REPUBLIC OF ESTONIA
MINISTRY OF ECONOMIC AFFAIRS
AND COMMUNICATIONS

Nordic Council of Ministers

# Final Report

## eCMR index registry prototype

Development under **DIGINNO-Proto project**

(public procurement no. 218902 “eCMR prototype development and testing”)

Funded by **Nordic Council of Ministers**

Prototype ordered by Estonian Ministry of Economic Affairs and Communications

and developed by FITEK EDI, UAB.

Version 1.03

**September 2020**

Latest version of Final Report and annexes possible download:
https://koodivaramu.eesti.ee/majandus-ja-kommunikatsiooniministeerium/ecmr-prototype-testing/-/tree/master/documents

Source code of eCMR index registry (server) is open for all and
it is licenced under MIT licence.

Download source code and install instructions:
https://koodivaramu.eesti.ee/majandus-ja-kommunikatsiooniministeerium/ecmr-prototype-testing

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# *Executive Summary*

This report summarizes the eCMR prototype development activities carried out between stakeholders of Estonia, Latvia. Lithuania and Poland under the development of the prototype contract (Tender nr 218902) with the wider DIGINNO-Proto project coordinated by the Estonian Ministry of Economic Affairs and Communications.

The main topics covered in the report are the overview of the context of the prototype development - DIGINNO-Proto project scope and details - and the details on the development of eCMR index registry and its testing process, review of testing results and analysis of participants' reviews. As well as selected feedback and initial recommendations for the next steps.

| Prototype development project: | |
|---|---|
| Development tender nr and reference | Tender nr 218902 as of 10 February 2020, deadline 10 March 2020. "eCMR prototype development and testing" https://riigihanked.riik.ee/rhr-web/#/procurement/1642150/general-info |
| Contract period: | 15.04.2020 - 15.09.2020 |
| Contractual developer of the prototype: | Fitek EDI, UAB (Lithuania) www.sis.lt<br>*Rišardas Bedulskis*<br>*(risardas.bedulskis@sis.lt, ph. +37068711072)*<br>*Greta Gelgotaitė*<br>*(greta.gelgotaite@sis.lt, ph. +370 682 55843)* |
| Framework project information: | |
| Project name: | DIGINNO-Proto<br>(prototyping DIGINNO cross-border e-service show-case) |
| Project number: | 18266 |
| Project period: | July 2019 - December 2020 |
| Funded by: | Nordic Council of Ministers |
| Total budget: | EUR 134 000 |
| Lead partner: | Republic of Estonia Ministry of Economic Affairs and Communications (MKM) www.mkm.ee<br>*Inna Nosach*<br>*(inna.nosach@mkm.ee, ph. +372 6256335)* |

| | |
|---|---|
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| Partner countries: | Estonia, Latvia, Lithuania, Poland |
| Project coordinators by country: | • (Latvia) Latvian Information and Communication Technology Association (LIKTA) likta.lv<br>• (Lithuania) Lithuanian Information and Communication Technology Association (INFOBALT) infobalt.lt<br>• (Poland) Polish Chamber of Commerce for Electronics and Telecommunications (KIGEIT) kigeit.org.pl<br>• (Estonia) Digilogistika Keskus www.dlk.ee |
| Project web page: | https://www.diginnobsr.eu/diginno-proto |

# *Abbreviations and Definitions*

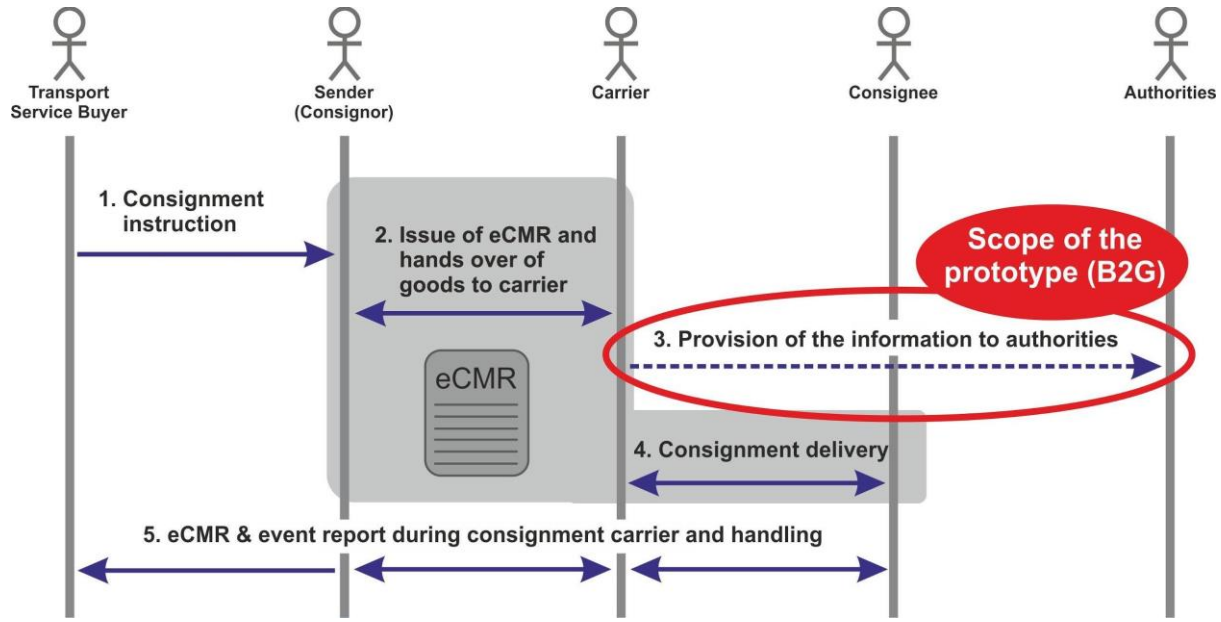
| | |
|---|---|
| **AWB** | An air waybill or air consignment note is a receipt issued by an international airline for goods and an evidence of the contract of carriage, it is a document of title to the goods. |
| **BOL** | A transport document for sea freight. |
| **B2B** | Business to Business. |
| **B2G** | Business to Government. |
| **DLT** | Distributed Ledger Technology. |
| **Distributed ledger technology** | Database that is consensually shared and synchronized across multiple sites, institutions, or geographies, accessible by multiple people. The participant at each node of the network can access the recordings shared across that network and can own an identical copy of it. There is no central administrator. |
| **EBSI** | European Blockchain Services Infrastructure. |
| **eCMR** | An electronic version of the consignment note used under the CMR Convention when transporting goods by road. |
| **eCMR index registry** | Servers exchange eCMR index(es) info on cross border level. |
| **eFTI** | European Union Regulation on Electronic Freight Transport Information. |
| **EDI** | Electronic Data Interchange. |
| **EDI provider** | A service provider who handles electronic (incl eCMR) documents and takes care of digital info and documents exchange between driver and logistics manager. EDI provider also exchanges metadata info with the national eCMR index registry. |
| **GUI** | Graphical user interfaces. |
| **Haulier** | A person or company employed in the transport of goods or materials by road. |

| | |
|---|---|
| **MMT** | Multimodal transport. |
| **Multimodal transport** | Combination of at least two or more different modes of transport (railer, road, sea, air) to move cargo from one location to another, may be within one country or between several countries. |
| **Semi-trailer** | A trailer having wheels at the back but supported at the front by a towing vehicle. |
| **Trailer** | An unpowered vehicle towed by another. |
| **UN/CEFACT** | The United Nations Centre for Trade Facilitation and Electronic Business. |
| **Warehouse** | A location where raw materials or manufactured goods may be stored prior to their distribution for sale or further transportation. |

# 1. Project context

## 1.1. Project focus

The project focused on digitalization of road transport document CMR.




