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BASIC EXAMINATION OF ELECTRONIC DATA INTERCHANGE IN ROAD, RAIL AND COMBINED TRANSPORT OF GOODS

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Abstract

As the usage of computers expands in commercial activities, it is a necessary issue to reduce the usage of papers and documents. That is why I focus in my research to find the way turning paper documents into electronic documents in freight transport. I examine road, rail and combined transport.

The first step is to map the main activities and the paper documents used for managing the processes. I compare the three transport modes, I determine the similarities and the differences. There are some paper documents which more or less contain all the information needed for all of the three processes. These are the commission, the consignment note, the customs declaration and the commercial bill.

The Electronic Data Interchange (EDI) proves to be the best solution for realisation. It has an international standard, called EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport).

Keywords: electronic data interchange, EDI, EDIFACT, freight transport.

1. Information Flow and the Electronic Data Interchange (EDI)

In the transportation process the most important thing is that the related information must be available at the right place and in the right time. By the experience the introduction of EDI is adequate, where business partners change huge amounts of data. That kind of demand appears during the transportation. Furthermore the features of activity of carriage transport affect the EDI application. These characteristics are the following:

- activity of transport covers a large size area;
- the goods are complex, a unit of goods contains different types of articles;
- the route is also complex and in the process there are a lot of partners;
- the most important and frequent criterion is the speed of movement of goods;
- the new production and distribution methods (for example JIT – Just In Time) need exact carriage and delivery time to consignee;
- the increase of effectiveness can be realised by improving the quality elements of freight transport.

These features and the increasing demands of carriage transport require quick and exact passing of information.

Using EDI during the freight transport, the process and the documents related to the process must be examined and analysed.

2. The General Information Model of Freight Transport

During the production the transportation needs information (about the quantity, features and handling of goods, forwarding and destination). The movements of goods in the process can be planned in time and the sender and the recipient partners can be effectively served. That is why the commercial data interchanging system of transport companies must be extended to production and sale.

The movement of goods can be seen in *Fig. 1*. As the figure shows the first group of information: I_1 is generated during the production, and the most important part is the process of market research. The other group of information is connected with the forwarding of goods: I_2, the third one originates in the transportation: I_3, the fourth one at the delivery of goods: I_4, and the fifth considerable group appears when selling goods: I_5. The information groups, as the figure shows, accompany the goods through the whole process.

All these information groups are very significant to the shipping of goods. There is some information which can be found in all groups – I_1, I_2, I_3, I_4, I_5. This information is essential for transporting and delivering goods.

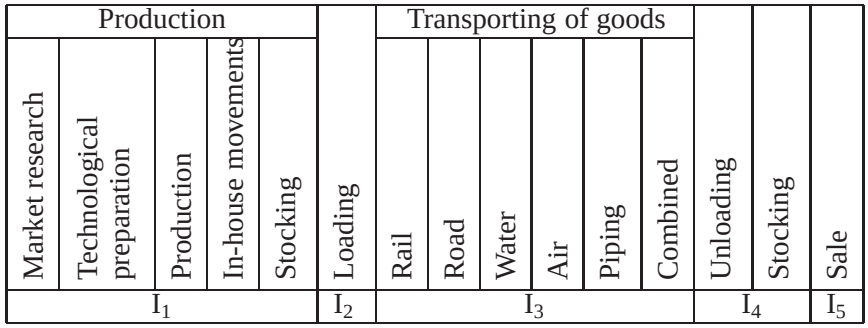

Fig. 1. Information connected to the movements of goods

The listed groups of information are the basis of commercial data interchange. These information groups I_1–I_5 must be integrated for the realisation. The number of redundant elements is considerable in these five information groups.

Integrated databases must be formed for the commercial electronic data interchange, which is satisfactory for the carriers, transport companies, customs and all partners in the process. The objective is that the data must be typed in the electronic

system only once and then transferred to match the technological process so that the flow of information is realised in a long distance data treatment.

