## DATA DIGITISATION IN TRANSPORT PROCESSES

### Marta Waldmann

Lukasiewicz Research Network – Poznan Institute of Technology, Poland E-mail: <u>marta.waldmann@pit.lukasiewicz.gov.pl</u>

## Karolina Kolinska

Poznan School of Logistics, Poland E-mail: <u>karolina.kolinska@wsl.com.pl</u>

> Received: July 19, 2022 Received revised: September 23, 2022 Accepted for publishing: September 26, 2022

### Abstract

The digitalisation of logistics processes is accelerating and technology and innovation are entering every part of the supply chain. The changes brought about by pandemics have accelerated data digitisation processes, also in logistics processes. Despite this, the exchange of information between transport participants still often takes place in a chaotic and inefficient way, using various means: telephones, various communicators, paper documents or e-mail. This organisation of the information flow no longer meets the challenges posed by the market and modern supply chains. In the logistics market, there is a need for electronic data and document exchange, reducing errors and increasing the reliability of exchanged information. It causes, that from the level of state administration, authorities, branch organizations and finally carriers themselves, the need of data digitalization and transfer of transport documents in a standardized digital form comes up. These changes are visible in every branch of transport, both at the level of the road, rail and sea transport, as well as in inland waterway transport. In this article, special attention will be given to the digitalization of data transmitted in the road transport process. An analysis will be made of data digitalization at the level of national and international transport in Poland, where in recent years dynamic changes have taken place to standardize and legalize the circulation of electronic transport documents in road transport. The initiatives supporting the development of digital documents in transport will be analysed, both from the state administration level as well as the solutions created by commercial providers.

Key words: transport, electronic consignment note, e-cmr, documents digitisation

### **1. INTRODUCTION**

The analysis of the impact of digitalization on transport processes raises the issue of initiatives within the Polish market that affect the digitization of transport documents. Given the interpenetration of the transport area from the countries of the European Union, and the mutual impact that changes and innovations in the countries of the Union have on each other, the study also outlines an overview of implementation activities in countries neighbouring Poland, implementing or assuming concepts corresponding to the Paperless initiative. The focus was then on technical implementation with the participation of Polish administrative bodies, organizations, and companies offering commercial solutions in line with the assumption of digitization of documents linked to the realization of logistics processes (Wahab et al., 2021). The cross-border impact of logistics from EU countries and the mutual impact of changes and innovations in EU countries suggest that innovation and digitization of transport documents in neighbouring countries will also affect the Polish market, and can serve as an example and model for initiatives in the future, Implemented in countries not yet involved in research work (Giyasidinov et al., 2020). The work also analysed and attempted to assess the processes in terms of how information flows, in a selected medium Polish transport company, which is engaged in high-quality international transport.

## 2. DIGITALIZATION OF TRANSPORT DATA AND DOCUMENTS

Various initiatives are being undertaken in the Polish market to digitize documents in the retail and TSL sectors. The transport environment notes the need to digitize documents, particularly in the area of transport letters, both in the area of road and rail transport (Heines, Rütttimmann, Jung, 2021; Wycislak, 2022). A wide field of use of electronic communications in the transport process also exists in the port area, where initiatives are being taken in both the B2G (Business-to-Government) and B2B (Business-to-Business) relationship to digitize the document flow.

The need to digitize documents in the TSL sector is recognized both in the European and Polish markets. Electronic documents are produced in accordance with EDI data exchange standards (Dębicki, Kolinski, 2018). R&D works initiated by public administrations, EU and commercial projects coming from the business environment are being undertaken. However, it should be pointed out that, despite the creation of document standards, **these standards are not always used in the development of electronic solutions**, and there are legal restrictions that prevent the full use of electronic transport document formats by transport. The process of digitizing transport documents is slow in all modes of transport. Each mode of transport may extract the basic transport documents in force for the transport, the digitization of which is essential and at the same time must comply with the provisions of the relevant conventions. Table 1 provides a summary of the basic transport documents to be digitized, together with information on the status of implementation work.