Schema: Life cycle of moving goods (Source: UN/CEFACT)

## 1.2. Review on the current situation

Compared to 2005, the total freight transport activity in the European Union is expected to increase by 40% in 2030 and by little over 80% by 2050.[1] Currently, the movement of goods within the EU is accompanied by the exchange of a large amount of information between the relevant parties both in the public and in private sector. Unfortunately, this information exchanged on paper in almost 99% of the cases that involve cross- border shipments in Europe.[2]

The handling of paper-based documents creates a significant administrative burden on the companies and officials involved with transport documents in the freight transport industry. By making the documents digital it could significantly increase transport efficiency and thus, contribute to the smooth functioning of the European Single Market which seeks to guarantee the

[1] European Commission, Transport 2050: The major challenges, the key measures, 28.03.2011. Retrieved 26.08.2019

[2] European Commission, Proposal for a Regulation of the European Parliament and of the Council on electronic freight transport information, 2018. Retrieved 26.08.2019.

free movement of goods and services within the European Union.[3]

The advantages of using electronic freight documents are many, both for carriers, shippers, especially SMEs and public authorities. It will allow a regional shift from paper to electronic documents – an opportunity for both businesses and authorities to gain efficiency and transparency through digitalization. It will enable businesses to manage their information and supply chain more effectively: optimize the processes, exchange resources, and integrate activities into a single network of information systems. It will also improve the data quality in the freight process, reducing the risk of recurring errors.

At the time of the project, electronic documents are partially accepted by national public authorities and eCMR is by law accepted in several EU member states, but there is no commonly agreed way of transferring electronic transport data across borders. SMEs stick to paper documents and there is a lack of universal, across EU borders, agreed rules and interoperable technical means which SME's could easily use to exchange information electronically.

As to the legislative context for digitalization of CMRs, the reporting of transport data to authorities across Europe is addressed by the work of the European Commission and its expert group Digital Transport and Logistics Forum. During the time of the Diginno Project, the relevant Regulation has first been proposed as a Regulation (in 2018) and at the time of the implementation of the DIGINNO-Proto Project, it has been adopted as a Regulation - to eFTI Regulation 2020/1056(EU) (2020) in the Official Journal of the European Union (*https://eur-lex.europa.eu/eli/reg/2020/1056/oj*).

> *"It's official! The eFTI Regulation has now been published in the EU Official Journal and will start life as a EU law on 20 August 2020 as Regulation (EU) 2020/1056 of the European Parliament and of the Council of 15 July 2020 on electronic freight transport information. When it will start applying as of August 2024, it will provide the framework for safe, secure and fully interoperable exchange of information between business and authorities on the movement of goods in the EU. It will allow the economic operators to record the cargo transport information only once, on an eFTI-certified platform of their choice, and share it electronically with the competent authorities in any EU Member State, and with their business partners, anytime, anywhere."*
>
> *Lia Potec, policy officer of European Commission (LinkedIn, 22.07.2020)*
> *responsible officer for the eFTI Regulation*

[3] European Commission, The European Single Market. Retrieved 26.08.2019.

## *1.3. DIGINNO project*

DIGINNO project (https://www.diginnobsr.eu) helps speed up the Baltic Sea region's transition to a single digital market by covering three common challenges: uptake of information and communication technologies in the business sector, innovation and interoperability of public services, and cooperation and coordination of digital policies on the macro-regional level.

These challenges can be tackled through strengthening the macro-regional knowledge base (e.g information sharing, studies), exchange of experience and mutual learning, designing and piloting transnational digital solutions, conducting policy and regulatory dialog.

The aim DIGINNO Work Package 3 (WP3) was increase the capacity and raise awareness of public institutions, organizations and businesses in developing G2B digital cross-border (CB) services, promote transnational collaboration by building G2B services digitalization network and community, raising knowledge and awareness of success cases, developed show-cases, opportunities and benefits.

The main output for WP3 was 4 show-case models of G2B cross-border e-services (incl. feasibility analyses and proofs of concept). These show-case models are practical tools for G2B services development, helping relevant public institutions to realize the opportunities of digitalization and understand its possible benefits.

DIGINNO project partners have chosen to focus on the following topics to develop further:

- **cross-border eCMR** - Paperless consignment notes in road transport, recognized by responsible institutions and used by businesses
- **cross-border online business registration** with Integrated eIDAS Framework
- **cross-border remote Know-Your-Customer processes** with eIDAS application
- **cross-border eReceipt application**

## *1.4. DIGINNO-Proto and activities timeline*

DIGINNO-Proto project is supporting and continuing the project DIGINNO activities.
The work done in DIGINNO does not cover practical testing of proposed solutions of the 4 cross-border show-cases, which were considered a key element to realize cross-border services.
DIGINNO-Proto project aimed to demonstrate through prototyping one of these showcases what are the real-life shortcomings and necessary changes, to realize the Digital Single Market, where citizens and entrepreneurs can seamlessly move across borders digitally.
The project was guided by a Steering Committee consisting of Lead Partner and representatives of DIGINNO WP3 Lead (INFOBALT) and WP4 Lead (Aalborg University Copenhagen).

DIGINNO-Proto project goal was to develop at least one working prototype of a cross-border e-service based on a showcase developed in the DIGINNO project.

For this purpose, DIGINNO-Proto:

- Conducted a call for proposals and received two applications from e-CMR and KYC.
- By the end of the evaluation process, the e-CMR prototype was selected for development.

Timeline of the DIGINNO-Proto project:

| Date | Activity |
|---|---|
| 01.07.2019 | Project management has started |
| 30.09.2019 | Applications are submitted for evaluation |
| 31.10.2019 | eCMR prototype is chosen for further development |
| 15.01.2020 | Tender drafting with partners |
| 10.02.2020 | International public procurement started |
| 10.03.2020 | Public procurement ended, partner for development is found |
| 15.04.2020 | The contract is signed with FITEK EDI, UAB |

| | |
|---|---|
| 15.09.2020 | The prototype is ready |
| 31.12.2020 | Outcomes are introduced to partners, reporting is done, the project is ended. |

# 2. Tender for Prototype development

Procurement for the eCMR prototype was initiated by Estonian Ministry of Economic Affairs and Communications on 10th of February 2020 and the deadline for submitting the tenders was 10th of March 2020. The public procurement was carried out electronically at www.riigihanked.riik.ee as an international public procurement process.

Three tenders were received: FITEK EDI, UAB (Lithuania), Waybiller OÜ (Estonia) and Catapult Labs OÜ (Estonia). FITEK EDI has received the most points during the evaluation and, as a result, a contract for eCMR prototype development and testing was concluded with the Lithuanian company FITEK EDI who is also known for its e-invoicing solutions.

Tender reference: 218902, "eCMR prototype development and testing"

Tender link: https://riigihanked.riik.ee/rhr-web/#/procurement/1642150/general-info

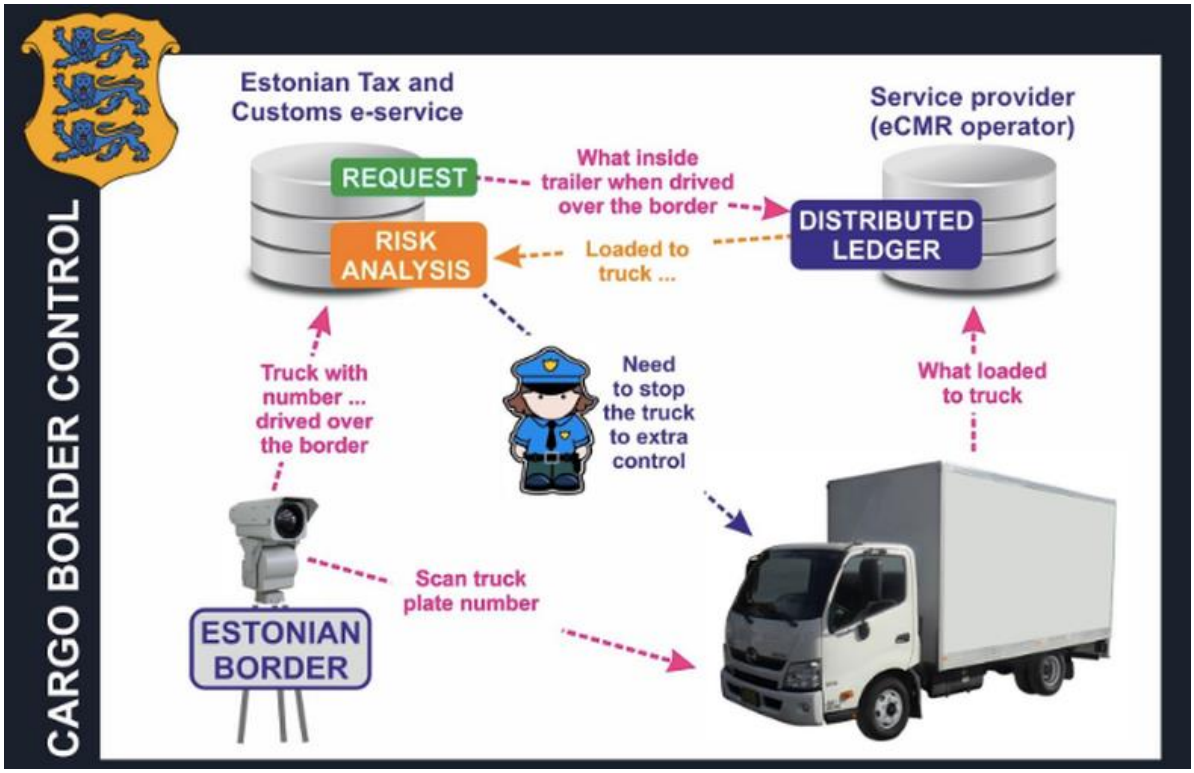
## 2.1. Scope of the proto development project

