# Method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds*

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**Abstract**

The article further develops a method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, which differs from the known in that it creates a clear binary tool for self-auditing the legal compliance of a contract for the carriage of goods by road, translates abstract legal requirements into specific actionable guidance, and does not only state the fact of a violation, but focuses on automating the preparation of the legal basis. The developed method provides a formalized algorithm for checking 17 mandatory essential conditions of a contract for the carriage of goods by road; guarantees the legal security of the contract; provides precise recommendations on which conditions need to be added to the contract; reduces the time for legal completion of the contract, allowing the logistician to quickly eliminate shortcomings without involving a lawyer, ensuring the prompt execution of the transportation; provides a rule base based on legal knowledge that ensures the completeness and unambiguousness of the contract verification; prevents financial and legal risks associated with incorrect execution of contractual relations, ensuring the performance of transportation only if 100% compliance with legal requirements; converts legal requirements for the essential terms of the contract into an unambiguous decision on the possibility/impossibility of transportation, while providing specific instructions to achieve legal compliance.

**Keywords**

Decision-making support, decision support systems (DSS), binary classifier, formalization of legal verification, contract of carriage of goods by road, essential terms of the contract.[1]

## 1. Introduction

Today, an important element of the transport and logistics infrastructure is the transportation of goods by road, which ensures the efficiency, flexibility and accessibility of cargo delivery both within Ukraine and abroad [1-3].

Cargo transportation in Ukraine is regulated by a significant number of national and international regulatory legal acts (Civil Code of Ukraine [4], Law of Ukraine "On the Peculiarities of Regulation of Activities of Legal Entities of Certain Organizational and Legal Forms in the Transitional Period and Associations of Legal Entities" [5], Law of Ukraine "On Road Transport" [6], international conventions, for example, "Convention on the Contract for the International Carriage of Goods by Road" [7], etc.).

* *AdvAIT'2025: 2nd International Workshop on Advanced Applied Information Technologies: AI & DSS, December 05, 2025, Khmelnytskyi, Ukraine, Zilina, Slovakia*
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For Ukrainian companies engaged in international transportation, it is extremely important to comply with EU standards and international transport law. Decision support systems contribute to the implementation of these norms in internal operational processes [8, 9].

In conditions of military operations in Ukraine, there is a need for rapid replanning of routes and adaptation to changed border crossing rules and new security requirements [8, 10]. The correct qualification of events as force majeure circumstances in accordance with civil law is relevant, which requires precise legal decisions to exempt from liability. Decision support systems can also help in this [10, 11].

Incorrect registration of contractual relations, selection of an inappropriate type of contract, incorrect application of liability (for loss, damage, delay in delivery) creates high financial and legal risks for all parties (consignor, carrier, consignee of cargo). Decision support systems help to quickly assess the legal consequences and choose the optimal contractual model, which minimizes the likelihood of disputes and losses [12-14].

The process of concluding a contract and preparing documents is time-consuming. Decision support systems allow to automate the verification of the necessary legal conditions and speed up the process [15-17].

Decision support systems can also help in making a decision on choosing a reliable carrier/forwarder with proper licenses and legal status, which is critically important for avoiding fraud or inability to fulfill obligations [18, 19].

In addition, not all transport companies, as well as other organizations [20, 21], have a lawyer on their staff, and transport company employees are unlikely to know all the requirements of current legislation. Given the impossibility of constant appeals to a lawyer by transport companies, it is precisely decision support systems taking into account civil law grounds [22, 23] that can significantly increase the efficiency and legal correctness of cargo transportation by road transport — by providing an opinion on the possibility/impossibility of cargo transportation by road transport from the point of view of civil law regulation.

Accordingly, decision-making support on the possibility of cargo transportation by road transport based on civil law grounds is becoming particularly *relevant*, especially given the intensification of logistics processes, international trade and the need to ensure a reliable and efficient supply chain, as it ensures legality, safety, efficiency and minimization of risks in the complex and dynamic field of road freight transportation.

## 2. Literature review

Let's conduct a survey of known decision support systems (DSS) regarding the possibility of transporting cargo by road based on civil law grounds.

DSS based on Fuzzy MCDM [24] rank logistics providers by quantitative and qualitative indicators. Choosing a reliable counterparty is key to preventing breach of obligations (transportation disruption, loss of cargo), which exempts from further litigation and financial liability.