**Table 1.** A summary of the transport documents to be digitized, depending on the mode of transport, taking into account the state of play and existing data exchange standards

Type of	Digitized	Is there an elaborate	Status of work in the European	Status of work on the Polish			
transport	documents	standard?	market	market			
Road transport	CMR			Developed solutions in Diginno			
		CRM standard developed	Commercial solutions exist on the	project			
		by UN/CEFACT	market or are being developed	Commercial IT solutions are			
				being developed			
Rail transport	CIM, CIM/SG MS	eCIM/SGMS standard developed by CIT	European projects are taking action on implementations	There are commercial solutions providing electronic waybill (ELP) individually by each carrier			
		ORFE US standard	Commercial solutions exist in the market or are being developed.	Work is underway to adapt the ELP to the requirements of the SGMS shipping law			
Sea transport	EMSWe		Ratified protocol regarding	Work is underway to create and			
	eManifest	There are standards for	establishment of EMSWe-	adapt the National Single			
	A range of	data exchange in the port	Many European ports have had a	Work is underway to develop			
	documents used	environment	Port Community System (PCS) in	the Polish Port Community			
	in port traffic.		place for years	System			

Source: own research

The recognition of the TSL (Transport, Shipping and Logistics) market for initiatives similar to Paperless in the field of road transport confirms the high need for digitization of documents in the TSL industry, especially for the digitization of international shipping letters. The need for the digitization of transport letters concerns both road and rail transport, but most of the initiatives for the digitization of documents in the TSL sector have been developed in the field of road transport. The top-up initiative, the European project DIGINNO, has brought together the activities of both the state administration and business organizations and entities, from both the international and Polish environment. At the same time, several commercial e-CMR initiatives have been developed, but all identified commercial initiatives are not standardized - the lack of cooperation - the obstacle to the dissemination of e-CMR; these solutions are potential users of the product of the DIINNO/DINNOCUP project. It is important that there is already a standard for the exchange of e-CMR data on UN/CEFACT, but among all the initiatives examined in the market, it is only used in research validation, and it is preventing the full functionality of electronic e-CMR documents from being hampered by inadequate legal regulations in Poland and neighboring countries

### 2.1. e-CMR

In Poland, many initiatives are being undertaken in the field of road transport. **The additional protocol of CMR**, adopted by the Polish authorities in 2019, allowed the start of work on the implementation of the electronic consignment note on the Polish transport market. The process of digitizing a CMR document is concerned with the whole road transport environment, bearing in mind the **advantages of digitization**, such as:

- Save time
- Reduce paper document errors

- Ability to monitor the execution of the order on-going
- Collection of documents in electronic form
- Ability to share documents in real-time B2G and B2B relationships
- The ability to invoice for the service immediately after confirmation of service delivery.

**Commercial initiatives** have been launched in IT services market to provide the TSL industry with e-CMR (Tomicová, Poliak, Zhuravlava, 2021). These solutions, however, are mostly in the test phase and face serious legal obstacles to full functioning in the Polish market. The main obstacle is **the lack of solid legal legitimacy for the e-CMR solution**, which requires paper documents from the carrier carrying out the goods (Poliak, Tomicová, 2020). The problem of insufficient legislative solutions to the Polish TSL market was also recognized in the Dinino project, which, as a top-up initiative, the European project, brought together public administrations and business entities to implement e-CMR on the Polish haulage market. The following steps propose the creation of a working group involving mainly the public administration, which is to work on solving the administrative problems facing the introduction of the full functionality of e-CMR in the Polish transport market. The final result is **the e-CMR format, which complies with the UN/CEFACT e-CMR standard**, and is intended to be made available free of charge to all transport users.

### 2.2. Digitization in rail transport

The market investigation carried out for this report has shown that there is also market demand in the area of rail transport for the digitization of transport **documents**. It has been concluded from the studies carried out that, although there is a need for the digitization of railway transport letters, there has been no top-up initiative in Poland to digitize railway transport documents. However, major railway operators offer their customers the possibility to send electronic railway letters, each in its format and system. Rail freight transport companies create electronic mail formats for their customers, thus eliminating the need to trade paper documents (Casado, Funes, García-Doncel, 2021). Railway R&D initiatives are directly involved by carriers and have not yet been established in Poland with a top-down initiative taken by the state administration or industry organizations to introduce a single standard for data exchange in the rail waybill. The data provided by PKP cargo S.A. shows that the current use of the electronic consignment note by customers transmitting shipments in domestic traffic amounts to 76%, while in international traffic 50%. It can therefore be seen that the electronic form of document transmission meets with customer approval and is likely that, with greater support for the availability of this solution in international traffic, the degree of use of this form of data exchange would be greater. However, it should also be noted that the electronic railway bill offered by carriers on the Polish market is created by each carrier separately, but no data is available to indicate whether railway waybills are being built according to the data exchange standard, e.g. those defined by CIT. At the initiative of CIT, the standard of the International Electronic Railway Letter CIM/SMGS has

been developed, but no data is available as to whether this format is used by carriers on the Polish market.