A common international eCMR indexing scheme was proposed to be developed and prototyped between partner countries: Estonia, Latvia, Lithuania and Poland.

The prototype involved the digital availability of a CMR document (preferred machine-readable) and a mechanism of indexing the availability of such documents across the partner countries via an indexing scheme.

The system is focused on business to government (B2G) information exchange by using indexing service and the indexing number. The appointed government institutions (see attachment no. 6 "Project parties") and controlling institutions of the involved country will be able to see where the eCMR is stored and receive agreed available data (see attachment no. 3 "eCMR business processes and technical decisions" for the semantic and syntax models). The developed system will help to

share and control data in a decentralized infrastructure that ensures high security, data immutability, transaction transparency and no single central point of control. All system development decisions are based on EU standards and UN/CEFACT best practices.




Schema: Estonia example of eCMR index registry working scheme.

E-government compatible distributed approach with application programming interface (API) accesses was deployed, using distributed ledger technology (DLT) approach. Every authorized governmental institution was able to access minimum available indexing information via specialized API and get a link to request original documents relevant data directory from eCMR service from the county of origin. Additionally, out of the scope of the project, GUI (graphical user interface) that has ensured smooth user experience was developed.

**The scope of the project** was to build an **expanded index** and **search system** that would help to navigate and control data in centralized or decentralized networks at the highest security level.

**eCMR documents distributed index** and **search engine** had to be a system where there is **no central server, but at the same time allows sharing necessary data according to various roles and access rights**. Unlike traditional centralized search engines, work such as crawling, data mining, indexing, and query processing is distributed among several peers in a decentralized manner where there is no single point of control.

The solution **needed to support a paperless logistics ecosystem in the best possible way.** The focus was on international road transport, but it could be expanded to the sea, train, plane or multimodal transport in later phases. Also must be possible to organize data exchange for all parties in the process - B2B, G2G, G2B.

Requirements to the development:

1. Connected eCMR index registers on based DLT technology
    a. Connected registers installed to Estonia, Latvia, Lithuania and Poland
2. API defined with a minimum set of data fields to exchange info between EDI provider and eCMR index registry
    a. document the result
3. Possible to make a search by vehicle plate number and by eCMR index ID number
4. Possible to see history:
    a. who created, viewed or updated info in registers connected with every index ID
    b. look what changes have been done during index ID lifecycle
5. Possible to control rights in the system based on user groups
6. Prototype documentation created and examples made on how to exchange information between parties
7. Testing the prototype in a real-life environment

# *3. Project plan and activities*

## 4.1. Start of the prototyping

The signing of the agreement between Republic of Estonia Ministry of Economic Affairs and Communications and Fitek EDI, UAB.

TIME SCHEDULE: 15.04.2020

## 4.2. Evaluation requirement

Gathering the requirements of all parties involved in the project:

1) communication with government institution representatives from Poland, Lithuania, Latvia, Estonia;
2) Creation and alignment of the semantic data model;

3) Alignment of other technical and functional requirements for the index server.

TIME SCHEDULE: 15.04.2020 – 08.05.2020

### 4.3. Building system architecture

1. The cross-border eCMR indexing development scheme plan;
2. Preparation of syntax;
3. Preparation of blockchain (DLT) network architecture.

TIME SCHEDULE: 23.04.2020 – 08.05.2020

### 4.4. Technical decisions alignment

Meetings with the advisory board (to be described in section no. 25 “Advisory Board”).

TIME SCHEDULE: 22.05.2020 – 11.09.2020

### 4.5. Development of core solution

The solution that enables eCMR index exchange between foreign Governmental institutions (Government to Government - G2G) following the national eGovernance and European Interoperability Framework principles was developed in these steps:

1) Preparation of the infrastructure
2) Deployment of indexing servers for initial testing
3) Configuration of indexing servers
4) Development of Smart Contract based on the semantic model

TIME SCHEDULE: 23.04.2020 – 08.05.2020

### 4.6. Development of API to the core solution

Application Programming Interface (API) layer development:

1) Index API development
2) Fabric Rest API development
3) Organization API development

TIME SCHEDULE: 18.05.2020 – 12.06.2020

### 4.7. Aligning the requirements of different parties

During this step of the project an intensive communication with project parties has been carried out:

1) communication with government institution representatives from Poland, Lithuania, Latvia, Estonia;
2) weekly meetings with project coordinators Ministry of Economic Affairs and Communications (Republic of Estonia);
3) communication with business companies (hauliers, EDI providers) that are willing to participate in the testing phase;
4) consulting project parties on the technical preparation for the testing.

TIME SCHEDULE: 15.06.2020 – 10.07.2020

### 4.8. Deployment

Deployment of indexing and query services and APIs:

1) Deployment of production indexing servers
2) Development and configuration of user management solution
3) Deployment of the API layer

TIME SCHEDULE: 13.07.2020 – 31.07.2020

### 4.9. Testing in a real environment (demonstration of the working prototype)

The main output of the eCMR prototype during the testing phase was enabling controlling institutions to check the availability of CMR transport documents of the foreign carriers driving through their territory in a secure and trustable way.

**ESTONIA**

In Estonia was carried out by the governmental institutions: Estonian Tax and Customs Board (EMTA), Estonian Police and Border Guard Board (in cooperation with SMIT) and Estonian Road Administration (MNT). The exchange of information and data between the public and private sectors during testing and the arrangement of roadside test days in Estonia was coordinated by Digilogistika Keskus OÜ - both data merger/gateway as well as Estonian hub for the index. Digilogistika Keskus also arranged a testing welcome page and UI gateway on its website: https://www.logixdigi.eu/proto. Estonian actions were

coordinated in partnership with Single Window Initiative Estonia and Prolog - Estonian Supply Chain Association.

Testing was carried out in cooperation with above mentioned governmental institutions together with private sector eCMR services and EDI providers companies Q-step Logiciel OÜ and Mobicarnet OÜ, interlinked to the indexing service by data service platform LogiXDigi. The key partners in testing from the transport sector were Ospentos International OÜ (EDI provider Q-step Logiciel OÜ) and VIA3L (EDI provider Mobicarnet OÜ) along with its supply chain partners.

Testing of eCMR index registry prototype in Estonia started on 14th August 2020 with virtual testing in Estonia. Live testing took place between 24th of August and 4th of September 2020. On selected sample dates, Tax and Customs Board as well as Police and Border Guard Board participated in both test stopping of the sample trucks and checking of the paper documents as well as comparing the available data online both on spot and from distance in the offices. On 27th of August, the test took place on the transit region of the Baltic trade in Pärnu and Uulu (Pärnumaa border region) and on 2nd of September, the test took place with the Tallinn region offices.

Test with following the vehicle and using the roadside cameras as well as the border camera was tested on the 27th of August. On the 8th of September, a dedicated additional test session took place with the Road Administration.

