Budapest University of Technology and Economics
Faculty of Transportation Engineering

By
János Toth Dr. Univ.
transportation engineer

OBSERVING THE PROCESS OF OVERLAND TRANSPORT OF GOODS WITH APPLICATION OF ELECTRONIC DATA INTERCHANGE

Overview of PhD Thesis

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I.   The task and precedents of research work

The role of informatics in transport processes has been experienced for many years. The development of transport modes a is different, slowly usage of new technical achievements are characteristics of carriage transport. At present this area grows the most intensive.

The development of economics and telematics reaches the level from wherever quality changes have to be done in informatics applications. The new ways in addition to connect the computers mean building the connection of the softwares. In this respect the leading effort is to realise electronic data interchange. The most important characteristic of this method is data sending in structured way between the softwares of participant's computers. In practise the goal is to minimise the human activities, the communication of softwares provides the successfully arrangements of the process.

The process of carriage transport covers huge area, it is based on many paperdocuments and many participants are involved. This characteristics generate the possibility (the market generates the necessity) to realise the electronic data interchange.

The general features of the electronic data interchange are occurred in international publications. The Hungarian translation can be found on the Internet and some of them in print. The lectures of conferences are very useful for domestic users. I wrote an electronic textbook to fill the gap between the national and international publications. [13] I present the features of electronic data interchange and the connecting EDIFACT standard, I make a model for the transport of goods, I show the function of key paperdocuments. I describe the techniques of analysing an information system.

In the scope of the strategic program of the Hungarian Academy of Science I wrote a study about infrastructure respects of electronic data interchange [10]. In this material I explore the different networks and telecommunication services, and the connection between the EDI and the network.

I worked out educational and training concept for all educational levels. [3]

I analysed the possibility to apply electronic data interchange in the different fields of transportation. [1] [7] [8] [9] [11] [12] Based on the experiences of these studies I wrote my dissertation. I examined the respects of electronic data interchange in carriage transport, public transport and passenger information system.

I examine the information systems of carriage transport in my studies for Institute of Transport Science. (Road – [4], Railway – [5], Combined transport – [6]). I summarise the results of the studies in my dissertation. We wrote a handbook for road transport with co-authors. [2] The most important results of my research I published in foreign language. [14]

Crowlay, R. T. [20] compiled his work for educational goal. The book clarifies the conceptual sphere of electronic data interchange, gives an instruction for the application of EDI, and analyses the potential usage areas. As the title shows from A to Z we can get answers about the most frequently asked questions in the book of Jilovec, N. [46] The necessity of the application of electronic data interchange is

described in the book. Phyllis K., Sokol [66] shows the formation and possible development of electronic data interchange, in the future marks the society applying electronic commerce. The publication of EFTA – European Free Trade Association [22] is written for beginners about the formation of EDI, about systems of terms of network and software. Message handling systems connecting to the electronic data interchange are shown in the Internet study of Chia, D. It describes the types of message handling systems, and marks those solutions which support the electronic data interchange.

On the web-site of United Nations can be found the general information about EDI and the detailed description of the standards. [72] [73] [85]

There are general information materials on the web-site ITB – Inter-departmental Committee of Informatics in Hungarian language. [40] [41] [42] [44] Already non-existing organisation HUNPRO edited informational booklet based on English publications. [34] [37] The ITB's report surveys the situation of electronic data interchange in European Union. [45] The possible data transfer solutions connected to the electronic data interchange are examined in HUNPRO informational booklet [35], proposals are put forward for the best solutions. The results of an international survey are shown in the publication of HUNPRO [36], it is about the effects of electronic data interchange to the transport. This material does not contain any analyses, it shows the advantages and disadvantages through figures.

The relationship between electronic data interchange and the domestic telecommunication services is surveyed in a study by Mazgon, S. [60] It is stated, that more services are complied with requirements of electronic data interchange and it is drawn up as a suggestions.

The secure problems of electronic data interchange are extremely important. These questions can be found in the studies of ITB [39] and Prime Minister's Office Informatics Co-ordination Bureau [61]. Both of them analyse those conditions which realisation – in data protection respect – the electronic communication is safe. Separately examined the data interchange on the Internet, it had poor safety characteristic during the study preparation. The law about the digital signature is already sprung up (2001. year XXXV. law.), it is a good base for the future.

