received, follow specific communication protocols, to IAPR network. This ensures centralized data management and the maintenance of uniform procedures for all operations.The ICC monitors the equipment of the system and the applications.

It is notable that the capabilities of the system include:

Roles and authorization management, Report Generator, Automatic Recognition and Recording of License Plates of Passing Vehicles and Electronic Photos, Reading of Travel Documents, Issuing and Reading Truck Access Cards for Crossing Bars, Closed Circuit Television (CCTV), Weighing Scales, Truck x-rays, GPS tracker, Risk Assessment modules , data storage and network of exchange information with other national law enforcement agencies. Lastly, the system has interoperability provisions, whereas the design foresees connectivity to the e-CMR, e- invoice, e-dispatch note, trsaffic fees registry, customs, myData, VAT Information exchange System for the economic operators with seat in EU. In addition, interoperability to other systems, such as the Electronic Customs and Greek Interoperable Tolling Service allows for toll and environmental fees payment, connection to the passport control system of national police, to the system of traffic licences of MIT and to the e-banking payment systems will simplify the administration control and procedures.

#### 1.4.1.4 Central Management and Analysis Hub for Multidimensional Big Data"

This project is included in the National Recovery and Resilience Plan "Greece 2.0," under Action 16842 - "Central Management and Analysis Hub for Multidimensional Big Data" /

Axis 2.2 (Information Society, 2022) . The goal of the Central Management and Analysis Hub for Multidimensional Big Data is to provide information to both governmental users (Central Government, Public Services, etc.) and external users (e.g., citizens, independent authorities, institutions, etc.) to adequately support governmental strategic planning, crisis management, monitoring of service quality to citizens, design of new services, and overall support for the information provision/decision-making process. The Central Management and Analysis Hub for Multidimensional Big Data will aggregate data primarily available in systems supporting internal processes such as the Integrated Information System of Fiscal Policy of the General Secretariat of Public Revenue (Gov ERP), Human Resources Management System (HRMS), Payroll System (Unified Payments Authority), Di@vgeia System, Electronic Public Procurement System (E-procurement), Electronic Document Management System (EDMS), etc.

An investigation of the eFTI stakeholders' websites indicated systems and registries that could be utilized ot provide information for the eFTI gates, as illustrated in Table 3.

**Table 3 : Indicative mapping of IS and Registers in Greek Public Administration (Author, 2024)**

| **Information Systems** | **Authority** | **Registers** |
|---|---|---|
| Notify on start of Business Activity (Notify Business) | **Ministry of Development** | General Commercial Registry (GCR) |
| National Observatory of Small and Medium Enterprises | | |
| | **Ministry of Infrastructure and Transport** | Electronic Toll Register |
| | | Registry of Imported Used Vehicles |
| | | National Register of Transport companies |
| | | Digital Registry of operating workshops, competent technicians, vehicle stations, car washes, and other related |

| | | |
|---|---|---|
| | | facilities serving both public and private vehicles. |
| | | Traffic Licence Register |
| Electroning townplan | **Ministry of Environment and Energy** | Electronic Waste Register |
| e-Permits | | Electronic Database for the carbon footprint submission |
| | **Commercial and Industrial Chamber of Athens** | Special Exporters Registry |
| Electronic tracking system for the movement of goods (Digital dispatch note) | **Independent Authority of Public Revenue** | Tobacco Traceability Register |
| e-invoice | | |
| MyData | | |
| Single Window for the Facilitation of Commerce (Information System of one stop shop services for the facilitation of Trade , imports and exports) | **Ministry of Foreign Affairs** | |
| Port Community System | **Ministry of Maritime Affairs and Insular Policy** | |
| | **Ministry of Rural Development** | Farmer and Agricultural Holdings Register |
| Passport Control System | **Hellenic Police** | |

This initiative aims to enhance data-driven decision-making processes within the Greek government, improve public service delivery, and promote transparency and accountability

in governance, therefore it is a unique opportunity to be utilized by aggregating data of the supply chain related sources already included in registries and Public Administration' s information systems and platforms as well as integrating the future data that will be generated by the new systems, namely the e-CMR for international transports, the e-dispatch note the digital boarders.

# 2. Research Methodology The Greek Public Administration Perspective Use Case

## 2.1 Ground Theory Steps

In this study the we perform data collection by structured interviews of the public sector representatives, namely e supply chain xperts in the implementation of eFTI and e-CMR , which will be combined with Ground Theory (GT) methodology (Allan, 2003) (Turner , 1981). GT is a systematic methodology in the social sciences involving the construction of theories through methodical gathering and analysis of data. It's particularly useful for qualitative analysis. The answers will be collected and GT will allow for qualitative analysis of the transcripts, based on GT coding, that will ultimately provide thematic axes and patterns of the insights. The AI tools of language models , GPT4.0, will be used for the purposes of the transcripts' analysis. Should the interviewees provide specialized subjects, the research approach ensures that the produced theory not only stems from thorough sources but also is data grounded.

The step-by-step to perform qualitative analysis using Grounded Theory coding on structured interviews, includes:

Step 1- Preparation : The interviews have been transcribed and translated into English language, while ensuring that all spoken words are written down accurately

Step 2- Initial (Open) Coding : Data are coded line by line and Open coding delivers breaking down the data into discrete parts for closely examination and labelling. In Vivo Codes , allow for use of exact words from the interviewees as codes when appropriate, in oeder to help stay true to the participant's voice, while Generate Codes support in additional generation providing insights on relevance or importance.

Step 3- Focused (Axial) Coding : Includes the categorization, whereas the initial codes are grouped into categories based on their similarities, supporting in organizing the data into meaningful clusters. Moreover, it includes the Relationships Identification, where we look for relationships between different categories. Furthermore coding involves selecting the

most significant and/or frequent initial codes to sort, synthesize, integrate, and organize the data.

Step 4- Theoretical (Selective) Coding : In this stage we identify the core category that represents the central phenomenon of the research and further relate other categories to the core category, namely integrate categories. In the use case we will perform a further specific analysis by use of words and phrases (namely provide own codes) on the objectives of *"interoperability"* which reflects the complexity of the initiative and will cast light on the perceived status, driven by the statements of interoperability act (European Commission, 2024) . Along with interoperability, we investigate the perspectives on *"Cybersecurity"* as one of the emerging megatrends (Calza et al, 2023) in digital technology and major considerarion (Economic Commission for Europe, Inland Transport Committee, 2023). A further investigation in *"interrelation between the challenges and the enablers"*, may support in assessing the preparedness of Public Administration. With consideration of the Public Administration's mission a deep dive to *"public policy"* will deliver a set of focus areas as proposals, while the analysis on *"citizen"* would verify the citizen orientation of its course of action .

Step 5- Theory Development : The continuous refinement of the categories (thematic axes and special analysis) delivers the development of the theory that will be checked for consistency and adequacy against the data, in order to ensure that your theory is grounded in the data and not influenced by preconceptions. Agreement Level and Cohen's Kappa will be used for this cause.

Step 6- Reporting : The theory is further developed and reflected as a narrative while potential visualization in terms of tables or schemes will be used to demonstrate findings.

## 2.1 Research questions

The aim is to index the feedback from the public sector actors, who carry responsibilities and experiences of the supply chain development from all regulatory, technological and control perspective. In brief, the study focused in identifying the stakeholders that have knowledge, interest and contribution in the implementation of the eFTI ecosystem from

documents access, control and high level visibility perspective, in accordance to the stakeholders analysis in previous chapter.

Therefore, the sampling and selection of representatives from the Public Administration eFTI ecosystem, aims to support the specialized nature of the topic in order to optimize the qualitative analysis of the study. The research questions with initial objectives of the research are summarized in the below Table 4:

**Table 4 : Structured interview questions (Author, 2024)**

| No | Question | Objectives |
|---|---|---|
| **Q1** | What are the key challenges, enablers and experiences on the implementation of eFTI and specifically in the e-CMR of the road FT sector, from Public Administration's POV? | Understanding the Public Administration's views on challenges and enablers as well as their experiences |
| **Q2** | How does organizational and regulatory frameworks affect the adoption and implementation of eFTI and e-CMR, what are the key challenges and the key enablers? | Assess the impact of organizational and regulatory framework, by understanding the Public Administration's views on challenges and enablers as well as their experiences |
| **Q3** | How does digital transformation influence the adoption and implementation of eFTI and e-CMR, based on converting the operational requirements into functional capabilities and what are the key challenges, enablers and experiences? | Assess the impact of digital transformation by understanding the Public Administration's views on challenges and enablers as well as their experiences |
| **Q4** | From market perspective, the adoption and implementation of eFTI and e-CMR are influenced by the company size, the workforce capabilities, the regulatory and market dynamics as well as the economic factors and long-term | Navigate suggestions for Public Policy |

| | | |
|---|---|---|
| | benefits. Which current or potential future public policies may have a positive impact on these factors? | |

The analysis of the feedback is anticipated to cast light on the factors that impact the the adoption of the eFTI , e-CMR , which ultimately reflects the readiness as well as the dynamics of the digital supply chain in Greece.