## 2.3. Digitization in the Polish port environment

In the process of digitisation in transport, **the environment of Polish maritime transport was also analysed in terms of initiatives for electronic documents and it was observed that in the area of maritime transport**, the most important initiative undertaken on the Polish market is the polish Port Community System (PCS) conception. The Polish PCS conception is intended to cover both the integration of business entities in B2B and B2G relations with the target integration of PCS with the National Single Window, the national maritime transport contact window operating in the B2G relationship. The scope of work to digitize the data flow is large and the Polish PCS does not provide detailed data on which documents will be digitized in the system. The work also observed that the port trading environment partially uses the UN/EDIFACT, IMO, and WCO electronic data exchange, but it is not clear in which state these standards will be implemented in the Polish Port Community System

### 2.4. Other solutions providing electronic documents in road transport

When examining the area of electronic documents on the Polish transport market, mention should also be made of documents for everyday use in transport processes that do not require regulation. Such documents, which operate in the supply chain, are often in paper form, as e-mail, as pdf messages, or messages exchanged by telephone (Kleedorfer, Huemer, 2017; Tmerge, Avramović, 2021). The most commonly exchanged messages during the transport process include:

- Transport order
- Load Disposition
- Vehicle authorization
- The status of the order
- Confirmation of unloading
- Freight Invoice.

For many years, the Polish market has been operating with TMS (Transport Management System), which aims to eliminate paper documents. Many solution providers offer TMS systems that offer electronic data transfer functionality, including transport order exchange, order acknowledgement, or transport invoice generation, providing an overview of TMS functionality.



Figure 1. A collection of basic TMS functionality

TMS can be integrated into enterprise operating systems and used as stand-alone tools. The main work area in TMS is the ability to manage mail orders, fleet management, invoice handling, and analysis and report modules. Most of the documents that can be generated and transmitted via the TMS do not require compliance with special regulations such as CMR (international consignment note), so there are several TMS solution providers whose solutions and document format can be tailored directly to the needs of a particular customer. TMS can also use standardized messages in the data exchange process. These messages may include both the order preparation process, the dispatch of the transport order, and the issue of an invoice. However, the level of standardization of individual components of TMS and the use of standards in individual databases requires interviews with suppliers and system users.

# 3. E-CMR AS A SIGNIFICANT DOCUMENT IN THE DIGITALIZATION OF TRANSPORT PROCESSES

Implementations aimed at the digitization of transport documents in the field of road transport focus mainly on the possibilities of digitization of the International des marchandises par route (CMR). The digitization of CMR, unlike the national waybill, requires compliance with the provisions of international law and recognition by public authorities, including customs and control services (Baublys, Batarlienė, 2015). This is a key document, both in transport and in the final settlement of the transport service, hence the need to digitize it and increase the accuracy of the data transmitted to the parties and control authorities. This need is clearly apparent in the transport environment, as demonstrated by the numerous initiatives taken in this respect by operators implementing or seeking to promote international transport.

An important document often linked to the consignment note, at least at the level of national road transport, is the WZ document (external edition). A WZ document is an important document issued in connection with the removal of goods from the trader's warehouse. This document is important in the marketing of goods and is also necessary for transport, as it will, for example, be used to check transport based on the document (and possible weights of the goods being dispatched). In order to avoid any problems, both accounting and transport, it is necessary that the document contains all the necessary information, is accessible and does not contain errors. The electronic form of this document is also desirable in the context of trade in goods, but the various initiatives do not focus on international trade.