The parts of information must be examined one by one according to the transportation modes which have just the same functional content at the critical points of freight transportation and accompany the goods from the production to the sale. These identical contents of information are the basis of the unified 'information bunches' which are satisfying the requirements of the database of the commercial electronic data interchange system. The logical review of transporting technological system of each transporting mode is essential for definition of quality parameters and regularity for itemised determination of transporting data elements.

It is important because the information system and its elements, which control and serve the processes, are correctly understandable only from the process side, for example:

- the feature of information, the time of transfer,
- the content of information,
- the place and function in the information system,
- the quantity of information, etc.

In general minimum twenty partners have to prepare transfer, receive, check, produce, transfer again and store hundreds of information elements during the freight transport.

All these kinds of activities are carried out in different forms and structures, according to different administrative formulas, in considerably different commercial and legal environment.

By a UN survey during an export-import transaction 40–50 different documents are used with more than 360 copies. On these documents there are 200 pieces of information which are often copied and refilled. Copying and refilling are very often the sources of clerical errors. Correcting mistakes needs much time and lots of money.

The partial computerisation does not give an optimal solution from the point of view of the total process, because the registered information must be printed and sent to the users. In this case the problems of forwarding paper documents must be solved.

The partial computerisation helps in creation of documents, but it does not decrease the number of papers. If the destination partner also uses computers, then he must re-encode the received information from the paper to the language of his system.

The first step of analysing information flow is to study the process. The next chapter shows the model of the road, rail and combined freight transport with the related documents.

3. The Main Aspects of the Model of Freight Transport

The international freight transport depending on number of partners, on transport modes and vehicles, on the goods, on the organisation and managing the transport can be divaricate. During the examination of participating partners we can find specific features, which are not the general characteristics of the freight transport. That is why a model has been developed to show the activities and information flow. One of the basic criteria of creation of the model is to display the activities, processes, documents and information, which are typical of the general freight transport.

We have to examine very carefully whether the required data of the process have to be included in the model and in this case, correct conclusions will be drawn concerning the information system.

Considering all of these thoughts the next limitations are valid for the examinations:

- The model does not cover:
  - hazardous goods, because during the freight transport the general documents can only be used if all the data included in the ADR agreement are contained in the documents;
  - goods accompanied by veterinary certificate or plant hygiene certificate (This type of goods can cross the Hungarian border, where the appropriate office operates. The office issues a special certificate on the result of the examination or they fill in the required boxes in the consignment note);
  - exceptional consignments (overweighted and oversized goods)
- I do not deal with the
  - vehicles carrying the previously written goods
  - special structured vehicles (for example: refrigerator vehicle, cattle vehicle etc.)
- Consignment is a kind of forwarded goods with one consignment note, or complex entirety of pieces of goods.
- During the freight transport process I examine the information flow between one sender and one recipient, because the number of information does not increase, only certain pieces of information can be repeated if more partners are in the process.
- I do not deal with groupage transport, only the carloads transport. This process is complex, the connecting activities are divericate, that is why I do not analyse this process, but I will examine the data which are essential for informatics, and they are not found in other transport modes. Only one consignment note is filled for one vehicle, as name of the goods groupage freight is indicated. In this case a list of load is necessary, which contains the list of goods loaded into the vehicle with their most important data.
- I do not deal with part load goods and express parcels.

- During the process there is no new information if more forwarding agents, carriers or banks are involved in the chain of activities. The existing data are transmitted among forwarding agents, carriers and banks.
- The general contracts made by using the information of one-time contracts of carriage add information concerning the volume of the connection and on the permanence. I examine only the one-time contract of carriage in the model.
- I do not analyse the information technological aspects of extra occurrences (for example: earthquake).
- I do not deal with cancelling of freight transport or the problems of delaying.
- I do not touch the storing.