The testing was accompanied with press releases and covered by both written media (articles published on 28th of August as well as TV show aired on 13th of September).

**LATVIA**

Real environment testing in Latvia was carried out on the 3rd of September, 2020. The truck was loaded in Riga (Latvia) and moved to Vilnius (Lithuania). Roadside checks did not take place in Latvia, but the eCMR documents were checked by Latvia's controlling agencies virtually.

**LITHUANIA**

The second step of the testing was organized in a real environment with the load of the truck in Lithuania. The real test in Lithuania was carried out on the 26th of August 2020. The truck loaded in Vilnius and headed to Riga (Latvia). In Lithuania, the truck's eCMR

documents were submitted by business and checked on the road by tax authority and customs.

**POLAND**

Testing was in Poland on the 7th and 8th of September, 2020. Trucks were loaded in Czechowice-Dziedzice and Bydgoszcz (Poland) and moved to Vilnius (Lithuania) and Riga (Latvia). Trucks´ eCMRs were checked on the road by the Road Transport Inspection of Poland.

Virtual testing of the trucks from Lithuania to Latvia was carried out until the 15th of September. Government institutions, interested in eCMR, were able to check the eCMR documents of real trucks in the index register.

TIME SCHEDULE: 14.08.2020 – 09.09.2020

### 4.10. Preparation of documentation

Preparation of the final report and its procedural and technical annexes (annexes have been preparing for the whole project time).

TIME SCHEDULE: 31.08.2020 – 11.09.2020

### 4.11. End of the Prototyping

Signing the final act of compliance.

TIME SCHEDULE: 14.09.2020 – 15.09.2020

# *4. Testing details*

**Testing arrangement:**

- Each participating country dedicated a Country Project Manager as well as Technical Manager to support the testing.
- Each participating country arranged test rides to be uploaded and indexed for every testing participant.

**Information exchange in testing:**

- The training was done in Estonia, Latvia, Lithuania and Poland for test managers/country coordinators on how to use the created solution (API, administration module).

- Information on virtual and real loads between partners participating in testing shared on Google Sheets (Annex 3. "Testing of eCMR Indexing and Search System", page 4).
- To speed up the exchange of information, information on the movement of goods was also shared by e-mail to project and technical managers in every country.
- Testing was performed behind remotely from offices and as a roadside check.
- Once the testing was done, participants were to complete a questionnaire (online formular).
- Several participants preferred to give their feedback directly to the testing managers at the time of testing.

**Media and press releases:**

- Testing initiation was covered by press releases and attention of media was drawn to the importance of the matter as well as the matter of the cross-border cooperation in this matter.
- In Estonia, the Ministry of Economic Affairs and Communications issued a press release (follow via https://bit.ly/indextesting2020) and collected both coverages in online news portals, a dedicated article in a daily newspaper and a section in a dedicated TV show.

**File types and APIs:**

- During the testing, the partners and EDI providers collected and indexed various types of files - whilst the XML was preferred, also PDF, JPG and Excel were uploaded and indexed. In that case, all Estonian presented test rides were accompanied with machine-readable files compatible for e-governance digital reporting.

# *5. Results of testing*

- All functionality and data exchange worked successfully in national and cross-border level
- Truck companies in cooperation with EDI providers shared two formats of documents through eCMR index registry:
    - Structured CMR document in format XML by UN/CEFACT
    - CMR document in format PDF
- In visual control PDF files are enough, but in the near future control institutions wait for all data inside the CRM document to be machine-readable (this enables the use of modern analytical tools based on risk patterns).

**Generic summary of the testing participants' survey:**

In the online survey, provided for the testing participants after the testing phase, 8 respondents have participated. 5 of the respondents were representing Customs and/or Tax Agency, 2 was representing other Government offices and 1 was representing Police and/or Border Agency. 5 respondents had participated in the testing from offices' (virtually), 3 respondents had participated in the real testing on the road.

Despite the number of respondents being low, the results reflect the fact that data both via the index and behind the provided URL was available (6 out of 8 responses) and only in few cases the data on the indicated truck plate number was not available.

Five respondents have evaluated eCMR data online for maximum points 7/7, 3 respondents have evaluated the importance to have eCMR data online 6/7 points, so this means, that eCMR Index Registry prototype is valuable for controlling institutions and business entities that are connected to logistics' environment activities. Comments, provided by the participants of the survey:

> "*In my opinion, it's a very good solution, as a customs worker I can see what is loaded and consider it in my work decisions."*
>
> *"I have some feedback (it's related only to my UX ideals, but maybe it will be useful): I work "on-road" and I use a relatively low-resolution laptop. On the road, there are two main important aspects: fast information gathering (faster is better) and usability with the ability to make a mistake. In my opinion, it is good to programmatically strip spaces in "Truck Registration Number" at Find Index Search Form. Currently "59 2MSP " is not treated as "592MSP" or "592 MSP".*
>
> *Error messages as the modal window are not good, cause as a user you lose time to close these pop-ups. In my opinion, a better solution is an additional info div on top. For faster input, some things like "Transport Country Code" is set default by user (browser) location - then I do not need to waste time on selecting it. It's good if "Truck Registration Number" is on focus after page loading - then I can start input as fast as form loaded, not need to select it with a touchpad. The main value of this system is the CMR document - therefore I think this (CMR) must be first what you see after the search, but licence plate number must be before it and larger (then I can confirm that I input correctly). Link on the CMR document can be duplicated as a button with the text "View CMR". I understand that documents stored not in this system, but some dynamic viewers are very welcome (here modal window is very ok) - it's a better solution than new window or download (cause it takes time). In conclusion, more important and valuable data must be first, controls elements need to be easily distingable - think about time and minimum movements on touchpad or keyboard." **(Note: this comment is connected with the out-of-scope result - prototype GUI).***

In roadside and office users direct spoken feedback, the respondents and test participants underlined the importance and usefulness of such a solution, the visibility and greeted the opportunity to check the CMR contents without stopping the truck as well as check the documentation from distance or from offices.

Responses of roadside and office testing feedback.

> *"I understand that there is a need for long history reports, but in the history view the system should allow me to quickly distinguish between the actions taken by the CMR provider (upload or change) and the checking views by other testers or users."*
>
> *"I like that I can take the CMR data from my office and calmly check the content as it is convenient for me, while not letting the driver wait. We would also like to check those that need checking"*

A high number of suggestions has been collected in terms of functioning and user interfaces of such solutions in the future. From search tools, visuals to the sequence of the listings or data to be highlighted, the officials and test partners gave input for further development.

For example, a suggestion while the eFTI Regulation implementation guides are not fully agreed is to mark vehicles with special signs and tags.

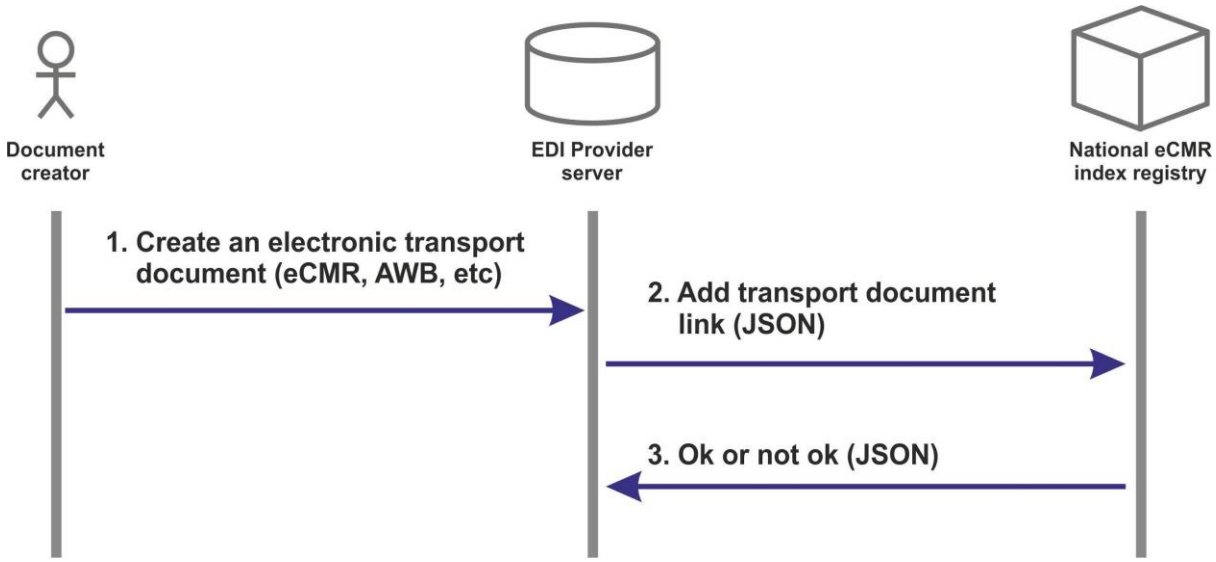

Picture: Possible visual solution on how to mark trucks and trailers on the road equipped with electronic documents in a transitional period.