The digitization of CMR in Poland was made possible by the ratification by the legislative authorities in 2019 of the additional Protocol to the 1954 CMR Convention. Despite the signing of the additional Protocol in September 2019, there is still a lack of specific legislative requirements, as well as some resistance in an international environment in which the relevant international partners do not allow the use of digitized documents (Bazina, 2022). In the case of Polish carriers, until recently it was important that e-CMR was not able to use e-CMR in Germany, which, as one of the few European countries, alongside Italy, had not ratified the protocol of the additional CMR Convention. The argument put forward by the Federal Ministry of Transport and digitization was that there was little interest in carriers to be able to use electronic transport documents and that other paper transport documents (e.g. dangerous goods transport documents) were required, which would undermine the reasonableness of holding the consignment note as the only electronic form.

On the other hand, however, a significant part of the international environment, including entrepreneurs, operating in Germany, recognizes the strong need for the market to abandon paper records. In this context, national administrations, the European Union and private companies are undertaking design, design and implementation activities to digitize the transport area and allow the transition to electronic documents. The German Transport and Logistics Association (DSLV) also called for the introduction of an electronic waybill in the country, noting the global trends in the digitization of documents, in a letter to the Federal Ministry of Justice and Consumer Protection, and the Federative Ministry of Transport and Digital Infrastructure

# 4. THE BENEFITS OF DIGITALIZATION OF TRANSPORT PROCESS AND DOCUMENTS

The letter of carriage, in both paper and electronic form, shall, from the point of view of legal applications, have, inter alia, the following functions:

- Proof of acceptance of the consignment for carriage and of receipt of the consignment
- Proof of the condition of the consignment in transit
- ID function gives you the right to dispose of the shipment
- An instruction function to inform about the required conditions of carriage

The above uses of the consignment note make its use very important for the interests of the supply chain. The cessation of the use of waybills in certain areas would prevent the parties from achieving certain legal effects. Even in those areas where it is legally possible to withdraw from the consignment note (e.g. on evidence), its absence would mean less convenience for the participants in the entire freight transport process and would negatively affect confidence in the circulation.

At the same time, it is clear that the current rate of movement of goods makes the use of traditional waybills in many cases burdensome and sometimes even prevents the use of legal institutions designed in times when the maximum reduction in transport time was not so high as to be a priority. Therefore, allowing the electronic presentation of the consignment note and the affixing of the same form of registration at the various stages of transport could have a very positive impact on both the legal security of the freight operators.

In addition to purely economic considerations resulting from the reduction in the cost of operations generated by the need to print a significant number of documents and the subsequent marketing of these documents, the studies show different benefits detailed in the table below. The survey was carried out in the first half of 2022 among the 68 supply chain-link companies. This test sample was assessed as representative under the test methodology set out in the publication (Domanski & Kolinski, 2020). The study aimed to identify the importance of the benefits of digitization of the supply chain. The present research was carried out as part of the research work of the PLANET project, in the field of standardisation of the digitisation of supply chains.

Potontial honofit	Importance					Average	
Potential benefit	0	1	2	3	4	5	value
Reduce the flow of documentation	1	1	2	5	27	32	4,235
No negative consequences for lost documents	1	2	2	4	21	38	4,294
Identification of persons involved in the transport	1	1	2	10	20	34	4,191
Reduce fraud opportunities	0	3	4	14	15	32	4,015
The date of acceptance of the consignment note shall be clearly specified	2	2	3	8	25	28	4,000
Limitation of refusals by insurers to pay compensation	2	2	4	9	18	33	4,029

Table 2. Analysis of the importance of the benefits of supply chain digitalisation

Source: own research from PLANET project

Each of the benefits analysed was rated at a high level of importance (mean above 4 on a Likert scale, supplemented by a level of 0). This indicates the need to consider all potential benefits in further research.

### Reduce the flow of documentation

The standard in the transport industry is to make the payment deadline for the transport service pay. Often, transport contracts also include contractual penalties for late delivery of documentation. Where drivers are often on the road for several weeks,

it is necessary either to send letters by mail to the carrier or to wait for up to a few weeks for the transport documentation to flow. The introduction of e-mail would allow for immediate verification of the end of the journey and reduce the time after which transport services would be paid.