The most comprehensive description about the electronic data interchange is in the Hungarian study written by The Institute of Transport Science – KTI Rt. [56] The material mainly contains the translation of international publications. Another study of KTI Rt. analyses the effect of electronic data interchange to the companies. [57]

Some informative lectures were on a conference in Hungary about the practical applications of electronic data interchange. [24] [26] [27] [28] [29] [31] [32] [33] [47] [48] [51] [52] [53] [55] [58] [63] [64] [65] [67] [69] [70] [87] The ITB examined the possible governmental solutions and put forward proposals for the different application areas. [38] The Hungarian State Railway (MÁV Rt.) has an educational material made about the electronic data interchange in the railway transport. [50] It compares the existing international railway computer systems and the electronic data interchange.

In Hungary many companies deal with installation of electronic data interchange systems. About the features of its product and service have been accesses on the Internet. [15] [59]

The different books on system planning do not give a detailed instruction about the situation analyses, the main parts of these books are the system concept and system planning. This is also true for book of Arató, I. – Schwarczenberger, I., which describes the most frequently used methods of system planning. The authors fill a gap in the Hungarian specialist bibliography in connection of systematising the well-known methods.

In the sense of the decision of Prime Minister's Office Informatics Co-ordination Bureau the SSADM – Structured Systems Analysis and Design Method – is the suggested methodology from the existing structured system-planning procedures. Bana, I. wrote a textbook about the SSADM. [17] This book is based on system organisation knowledge. In the first chapter it deals with methodology bases, the second chapter shows the structure of SSADM, and the third chapter gives an overall about the techniques of SSADM.

Kovács, J. – Hartványi, T. highschool textbook [54] describes complex methodology of system developing. The goal is to show the most frequently used methods.

The textbooks of Westsik, Gy. rise from the publications of system planning. [88] [92] The techniques and methods of system analysing and the steps of creation system concept and the plan of a system are shown very detailed in these books. Transport systems can be found in these books as examples, which were useful for my research.

I got help concerning the application of data electronic interchange in railway freight transport from the book of Kisbakonyi, J. – Kovács, J.

A brief account is in the publication of EFTA about the basic process of freight transport. [23] The textbooks of Westsik, Gy. illustrate informatics background of freight transport, non-detailed the examination of the procedures and the documents. [88] [89] [90] [91]

During the modelling of the processes the study of Streng, R. A. G. J. [68] was very useful. It shows the dynamic modelling illustrating of the values of electronic data interchange.

The publication connecting EDI standards is in English, only some elements of the standard can read in Hungarian. The specialist literature connecting to the fourth chapter of the dissertation is on the Internet (on the web-site of UN – www.unece.org). [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] The structure and the description of the standard elements of the messages are in the bibliography [78] [79] [80] [81] [82] [83] and [84]. The EDIFACT standard and the connecting rules are in the materials of UN. [72] [73] The syntactic rules are in the UN Internet standard descriptions [75] and [76]. The message design guidelines on the Internet was very useful to put forward a proposal connecting to the processes of freight transport. [77]

A general and short introduction of EDIFACT standard can be read in the books of Busby, M. – Stultz, R. A. [18], Crowlay, R. T. [20], Hendry, M. [30], Jilovec, N. [46] and Phyllis K. Sokol [66].

A booklet of EFTA [22] and a book of The National Computing Centre [71] are published to guide EDI and EDIFACT implementation. Both of them widely help to initiate into electronic data interchange and to change into a new informatics system. The handbook gives a detailed description about all of the steps, choosing the messages, and the rules of the message design.