The creation of the model is based on international freight transport, because the national process considering the information flow is a subset. The similar reason leads to examination of the detailed process of forwarding business instead of the process of carriage. Namely, a carrier very rarely gets a transport task without a forwarding agent (a forwarding agent is always needed for organising carriage back to the starting point). The model does not include the special activities of forwarding agent such as

- groupage transport described previously,
- re-export business transaction, where the forwarding agent increases the safety of the process and makes the necessary neutralisation. Re-export means in international freight transport that the goods are sold for a buyer from a third country, thus it is a combination of an export and an import;
- Fair and exhibition activities, which have peculiarities that the goods will be returned to the country of origin, so the activity is an export and an import process supplemented by storing and moving of the goods at the exhibition or market;

According to the model the partners are:

- sender,
- recipient,
- forwarding agent (at the combined transport operator) – in the rail process it is not definitely on the scene,
- carrier (in the case of rail freight transport the domestic and foreign rail companies),
- customs office,
- bank.

The customs authority means the customs offices of the countries during the routes. The movements of the goods happen by the TIR agreement. The official customs document is Customs Declaration. The goods do not need any special handling during the transport. The sender makes the transport carry out, thus he gives commission to the forwarding agent or to the operator or to the rail company. For the information flow it means simplicity, if the sender is the consigner and cost

bearer at the same time in the model. The occurring costs are paid by the consigner during whole transport.

During the combined transport the operator connects the sender and the rail company. He has a contract with the rail company and makes an agreement on the selected destination train and the free capacity of these trains are sold to the senders (forwarding agents). The destination trains have their own timetables. Beyond this he can make an extra contract with the railway company for a particular relation. Then in the case of consigner needs, the goods will be carried on a fixed route and price, and during movement also shunting exercises appear. The operator can be a forwarding agent at the same time whose exercise is the organisation of combined transport. The agents of operator can work at the border stations and the multimodal terminals. The task of the agents is the control and taking care of the actual physical process, and the selling of transport capacity. Furthermore I regard the agent and operator as one participant.

I suppose export freight transport, because in the case of import process the same information must be given to the participant of the process as in the export, only customs rules vary. Instead the listed simplicities are valid.

4. The Activities of Freight Transport

The process of the model can be divided into the same six phases at the three examined transport modes:

I. Preparations of the partners for the activities of freight transport.
II. Preparation of the necessary contracts for the freight transport and signing.
III. Preparation of freight transport immediately before the movements of goods.
IV. The activities connected to the movement of goods.
V. Activities immediately after the movement of goods.
VI. Invoicing and payment.

Some differences in the process phases are shown in *Table 1*.

Table 1. The activities of freight transport

Phase	Road transport	Rail transport	Combined transport
I.	The carrier obtains the permissions needed for the transport.	The railway companies inform each other about the limits of freight transport.	
	Signing insurance contracts (on vehicle, on goods). They generally have periodical payment (quarter of a year, half a year).		The operator signs contracts on destination trains and on the trains without road vehicle drivers with railway company and other contracts with terminals.
	The carrier obtains the TIR Carnet. Generally more than one at the same time, but only one is used for one transport.		

Phase	Road transport	Rail transport	Combined transport
II.	The sender and the recipient conclude the sale contract.		
	The sender obtains the certificate of the origin of the goods, if it is requested by the recipient.		
	The sender seeks for a forwarding agent (requests an offer, bargains by phone or fax).	The sender or the forwarding agent put in charge of the sender requests an offer from the railway company (by phone or fax).	The sender or the forwarding agent put in charge of the sender requests an offer from the operator (by phone or fax).
		The railway company sends its offer.	The operator sends his offer. In order to reply in a short time, every year he elaborates the tariff for the whole year based on the agreement on tariffs.
	The sender pays charges to the selected forwarding agent.	The sender can give a preliminary transport commission.	The sender gives a transport commission.
		Confirming the preliminary transport commission (if any), or ordering the transport. The sender can request recorded transit of wagons.	The sender can request recorded transit of wagons from the operator and the operator from the railway company.
	The forwarding agent acknowledges.	The railway company acknowledges the confirmation or order (transport contract has been reached).	The operator acknowledges the order (transport contract has been reached).
	The forwarding agent seeks for a carrier (requests an offer, bargains by phone or fax).		
	The forwarding agent pays charges to the selected carrier.		
	The carrier acknowledges.		
	The sender or the forwarding agent signs an insurance contract for the goods. (Generally the forwarding agent has a third-party insurance).		
III.		The railway company informs the sender that the empty vehicles can be loaded. (by phone or fax).	The railway company informs the operator that the empty vehicles can be loaded. (by phone or fax). It does not happen if the trains run by timetables.
			The registered booking is sent to the terminals by the operator by fax.
		The empty vehicles are placed out for loading.	The empty vehicles or trains are placed out for loading, or prepared for loading. The operator sends the needed documents to the terminals, because filling the documents happens on terminals.
			The trucks's registration at the terminals, the arrival books are filled. The drivers give the road transport documents to the staff of the terminal to fill the rail transport documents (CMR, TIR-Carnet …)