# 6. Prototype's technical details

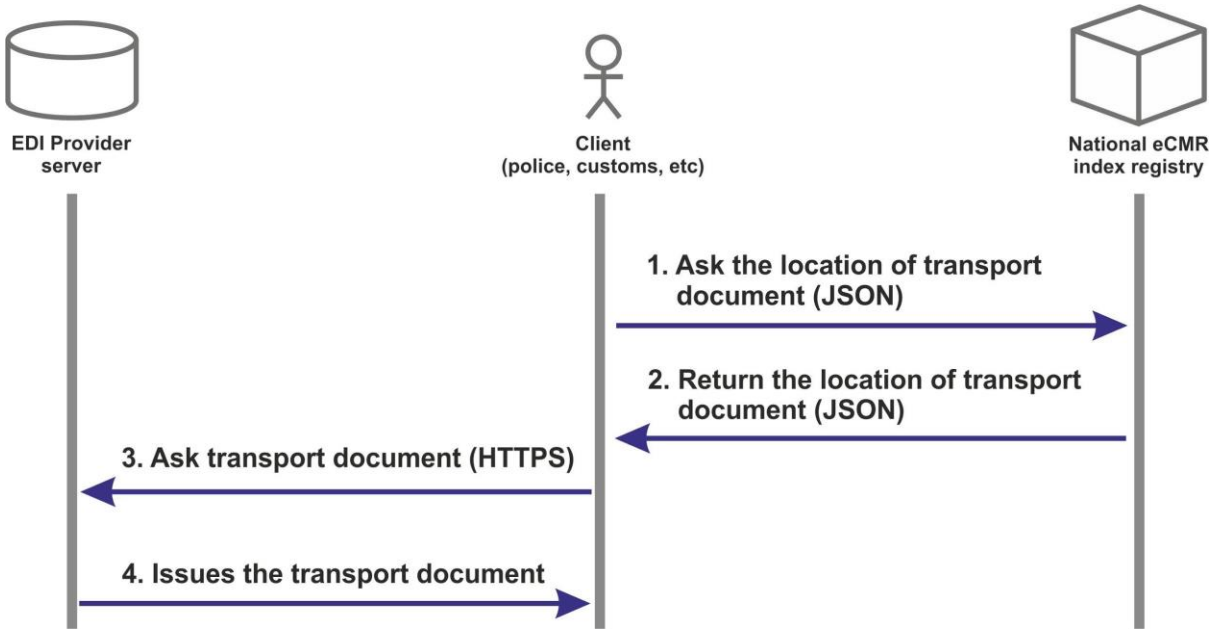
The developed solution supports the following functionality:

- Adding or updating the eCMR index(es)
- Making search by vehicle plate number or by eCMR index ID
- Possibility to see who and when (date/time) added or updated the index
- Possibility to follow who has viewed eCMR index (certificates)
- The system works with both - a single truck with loading place and a truck train
- User rights based on two groups: "government" and "business"
    - The created system allows very easy to add extra groups or remove them from the registry if required
- All functionality and data exchange works at national and cross-border level

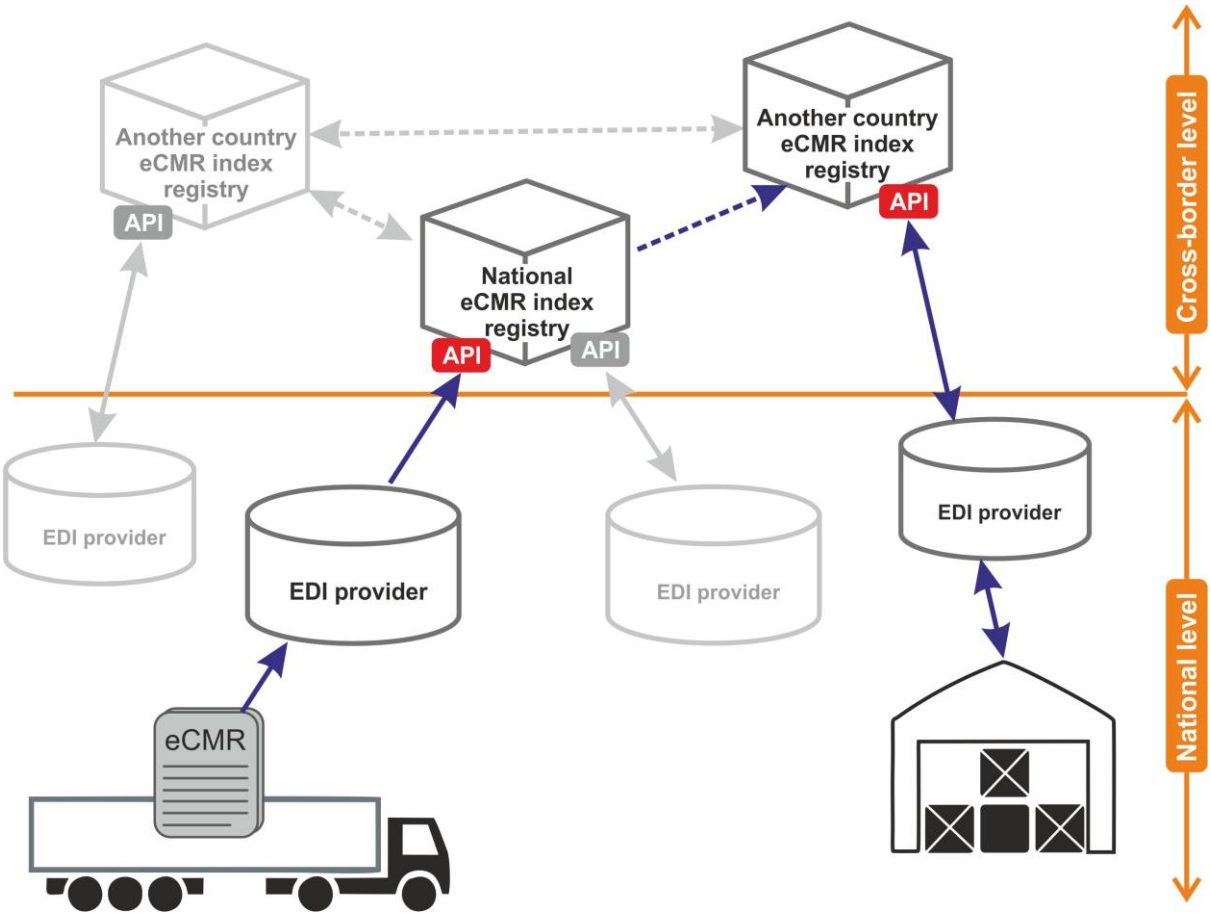
During the project the information exchange between parties has been developed as follows:



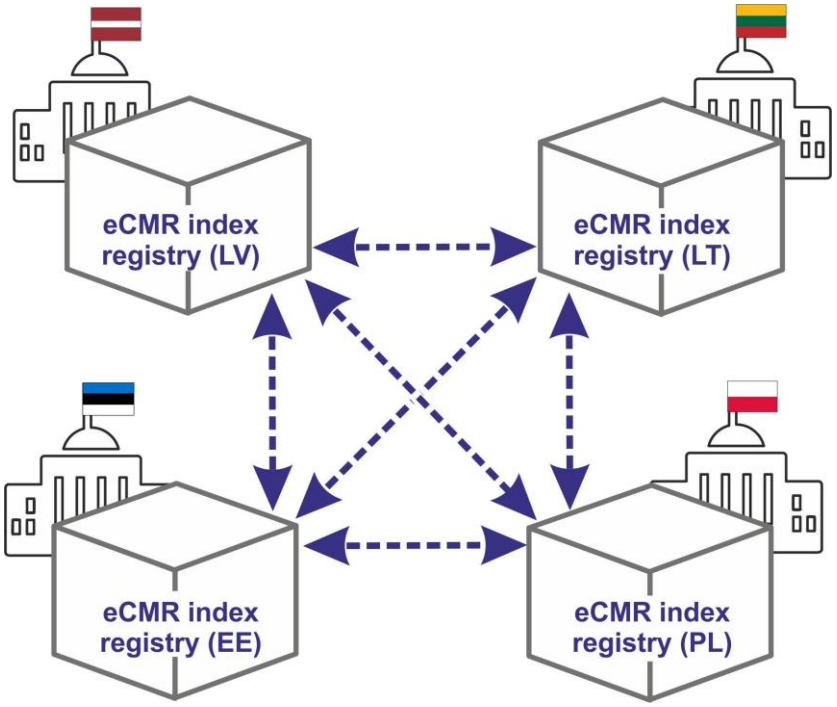

Schema: Adding transport electronic documents to national eCMR index registry.



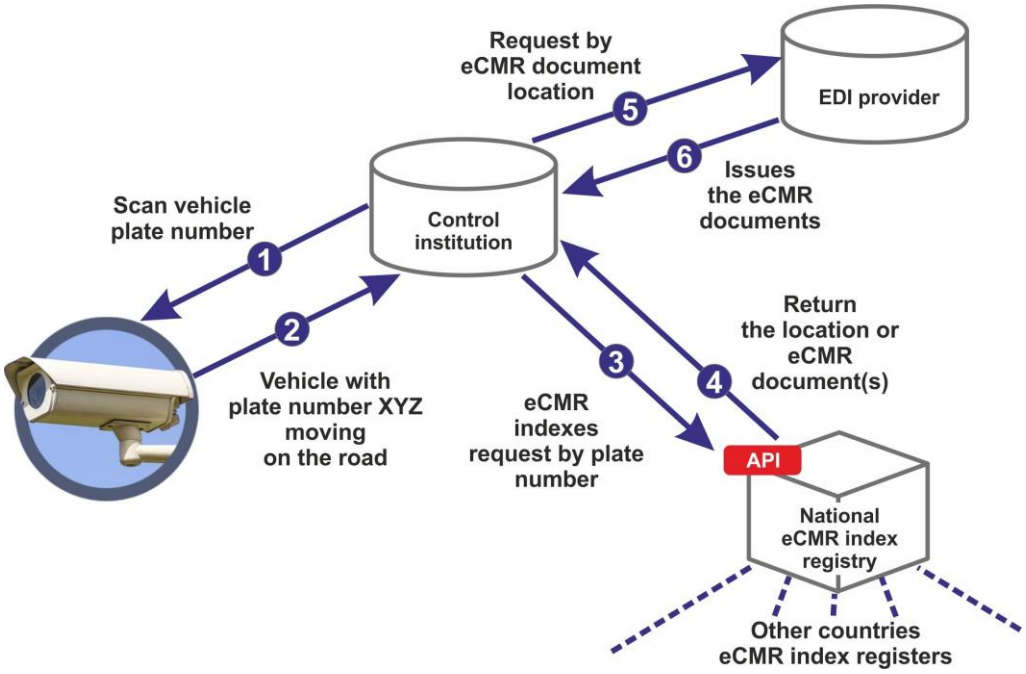

Schema: The process of information exchange between parties.




Schema. Country EDI provider exchanges information with the national eCMR index registry over the API.




Schema. The index registries exchange data with each other using DLT technology.




Schema: Exchange of information then controlling institutions use cameras on the road.

Implementation of this project marks a significant step towards the EU Single Digital Market and gives input for solving the existing problem related to the lack of digitalization within the freight

transport sector. This project will foster the implementation of EU regulation on electronic freight transportation exchange, which implementation is scheduled only for 2024. It is especially relevant during COVID times (since mid-March 2020) when green corridors and quick and safe delivery of goods has become of utmost importance for both employees (i.e. truck drivers) and consumers within the EU.

## *7. Performance of DLT system in eCMR showcase*

Network topology and server power (CPU, memory, disk space) may affect the performance. Transactions per Second (TPS) is a standard performance indicator for this case.

If analyzing requirements to the system, then the number of transactions need to be indicated.

Testing solutions based on the same technology as the eCMR index registry created shows that transactions can run up to 20,000 TPS per server. Still, if it turns out that the server at this point needs more transactions, then additional solutions need to be included (optimizing the information exchange, adding an extra server, cache information).

While developing DLT ecosystems it is important to use standardized APIs (service access, data dictionary, communication protocol, encryption algorithm and system testing). It guarantees that multiple vendors can provide similar services for the customers.

## *8. Advisory Board meetings during the project*

To ensure the quality of the technical decisions the Advisory Board was formed. Members from pilot project partner countries‘ institutions, technical background specialists, business representatives were asked to join the board. During the project implementation phase, **four** Advisory Board meetings have been organized:

**a) Meeting date: 22.05.2020**

Discussed questions:

- Technical decisions document presentation
- Index registry semantic model alignment
- Questions about DLT technology, used for the development of the prototype

**b) Meeting date: 19.06.2020**

Discussed questions:

- Presentation on infrastructure decisions: Google Cloud (Kubernetes)
- User management and DLT certificates (Keycloak)
- Each country's CA (certificates, embedded attributes)
- Testing scale (visual scheme)
- Future perspectives (eFTI)

**c) Meeting date: 30.07.2020**

Discussed questions:

- Discussion on the prepared API documentation: https://koodivaramu.eesti.ee/majandus-ja-kommunikatsiooniministeerium/ecmr-prototype-testing/-/blob/master/index-api/resources/api-docs.pdf
- Discussion on the Alfa testing between Lithuania and Estonia (sharing this testing results and experiences)
- Presentation of the procedure of eCMR index system management in admin level

**d) Meeting date: 11.09.2020**

Topics on the meeting:

- Results of testing
- Final results of the prototyping
    - Feedback to final documentation
- Share eCMR index registry software with source code in Koodivaramu https://koodivaramu.eesti.ee, software under MIT licence
- Next steps when the project is over
    - DIGINNOCUP as a follow-up to DIGINNO-Proto project
    - "Expectations and recommendations for further steps" from final documentation - scope to DIGINNOCUP