## 2.3 Experts Selection

According to stakeholders analysis the in this study the aim is to include as much representation from the total ecosystem, namely the Supply Chain Development departments, i.e. the Ministry of Development and the Ministry of Infrastructures and Transport, the Public Administration ICT, namely the Ministry of Digital Governance, as well as the controlling authorities, i.e. the Independent Authority for Public Revenue, in order to develop a well rounded and multifaceted approach of in depth insights from subject matter experts, in terms of policy, operations and technology.

Expert A is the head of the Supply Chain Development Service of the Ministry of Development, holding functional responsibility of the implementation of the eFTI. Expert A possesses extensive knowledge of the national logistics infrastructure as well as regulatory framework, particularly in eFTI regulation. Expert A also participates in the project eFTI4EU, bringing the EU Regulation 2020/1056 into life and specifically in the 14 member states consortium under the lead of Finnland. Therefore, Expert A has a significant overview in both the European and national the policy implications, challenges, enablers and support mechanisms crucial for the successful implementation of eFTI regulation. Expert B is the head of the department of the opera tion of applications and information systems of the financial operations of the general Directorate of development and productive operations of the public finance and public services Information Systems, of the General Secretariat of information systems and digital governance of the MDG. Apart from having

great experience in digitalization of financial services, the Expert B has e background in all design, implementation and support of information systems for customs and taxation as well as digital public services for the IAPR. The Expert B brings the experiences of the controlling authorities' information systems and policies, supporting in drafting all challenges and enablers within Public Administration in terms of converting a regulation into actual controlling systems. The Expert C comes from the transportation sector, namely the Hellenic Institute of Transport participating in the greek eFTI implementation ecosystem since a very early European policy stage and having act as a partner and research delegate of the ministry of transportation in the eFTI and e-CMR policy development. The Expert C has a very thorough understanding of the Greek logistics operations and mapping combined to the continuous regulation updates as well as the Public Administration's organizational framework with focus in transport responsibilities and legislation, The expert C will provide a wide range of experiences, on the grounds of experience in the Greek logistics both from practical and organizational perspectives, leading to insightful examples of enablers and challenges having ultimately an impact on public policy. Expert D comes from the Independent Department of Strategy, Planning, and Project Management of the General Secretariat of information systems and digital governance of the MDG, The expert D has been selected in order to provide insights from the Greek digital strategy and investments perspective, having an overview of the ICT projects for Public Administration as well as challenges addressed and enablers that support implementation. Moreover, the Expert D holds experiences and insights of digitalization feasibility studies (incl. eFTI and e-CMR investigations) and projects implementation in public sector with additional overview of onboarding private sector into Public Administration requirements.

## 2.4 Foreseeable problems, impact of the research & limitations and practical contribution

The interview analysis will be based on a limited number of participants, on the grounds that the level of exposure to the eFTI regulation is still low, as also clearly stated during the interviews. In addition, the focus is set on the bodies that have the authority to issue regulatory acts. Therefore, extended authorities (e.g. General Chemical State Laboratory

under the auspision of Ministry of Finance) are not subject to the specific research. The limited knowledge of eFTI has been also demonstrated by the fact that limited reference to the eFTI occurs in the scope of the Hellenic Customs Digital Borders (HCDB) despite servicing same goals and foreseeing integration of e-CMR. The limited representatives from the authorities, have also been subject to new announcement and replacements, stressing the identification and finally their availabilities. In this context, potential limited participation may reflect subjectivity or biases on the conclusions, as well as a less rounded overview. The level of familiarity with the objectives of eFTI, e-CMR, may introduce imbalanced or generalization in the answers as well. Moreover, the digital maturity of the representatives' organization and the digital skills profile of each participant may encounter as a positively or negatively bias towards digitalization of supply chain. Furthermore, the organizational culture attributes of Public Administration may result in answers' overrating regulation and responsibility fragmentation over operations and functionality. Finally, the GT theory depends on the interpretation of results by the researcher implying subjectivity, while there is a potential inaccuracy risk when broad conclusions derive from complex context and dynamics.

The study's significance lays primarily on the timing, on the grounds of the very recent local regulation for the adoption of the e-CMR and the upcoming EU eFTI Regulation's entry into force. The review of the status as well as the insights on the implementation will provide valuable feedback for policy makers that enables decision making for the digital upgrade of the supply chain, while contributing in the eFTI literature.

# 3. Research Results

## 3.1 Coding

Starting from the initial coding of the interviews it is indicated that the implementation of eFTI and e-CMR systems faces several significant challenges, including scheduling delays, high costs, data security concerns, and the need for skilled personnel, especially impacting SMEs. Organizational hurdles such as the lack of a clear framework and dispersed laws further complicate the process. Regulatory support is crucial, with clear, adaptable regulations and strong legal enforcement being pivotal. Digital transformation offers benefits like cost reduction and efficiency gains but requires substantial investments and effective integration with existing systems. Public-private partnerships and stakeholder coordination are essential to drive innovation and support adoption. Incentives for SMEs, workforce development programs, and policies focusing on cost reduction and collaboration between public and private sectors are vital enablers for successful implementation.
Addressing the open code per question, there are several insights captured demonstrated in Appendix A: Organisation of open codes.

## 3.2 Thematic Synthesis

### 3.2.1 Axial Coding

Following to the codes identified by the interviews, five thematic categories have been formed with similarities and cross refferances.

**The 1st Thematic Axis**, is **Challenges**, whereas it is evident that the implementation of eFTI and e-CMR systems is fraught with numerous challenges that hinder progress and efficiency. Key among these are schedule delays and the lack of readiness from the European Commission, which impact timelines and create uncertainty. The perceived high cost of digital transformation and actual budget constraints pose significant financial barriers, especially for SMEs that struggle with resource allocation. Additionally, external factors such as geopolitical issues and the coronavirus pandemic exacerbate these challenges by affecting implementation schedules. Other notable obstacles include the need for skilled personnel, integration challenges with existing systems, and concerns over data security.

These issues collectively make the digital transformation process complex and demanding for Public Administrations and businesses alike.

**The 2nd thematic Axis** focuses in **Regulatory and Organizational Support**. Effective regulatory and organizational support is essential for the successful adoption and implementation of eFTI and e-CMR systems. Clear and consistent regulations are necessary to provide a framework that all stakeholders can follow, reducing ambiguity and fostering compliance. Legal enforcement plays a crucial role in ensuring adherence to these regulations. Organizational support at various levels, including involvement from multiple entities like the Hellenic Revenue Authority and support from the European Commission, is critical. Additionally, the customization of information systems to meet regulatory requirements and the adaptation of regulatory frameworks to the national context are pivotal. Dispersed laws and provisions need to be streamlined to avoid inefficiencies and support cohesive organizational structures.

**The 3rd thematic Axis** refers to the **Digital Transformation and Technology**. Digital transformation and technology adoption are at the heart of implementing eFTI and e-CMR systems, offering numerous benefits such as cost reduction, efficiency improvements, and enhanced data security. However, this transformation requires significant investment and poses challenges such as the integration of new systems with existing ones and the lack of standardization. Large companies have already made strides in digitization, setting examples for others to follow. Public-private partnerships and sector linkages are vital in driving innovation and facilitating this transformation. Simplification of processes and green practices are also crucial enablers, enhancing the appeal and feasibility of digital transformation initiatives.

**The 4th thematic Axis** reflects the **Market and Stakeholder Impact**, whereas the respective dynamics significantly influence the adoption and implementation of eFTI and e-CMR systems. The size of the company plays a crucial role, with smaller companies facing more significant challenges due to limited resources. Public Administration policies can positively impact market dynamics by providing incentives and support for workforce development. Effective stakeholder coordination, including international consortium participation and inter-ministerial collaboration, is essential for addressing the multifaceted challenges of digital transformation. Training programs and public-private partnerships further support this process by equipping the workforce with necessary skills and fostering

collaborative innovation. Policies focusing on cost reduction and facilitating public-private sector collaboration are key to overcoming barriers and ensuring successful implementation. **The 5th thematic Axis** encloses the **Enablers**, leading to a forward looking aspect of the implementation. Several critical enablers facilitate the successful implementation of eFTI and e-CMR systems. Support from the European Commission and member state obligations provide a robust framework for compliance and progress. Simplification and speed of action, along with green practices, make digital transformation more attractive and feasible. Clear regulatory frameworks and stakeholder coordination are essential for ensuring consistency and collaboration among various entities. Training programs for the workforce and investment in technological infrastructure address the skills gap and provide the necessary tools for implementation. Coordination among ministries and policies focusing on cost reduction further enhance the effectiveness of these initiatives, ensuring a smooth transition to digital systems. Public-private sector collaboration is a pivotal enabler, driving innovation and sharing resources and expertise.

### 3.2.2 Sellective Coding

Apart from the initially constructed categories, as thematic axis which provide a very insightful approach, we perform a further specific analysis on the objectives of interoperability, Cybersecurity, interrelation of challenges and enablers, public policy and citizen, as described in the methodology.