DSS [25] includes risk management modules, integrates data on litigation history and financial status. Such DSS helps to avoid concluding a contract with companies that may be unable to fulfill their obligations (for example, do not have proper licenses or are in the process of bankruptcy).

DSS integrated with AI/NLP [14, 26] provide automatic audit and verification of contracts and transport documents. Such systems ensure that contracts clearly spell out essential terms and correct references to liability rules, and speed up the verification of the presence and correctness of reservations (for example, about damage to cargo).

DSS [15] uses AI to legal relation extraction from the text of the contract, helping to quickly distinguish between a contract of carriage and a contract of forwarding at the drafting stage, ensuring the correct qualification of relations and, accordingly, the correct application of liability rules.

DSS for supply chain risk management (SCRM) with a risk prediction and modeling module [12] provides objective data on the unpredictability and inevitability of an event (for example, based on geospatial and political data), helping to legally justify the exemption from liability.

In the article [27], a detailed role model for the integration of smart contracts in the DSS is developed. The system automates the interaction between 7 main roles of logistics, ensures a clear demarcation of rights and responsibilities, reduces the risk of conflicts and automates the execution of the contract, which is the basis of civil legal relations.

DSS integrated with blockchain [28] provides automatic generation of documentation (for example, e-CMR) and regulatory compliance. Smart contracts can be programmed to automatically comply with regulations, they create an immutable audit trail, which is decisive evidence in disputes about loss, damage or late delivery.

Article [29] describes the automation of transactions - the release of payments based on the achievement of certain control points (milestone-based payments). Automatic verification of the fulfillment of conditions before the release of the payment (e.g., checking the compliance with delivery deadlines and quality) reduces the likelihood of payment disputes and ensures rapid compensation.

Article [30] describes the use of artificial intelligence to detect fraud patterns and verify the identity of the carrier using a DSS integrated with public/private databases (e.g., DOT, RMIS), which allows verifying the legitimacy of the carrier before concluding a contract, avoiding unauthorized double brokering and identity theft, which lead to significant legal losses.

Article [31] discusses the automation of tracking the validity of licenses, certificates and insurance policies (e.g. CMR-insurance) using DSS, which ensures that at the time of conclusion of the contract the carrier has the appropriate legal capacity and the necessary insurance. This is a mandatory legal condition and is critical for obtaining compensation in case of damage to the cargo.

Article [32] describes a system of Quantitative Legal Support, the methodology of which is applicable to any transnational legal compliance. DSS helps designers/logistics to better understand the reasons for legal decisions from their own perspective. This approach can be used to quantify the strength of the legal significance of different provisions in international transport agreements.

The authors of [33] propose a classification of legal status using simple AI models with high accuracy, which can help logistics companies correctly classify drivers and forwarders as independent contractors or employees (a critically important issue for taxation and legal liability in civil law).

In [34], a rule-based expert system is developed that asks the user to answer a series of legal questions (e.g., “Does the company involve a third party?”, “Is the price fixed?”, etc.) and helps the logistician accurately classify the contractual relationship as transportation, forwarding, or agency. This is critically important, since the type of contract determines the subject and the limits of civil liability (e.g., full liability of the carrier or limited liability of the forwarder, etc.).

A rule-based diagnostic expert system [35] analyzes input data about the event (location, time, nature of damage, presence of caveats in the CMR) and predicts the probability of successful application of liability to the carrier or its release (force majeure, own miscalculations, etc.).

The review demonstrates significant advances in the use of decision support systems for logistics automation. However, from the point of view of direct, comprehensive decision support based on civil law grounds, known solutions have several key weaknesses. The biggest weakness is the lack of a single, integrated DSS that would cover all civil law aspects — some DSS [24, 25] focus on the selection of a counterparty (the risk of non-fulfillment of obligations), others [14, 26, 15] — on the audit of the contract text (essential conditions), others [12] — on force majeure situations, and others [15-17] — supposedly provide automatic audit and verification of contracts and transport documents, but are not adapted to the current legislation of Ukraine, etc. In addition, most DSS do not provide a quantitative assessment (in monetary terms) of the probability of losing in court due to incorrect qualification of the contract, incorrectly executed contract or insufficient level of insurance. They only identify the risk, but do not assess its scale. Therefore, there is

currently no single DSS that would automatically select a reliable carrier, create a legally impeccable contract (having qualified it correctly), generate the necessary transport documents (e-CMR) and model liability in the event of an event (for example, damage to the cargo), and also provide the cost of a probable loss in court due to incorrectly executed documents.