# *9. Expectations and recommendations for further steps*

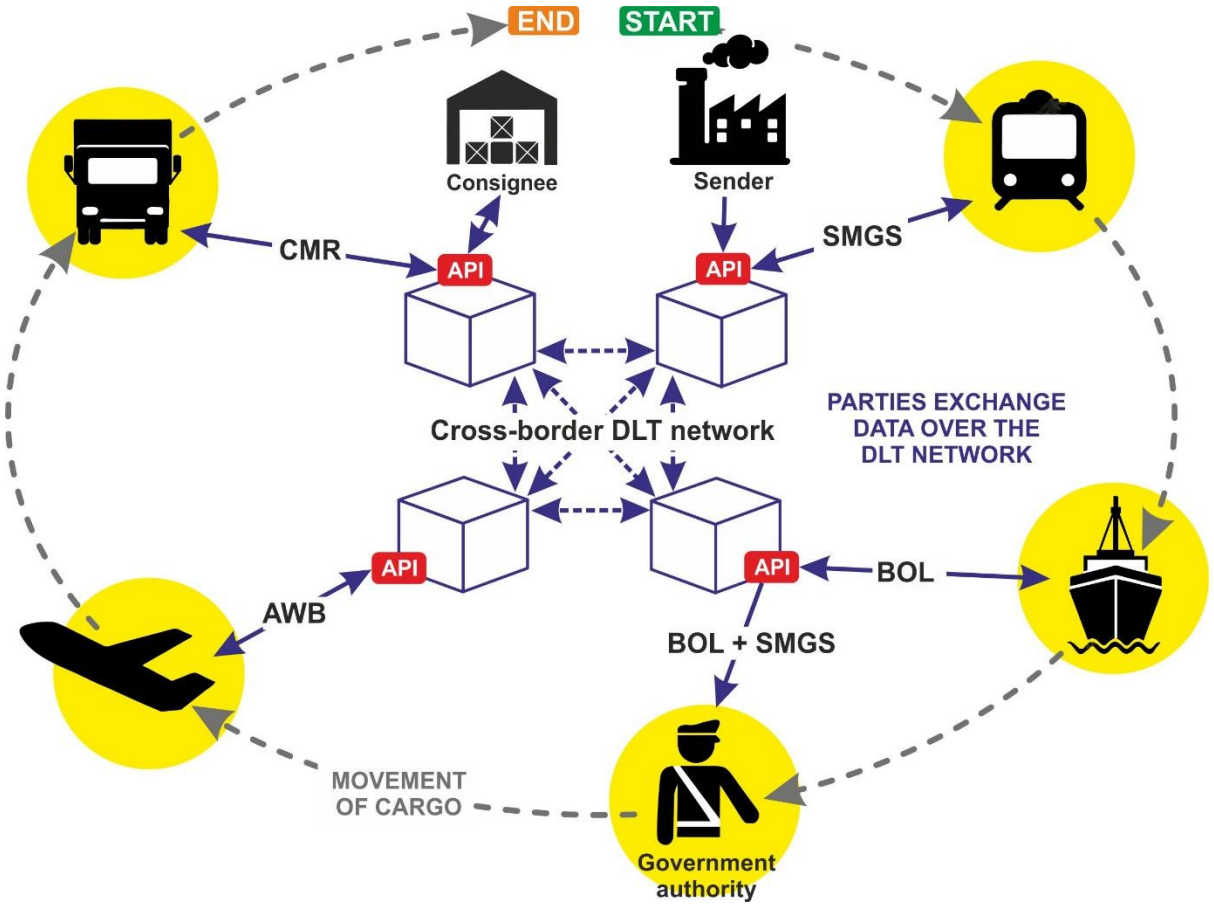
**Expressed expectations** after practical eCMR testing:

- the expectation from the business side is that eCMR would be recognized legally, but would not be mandatory from the government side for business;
- non-logistic companies have expressed interest in the digitalization of other documents connected to the logistic processes' (invoices, certificates of origin, etc.);
- the project has a potential for expansion to non-EU, but Baltic neighborhood countries, in particular, to Ukraine and Belarus as part of the EU digital transport corridors strategy (DTC) and as a part of EU4Digital collaboration.
- Further, the prototype may be a launchpad for implementing eFTI solutions in those countries. Ukraine as an associative partner of the project team (in face of PPL 33-35 Ltd) demonstrates a high degree of readiness and interest in the development of the project.
- Another area of expansion is countries of Benelux, in particular, Luxemburg. High interest in the DIGINNO-Proto project from their side is a good point for starting an interoperability assessment.

**Recommendations:**

- ensure the continuous test of the prototypes for further development (each country could keep the prototype testing teams and infrastructure for smooth transition);
- to legalize the presented prototype logic (not particularly the specific technical solution);
- support establishing the index production infrastructure for all participating member states and countries;
- discuss and align with eFTI and other legislation (national/regional/international);
- extend eCMR indexing initiative and prototype testing to:
    - other Baltic Sea Region countries;
    - EU level;
    - Europe neighborhood countries (e.g. Ukraine, Belarus, etc.).
- add to the index server other digital documents as part of document container:
    - Customs import and export declarations;
    - invoices;
    - veterinary certificates and documents etc.

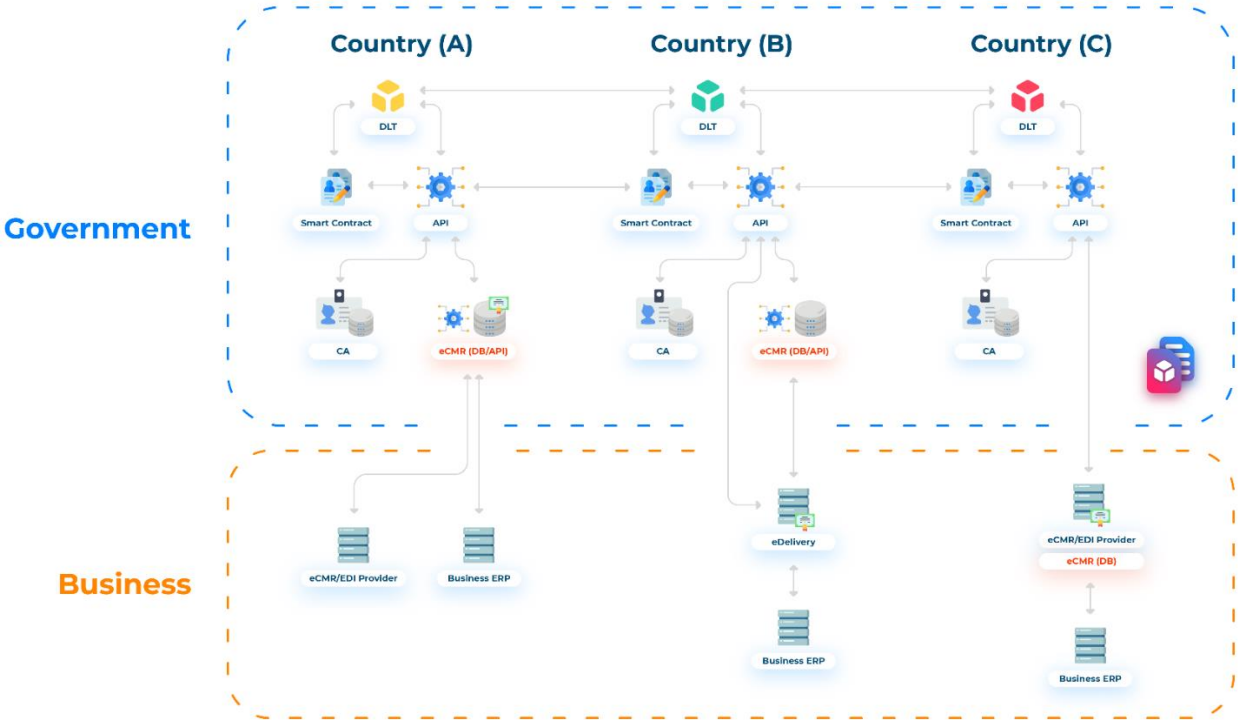
- Scaling up to eFTI datasets
- current eCMR index system scale-up to be compliant with EBSI infrastructure
- Scaling up eCMR testing with another ongoing eCMR digital initiatives in EU (e.g. FEDeRATED project, Benelux eCMR project)




Schema: Parties sharing electronic cargo documents (CMR, AWB, BOL, import and export declarations, etc.) in machine readable format over the DLT network.

- make it useful to multimodal transport modes (train, plane, ferry) by extending the prototype development by following eFTI recommendations;
- Recommendation to use (as the basis for eCMR development as the electronic document) results from UN/CEFACT (see annexe no. 8) and OASIS UBL Waybill 2.1. (https://docs.oasis-open.org/ubl/cs1-UBL-2.1/mod/summary/reports/UBL-Waybill-2.1.html)
- continuous works with DIGINNO WP3 and compatibility with WP4 conclusions

- Increasing the awareness of needs and benefits of using eCMR and other electronics documents in the transport sector. However, there is a considerable difference in the pace of development in different countries.
- In DIGINNO project partners developed a cross-border eCMR architectural solution (picture provided below) and defined conditions needed to its implementation. API part of this architectural solution for eCMR/EDI providers to need to be realized and tested, the middle intermediate (eCMR DB/API) layer should be created.




Schema: Illustration of eCMR index registry architecture. API part for eCMR/EDI providers needs to be created in the next steps of the eCMR development to ensure the security of sharing data.