**A. Spesific analysis in Interoperability**

Interoperability is a critical factor in the successful implementation of eFTI and e-CMR ystems. It refers to the ability of different systems, organizations, and countries to work together seamlessly by exchanging information and data in a standardized manner . This section analyzes the key challenges, enablers, and experiences related to interoperability based on the interview findings.

Starting with experiences in interoperability, the interviewees underpinned that Greece's participation in a consortium of 13 countries under Sweden's umbrella is an example of international collaboration to achieve interoperability. Such consortia can work towards developing and adopting common standards. Another interviewee explains according to experience, that interoperability can also support broader policy goals, while a different

interviewee builds on the move towards implementing electronic systems for document checks for road transportation indicates progress towards interoperability. However, this requires coordinated efforts and standard protocols to ensure compatibility.

From challenges perspective, all intervewees have contributed in identification of lack of Standardization, which is highlighted by the absence of a standard form even in paper versions, posing significant challenges. Without standardization, different systems may not be able to communicate effectively, leading to inefficiencies and errors in data exchange. Moreover, the Integration Challenges, are amplified by the difficulcy in integrating new digital systems with existing infrastructure. This challenge is particularly pronounced when different entities use varied systems that are not designed to work together. Moreover, an interview raised concerns about data security, which is a critical aspect of interoperability. Ensuring secure data transfer between different systems is essential to maintain trust and protect sensitive information. Finally, the Coordination Among Multiple Entities may is challenged by the involvement of multiple entities such as customs authorities and the other public administrator actors in European and national level, which complicates the interoperability landscape. Effective coordination would be therefore required to ensure that all systems and processes are aligned.

In the context of enablers, Clear Regulatory Frameworks have been stressed for clear and harmonized specifications to avoid ambiguity. Such frameworks can define standard protocols and procedures for data exchange, facilitating interoperability. The initiative of Stakeholder Coordination brings together various stakeholders, including government agencies, private companies, and international bodies that can help establish common standards and practices. The Support from European Commission in terms of regulations, standardization and semantic interoperability capabilities are crucial enablers. The European Commission can play a leading role in setting interoperability standards across member states (European Commission, 2024). Should Public-Private Partnerships be in place, then they can drive innovation and develop interoperable solutions. Collaboration between the public sector and private companies can leverage the expertise and resources of both sides to create effective interoperability frameworks. Finally, investment in Technological Infrastructure is essential to support interoperable systems. Advanced technologies and robust IT infrastructure can facilitate seamless data exchange and integration.

In conclusion, interoperability is a cornerstone of the effective implementation of eFTI and e-CMR systems. While challenges such as lack of standardization, integration difficulties, and data security concerns persist, several enablers can facilitate progress. Clear regulatory frameworks, stakeholder coordination, support from the European Commission, public-private partnerships, and robust technological infrastructure are critical to achieving seamless interoperability. Experiences from international consortia and the implementation of electronic systems provide valuable insights into best practices and potential pathways forward. Addressing these challenges and leveraging the enablers can significantly enhance the interoperability of eFTI and e-CMR systems, leading to more efficient and effective freight transport operations.

**B. Specific Analysis on Cybersecurity**

Cybersecurity is a critical concern in the implementation of eFTI and the e-CMR systemsThe interviews provided several insights into the challenges, enablers, and experiences related to Cybersecurity in the context of these digital transformations.

As regards to the Challenges in Cybersecurity, interviews aised significant concerns about data security, emphasizing the need for secure data transfer between systems. As eFTI and e-CMR systems involve the exchange of sensitive freight and transport information, ensuring the integrity and confidentiality of this data is paramount. The Integration Challenges, appear also in this analysis, since integration of new digital systems with existing infrastructures, initiates the challenge of maintaining Cybersecurity standards across disparate systems. The integration process can create vulnerabilities if not managed properly. With focus on Cybersecurity measures, the challenges of Investment is brought up. Ensuring adequate funding for Cybersecurity is a challenge, particularly for SMEs with limited resources.

Regarding the enablers for enhancing Cybersecurity, the clear Regulatory Frameworks would deliver adherence to Cybersecurity standards. Regulations that mandate robust Cybersecurity practices can help protect data and build trust among stakeholders. From Public-Private Partnerships perspective, the exchange of best practices between the public and private sectors can leverage the expertise and resources needed to address Cybersecurity challenges. Lastly, Investment in technological by means of Cybersecurity infrastructure

using advanced technologies and robust IT systems are essential to safeguard data and ensure secure operations.

Finally , the experiences with Cybersecurity , the Customization of Information Systems to align with new regulations includes incorporating Cybersecurity measures, while ensuring that systems are secure by design helps mitigate risks from the outset. Data Security Investment is stated on the grounds that organizations are aware of the importance of protecting their data and are taking steps to invest in necessary Cybersecurity measures. Finally, the coordination among different ministries, which includes aligning on Cybersecurity standards and practices will lead to implementation of eFTI and e-CMR systems adhere to the same security protocols.

In conclusion, Cybersecurity is a fundamental aspect of the successful implementation of eFTI and e-CMR systems, addressing data security concerns, integration challenges, and the need for significant investment. Clear regulatory frameworks that mandate robust Cybersecurity practices, public-private partnerships that leverage combined expertise and resources, and investments in technological infrastructure are essential enablers for enhancing Cybersecurity. Experiences from the interviews indicate that customizing information systems to include security measures, making targeted data security investments, and ensuring inter-ministerial coordination are critical steps in mitigating Cybersecurity risks. By focusing on these areas, stakeholders can build a secure and trustworthy digital infrastructure for freight transport information and consignment note systems.

### C. Specific Analysis on Interrelation Between Challenges and Enablers

Understanding the interrelation between challenges and enablers is crucial for effectively addressing the barriers to implementing eFTI and e-CMR systems. Below is an analysis of how specific enablers can mitigate the identified challenges Table 5.

**Table 5 : Challenges and mitigating Enablers according to interviews (Author, 2024)**

| Challenge | Description of challenge | Enablers |
|---|---|---|
| Schedule Challenges | Delays in the implementation schedule, influenced by the | 1.Clear Regulatory Frameworks: Establishing clear, consistent, and |

| | | |
|---|---|---|
| | European Commission's readiness and external factors. | adaptable regulations can streamline processes and reduce delays.<br>2.Organizational Coordination: Enhancing coordination among various entities, including inter-ministerial committees, can ensure that timelines are adhered to and that any delays at one level do not cascade down to others. |
| High Implementation Cost | Substantial investment required for digital transformation, particularly a barrier for SMEs. | 1.Financial Incentives and Support: Providing grants, subsidies, and tax incentives can offset the high costs of implementation for companies, especially SMEs.<br>2.Public-Private Partnerships: Leveraging partnerships can share the financial burden and provide access to additional resources and expertise. |
| Need for Skilled Personnel | A skilled workforce is necessary for successful implementation, highlighting the need for targeted training programs. | 1.Workforce Development Programs: Investing in training and upskilling initiatives ensures that employees have the necessary digital skills.<br>2.Collaboration with Educational Institutions: Partnering with universities and training centers to develop specialized curricula and certification programs. |

| | | |
|---|---|---|
| Budget Constraints | Limited financial resources complicate implementation efforts, particularly in the public sector. | 1.Strategic Funding Allocation: Prioritizing funding for critical areas and seeking external funding sources, such as EU grants and international aid.<br>2. Efficient Resource Management: Implementing cost-effective solutions and optimizing existing resources to stretch available budgets. |
| Lack of Readiness from the European Commission | Readiness at the European Commission level affects the entire implementation process. | 1.Proactive Engagement: Actively engaging with the European Commission to provide feedback and support can accelerate readiness and ensure that national concerns are addressed.<br>2.Pilot Projects: Initiating pilot projects at the national level to demonstrate readiness and capability can encourage quicker adoption and support from the European Commission. |

The review of the the challenges in implementation and corresponding enablers and the detailed interrelation analysis generates a set of strategic initiatives as demonstrated in the below visual Figure 7.

**Clear Regulatory Frameworks and Organizational Coordination**

- By establishing clear regulations and improving coordination among entities, the implementation schedule can be better managed. Clear regulations reduce ambiguity and streamline processes, while effective coordination ensures that all parties are aligned and working towards the same timelines.

**Financial Incentives and Public-Private Partnerships**

- Addressing high implementation costs requires financial support and collaborative efforts. Financial incentives reduce the direct cost burden on companies, while public-private partnerships can provide additional resources, share risks, and offer expertise that can lower overall costs.

**Workforce Development Programs and Collaboration with Educational Institutions**

- Developing a skilled workforce is essential for digital transformation. Workforce development programs provide the necessary training, while partnerships with educational institutions ensure a steady pipeline of qualified individuals. These enablers directly address the challenge of needing skilled personnel.

**Strategic Funding Allocation and Efficient Resource Management**

- Overcoming budget constraints involves prioritizing funding for critical areas and optimizing resource use. Strategic allocation ensures that limited funds are used where they are most needed, and efficient management maximizes the impact of available resources.