The studies of Inter-departmental Committee can be picked out from the Hungarian publications because of their contents and sizes, although they can be found only in the Internet. [39] [40] [41] [42] [43] The latest is about the standard UN-EDIFACT. The HUNPRO [34] [37] and the KTI Rt. [56] made guiding materials about the standard. The Hungarian standard MSZ ISO 9735 contains syntactic rules of electronic data interchange of administration, commercial and transportation. [62]

A lecture was on a conference about the experiences of practical feasibility. [21]

The goal of my dissertation is to examine the processes of overland freight transport with the connecting information system and put forward a proposal the application of electronic data interchange. The subjects of my research are the road, railway and combined freight transport. There are no any detailed Hungarian or international publications on describing processes in terms of information techniques. This is the reason that the written and graphical part of my dissertation illustrates my research work. During the analyses of information techniques I discuss the feasibility of electronic data interchange. The analyse of paperdocuments and the information in the model are inevitable.

My goal is not to show the electronic data interchange connections of a particular freight transport company, but to put forward a general proposal on the conclusions based on the analyses. Therefore the core of my research is the examination the practicability the substitution of paperdocuments for electronic interchange messages. Thus the BPR – Business Process Reengineering (from the system planning procedures) is not part of my dissertation.

Systemic approach independently of the transport modes, the integrated examination of the freight transport are important in my opinion. Developing a complex system can not be realised in one step, more modules must be assured. Therefore in the first module the freight transport system must have been able to communicate using electronic data interchange, after that step by step has to change the paperdocuments into electronic data interchange messages.

Sending information by electronic data interchange is not typical in our country. Paperdocuments have the role to carry the information. Contemporaneously the features of the process show the possibility of the application of electronic data interchange. My research covers the analyses the overland freight transport and the connecting information flow. I examined the common features of the information handling of different freight transport modes. The conclusion is the possibility of the integration of information systems. I put forward a proposal for all three transport modes based on the examination.

II.   The method and the result of research

During the examination of the activities of road, rail and combined freight transport I applied the traditional methods of the system analyses (Chapter 2). I worked out a new analysing method for information content of paperdocuments in case of information flow. The goal is to make easier the change into electronic data interchange. The meaning all the data on the paperdocument and the connecting background information can be read out with the help of the table.

A model of freight transport was worked out to compare certain freight transport modes (chapter 3). The main point of the model is that the real process is simplified without losing any relevant information. The data ordered by laws and the data supported the activities are involved in the model.

The table in chapter 3.4 compares the activities connecting to the certain freight transport modes. There are very few numbers of elements of the process, which are the same in the three overland freight transport. The main similarities can be found comparing the rail and combined transport modes, because they have the same the primary freight transport vehicle. Without analysing the billing process and the payment only the order/commission can be considered similar in the 2nd phase of the process. The time co-ordinated flow diagrams of the activities are on figure 13. (road), figure 14. (rail) and figure 15 (combined transport).

I examined the paperdocuments connecting to the activities from the point of view of getting to know information flow. (The documents co-ordinated flow diagrams can be found in appendixes IV.-VI.) In this case I also compared the three freight transport modes. Some documents act similar functions and contents in the case of all three freight transport methods, but at the same time analysing data, these papers proved to be very significant certificate of processes. The commission, the consignment note, the Customs Declaration and the commercial bill can be picked our 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 of the freight transport activities. The last two considerations are particularly important when the question rises which paperdocuments must be changed into electronic message. The tables in appendixes VII.-XI. show the analyses of the information contents.

After analysing the information system I systematised the standards connecting to the electronic data interchange in chapter 4. My textbook – legible on the Internet - "Electronic data interchange in transport", was used for this part of the research. I made a particular and detailed illustration of EDIFACT building bricks including building bricks design. Without this knowledge proposal the part of the dissertation (chapter 5) could not be worked out. I made the 40 points rule of building bricks and the messages which are based on the message design guidelines.

Based on the rules two methods can be drafted for changing paperdocuments over electronic message.

- An existing electronic message or some parts of it are used (in this case a subset is worked out).

- Designing a totally new message, co-operating with different bodies of standardisation.

I applied the first solution, because there are existing standardised electronic messages adequate to the paperdocuments. I named the electronic messages suitable for the function and data contents of key documents in chapter 5. There are existing messages for consignment note, Customs Declaration and the commercial bill with same function (IFTMCS, CUSDEC, INVOIC), only the practical usage must be realised. In case of commission I developed a subset of the message IFTMIN, because on the basis of the connection of the electronic message and the paperdocument I had to restrict the set of data. (Table 19.)