# *10. Relevant projects/ongoing initiatives*

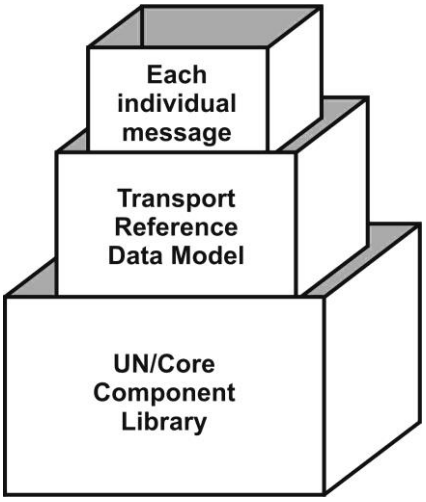
### 13.1. UN/CEFAT eCMR

UN/CEFACT is the United Nations Centre for Trade Facilitation and Electronic Business.

In 2008, an Additional Protocol on eCMR was introduced to support paperless versions of the eCMR Note. Though several pilot tests have been conducted in the subsequent years, there has not been an official standardized message format for the Electronic Consignment Note. In 2017, a United Nations Centre for Trade Facilitation and Electronic Business project developed a business requirements specification, core component eCMR message structure and XML message standard. Now provides a set of documents serving like an international standard in electronic documents exchange.

eCMR project deliverables:

- BusinessRequirementsSpecification(BRS)for Electronic Road Consignment Note (eCMR) based on the high-level MMT BRS
- Subset exchange syntax-neutral message structures for eCMR
- XML schemas of the eCMR messages
- Mapping to the relevant existing UN/EDIFACT UNSM (IFTMIN)




The eCMR is a subset of MMT – multimodal transport model – hierarchical data structure, developed by UN/CEFACT to facilitate transport and trade procedures in the real world.

- The MMT project is creating a limited structured subset of the UN/CCL (Core Components Library)
    - Only 132 ABIEs (Aggregated Business Information Entities) needed for the project scope
- Providing semantic links with EDIFACT implementations

- eCMR project
- Data pipeline structure project for the standardized provision of pre-arrival data to regulatory agencies in line with the EU Cassandra, CORE and SELIS projects

MMT ensures the next goals:

- Providing Exchange Syntax Neutral Reference Data Model for Supporting Domain Data Exchange Interoperability
- Supporting Cross-Border Regulatory Interfaces
- Providing mappings to/from UN/EDIFACT message implementations
- Providing mappings to Related Data Models
- Generating equivalent interoperable XML message schemas

The interoperability is based on semantic due to harmonization of:

- Party and Role Definitions
- Semantic Anchors
- Message Structures
- Contextualized Code Subsets
- Contextualized Business Rules

The fact that eCMR is based on UN/CEFACT MMT provides a strict relationship between transport and sales contracts and also between different modes of transport. That also ensures the possibility to seamlessly expand the eCMR prototype project to a universal transport platform with proved trust, interoperability and multimodality.

### 13.1. Digital Transport and Logistics Forum (DTLF)

The DTLF is a group of experts that brings together stakeholders from different transport and logistics communities, from both the private and the public sector, with a view to building a common vision and road map for digital transport and logistics. The DTLF also contributes to identifying needs for measures at the EU level and supporting their development and implementation where relevant.

https://www.dtlf.eu/

### 13.2. European Blockchain Services Infrastructure (EBSI)

The European Blockchain Services Infrastructure (EBSI) is a joint initiative between the European Commission and the European Blockchain Partnership (EBP) to deliver EU-wide, cross-border public services through the use of blockchain technology. The EBSI will materialise as a network of distributed nodes across Europe – the blockchain infrastructure – leveraging an increasing number of applications focused on specific use cases. EBSI is a CEF Building Block, providing reusable software, specifications, and services to support adoption by public administrations, businesses and citizens.

### 9.3. FEDeRATED project

The FEDeRATED project is an EU Member States driven initiative to contribute to the establishment of a viable federated network of platforms for data sharing in the freight transport and logistics domain at EU level (and beyond). The main objective is to enable a smooth and effective public involvement with logistic chains for the execution of public duties. The FEDeRATED project shall run from 01.01.2019 (“the starting date”) until 29.12.2023 (“the completion date”) and is funded by Connecting Europe Facility (CEF).

The FEDeRATED project is built upon the work and recommendation of the Digital Transport and Logistic Forum (DTLF), and in particular its subgroup 2, to create such viable and valid federative network of platforms as an enabler for Business to Administration (B2A), Administration to Business (A2B), and Business to Business (B2B) data exchange and sharing.

### 9.4. Single Window Initiative Estonia

The Single Window Initiative Estonia is a cluster/network, established in 2017, is working towards Estonian and European digital transport & logistics solutions, digital supply chains and application of Single Window principles. The main aim of the initiative is to promote and encourage the digital shift in transport-related information flow for the benefit of all market participants. For reaching the aim, the initiative works consistently on applied research on the feasibility of such digitalization as well as moderates the exchange of best practices while developing digital solutions and prototypes. The Initiative is represented in the Digital Transport and Logistics Forum

and participates in legislative processes, including the eFTI Regulation and the implementing acts of it.

https://singlewindow.ee/en/

## 11. List of annexes and work documents

During the prototype development, a list of technical and procedural documents was prepared. Documents were shared with pilot project parties: government institutions, business companies, EDI providers, project coordinators. All the annexes connected with this report.

**Annex 1." Description of eCMR Index Registry and Tested Use Case Example by Fitek Team"**

This document provides the most important decisions made during the preparation for the pilot development. It includes a semantic data model of the core elements of an eCMR index, business requirements specification. Also, specifies the processes in a distributed eCMR indexing system and provides the main information on technical solution decisions (e.g. exchanged indexing data structure/format, smart-contract input/output structure, etc.). Also it provides information about the testing scenarios and gives real examples of how the testing looks in the index registry system. Information about used eCMR index registry parameters in this internal test is provided as well. A visual view of the use case process can be found in this document.

**Annex 2. "Instruction on How to Use eCMR Index Registry Administration Console"**

Document dedicated to country administrators who are in charge for users management in eCMR index server in their country. Detailed instruction for the user management system is provided.

**Annex 3. "Testing of eCMR Indexing and Search System"**

Document with the planned timeline, identified testing activities for different parties and the description of the planned testing scenarios. Added the list of the loads used for real environment and virtual eCMR index registry testing.

**Annex 4. "eCMR Index Registry Adding Guide"**

Detailed instruction on how to connect index servers.

**Annex no 5. "eCMR Prototype Project Parties"**

Document dedicated to indicating all parties involved in the project (business, government, etc.) and provide the contact details of representatives from each pilot party.

# *12. Useful links*

1. **UN/CEFACT. Business Requirement Specifications (BRS)**, find in page "e-CMR" (26.08.2020)
https://www.unece.org/cefact/brs/brs_index.html

2. **edi3. Supply Chain Standards and Tools for Web Developers** (27.08.2020)
https://edi3.org/

3. **Keycloak. Open Source Identity and Access Management For Modern Applications and Services** (27.08.2020)
https://www.keycloak.org/

4. **OAuth 2.0** (04.09.2020)
https://oauth.net/2/

5. **World Bank Group. Distributed Ledger Technology (DLT) and Blockchain** (27.08.2020)
https://responsiblefinanceforum.org/wp-content/uploads/2018/04/Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf

6. **European Union. eFTI Regulation**
https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596465759558&uri=CELEX:32020R1056

7. **CEF Digital Connecting Europe. Introducing the European Blockchain Services Infrastructure (EBSI)** (27.08.2020)
https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/EBSI

8. **European Commission. The European Single Market** (27.08.2020)
https://ec.europa.eu/growth/single-market_en

9. **Kristo Vaher. Next Generation Digital Government Architecture** (27.08.2020)
https://docs.google.com/document/d/1UJ-5wi9wavWzA2n4LhsbONJqdxjUSIgMxKJNaZZslas/edit?fbclid=IwAR2rrBNjwHFagHIvi-9Pv6uvKI0IZH_m4IdAfaq7hbjALlIjRH8nEuUVuic