**Proactive Engagement and Pilot Projects**

- Engaging with the European Commission and demonstrating readiness through pilot projects can address the challenge of lack of readiness at the European level. Proactive engagement helps in providing feedback and influencing decision-making, while pilot projects showcase national capabilities and encourage quicker support and adoption.

**Figure 7: Strategic initiatives to compensate challenges by deploying enablers (Author, 2024)**

By understanding and leveraging the interrelation between challenges and enablers, stakeholders can develop more effective strategies for implementing eFTI and e-CMR systems. Addressing challenges through targeted enablers ensures a smoother and more successful implementation process, facilitating digital transformation and improving the efficiency and sustainability of logistics.

Comparison to existing literature

Provided that the understanding of challenges can be instrumental the further policies and actions, there has been an attempt to compare the challenges addressed to the national literature provided "White Paper" published in the Greek eFTI information portal (Chountalas et al, 2023) and the interviews conducted, by use of AI Linguistic Modelling tool. Both transcriptions of the interviews and the 7th chapter of the White Paper have been provided as linguistic data to the tool to capture similarities and differences. The results ( provided analytically in Appendix C: Comparison of Interviews Results and eFTI White Paper Results) of both sets of data highlight significant challenges and enablers in the areas of legal and regulatory frameworks, technical infrastructure, organizational coordination, cost and resource management, and user adoption. The primary differences lie in the emphasis on certain aspects, such as the focus on skilled personnel and financial constraints in the interviews, compared to the broader strategic frameworks and support measures discussed in the white paper. This comparison underscores the multifaceted nature of implementing eFTI and e-CMR systems, requiring coordinated efforts across various domains.

**D. Specific Analysis in Public Policy**

Delving deeper into the public policy aspects captured in the interviews, focusing on the themes of regulatory frameworks, enforcement, and support mechanisms, there are four dominant public policy thermes Figure 8.

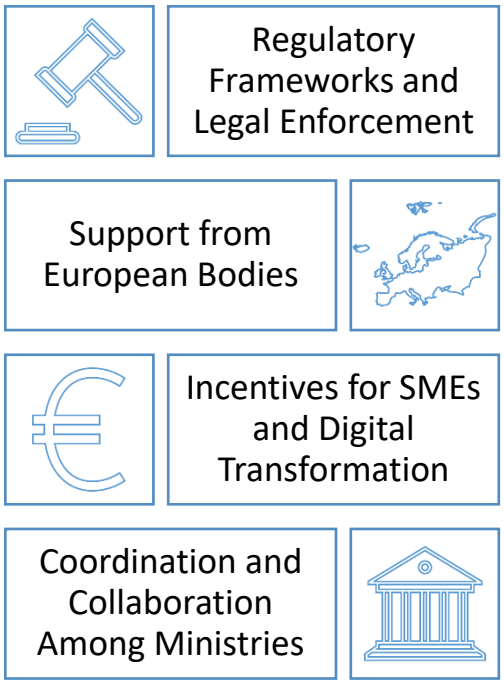


**Figure 8 : The key themes for public policies (Author, 2024)**

1. Regulatory Frameworks and Legal Enforcement

In the fields of administrative law, the Public Administration acts according to what is permitted by law while the private ecosystem (citizens, enterprises, businesses) acts according to what is not against the law. The specific quote is reflected in all the interviews with statements as "*Each member state must, by 2026, accept the digital documents of all individuals for the transport of goods within the European Union digitally through the platform provided by the European Commission*" and "*The regulatory framework must be adapted to the current maturity level at the national level to be realistic and implementable promptly"* or "*The strongest enabler is the legal enforcement*" and *"Emphasizes the need for a clear regulatory framework to avoid ambiguity and ensure consistent implementation"* .

Therefore, the regulatory framework is pivotal in the implementation of eFTI and e-CMR. Legal enforcement ensures compliance and standardization across member states. However, the adaptation of these frameworks to the national context is crucial. Policies should consider the existing maturity levels of digital infrastructure within member states to make the regulations practical and enforceable. In this context, the policy implications may involve the adoption of EU-wide Standards by means of uniform regulations to be adapted

to national contexts, legal enforcement mechanisms to ensure compliance and continuous review and adaptation in order to address emerging challenges and technological advancements.

2. Support from European Bodies

The interviews have underpinned that the support from the European Commission and the obligations imposed on member states form the backbone of this regulatory push, while the organization by the EU may have a positive impact if inclusive and decisive with clear guidance and alignment.

With respects to these statements, the European Commission's support is fundamental in driving the implementation of eFTI and e-CMR. This includes providing clear guidance, technical assistance, and funding. The inclusive approach by the EU can help in addressing the diverse needs and readiness levels of different member states. In addition, the policy Implications may include technical assistance programs to provide technical support and capacity-building for member states, funding and grants in order to assist member states in building the necessary infrastructure, as well as inclusive policymaking to input from all member states to cater to diverse needs.

3. Incentives for SMEs and Digital Transformation

Identifying that Public Administration acknowledges that the *"Entrepreneurship in Greece perceives this digital transformation as a cost"* and that *"Incentives should be given to smaller companies, which do not inherently have the culture for this"* it can be assumed that SMEs face significant challenges in digital transformation due to high costs and lack of expertise. Public policies that provide incentives, subsidies, and support mechanisms can alleviate these challenges. This includes financial incentives, tax breaks, and technical assistance to promote digital adoption among SMEs. The respective policy implications may then include either financial Incentives in terms of grants, subsidies, and tax incentives for SMEs to adopt digital technologies or training and development to enhance digital skills among SME employees, as well as foster partnerships between the government and private sector to provide resources and support for SMEs.

4. Coordination and Collaboration Among Ministries

The interviewees have shared that issues in coordination and legislation, namely too many dispersed laws and provisions may set a drawback to an efficient organization with clear

roles and responsibilities, while three ministries need to collaborate, each with their role, to make eFTI and e-CMR available.

Effective coordination among various governmental ministries is essential for the successful implementation of eFTI and e-CMR. Fragmented laws and lack of collaboration can impede progress. Policies should focus on creating a unified approach and fostering inter-ministerial collaboration. The policy implications articulate Inter-Ministerial Committees to oversee the implementation of eFTI and e-CMR, ensuring collaboration across ministries, regulations' streamlining to eliminate redundancies and conflicts and a potential central coordination unit to coordinate efforts and monitor progress.

**E. Specific Analysis on the Impact on Citizens from the Implementation of eFTI and e-CMR Systems**

The implementation of eFTI systems in the road freight transport sector has direct and indirect implications for citizens. The following analysis explores the challenges, enablers, and experiences related to the impact on citizens based on the interview findings.

Challenges Impacting Citizens : An indirect financial burden may occur when high costs associated with digital transformation. Companies facing high implementation costs might pass these costs onto consumers, leading to higher prices. Data privacy concearns may also arise steemning from data security. Ensuring the protection of personal data in the logistics and transport systems is critical to maintaining citizen trust. Any breach could result in significant public backlash and loss of confidence in digital systems. Finally, the digital divide might be at stake due to implementation of advanced digital systems. Citizens in regions with less developed digital infrastructure or lower digital literacy may not benefit equally from these advancements, leading to disparities in service quality and access.

Enablers Benefiting Citizens: Should the eFTI and e-CMR increased efficiency and lower costs, there is a potential for lowering operational costs. These savings can be passed on to consumers in the form of lower prices for goods and services, benefiting citizens financially. Moreover, the implementation of eFTI and e-CMR systems can enhance the transparency and reliability of logistics operations. Citizens may experience improved service quality, such as faster delivery times and better tracking of goods, enhancing their overall experience. Furthermore, by integration of environmental considerations into logistics improvements, citizens can benefit from reduced emissions and environmental impact due

to more efficient and sustainable transport practices. Finally, potential investment in data security measures as part of digital transformation efforts can ensure the protection of personal data, while robust Cybersecurity practices can build citizen trust in digital systems and ensure their privacy is maintained.

In conclusion, the implementation of eFTI and e-CMR systems has a multifaceted impact on citizens. While there are challenges such as potential financial burdens, data privacy concerns, and the risk of exacerbating the digital divide, there are also significant benefits. Increased efficiency, improved service quality, environmental benefits, and enhanced data security can positively affect citizens. Experiences from the interviews highlight the importance of maintaining public trust, ensuring regulatory compliance, and promoting inclusive policies to maximize the benefits for all citizens. By addressing these challenges and leveraging the enablers, stakeholders can ensure that the digital transformation in the freight transport sector leads to broader societal benefits, enhancing the quality of life for citizens.

## 3.3 Deriving Theories from findings

Following to the findings of the analysis based on coding, there is a theory developed per analysed dimension, as illustrated in Figure 9.