Therefore, *this study will be aimed* at designing the first module of such a unified DSS, in particular, at developing a method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, which will ensure the verification of a contract for the carriage of goods by road and the formation of a conclusion on the possibility/impossibility of concluding such a contract and transporting goods by road on the basis of civil law grounds.

## 3. Civil law regulation of the contract of carriage of goods by road

Before developing this method, let us consider the civil law regulation of the contract of carriage of goods by road, defined in [4-7]. First of all, it is necessary to dwell on the subject composition of the parties to the contract of carriage by road.

A road carrier is an individual or legal entity that carries out, on a commercial basis or at its own expense, the transportation of passengers and (or) goods by means of transport.

A consignor is an individual, an individual entrepreneur or a legal entity that provides the carrier with goods for transportation and enters the relevant information into the consignment note or other document for the goods specified by law.

A consignee is an individual, an individual entrepreneur or a legal entity that accepts the goods and unloads the vehicle in accordance with the procedure established by law.

Accordingly, a contract for the carriage of goods must be concluded between the parties, which is a legal document between the carrier, consignor or consignee, which regulates the volume, term and conditions of carriage of goods, the rights, obligations and responsibilities of the parties for their observance.

Therefore, contracts for the carriage of goods by road are concluded between individuals and legal entities that carry out road carriage of goods on a commercial basis (hereinafter referred to as carriers), and consignors or consignees (hereinafter referred to as customers).

A contract for the carriage of goods may be concluded by a carrier with an intermediary enterprise that exercises the rights and bears the obligations and responsibilities provided for consignors and consignees.

Both the carrier and the consignor (consignee) — the future customer — can initiate the establishment of contractual relations for the carriage of goods by road.

After the carrier and the customer have agreed on the terms of transportation and calculations, the carrier is obliged to send the draft contract, approved by the carrier's signature, with the necessary annexes to it in two copies to the customer no later than three days after its approval.

The customer shall sign the draft contract and its annexes no later than 10 days after receiving the contract from the carrier, and return one copy to the carrier.

If the customer has any disagreements under the contract, he shall formulate his proposals in a protocol of disagreements and send them to the carrier together with the contract within 10 days.

The carrier shall consider the protocol of disagreements of the customer, if necessary – together with him, and include all accepted proposals in the contract.

In accordance with the contract, the carrier and the customer shall, within the framework of the quarterly plan, determine monthly plans with ten-day planned tasks for the transportation of goods 10 days before the beginning of each month.

For the transportation of goods by road, the customer shall, if there is a contract, submit to the carrier an application in accordance with the established form and within the period specified in

the contract. By agreement of the parties, the application may be submitted for one day, week, ten-day period or month.

In the case of mass transportation of goods, especially construction goods to construction sites, as well as agricultural goods for their processing or to places of long-term storage, the customer must also attach to the application a transportation schedule agreed with the carrier, indicating the daily or average daily volume of transportation, as well as the beginning and end of work shifts.

The contract for the carriage of goods by road shall be concluded in writing. The essential terms of the contract are:

1. Name and location of the parties.
2. Term of the contract.
3. Name and quantity of the cargo, its packaging.
4. Conditions (mode of operation for the delivery and acceptance of cargo, ensuring the safety of the cargo, carrying out loading and unloading operations, etc.) of the cargo transportation.
5. Term of cargo transportation.
6. Place and time of cargo loading and unloading.
7. Cost of cargo transportation and payment procedure.
8. Procedure for determining rational routes.
9. Obligations of the parties, their responsibilities.

If the parties have not agreed on at least one essential condition, this means that the contract is considered unconcluded (i.e., one that does not create rights and obligations for the parties).

It is no coincidence that one of the essential conditions of a contract for the carriage of goods by road is the term of carriage. The terms of delivery of goods for intercity carriage are agreed upon jointly by the Carrier and the Customer, based on the road conditions between the points of acceptance of the goods for transportation and their delivery at the destination. These terms are recorded in writing in an application or a one-time agreement.