An illustration of a new message or subset – based on the message design guidelines – needs 4 steps. I used it for the subset of commission. I illustrate the hierarchical structure of the subset with branching diagram (Figure 18.). The segment table names the segments of the subset (Table 20.) In addition to the name of the segments the segment summary describes the function of the segment. I summarised the segment layouts in appendix XIII. These all together illustrate the structure, function and data contents of the subset for users. This subset is a proposal, the possible usage depends on the partners involved in the communication, which is drafted in data interchange contract.

As final conclusion it can be stated, that EDI and the connecting standard (EDIFACT) provide a possibility for the partners of freight transport to send structured electronic messages. The order/commission paperdocuments are used by all of three examined freight transport modes and the data contents are the same. For this reason it seems to be expedient to create a uniform electronic message. (chapter 5.3)

On the other hand it contains that kind of information, which units can be used for other electronic documents (consignment note, Customs Declaration etc.) moving the adequate segments. It points forward to the electronic information handling covering the total process.

Appearing the uniform electronic documents in the distributing and collecting centres result effective changes. The data interchange between the different freight transport modes becomes fast and exact execution. Handling of the information is in uniform and integrated way.

III. New scientific achievements, thesis

1. **I worked out a new method of analysing information contents of a paperdocument.**

   I examined the traditional procedures of the situation analyses. I pointed out the lack of the relation methodology between paperdocuments and electronic information. I worked out a new method for dynamic structure of changing over paperdocuments into electronic messages. It helps to change the informatics system. The table form contains all features, which helps to choose the necessary standardised data elements and segments. Developing the computer network

connection and pointing the route of electronic messages are supported by the filling part of the table. (chapter 2.2.1)

2. I worked out a general freight transport model to compare certain transport modes and to provide uniform proposals for electronic data interchange.

I built up a general model for examination of road, rail and combined (road-rail) freight transport and the connecting 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, and let the possibility handle the information of special activities. I pointed the participant of the process, and I determined the goods, the types of vehicles and the activities constituting the basis of the model. Hereby I created the possibility to compare the certain transport modes, and to put forward proposals – based on the similar processes of information flow – for working out the application of electronic data interchange. (chapter 3.3)

- **I determined those activities, which are the same in all three transport mode.**

  I drew time co-ordinated flow diagrams and comparing tables. Based on the diagrams and tables I determined – using set theory notation – those series of activities, which can be the core of the proposals for electronic data interchange. (chapter 3.4)

- **I determined the function of freight transport paperdocuments. I pointed those documents which have the same function and in information contents respect those data which are essential during the freight transport processes.**

  I made time co-ordinated flow diagrams and comparing tables. The chosen documents in uniform and electronic form are able to have the same role than the equivalent paperdocuments. (chapter 3.5)

3. I analysed the information contents of the key documents of freight transport process, the results are in table form in appendixes.

The examination method – worked out by me – wee used for analysing the key documents. I surveyed all the information unit in the paperdocuments in the content and filling instruction respect. I determined the groups of data and based on the information contents I pointed out the determinant role of paperdocument commission. Hereby I established the proposals, as the standard elements of electronic data interchange and the information units have made possible to relate. (chapter 3.5.4, 3.5.5)

4. I systematised the standards connecting to the electronic data interchange (UN EDIFACT) with special regard to message design guidelines, on the basis of this I compiled the rules of designing electronic messages.

I presented the structure of the standard and the features of building bricks (the element of the hierarchy of messages) because of the lack of Hungarian literature. During the interpretation of UN standard I drafted the most important rules of message design, which were used for putting forward proposals.

5. **I put forward a proposal for the electronic documents of freight transport.**

Standardised electronic messages were named suitable for the function and data contents of key documents. Concerning the paperdocument order/commission I created a concrete subset, which can be used uniformly at the transport modes. I tried to find the analogy between the information units of paperdocuments and standardised elements of electronic data interchange. I described the subset as detailed as it is required by the message design guidelines and it is suitable for practical usage.

IV. The author's technical literature connecting to the dissertation

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