### No negative consequences for lost documents

The contracts in the TSL industry regularly contain provisions which allow the payer to avoid payment of the remuneration for the carriage or to limit it significantly in the event of loss of transport documents even where the performance of the carriage is beyond doubt and is not the subject of a dispute between the parties. Part of the contracts of carriage contains even clauses whereby the main part of the carrier's remuneration is payable for the supply of documents and only a small part for the carriage itself. Electronic waybills could eliminate the effects of such clauses, which, although contrary to the substance of the contract of carriage and therefore regularly challenged by the courts, have in practice an impact on the relationship between carriers and their customers (Antonov, 2020).

### Identification of persons involved in the transport

The practice of road transport both domestic and international shows that, in the vast majority of cases, the signatures on the waybills alone do not allow the identification of the persons who issued the consignment note, accepted the consignment on behalf of the carrier or removed it from the consignee. This constitutes a significant impediment to disputes arising from the proper performance of the carriage and the signature on the document without the relevant stamp often prevents the party from showing that the person concerned has actually received the consignment. However, even if the issue of the consignment itself is not disputed, it is in many cases difficult to determine which specific individuals have participated in, for example, the receipt of the consignment or the delivery of the consignment to the consignment. These negative developments would not occur in the case of the use of electronic waybills, where an appropriate digital signature would allow a clear identification of the person who made it.

### Reduce fraud opportunities

The transport industry is used to commit high-value fraud in two basic ways. First, criminals pretend to be honest carriers to obtain a transport order and then disappear with loads. Secondly, criminals pretending to be well-known companies and ordering goods with deferred payment dates (which are what vendors are getting in the recognized reputation of buyers) lead to shipments in places that do not allow them to be identified later. The use of electronic waybills could allow this phenomenon to be reduced. The need to send the digital data of the carrier necessary for the issue of the electronic consignment note would reveal cases where a transport order would be received by a person who does not have such data but merely tries to impersonate a carrier. Similarly, criminals pretending to be other companies that order merchandise would in many cases not be able to effectively confirm receipt of the shipment, as they would not have the digital signature of the people who allegedly ordered the item.

### The date of acceptance of the consignment note shall be clearly specified

The time at which the consignment note is accepted by the consignee is extremely important in determining the person entitled to claim from the carrier. With this point, the right of the consignor to dispose of the consignment is transferred to the consignee. Most often, this moment is clear, but there are situations where it is a disputed situation. This is particularly the case in cases where the consignee refuses to accept the consignment. Such acceptance is often accompanied by the inclusion of entries in the consignment notes, but in the course of the dispute it is difficult to determine who made those entries. The digital signature on the electronic consignment note would make it clear whether the consignee has accepted this letter or not and thus resolved the issue of the identity card for the recovery of the carrier.

#### Limitation of refusals by insurers to pay compensation

The practice of Polish insurers, as described above, making the existence of insurance cover in the carrier's liability insurance contracts conditional on the inclusion of insured data in the transport list, will no longer be an important problem for both carriers and the entities commissioning them. The negative effects of this practice may be limited where the electronic system of circulation of the transport documentation is organized in such a way that it will require all carriers involved in the carriage of the consignment to be added to the consignment note.

### 5. CONCLUSION

So far, many initiatives have been set up to digitize transport documents, including international e-CMR letters, but mostly from the business environment. The opening of the national market to the use of CMR's electronic document, by signing the additional Protocol to CMR in 2019, has increased the interest in the use of the document and many companies have taken steps to create a commercial solution for the provision of e-CMR to carriers and their customers.

As yet, the solutions offered, according to the information obtained from their suppliers, are not standardized solutions and, despite compliance with legal requirements as to the format of the document, do not rely on any data exchange standards previously developed, such as the UN/CEFACT e-CMR format.

There was an initiative in the Polish market involving public administrations and industry organizations in the field of road transport – a project DIINNO. This research takes a reverse approach to e-CMR's commercial suppliers and assumes, above all, the integration of international public administrations in order to allow control bodies to operate e-CMR, and then to allow business operators to use the standardized e-CMR format.

The benefits of digitization of documents, including CMR documents, encourage economic operators and public organizations to move toward the implementation and promotion of such solutions. Industry organizations and road transport associations follow the market and demonstrate their willingness to engage in the development of an environment favourable to the operation of electronic road transport documents (Ismailiva, 2020).