The consignor is obliged to provide information to the consignee about the approximate terms of delivery of the goods to him. If the delivery date of the goods falls on a non-working day, the consignee must ensure the receipt of the goods on such a day.

If it is impossible to deliver the cargo to the consignee due to a reason beyond the control of the carrier, he must notify the customer, who is obliged to give him an order for another consignee within the terms stipulated by the contract.

If such an order is not received, as well as if it is impossible to deliver the cargo to the new destination, the carrier returns the cargo to the customer.

A contract for the carriage of goods by road is an independent type of civil law contract, its legal nature is based on a combination of the norms of civil and transport legislation. In the context of the development of logistics, digitalization and significant changes in economic realities (in particular, during the war in Ukraine), the relevance of the contract for the carriage of goods by road is increasing, because it guarantees clarity, responsibility and transparency in this area, contributes to the stability and efficiency of economic activity.

## 4. Method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds

The main legal document and, accordingly, the source of information is the contract of carriage of goods by road. Considering the above-mentioned foundations of civil law regulation of the contract of carriage of goods by road, as well as the methodology for the development and application of clinical decisions support information technologies with consideration of civil-legal grounds [22], *the reference set-theoretic model of the contract of carriage of goods by road*, correct from the point of

view of civil law regulation (with all the essential conditions that must be contained in it), has the following form:

$$CCGR = \{ccgr\,1..ccgr\,17\} = \{np, lp, tc, nc, qc, pc, cct, tct, pl, tl, pul, tul, ctt, pp, pdrr, op, rp\}$$

where *np* — name of the parties, *lp* — location of the parties, *tc* — term of the contract, *nc* — name of the cargo, *qc* — quantity of the cargo, *pc* — packaging of the cargo, *cct* — conditions of cargo transportation, *tct* — term of cargo transportation, *pl* — place of cargo loading, *tl* — time of cargo loading, *pul* — place of cargo unloading, *tul* — time of cargo unloading, *ctt* — cost of cargo transportation, *pp* – payment procedure, *pdrr* — procedure for determining rational routes, *op* — obligations of the parties, *rp* — responsibility of the parties.

Let's synthesize the appropriate *structure of the contract for the carriage of goods by road* for its preprocessing. Therefore, the contract for the carriage of goods by road should consist of the following clauses (clauses can be present in the contract only if after the clause in the contract there is text describing a particular clause):

- Name of the parties.
- Location of the parties.
- Term of the contract.
- Name of the cargo.
- Quantity of the cargo.
- Packaging of the cargo.
- Conditions of cargo transportation.
- Term of cargo transportation.
- Place of cargo loading.
- Time of cargo loading.
- Place of cargo unloading.
- Time of cargo unloading.
- Cost of cargo transportation.
- Payment procedure.
- Procedure for determining rational routes.
- Obligations of the parties.
- Responsibility of the parties.

*The method of synthesizing a real model of a contract for the carriage of goods by road* consists of the following steps:

1. Preprocessing of a contract for the carriage of goods by road (applies only to that part of the contract that represents essential conditions) — presenting the contract in a form suitable for automated processing, in accordance with the above-synthesized contract structure according to the following rules:
    a. if the contract contains text describing the names of the parties to the contract, then the contract contains the item "Name of the parties";
    b. if the contract contains text describing the location of the parties to the contract, then the contract contains the item "Location of the parties";
    c. ...
    d. if the contract contains text describing the responsibility of the parties to the contract, then the contract contains the item "Responsibility of the parties".
2. Analysis of the contract for the purpose of identifying all available essential conditions — search for elements of the *CCGR* set in the real contract of carriage of goods by road prepared for automatic processing.

3. Synthesis of the real set-theoretic model of the contract of carriage of goods by road — if the element $ccgr_i$ ($i=1..17$, since the contract must provide 17 mandatory essential conditions) is in the contract of carriage of goods by road, then the element $ccgr_i$ is filled into the set of available conditions in the real contract *RCCGR*; if the element $ccgr_i$ ($i=1..17$) is absent in the contract of carriage of goods by road, then the element $ccgr_i$ is filled into the set of missing conditions in the real contract *ACCGR*.
4. Verification of the real set-theoretic model of the contract by checking whether the formation of the sets of available and absent mandatory conditions has been performed correctly - the number of elements of the set of available mandatory conditions *RCCGR* and the set of absent mandatory conditions *ACCGR* together should be 17.