Phase	Road transport	Rail transport	Combined transport
	The goods are loaded into the vehicle. The carrier receives the goods. The carrier has signed the stay certificate.	Loading the wagons.	Loading the road transport devices onto wagons.
	Customs clearing during the goods loading, but it can be during the movement of goods or at the border. The customs officer identifies the goods, checks the certificate about the origin of the goods, the sender fills the customs declaration.		
	The carrier receives the needed documents for transport (consignment note, customs declaration, commercial bill, and certificate about the origin of the goods, bill of lading).	The railway company receives the needed documents for transport (consignment note, customs declaration, commercial bill, and certificate about the origin of the goods).	The railway company receives the needed documents for transport (consignment note, customs declaration, commercial bill, and certificate about the origin of the goods, bill of lading and ticket for the train).
		Measuring the weight and counting the number of the goods.	The sender declares the weight and the number of the goods. The railway company does not measure road vehicles or containers.
		Locking the wagons (commercial acceptance).	Locking the devices which contain the goods (container, road vehicle) (commercial acceptance).
			The terminal sends the bill of lading and the list of the drivers to the operator.
		Determining the transport charges	
		The sender discharges the bill in cash trade.	
		Shunting of the wagons.	Shunting of the wagons if it is in a train without timetable.
IV.	Movement of the goods.		
	The carrier informs the forwarding agent and – through the forwarding agent – the sender (mostly by phone).	The railway company informs the sender if it is a recorded transit of wagons.	The railway company informs the operator, the operator informs the sender if it is a recorded transit of wagons.
	Customs clearing in interim countries (examination of locking of the vehicles and stamp the TIR-Carnet and one copy of the document remains in the customs office.	Customs clearing in interim countries.	
		During the movement the additional charges are entered in the consignment note.	
		The railway company informs the recipient about the probable arrival of the goods.	The railway company informs the operator, the operator informs the recipient about the probable arrival of the goods, or the timetable is authoritative.
	The carrier informs the recipient about the arrival of the goods.	The railway company sends the delivery note to the recipient about the arrival of the goods.	The operator sends the delivery note to the recipient about the arrival of the goods (in case of trains without timetable). The recipient informs the customs office.

Phase	Road transport	Rail transport	Combined transport
	Customs clearing in the destination country on the basis of the consignment note, TIR-Carnet, customs declaration, commercial bill and the certificate about the origin of the goods. Stamping the TIR-Carnet. The recipient receives the resolution of the customs.	Customs clearing in the destination country on the basis of the consignment note, customs declaration, commercial bill and the certificate about the origin of the goods.	
		The loaded vehicles are placed out for unloading.	The loaded vehicles or trains are placed out for unloading in terminals.
	The recipient informs the sender and the carrier informs the forwarding agent about goods arriving.	The recipient informs the sender about goods arriving.	
V.		Fare calculation and control in cash trade, paying the costs.	
	The recipient unloads or has the vehicle unloaded.	Unloading stocks.	Unloading containers and road vehicles from wagons.
		Measuring the weight and counting the number of goods.	
	The carrier organises (possibly asking a forwarding agent) a carriage back to the point of origin.	Turning back the unloaded stocks.	
VI.	The carrier makes out the bill for the forwarding agent, the rider of it is the consignment note. The forwarding agent also sends the bill with consignment note to the sender.	Fare calculation and control in the course of centralised accountancy (made by railway company). Making out the bill.	
	The recipient pays to the sender; The recipient pays the customs; The sender pays to the forwarding agent; The forwarding agent pays to the carrier.	Making out the bill in the course of the centralised accountancy.	The operator makes out the bill for the sender.
		Payment at centralised accountancy.	
	Sending back the TIR Carnet to the issuing authority.		Accounting the costs and profits among the combined transport companies.