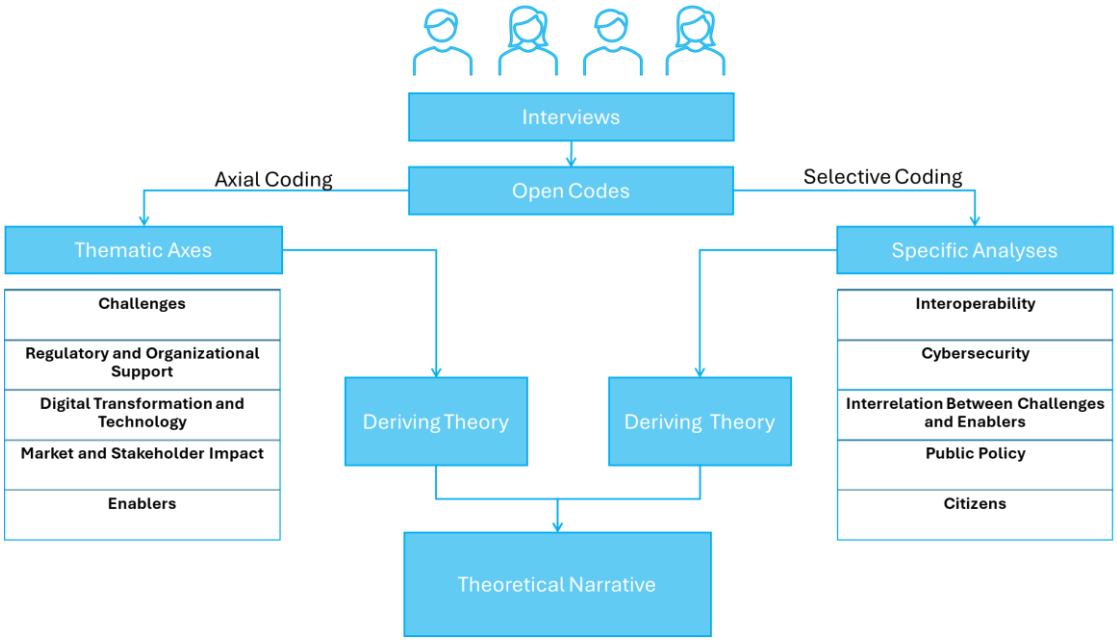


**Figure 9 : The flow of synthesis of the thematic axes and the specific analysis into a theoretical narrative using Ground Theory (Author, 2024)**

### 3.3.1 Deriving Theories from Thematic Axes

Based on the thematic axes identified from the interviews, here are the deriving theories for each thematic axis. These theories provide a synthesized understanding of the data and offer a coherent explanation of the phenomena observed in the implementation of eFTI and e-CMR systems.

1. Challenges in Implementation : The implementation of eFTI and e-CMR systems is significantly hindered by a range of challenges, including scheduling delays, high costs, data security concerns, and integration issues with existing systems. These challenges are exacerbated by external factors such as geopolitical issues and the coronavirus pandemic. For SMEs, these barriers are more pronounced due to limited resources and financial constraints. Addressing these challenges requires a coordinated effort to provide financial support, enhance data security measures, and streamline integration processes to ensure a smooth transition to digital systems.

2. Regulatory and Organizational Support : Effective regulatory and organizational support is crucial for the successful adoption and implementation of eFTI and e-CMR systems. Clear, consistent, and adaptable regulatory frameworks are essential to reduce ambiguity and foster compliance. Strong legal enforcement ensures adherence to these regulations,

while involvement from multiple entities, such as the Hellenic Revenue Authority and support from the European Commission, facilitates a coordinated approach. Customizing information systems to align with new regulations and streamlining dispersed laws and provisions are critical steps in building a cohesive organizational structure that supports digital transformation.

3. Digital Transformation and Technology : Digital transformation and technological advancement are key drivers of the successful implementation of eFTI and e-CMR systems. The transition to digital systems offers significant benefits, including cost reduction, improved efficiency, and enhanced data security. However, this transformation requires substantial investment and poses challenges related to system integration and standardization. Public-private partnerships and collaboration across sectors are vital in driving innovation and developing interoperable solutions. Simplification of processes and the integration of green practices further enhance the feasibility and appeal of digital transformation initiatives, contributing to a more sustainable and efficient logistics chain.

4. Market and Stakeholder Impact : The adoption and implementation of eFTI and e-CMR systems are heavily influenced by market dynamics and stakeholder interactions. Company size plays a crucial role, with SMEs facing greater challenges in digital transformation due to resource limitations. Public Administration policies that provide financial incentives, support workforce development, and facilitate stakeholder coordination are essential in addressing these challenges. Effective coordination among stakeholders, including international consortia and inter-ministerial collaboration, fosters a collaborative environment that supports innovation and smooth implementation. Investment in training programs equips the workforce with necessary digital skills, ensuring a capable and adaptable labor force.

5. Enablers: Several key enablers are critical to the successful implementation of eFTI and e-CMR systems. Support from the European Commission and member state obligations provide a robust framework for compliance and progress. Simplification and speed of action, along with green practices, enhance the attractiveness and feasibility of digital transformation efforts. Clear regulatory frameworks and effective stakeholder coordination ensure consistency and collaboration among various entities. Investment in technological infrastructure and training programs addresses the skills gap and provides the necessary tools for implementation. Coordination among ministries and policies focusing on cost

reduction further enhance the effectiveness of these initiatives, ensuring a smooth and successful transition to digital systems. Public-private sector collaboration is a pivotal enabler, driving innovation and sharing resources and expertise to overcome challenges.

Calculation of the Percentage Agreementand Cohen's Kappa (available in Appendix B: Agreement Level Calculations) for the thematic axes of the responses from the interviews for the typical qualitative analysis method has been performed over the tool GhatGPT version 4.0 and delivered perfect agreement 100% and K =1. The percentage agreement indicates a perfect consensus among the interviewees on the identified themes. Cohen's Kappa value of 1 suggests a perfect agreement, meaning the agreement is not due to chance but genuine consensus among the respondents.

### 3.3.2 Deriving Theories from the Specific Analysis

A. Interoperability : The successful implementation of eFTI and e-CMR systems in the road freight transport sector hinges on achieving seamless interoperability among different systems, organizations, and countries. Addressing the challenges of lack of standardization, integration difficulties, and data security concerns requires strategic enablers such as clear regulatory frameworks, technological investments, public-private partnerships, and effective stakeholder coordination. Developing standardized protocols through clear regulatory mandates ensures consistent data exchange practices. Significant investments in advanced technological infrastructure and robust Cybersecurity measures facilitate the integration of new systems with existing ones, ensuring secure and efficient data exchange. Public-private partnerships leverage combined expertise to address data security concerns and foster innovation in developing interoperable solutions. Effective coordination among multiple entities ensures that all stakeholders are aligned and working towards a common goal. By leveraging these enablers, stakeholders can overcome interoperability challenges, creating a cohesive and efficient digital infrastructure that enhances the overall effectiveness of eFTI and e-CMR systems.

B. Cybersecurity : The implementation of eFTI and e-CMR systems in the road freight transport sector hinges on establishing a robust Cybersecurity framework that addresses key challenges such as data security concerns, integration difficulties, and financial constraints. Clear regulatory frameworks that mandate stringent data security standards provide a

structured approach to protecting sensitive information and ensuring secure data exchange. Significant investments in advanced technological infrastructure, particularly in Cybersecurity, are essential for maintaining consistent and robust security measures across integrated systems. Public-private partnerships are critical for developing scalable and affordable Cybersecurity solutions, leveraging pooled resources and expertise to overcome financial constraints. Strong legal enforcement mechanisms that ensure compliance with security protocols and transparent reporting are vital for maintaining public trust. By leveraging these enablers, stakeholders can create a secure and trustworthy digital environment that supports the efficient and effective implementation of eFTI and e-CMR systems, enhancing overall data security and operational efficiency.

C. Enablers mitigating challenges : The successful implementation of eFTI and e-CMR systems is contingent upon effectively addressing the significant challenges through strategic enablers. These challenges include schedule delays, high costs, data security concerns, integration issues, and a lack of skilled personnel. The interaction between these challenges and their corresponding enablers—such as clear regulatory frameworks, stakeholder coordination, technological investments, and public-private partnerships—creates a pathway for overcoming barriers and facilitating digital transformation.

D. Public Policy : The implementation of eFTI and e-CMR systems in the road freight transport sector is profoundly influenced by public policy. Clear regulatory frameworks and strong legal enforcement are critical for reducing ambiguity and ensuring compliance among stakeholders. Financial incentives and cost reduction policies are essential for making digital transformation accessible, particularly for SMEs facing significant financial barriers. Investment in workforce development and training programs addresses the skills gap, ensuring a capable and adaptable labor force to support digital initiatives. Public-private partnerships and effective stakeholder coordination drive innovation and resource utilization, developing interoperable solutions and aligning efforts towards common goals. Incorporating environmental and sustainability considerations into public policies ensures that digital transformation supports broader environmental objectives. By leveraging these policy enablers, stakeholders can overcome implementation challenges and achieve a successful digital transformation in the freight transport sector, leading to enhanced efficiency, security, and sustainability.