Then *the criterion for the possibility of transporting goods by road*: if $ACCGR = \varnothing$, then transporting goods by road is possible; if $ACCGR \neq \varnothing$, then transporting goods by road is impossible.

Considering this criterion for the possibility of transporting goods by road, let's develop *the method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds* (binary classifier $RCCGR \rightarrow Y$, where $Y = y(RCCGR) \in \{0;1\}$ – conclusion about the impossibility (0) or about the possibility (1) of transporting goods by road from the point of view of the current legislation of Ukraine), consisting of the following steps:

1. Filling the first row of the *gcc* matrix and counting the number of available essential conditions in the contract for the carriage of goods by road (counter *j)* according to the rules:
   a. if the contract contains the item “Name of the parties” (element *ccgr1 = np* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,1]=0*, else *gcc[1,1]=1;*
   b. if the contract contains the item “Location of the parties” (element *ccgr2 = lp* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,2]=0*, else *gcc[1,2]=1*;
   c. if the contract contains the item “Term of the contract” (element *ccgr3 = tc* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,3]=0*, else *gcc[1,3]=1*;
   d. if the contract contains the item “Name of the cargo” (element *ccgr4 = nc* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,4]=0*, else *gcc[1,4]=1*;
   e. if the contract contains the item “Quantity of the cargo” (element *ccgr5 = qc* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,5]=0*, else *gcc[1,5]=1*;
   f. if the contract contains the item “Packaging of the cargo” (element *ccgr6 = pc* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,6]=0*, else *gcc[1,6]=1*;
   g. if the contract contains the item “Conditions of cargo transportation” (element *ccgr7 = ct* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,7]=0*, else *gcc[1,7]=1*;
   h. if the contract contains the item “Term of cargo transportation” (element *ccgr8 = tt* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,8]=0*, else *gcc[1,8]=1*;
   i. if the contract contains the item “Place of cargo loading” (element *ccgr9 = pl* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,9]=0*, else *gcc[1,9]=1*;
   j. if the contract contains the item “Time of cargo loading” (element *ccgr10 = tl* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,10]=0*, else *gcc[1,10]=1*;
   k. if the contract contains the item “Place of cargo unloading” (element *ccgr11 = pul* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,11]=0*, else *gcc[1,11]=1*;
   l. if the contract contains the item “Time of cargo unloading” (element *ccgr12 = tul* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,12]=0*, else *gcc[1,12]=1*;
   m. if the contract contains the item “Cost of cargo transportation” (element *ccgr13 = ctt* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,13]=0*, else *gcc[1,13]=1*;
   n. if the contract contains the item “Payment procedure” (element *ccgr14 = pp* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,14]=0*, else *gcc[1,14]=1*;

o. if the contract contains the item “Procedure for determining rational routes” (element *ccgr15 = pdrr* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,15]=0*, else *gcc[1,15]=1*;
p. if the contract contains the item “Obligations of the parties” (element *ccgr16 = op* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,16]=0*, else *gcc[1,16]=1*;
q. if the contract contains the item “Responsibility of the parties” (element *ccgr17 = rp* is available in the set *RCCGR*), then: *j=j+1* and *gcc[1,17]=0*, else *gcc[1,17]=1.*