Commercial e-CMR suppliers consider that cooperation discussions are of interest to shipping companies, but there is a perceived legal barrier. The lack of legal certainty about the feasibility of the e-CMR document is also highlighted by the researches, who place a strong emphasis on the involvement of administrative authorities in the process of exchanging and sharing data in the B2G, G2G relationship. However, the legislative problem is not solely on the part of the Polish services. In the European Union (the EU currently has 27 Member States), work is still being done to clarify the legal framework for e-CMR in the countries that have ratified the additional CMR Protocol (the Protocol has been ratified by 23 countries). It should be stressed that not all the countries of the European Union have accepted and enabled, at least in theory, the use of an electronic waybill. For Polish carriers, for example, the failure of the German administration to use e-CMR in Germany to date is a major restriction, which in the case of international transport, to a large extent using German road infrastructure, is a clear and substantial restriction, even preventing the switchover to electronic transport documents.

## Acknowledgments:

This paper is the result of research carried out in the '<u>P</u>rogress towards Federated <u>L</u>ogistics through the Integration of TEN-T into <u>A</u> Global Trade <u>Net</u>work' - PLANET project.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 860274.

## 6. REFERENCES

Antov, M. (2020). *Possibilities for application of e-CMR from a customs point of view*. Conference Proceedings: Economic and Business Trends Shaping the Future, 128-136

Baublys, A., & Batarlienė, N. (2015). *The possibilities of installing electronic CMR waybill in road transport sector*. Mokslas–Lietuvos ateitis/Science–Future of Lithuania, 7(5), 583-588.

Bazhina, M. (2022). *Disputable Questions of the Use of Digital Technologies in Transportation*. International Journal of Law in Changing World, 1(1), 33-45.

Casado, J. M. P., Funes, A. G., & García-Doncel, J. G. (2021). *Digital Transformation: Advantages and opportunities of E-CMR in international cargo logistics*. ESIC Digital Economy and Innovation Journal, 1(1), 84-102.

Debicki, T., & Kolinski, A. (2018). *Influence of EDI approach for complexity of information flow in global supply chains*. Business Logistics in Modern Management.

Domański, R., & Kolinski, A. (2020). Assessment of the Level of Information Integration in CRM Systems for SMEs for the needs of omnichannel retailing. Business Logistics in Modern Management.

Giyasidinov, A. S., Maxmudov, J., Samatov, G. A., & Sarvirova, N. S. (2020). *E-CMR-an impulse to innovative development of the transport industry*. IEJRD-International Multidisciplinary Journal, 5(4), 1-6.

Heines, R., Rüttimann, S., & Jung, R. (2021). Design of a DLT-based document management system in road transport. In Adapting to the Future: How Digitalization Shapes Sustainable Logistics and Resilient Supply Chain Management. Proceedings of the Hamburg International Conference of Logistics (HICL), Vol. 31, pp. 275-299

Ismailova, R. (2020). *E-CMR as a basic condition on fulfillment of obligations under agreement for international carriage of goods by road*. Society and innovations, 1(2/S), 177-183

Kleedorfer, F., & Huemer, C. (2017). Towards a web based transportation infrastructure. In Digitalization in Supply Chain Management and Logistics: Smart and Digital Solutions for an Industry 4.0 Environment. Proceedings of the Hamburg International Conference of Logistics (HICL), Vol. 23, pp. 55-73

Poliak, M., & Tomicová, J. (2020). Transport document in road freight transportpaper versus electronic consignment note CMR. The Archives of Automotive Engineering, 90(4), 45-58

Talić, T., & Avramović, Z. Ž. (2021). Control Towers in Supply Chain Management: Standardization and Documentation Preparation. In The 1st International Conference on Maritime Education and Development. Springer, Cham, pp. 389-396.

Tomicová, J., Poliak, M., & Zhuravleva, N. A. (2021). *Impact of using e-CMR on neutralization of consignment note*. Transportation Research Procedia, 55, 110-117.

Wahab, S.N., Rajendran, S.D., & Yeap, S.P., (2021). Upskilling and reskilling requirement in logistics and supply chain industry for the fourth industrial revolution. LogForum 17 (3), 399-410.

Wycislak, S., (2022). *Exploring real-time visibility transportation platform deployment*. LogForum 18 (1), 109-121.