5. Paper Documents

The paper documents with their information are closely connected to the process.

The goods generally cover a very long distance from the sender to the recipient during the freight transport. Meanwhile the partners fill in numerous documents and send them to each other. Thus the activities of the freight transport are spatially expanded and suppose many participants. That is why information processes, which are connected to the activities, establish the information relationship among the partners who are far away from each other.

Generally, the paper based documents carry the information among partners nowadays. Naturally, in many cases the telephone, the fax or some other electronic ways are used for the data interchange.

The documents used for the freight transport can be divided into three groups by the relevant regulations:

1. Documents regulated by international agreements (for example consignment note, TIR certificate).
2. Indispensable documents used for international freight transport not regulated by international agreements (for example commercial bill, bill of lading).
3. Various documents in different countries with their own features depending on the practice without any regulations about their information content (for example requesting offer, commission, acknowledgement).

One part of the paper documents is used only in a short period of the process, the other part accompanies the goods through the whole movement. The latter one contains useful information for more participants and is filled in different places by the partners.

It can be seen that the individual documents are connected to different activities. The functions of a document lie in chain of activities which are connected to the document and caused by the document, as well as in the rights and obligations of the owner of the documents.

Revision of the functions of the documents results in an important practical issue, re-engineering the business and information processes (BPR-Business Process Re-engineering).

Based on the functions of the documents the commission, the consignment note, the Customs Declaration and the commercial bill can be picked out from all of the documents of the freight transport, because they determine the activities of the transport, and their data carry the most important information. These aspects are very important when the question is asked: Which paper documents can be turned into an electronic message.

The commission is an agreement between the partners, which regulates the co-operation. The sender concludes a contract with the forwarding agent, the forwarding agent makes a contract with the carrier. These contracts contain all the information, which are necessary for transporting goods (for example the type, the weight of the goods, transit period). There are no regulated forms of these contracts, data on them are specified by the order. The data of the most other documents are based on these contracts.

The consignment note has a standard form in each transport mode. Thanks to the international regulations the structure and the places of the data boxes are uniform, irrespective of the transport mode. At this point we must refer to the international ambitions for standardisation of the structure of the documents used for international freight transport. This means that the same data can be found on the same position of the documents and, if it is possible, in a unified form (for example codes). The consignment note is the basic document of the freight transport, it

is moving with the goods. It is a multicopied document, every copy has its own function (for example one is for billing, the other is for customs). The main function of the consignment note is that all of the participants can read out the information which gives instructions for them to send the goods to the recipient. In addition, the participants can enter the data, comments which are permitted by the international agreement.

The customs declaration is used for international freight transport. Irrespective of transport modes it has a standard form. The document has 8 copies, and different numbers of copies are needed to the different customs clearing procedures depending on the direction of the movement (export, import, transit, storing).

During the export process the customs office at the point of origin, the customs office at the point of destination and the participant requesting the customs clearance receive one copy. During the import process the customs office making the customs clearance, the participant requesting the customs clearance and the participant paying the customs fees (the last two can be the same person or organisation) receive one copy. During the transit process the two customs offices (in and out) and the participant requesting customs clearance receive a copy, and one copy as a certificate is sent by the customs office of exit to the customs office of entry.

The bills are needed for the moving of money. The cost bearer must pay the value of the services. There are no regulations about the structure of the bills used in international, national processes. However, the information used in a bill are regulated in the national process. The tax offices accept many types of bills.

For developing data interchange in freight transport the written documents must be analysed.

6. Conclusions

There are only few common activities of the different transport modes. After analysing the selected paper documents there is an opportunity to give recommendations for using EDI irrespective of transport modes. Therefore connecting transport modes would be simpler. The data can flow in a structured way from one participant to another. It would be a common communication language in freight transport.

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