2. The elements of the second row of the matrix *gcc* is filled the necessary essential terms of the contract for the carriage of goods by road, namely: *gcc[2,1]* = «Name of the parties»; *gcc[2,2]* = «Location of the parties»; *gcc[2,3]* = «Term of the contract»; *gcc[2,4]* = «Name of the cargo»; *gcc[2,5]* = «Quantity of the cargo»; *gcc[2,6]* = «Packaging of the cargo»; *gcc[2,7]* = «Conditions of cargo transportation»; *gcc[2,8]* = «Term of cargo transportation»; *gcc[2,9]* = «Place of cargo loading»; *gcc[2,10]* = «Time of cargo loading»; *gcc[2,11]* = «Place of cargo unloading»; *gcc[2,12]* = «Time of cargo unloading»; *gcc[2,13]* = «Cost of cargo transportation»; *gcc[2,14]* = «Payment procedure»; *gcc[2,15]* = «Procedure for determining rational routes»; *gcc[2,16]* = «Obligations of the parties»; *gcc[2,17]* = «Responsibility of the parties».
3. Formation of a conclusion on the possibility/impossibility of transporting goods by road from the point of view of the current legislation of Ukraine — if *j=17* та *ACCGR* = *Ø*, then “Cargo transportation by road is possible”, else “Cargo transportation by road is impossible”.
4. If a conclusion on the possibility of transporting goods by road from the point of view of the current legislation of Ukraine is formed, then a contract for the transportation of goods by road is concluded and the corresponding service is provided under this contract, otherwise, if a conclusion is made about the impossibility of transporting goods by road from the point of view of the current legislation of Ukraine, then the mandatory essential conditions missing from the contract are provided — if the matrix element *gcc[1,i]=1 (i=1..17)*, then the user is shown the corresponding element of the matrix *gcc[2,i]* as a guide as to which mandatory essential conditions should be added to the contract to ensure the possibility of concluding a contract and transporting goods by road under this contract.

So, method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds further developed, which differs from the known in that it creates a clear binary tool for self-auditing the legal compliance of a contract for the carriage of goods by road, translates abstract legal requirements into specific actionable guidance, and does not only state the fact of a violation, but focuses on automating the preparation of the legal basis. The developed method provides a formalized algorithm for checking 17 mandatory essential conditions of a contract for the carriage of goods by road; guarantees the legal security of the contract; provides precise recommendations on which conditions need to be added to the contract; reduces the time for legal completion of the contract, allowing the logistician to quickly eliminate shortcomings without involving a lawyer, ensuring the prompt execution of the transportation; provides a rule base based on legal knowledge that ensures the completeness and unambiguousness of the contract verification; prevents financial and legal risks associated with incorrect execution of contractual relations, ensuring the performance of transportation only if 100% compliance with legal requirements; converts legal requirements for the essential terms of the contract into an unambiguous decision on the possibility/impossibility of transportation, while providing specific instructions to achieve legal compliance..

## 5. Results & discussion

Let's consider examples of the application of the method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds.

So, the logistician prepared a *contract1* for the carriage of goods by road. According to the method of synthesis of a real model of a contract for the carriage of goods by road, preprocessing of the contract1 took place, analysis of the contract1 for the purpose of identifying all available essential conditions, synthesis of a real set-theoretic model of the contract1 — formation of a set of available conditions in the real contract $RCCGR_1=\{np, lp, tc, nc, qc, pc, cct, tct, pl, tl, pul, tul, ctt, pp, pdrr, op, rp\}$ and a set of absent conditions in the real contract $ACCGR_1 = \emptyset$, after which verification of the real set-theoretic model of the contract1 took place — since the number of elements of the set of available mandatory conditions $RCCGR_1$ is 17, the number of elements of the set of absent mandatory conditions $ACCGR_1$ is 0, together 17+0=17, then the real set-theoretic model of the contract1 is correct.

Further, according to the first step of the method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, the first row of the *gcc* matrix was filled and the number of available essential conditions in the contract of carriage of goods by road (counter *j*) was counted according to the proposed rules, as a result of which the following results were obtained: *gcc[1,i]=0 (i=1..17)* (for all 17 elements), *j=17*. According to the second step of the developed method, the necessary essential conditions of the contract of carriage of goods by road were recorded in the elements of the second row of the *gcc* matrix. According to the third step of the developed method, a conclusion was formed on the possibility of transporting goods by road from the point of view of the current legislation of Ukraine, since *j=17* and $ACCGR_1= \emptyset$, after which the contract1 for the carriage of goods by road was concluded and the corresponding service under this contract was provided.

Another logistician prepared a *contract2* for the carriage of goods by road. According to the method of synthesis of a real model of a contract for the carriage of goods by road, preprocessing of the contract2 took place, analysis of the contract2 for the purpose of identifying all available essential conditions, synthesis of a real set-theoretic model of the contract2 — formation of a set of available conditions in the real contract $RCCGR_2=\{np, tc, nc, qc, cct, tct, pl, pul, tul, ctt, pp, op, rp\}$ and a set of absent conditions in the real contract $ACCGR_2=\{lp, pc, tl, pdrr\}$, after which verification of the real set-theoretic model of the contract2 took place — since the number of elements of the set of available mandatory conditions $RCCGR_2$ is 13, the number of elements of the set of absent mandatory conditions $ACCGR_2$ is 4, together 13+4=17, then the real set-theoretic model of the contract2 is correct.