E. Citizens : The implementation of eFTI and e-CMR systems in the road freight transport sector significantly impacts citizens, necessitating public policies and strategies that prioritize citizen needs and concerns. Addressing financial impacts through policies that incentivize cost reductions and provide financial support ensures that the benefits of digital transformation are passed on to consumers, preventing increased financial burdens. Ensuring strong data privacy and security through clear regulatory frameworks and robust Cybersecurity practices maintains citizen trust in digital systems. Bridging the digital divide through inclusive digital infrastructure development and digital literacy programs promotes equitable access to digital services, supporting societal inclusion and economic development. Implementing service quality standards and incorporating citizen feedback mechanisms ensure that digital transformation leads to tangible improvements in service delivery. Promoting sustainable practices and green logistics through public policies aligns digital transformation with environmental objectives, enhancing public health outcomes and supporting long-term sustainability. By leveraging these enablers, stakeholders can maximize the societal benefits of eFTI and e-CMR systems, ensuring a successful and inclusive digital transformation that enhances the quality of life for citizens.

Calculation of the Percentage Agreement and Cohen's Kappa for the specific analyses (available in Appendix B: Agreement Level Calculations) of the responses from the interviews for the typical qualitative analysis method has been performed over the tool GhatGPT version 4.0 and delivered perfect agreement 100% and K =1. The percentage agreement indicates a perfect consensus among the interviewees on the identified themes. Cohen's Kappa value of 1 suggests a perfect agreement, meaning the agreement is not due to chance but genuine consensus among the respondents.

## 3.4 Theoretical Narrative

Factors Influencing the Implementation of eFTI and e-CMR

The implementation of the eFTI and e-CMR systems in the road freight transport sector faces several significant challenges and enablers from the perspective of Public Administration.

Implementation Challenges primarily revolve around delays in the schedule, exacerbated by external factors such as the coronavirus pandemic and geopolitical issues, leading to the European Commission's lack of readiness. Data security remains a pressing concern, requiring substantial investments. SMEs, particularly in Greece, face high costs associated with digital transformation, viewing it as a financial burden rather than an opportunity. The complexity of integrating international and European initiatives further complicates the process, and coordination issues within national administrations, such as Greece's dispersed laws, hinder efficient implementation.

Conversely, several Regulatory and Organizational Enablers have the potential to facilitate this implementation. The support from the European Commission and the obligations imposed on member states form the backbone of this regulatory push. Unified compliance with European regulations ensures standardization and legal enforcement serves as a strong motivator for adherence. Simplification, speed of action, and green practices align with broader European goals, enhancing the appeal and feasibility of these digital initiatives. Clear regulatory frameworks are critical, providing robust guidelines that simplify the complex landscape.

From the Experiences and Perspectives of stakeholders, the involvement of Greece in a consortium with other countries under Sweden's leadership exemplifies collaborative efforts to tackle these challenges. The ongoing wait for the European Commission's approval of proposals highlights the bureaucratic hurdles and the importance of timely decision-making. The potential positive impact of EU-led organization depends on its inclusivity and decisiveness, offering a double-edged sword that could either streamline or stall progress. National administrative issues, such as those faced by Greece, underscore the need for internal reforms to complement these European initiatives.

In conclusion, the successful implementation of eFTI and e-CMR systems hinges on addressing the outlined challenges through strategic enablers, leveraging support from European bodies, and fostering collaboration across national and international stakeholders. The dynamic interplay between regulatory mandates and organizational readiness will ultimately determine the efficacy and sustainability of these digital transformations in the road freight transport sector.

# 4. Conclusions

In 2022, total EU road freight transport accounted for more than 13.6 billion tonnes and 1 920 billion tonne-kilometres according to Eurostat. According to quarterly data of 2023, Greece fluctuates between 15-18$^{th}$ position in 32 countries with more than 550 millon vehicle kilometres per quarter for transportation of 60 -72 million tones of products in the same period, holding the 12$^{th}$ position in 32 countries[2] .

The large amount of products transported in a globalized and growing economy, as well as the significant environmental footprint combined with the onslaught of digital technology, entail the emerging need of robust and online information flows to enable efficiency and controls. The respective Freight Transport Information has been captured by the European Commission as the e-FTI regulation, for member states to be compliant, while a crossing information flow deriving from the traditional consignment note, has been captured as the e-CMR protocol by the United Nations Economic and Social Council, for states in the globe to ratify and apply. The respective frameworks include details on cargo, transport instructions, and various documents to be exchanged, with the aim to improve efficiency, transparency and reduce errors, while enhancing security and green practices.

Having mapped the Greek Public Administration ecosystem for the supply chain and freight transport and further investigated the roles and responsibilities for the implementation of eFTI and e-CMR, a number of interrelations and potential overlaps may occur, while further organizational and regulatory activity relys on the progress of the european works. Identification of the key projects and national actions supporting the initiative, indicates that there is a promising evident engagement by the Public Administration and controlling competent authorities.

To further understand the status as well the factors that will positively impact the adoption of regulations and systems by the Public Administration in Greece going forward, to the

[2] Statistics | Eurostat (europa.eu)

benefit of all public authorities, businesses and citizens. the conducted research within the captured key insights for the implementation of the eFTI and e-CMR .

The theory constructed by the insigts, suggests that there are several factors influencing the Implementation of eFTI and e-CMR and as a consequence, the implemetntation of respective systems in the road freight transport sector will be confronted with significant challenges and enablers according to the perspective of Public Administration. In this context, it is claimed that delays in implementation occur due to external factors like the coronavirus pandemic and geopolitical issues, significant data security concerns requiring substantial investments are rasied, and digital transformation is viewed as a burden by SMEs due to high costs. Additionally, integrating international and European initiatives is complex, and coordination issues within national administrations, such as Greece's dispersed laws, hinder efficient implementation.

The constructed theory continues with the regulatory and organizational enablers that can facilitate this process, such as support from the European Commission and the mandates imposed on member states which form a regulatory backbone. Unified compliance with European regulations ensures standardization, while legal enforcement and clear regulatory frameworks simplify the complex landscape. Collaborative efforts, such as Greece's involvement in a consortium under Sweden's leadership, highlight the importance of collective action. The potential positive impact of EU-led organization depends on its inclusivity and decisiveness, with national administrative issues underscoring the need for internal reforms to complement European initiatives.

The comparison of the interviews to existing literature indicates that there is agreement on the challenges and enablers in the areas of legal and regulatory frameworks, technical infrastructure, organizational coordination, cost and resource management, and user adoption. The primary differences lie in the emphasis on certain aspects, such as the focus on skilled personnel and financial constraints in the interviews, compared to the broader strategic frameworks and support measures discussed in the white paper. This comparison underscores the multifaceted nature of implementing eFTI and e-CMR systems, requiring coordinated efforts across various domains.

The additional analysis on specific themes indicates that, in order to achieve seamless interoperability, clear regulatory frameworks, technological investments, public-private

partnerships, and effective stakeholder coordination will be required. Moreover, ensuring robust Cybersecurity practices through regulatory mandates, technological infrastructure investments, public-private collaborations, and legal enforcement is fundamental to build trust and protect data. Public policies that provide financial incentives, support workforce development, and promote public-private partnerships are crucial for overcoming financial and regulatory barriers, fostering innovation, and ensuring equitable access. Addressing the needs and concerns of citizens through targeted policies that prevent financial burdens, protect data privacy, bridge the digital divide, enhance service quality, and promote sustainability maximizes societal benefits and supports inclusive digital transformation. By leveraging these enablers, stakeholders can create a secure, efficient, and sustainable digital infrastructure that enhances the overall effectiveness of eFTI and e-CMR systems, benefiting businesses, governments and citizens alike.

In conclusion, there are already Pablic Administration actions in progress, though the successful implementation of eFTI and e-CMR systems hinges on addressing the outlined challenges through strategic enablers, leveraging support from European bodies, and fostering collaboration across national and international stakeholders. The dynamic interplay between regulatory mandates and organizational readiness will ultimately determine the efficacy and sustainability of the digital transformations in the road freight transport sector.

The generated comprehensive theory provides a holistic understanding of the factors influencing the implementation of eFTI and e-CMR systems and can guide policymakers, organizations, and stakeholders in their efforts to achieve successful digital transformation in the sector. Additional research and studies in either broader perspective from extended ecosystem actors or in focused authorities areas may deliver additional valuable insights, while research in the technical implementation of the architecture of the systems will be of a valuable contribution and well aligned to the current research of the respective forums.