Further, according to the first step of the method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, the first row of the *gcc* matrix was filled and the number of available essential conditions in the contract of carriage of goods by road (counter *j*) was counted according to the proposed rules, as a result of which the following results were obtained: the first row of the *gcc* matrix: *[0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0]*, *j=13*. According to the second step of the developed method, the necessary essential conditions of the contract of carriage of goods by road were recorded in the elements of the second row of the *gcc* matrix. According to the third step of the developed method, a conclusion was formed about the impossibility of transporting cargo by road from the point of view of the current legislation of Ukraine, since $j \neq 17$ and $ACCGR_1 \neq \emptyset$, after which the elements of the matrix *gcc[2,2]* = «Location of the parties», *gcc[2,6]* = «Packaging of the cargo», *gcc[2,10]* = «Time of cargo loading», *gcc[2,15]* = «Procedure for determining rational routes» were output as a guide, which mandatory essential conditions should be added to the contract2 to ensure the possibility of concluding a contract2 and transporting cargo by road under this contract.

Thus, the logistician, using the developed method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, receives a conclusion on the possibility/impossibility of transporting cargo by road from the point of view of the current legislation of Ukraine, and in the event of receiving a conclusion on the impossibility of transporting cargo, the logistician receives an accurate list of mandatory essential conditions that

should be immediately added to the contract to ensure its legal force and the possibility of transportation, eliminating the risk of the contract being declared invalid.

## 6. Conclusions

Decision-making support on the possibility of cargo transportation by road transport based on civil law grounds is becoming particularly relevant, especially given the intensification of logistics processes, international trade and the need to ensure a reliable and efficient supply chain, as it ensures legality, safety, efficiency and minimization of risks in the complex and dynamic field of road freight transportation.

This study is aimed at developing a method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, which will ensure the verification of a contract for the carriage of goods by road and the formation of a conclusion on the possibility/impossibility of concluding such a contract and transporting goods by road on the basis of civil law grounds.

The article further develops a method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, which differs from the known in that it creates a clear binary tool for self-auditing the legal compliance of a contract for the carriage of goods by road, translates abstract legal requirements into specific actionable guidance, and does not only state the fact of a violation, but focuses on automating the preparation of the legal basis. The developed method provides a formalized algorithm for checking 17 mandatory essential conditions of a contract for the carriage of goods by road; guarantees the legal security of the contract; provides precise recommendations on which conditions need to be added to the contract; reduces the time for legal completion of the contract, allowing the logistician to quickly eliminate shortcomings without involving a lawyer, ensuring the prompt execution of the transportation; provides a rule base based on legal knowledge that ensures the completeness and unambiguousness of the contract verification; prevents financial and legal risks associated with incorrect execution of contractual relations, ensuring the performance of transportation only if 100% compliance with legal requirements; converts legal requirements for the essential terms of the contract into an unambiguous decision on the possibility/impossibility of transportation, while providing specific instructions to achieve legal compliance.

The logistician, using the developed method for supporting decision-making regarding the possibility of transporting goods by road based on civil law grounds, receives a conclusion on the possibility/impossibility of transporting cargo by road from the point of view of the current legislation of Ukraine, and in the event of receiving a conclusion on the impossibility of transporting cargo, the logistician receives an accurate list of mandatory essential conditions that should be immediately added to the contract to ensure its legal force and the possibility of transportation, eliminating the risk of the contract being declared invalid.

Further research by the authors will be aimed at designing and developing all modules of a single DSS that would automatically select a reliable carrier, create a legally flawless contract, generate the necessary transport documents, and model responsibility in the event of an event, as well as provide the cost of a probable loss in court due to incorrectly executed documents.

## Declaration on Generative AI

During the preparation of this work, the authors used Grammarly in order to: grammar and spelling check; DeepL Translate in order to: some phrases translation into English. After using these tools/services, the authors reviewed and edited the content as needed and take full responsibility for the publication’s content.

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