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# Appendix A: Organisation of open codes

**Table 6 : Structures interviews GT Open Codes (Author, 2024)**

| Q | I | Open Code | Q | I | Open Code |
|---|---|---|---|---|---|
| 1 | 1 | Schedule challenges | 2 | 1 | Involvement of multiple entities |
| 1 | 1 | Lack of readiness from the European Commission | 2 | 1 | Role of Hellenic Revenue Authority |
| 1 | 1 | Perceived cost of digital transformation | 2 | 2 | Dispersed laws and provisions |
| 1 | 1 | External factors affecting implementation schedule | 2 | 2 | Dispersed laws and provisions |
| 1 | 1 | Difficulty in digital transformation for SMEs | 2 | 2 | Legal enforcement |
| 1 | 2 | Public-private sector linkage | 2 | 3 | Need for clear regulations |
| 1 | 2 | International vs. European initiatives | 2 | 3 | Adaptation of regulatory framework |
| 1 | 2 | Legal adherence | 2 | 3 | Importance of legal enforcement |
| 1 | 2 | External factors affecting implementation schedule | 2 | 4 | Need for clear regulatory frameworks |
| 1 | 3 | Environmental approach | 2 | 4 | Supportive organizational framework |
| 1 | 3 | Lack of organizational framework | 3 | 1 | Perceived cost of digital transformation |
| 1 | 3 | Need for stakeholder coordination | 3 | 1 | Investment in digital transformation |
| 1 | 3 | Budget constraints | 3 | 1 | Digitization to reduce costs |
| 1 | 4 | Schedule challenges | 3 | 1 | Data security investments |
| 1 | 4 | High implementation cost | 3 | 1 | Application of EFTI through customs |
| 1 | 4 | Need for skilled personnel | 3 | 1 | Digitization by large companies |
| 1 | 4 | Implementation of electronic systems | 3 | 2 | Public-private partnerships |
| 1 | 4 | Need for technological infrastructure | 3 | 2 | Simplification and speed of action |
| 1 | 1 | Need for implementation measures | 3 | 2 | Lack of standardization |
| 1 | 1 | Involvement of multiple entities | 3 | 4 | Efficiency and transparency |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 1 | Role of Hellenic Revenue Authority | 4 | 1 | Impact of company size |
| 1 | 1 | Customization of information systems | 4 | 3 | Incentives for SMEs |
| 1 | 1 | Support from European Commission | 4 | 1 | Impact of company size |
| 1 | 2 | Importance of organizational support | 4 | 1 | Difficulty in digital transformation for SMEs |
| 1 | 2 | Public-private sector linkage | 4 | 1 | Role of Public Administration policies |
| 1 | 1 | Support from European Commission | 4 | 1 | International consortium participation |
| 1 | 1 | Member state obligations | 4 | 2 | Incentives for SMEs |
| 1 | 1 | Unified compliance with European regulations | 4 | 2 | Support for workforce development |
| 1 | 2 | Simplification and speed of action | 4 | 3 | Need for stakeholder coordination |
| 1 | 2 | Green practices | 4 | 3 | Workforce training |
| 1 | 2 | Clear regulatory frameworks | 4 | 3 | Public-private partnerships |
| 1 | 3 | Stakeholder coordination | 4 | 4 | Inter-ministerial coordination |
| 1 | 3 | Training programs for the workforce | 4 | 4 | Cost reduction policies |
| 1 | 4 | Technological infrastructure | 4 | 4 | Public-private sector collaboration |
| 1 | 4 | Coordination among ministries | 4 | 4 | Public-private sector collaboration |
| 1 | 4 | Cost reduction policies | | | |

**Table 7 : Thematic Axis 1 Open Codes (Author, 2024)**

**Thematic Axis: Challenges**

| I | Q | Open Code |
|---|---|---|
| 1 | 1 | Schedule challenges |
| 1 | 1 | Lack of readiness from the European Commission |
| 1 | 1 | Perceived cost of digital transformation |
| 1 | 1 | External factors affecting implementation schedule |
| 1 | 1 | Difficulty in digital transformation for SMEs |
| 1 | 2 | Involvement of multiple entities |
| 1 | 2 | Role of Hellenic Revenue Authority |
| 1 | 3 | Perceived cost of digital transformation |
| 1 | 3 | Investment in digital transformation |
| 1 | 4 | Impact of company size |
| 2 | 1 | Public-private sector linkage |
| 2 | 1 | International vs. European initiatives |
| 2 | 1 | Legal adherence |
| 2 | 1 | External factors affecting implementation schedule |
| 2 | 2 | Dispersed laws and provisions |
| 3 | 1 | Environmental approach |
| 3 | 1 | Lack of organizational framework |
| 3 | 1 | Need for stakeholder coordination |
| 3 | 1 | Budget constraints |
| 3 | 4 | Incentives for SMEs |
| 4 | 1 | Schedule challenges |
| 4 | 1 | High implementation cost |
| 4 | 1 | Need for skilled personnel |
| 4 | 1 | Implementation of electronic systems |
| 4 | 1 | Need for technological infrastructure |

**Table 8 : Thematic Axis 2 Open Codes (Author, 2024)**

| **Thematic Axis: Regulatory and Organizational Support** | | |
|---|---|---|
| **I** | **Q** | **Open Code** |
| 1 | 1 | Need for implementation measures |
| 1 | 1 | Involvement of multiple entities |
| 1 | 1 | Role of Hellenic Revenue Authority |
| 1 | 1 | Customization of information systems |
| 1 | 1 | Support from European Commission |
| 2 | 1 | Importance of organizational support |
| 2 | 2 | Dispersed laws and provisions |
| 2 | 2 | Legal enforcement |
| 3 | 2 | Need for clear regulations |
| 3 | 2 | Adaptation of regulatory framework |
| 3 | 2 | Importance of legal enforcement |
| 4 | 2 | Need for clear regulatory frameworks |
| 4 | 2 | Supportive organizational framework |

**Table 9: Thematic Axis 3 Open Codes (Author, 2024)**

| **Thematic Axis: Digital Transformation and Technology** | | |
|---|---|---|
| **I** | **Q** | **Open Code** |
| 1 | 3 | Digitization to reduce costs |
| 1 | 3 | Data security investments |
| 1 | 3 | Application of EFTI through customs |
| 1 | 3 | Digitization by large companies |
| 2 | 1 | Public-private sector linkage |
| 2 | 3 | Public-private partnerships |
| 2 | 3 | Simplification and speed of action |
| 2 | 3 | Lack of standardization |
| 3 | 1 | Environmental approach |
| 3 | 3 | Investment in digital transformation |
| 3 | 3 | Integration challenges |
| 4 | 3 | Efficiency and transparency |
| 4 | 1 | Implementation of electronic systems |
| 4 | 1 | Need for technological infrastructure |

**Table 10: Thematic Axis 4 Open Codes (Author, 2024)**

**Thematic Axis: Market and Stakeholder Impact**

| I | Q | Open Code |
|---|---|---|
| 1 | 4 | Impact of company size |
| 1 | 4 | Difficulty in digital transformation for SMEs |
| 1 | 4 | Role of Public Administration policies |
| 1 | 4 | International consortium participation |
| 2 | 4 | Incentives for SMEs |
| 2 | 4 | Support for workforce development |
| 3 | 4 | Need for stakeholder coordination |
| 3 | 4 | Workforce training |
| 3 | 4 | Public-private partnerships |
| 4 | 4 | Inter-ministerial coordination |
| 4 | 4 | Cost reduction policies |
| 4 | 4 | Public-private sector collaboration |

**Table 11 : Thematic Axis 5 Open Codes (Author, 2024)**

**Thematic Axis: Enablers**

| I | Q | Open Code |
|---|---|---|
| 1 | 1 | Support from European Commission |
| 1 | 1 | Member state obligations |
| 1 | 1 | Unified compliance with European regulations |
| 2 | 1 | Simplification and speed of action |
| 2 | 1 | Green practices |
| 2 | 1 | Clear regulatory frameworks |
| 3 | 1 | Stakeholder coordination |
| 3 | 1 | Training programs for the workforce |
| 4 | 1 | Technological infrastructure |
| 4 | 1 | Coordination among ministries |
| 4 | 1 | Cost reduction policies |
| 4 | 4 | Public-private sector collaboration |

# Appendix B: Agreement Level Calculations

## 1. Calculation of Agreement Level and Cohen's Kappa for the interviews based on Thematic Axes.

Thematic Axes

1. Challenges in Implementation
2. Regulatory and Organizational Support
3. Digital Transformation and Technology
4. Market and Stakeholder Impact
5. Enablers

Step-by-Step Calculation

1. Identify and Categorize Responses

categorization of interview responses:

Challenges in Implementation:

Interview 1: Discussed delays, complexity in regulations, and schedule challenges.

Interview 2: Mentioned complexity and potential delays due to "permacrisis."

Interview 3: Emphasized the need for simplification of processes and environmental considerations.

Interview 4: Highlighted the lack of organizational framework and understanding.

2. Regulatory and Organizational Support:

Interview 1: Mentioned the role of ministries and the need for a national system.

Interview 2: Highlighted the need for clear roles and efficient organization.

Interview 3: Stressed the importance of an adaptive regulatory framework.

Interview 4: Discussed the role of multiple ministries and the need for capacity building.

3. Digital Transformation and Technology:

Interview 1: Discussed the need for IT infrastructure and digital readiness.

Interview 2: Emphasized digital transformation as an accelerator.

Interview 3: Highlighted digitalization's role in reducing administrative processes.

Interview 4: Mentioned the current state of digitalization and the need for advancement.

4. Market and Stakeholder Impact:

Interview 1: Focused on stakeholder roles, including individuals and states.

Interview 2: Discussed the impact on market operations and public benefits.

Interview 3: Emphasized the need for investment and incentives for smaller companies.

Interview 4: Highlighted the need for a master plan and data observatory for logistics.

5. Enablers:

Interview 1: Mentioned the role of the European Commission and member states.

Interview 2: Highlighted legal enforcement and digitalization momentum.

Interview 3: Discussed trust in digital processes and environmental benefits.

Interview 4: Stressed the importance of coordinated intervention and specifications.

2. Calculation Percentage Agreement

number of interviews that addressed the theme.

- Challenges in Implementation: 4/4
- Regulatory and Organizational Support: 4/4
- Digital Transformation and Technology: 4/4
- Market and Stakeholder Impact: 4/4
- Enablers: 4/4

Percentage Agreement=Total Possible Agreements/Number of Agreements×100=20/20×100=100%

3. Calculation Cohen's Kappa

Using the formula for Cohen's Kappa, where Po is the observed agreement and Pe is the expected agreement by chance:

Observed Agreement (Po):

Po=Total items/Number of agreements=20/20=1

Expected Agreement (Pe):

To calculate Pe , we assume each theme has an equal probability of being addressed (0.2, since there are 5 themes).

Pe=∑(Ptheme×Ptheme)=5×(0.2×0.2)=0.2

Cohen's Kappa:

κ=[1−Pe ]/[ Po−Pe]=[1−0.2]/[1−0.2]=0.8/0.8=1

- Percentage Agreement : 100%
- Cohen's Kappa : 1 (Perfect Agreement)

## 2. Calculation of Agreement Level and Cohen's Kappa for the interviews based on specific analyses.

Specific Analyses

3. Interoperability
4. Cybersecurity
5. Enablers Mitigating Challenges
6. Public Policy
7. Citizens

Step-by-Step Calculation

1. Responses Categorization

Interoperability:

Interview 1: Discussed interoperability in the context of connecting national and European platforms.

Interview 2: Highlighted the importance of interoperability between different systems and organizations.

Interview 3: Emphasized the challenge of achieving interoperability in logistics and digital platforms.

Interview 4: Mentioned the need for interoperability among ministries and private sectors.

Cybersecurity:

Interview 1: Addressed the importance of data security and privacy.

Interview 2: Discussed challenges in managing access, authentication, and data protection.

Interview 3: Highlighted the need for secure data exchange and protection measures.

Interview 4: Mentioned the role of different ministries in ensuring data security.

Enablers Mitigating Challenges:

Interview 1: Mentioned the role of the European Commission and national authorities.

Interview 2: Highlighted legal enforcement and digitalization as key enablers.

Interview 3: Discussed the trust in digital processes and environmental benefits.

Interview 4: Stressed the importance of coordinated intervention and support.

Public Policy:

Interview 1: Focused on the role of ministries and national law.

Interview 2: Discussed the impact of clear regulatory frameworks.

Interview 3: Highlighted the need for adaptive regulatory frameworks.

Interview 4: Mentioned the role of multiple ministries in shaping policy.

Citizens:

Interview 1: Mentioned the impact on individuals and final recipients.

Interview 2: Discussed benefits for citizens and public revenue.

Interview 3: Emphasized the role of digitalization in improving citizens' lives.

Interview 4: Highlighted the need for capacity building among Public Administration for better citizen services.

2. Calculation Percentage Agreement

number of interviews that addressed the theme

Interoperability: 4/4

Cybersecurity: 4/4

Enablers Mitigating Challenges: 4/4

Public Policy: 4/4

Citizens: 4/4

Percentage Agreement=Number of Agreements /Total Possible Agreements×100=20/ 20×100=100%

3. Cohen's Kappa

Using the formula for Cohen's Kappa, where Po is the observed agreement and Pe is the expected agreement by chance: Observed Agreement (Po): Po=Number of agreements/Total items=20/20=1

Expected Agreement (Pe): assume each theme has an equal probability of being addressed (0.2, since there are 5 themes).

Pe=∑(Ptheme×Ptheme)=5×(0.2×0.2)=0.2

κ=[1−Pe ]/[ Po−Pe]=[1−0.2]/[1−0.2]=0.8/0.8=1

Percentage Agreement: 100%

Cohen's Kappa: 1 (Perfect Agreement)

# Appendix C: Comparison of Interviews Results and eFTI White Paper Results

**Similarities**

Legal and Regulatory Challenges

- Ambiguity in Regulations:
  - Interview Results: Highlighted ambiguity in regulations and dispersed laws as barriers to implementation.
  - White Paper Results: Mentioned delays in European law enforcement and lack of progress in national law.
- Standardization:
  - Interview Results: Lack of standardization in digital processes.
  - White Paper Results: Need for common standards and protocols to ensure seamless integration.

Legal and Regulatory Enablers

- Clear Regulatory Frameworks:
  - Interview Results: Emphasized clear regulatory frameworks and strong legal enforcement.
  - White Paper Results: Highlighted the European Interoperable Framework and regulatory support measures.

Technical Challenges

- Data Security:
  - Interview Results: Concerns over secure data transfer and data security.
  - White Paper Results: Emphasized robust security measures, including access controls and encryption.
- Integration with Existing Systems:
  - Interview Results: Integration difficulties with existing infrastructure.
  - White Paper Results: Complexity in integrating eFTI with diverse systems.

Technical Enablers

- Investment in Technology:
  - Interview Results: Investments in advanced technological infrastructure, including cybersecurity tools.
  - White Paper Results: Common standards and protocols, and support from subject matter experts.
- Public-Private Partnerships:
  - Interview Results: Collaborative efforts in public-private partnerships for scalable solutions.
  - White Paper Results: Encouragement of collaboration and partnership among stakeholders.

Organizational Challenges

- Stakeholder Engagement and Coordination:
  - Interview Results: Lack of clear organizational framework and coordination among entities.
  - White Paper Results: Ensuring participation of all stakeholders and managing various components of the eFTI system.

Organizational Enablers

- Effective Stakeholder Coordination:
  - Interview Results: Effective stakeholder coordination and public-private partnerships.

- White Paper Results: Comprehensive training, awareness of benefits, and effective project management.

Cost and Resource Challenges

- High Implementation Costs:
  - Interview Results: High costs associated with digital transformation impacting SMEs.
  - White Paper Results: Funding and resource challenges, including securing adequate resources.
- Financial Constraints:
  - Interview Results: Financial constraints hindering investment in cybersecurity.
  - White Paper Results: Access to technical skills and proper budget allocation.

Cost and Resource Enablers

- Financial Support:
  - Interview Results: Financial incentives such as grants and subsidies.
  - White Paper Results: Proper budget allocation and collaboration among stakeholders.

User Adoption Challenges

- Service Quality and Digital Divide:
  - Interview Results: Ensuring quality of services and addressing the digital divide.
  - White Paper Results: Providing adequate training and ensuring stakeholder motivation.

User Adoption Enablers

- Training and Ease of Use:
  - Interview Results: Investment in workforce development and infrastructure investments.
  - White Paper Results: Providing incentives and making the system user-friendly.

**Differences**

Legal and Regulatory Challenges

- Interview Results: Focused on ambiguity and dispersed laws.
- White Paper Results: Highlighted European law enforcement delays and varying national regulations.

Technical Challenges

- Interview Results: Emphasized the need for skilled personnel.
- White Paper Results: Focused on the complexity of integrating eFTI with existing systems.

Organizational Challenges

- Interview Results: Mentioned fragmented efforts among stakeholders.
- White Paper Results: Highlighted the importance of defining roles and responsibilities clearly.

Technical Enablers

- Interview Results: Mentioned investments specifically in cybersecurity tools.
- White Paper Results: Highlighted the importance of testing environments (sandbox) for innovative solutions.

Organizational Enablers

- Interview Results: Focused on the involvement of entities like the Hellenic Revenue Authority.
- White Paper Results: Emphasized awareness of benefits to motivate stakeholders.

Cost and Resource Enablers

- Interview Results: Emphasized the financial impact on citizens and public-private partnerships.
- White Paper Results: Highlighted proper budget allocation and collaboration among stakeholders.

User Adoption Challenges

- Interview Results: Addressed the digital divide affecting citizens in less developed regions.
- White Paper Results: Focused on providing training and motivation for stakeholders.

User Adoption Enablers

- Interview Results: Emphasized policies to bridge the digital divide and improve service quality.
- White Paper Results: Focused on providing incentives and making the system easy to use.

Author's Statement:

I hereby expressly declare that, according to the article 8 of Law 1559/1986, this dissertation is solely the product of my personal work, does not infringe any intellectual property, personality and personal data rights of third parties, does not contain works/contributions from third parties for which the permission of the authors/beneficiaries is required, is not the product of partial or total plagiarism, and that the sources used are limited to the literature references alone and meet the rules of scientific citations.