Summary

Recent developments in production of high-valued goods and mounting competition between manufacturing companies have increased pressure to improve delivery performance in a more efficient (just-in-time) environment. As a result, the need for railways to restructure their technological and management practices to respond to market demand for highly reliable and flexible freight transportation services, is urgent. During the last decade, the technological resolution in the telecommunications sector, quickly moved into the transportation sector, by allowing new forms of external contacts with suppliers and customers. Thus, Electronic Data Interchange, EDI, is today a powerful tool for communication between trading partners performing a variety of functions not only in terms of contributing to the efficiency of just-in-time production management but also in tracking and security. EDI allowed carriers to differentiate themselves from competition by offering such services as electronic freight tracking. This paper looks at a particular application of EDI to railway freight logistics to examine the institutional context in which it operates and to explore its current strengths and weaknesses as they relate to economic modeling.

Keywords
Railway Freight Logistics, Just-in-time Production Management, Electronic Data Interchange (EDI), EDI implementation, EDIFACT.

Introduction

EDI is applied in a growing number of sectors - trade and industry, manufacturing, finance/banking, tourism/travel, all transport, Government - and its principles are often taught and discussed in academic institutions. EDI should not be seen as a single approach to information management but rather reflects a generic attitude to the use of modern computing technology for the control of inventories. It is generally defined as the direct computer-to-computer communication of business documents and information in a machine readable, structural format that permits data to be processing by the receiver. EDI is not a new concept or a new practice. It has existed for over two decades in Europe and North America in industrial sectors with products or services having a short shelf life but a high unit price. More recently the profile of EDI has been increasing. A number of factors, including drastically reduced costs of computing hardware, software and telecommunications combined with the lifting of trade barriers across Europe, mean that EDI is moving from an embryonic, innovative phase into a phase of exponential global growth. Another major factor is the increasing realization of the role of EDI as a business enabler in increasing competitive and dynamic markets.
Specific Benefits of EDI

The basic benefits of EDI are:

- **time savings**, by speeding up physical flows and data interchange. Producing contracts of carriage in the form of hard copy today is increasingly incompatible with the speed of forwarding demanded by the market, because of the cumbersome processing stages involved.

- **improvement of service quality**, since the information, once correctly captured, circulates unadulterated among all the parties concerned, they do not have to engage in further data capture operations that could be a source of error.

- **advantages in terms of reliability and availability**, since the circulation of information is not dependent on the physical movement of documents in which it is only the operator that happens to be in possession of a particular document that therefore has access to the information it contains. This reduces the time element in consumers’ generalized cost function and reduces inventory holdings.

- **improvement in productivity**, by doing away with manually compiled documents, successive data capture and time losses due to the absence of information at the requisite moment, and through the possibility of better stock management as a result of earlier access to information. This reduces the costs of providing transport services.

Communications network

The ways in which information systems are used in logistics can vary considerably. In freight transportation, cargo is unitized to permit more efficient handling in multimodal transport. In the United States – and soon in Europe – sales activities in railways are carried out more and more through terminals or forwarding agents, who will deal with the carriers on a large-scale basis. Thus these agents use multi-company electronic systems for ordering supplies in real time on the basis of market demand. In this study the interest is focused on the railway freight forwarder who by use of an informal network of motor carriers, railways and the package express companies - which can be referred as integrators - maintains a communications network, capable of tracking and facilitating the movement of freight throughout the system. This network acts to integrate the formal and informal networks within the forwarder’s system structure. The integrators which are fast paced and globally expanded, have been closely linked with information technology advances, included EDI, advanced cargo tracking and handling techniques, hub facilities for overnight package sorting, and computerized truck routing systems.

The productivity level of the forwarder depends upon its ability to synthesize information quickly within the informal operations of the network selecting and coordinating the modes of transportation according to the time-definite demands of the shipper, the distance the cargo is to be transported, the weight and dimensions of the shipment, the shippers’ pricing limitations, and, when necessary, the carriers’ cargo tracking capabilities. Figure 1 provides an indication of the complexities of such a communications network.
From the figure 1 we can see that a shipment moved by train within the informal transport network, with motor carrier and train selections made upon receipt of the shipper’s orders, operates as following [1]:

- shipper contacts forwarder (by telephone or fax) with job specifications
- forwarder contacts motor carrier (by telephone or fax) with job specifications and reserves rail cargo space (by telephone)
- forwarder receives confirmation of drop from the driver (by telephone or Internet) and boarding confirmation from the railway (by telephone or Internet)
- forwarder alerts driver of cargo pick-up time at railway and job specifications (by fax or telephone).
- forwarder receives Proof of Delivery (POD) from driver (by telephone, fax, or Internet) and contacts shipper with POD (by telephone, fax or Internet)

The cost of use of EDI systems to the forwarder is minimal. Only a computer is needed with a modem and an Internet connection. However the cost of delay of the adoption of new information technologies maybe great, with loss of business due to the lack of real-time freight tracking capabilities and loss of marketability of the forwarder’s services. As we can see from figure 2, the benefits of these new tracking technologies are significant for many agents in the overall freight movement of the logistics process [2]. These can cut costs and enhance the overall quality of service offered due to the significant elimination of errors, reduction of paper work and the better use of resources, including personnel, reduction in travel time for trucks and the ability to handle greater quantities of freight.
Figure 2 Benefits of EDI implementation
EDI Resources

For Electronic Data Interchange, it is necessary to have:

- **Standards.** Given that the purpose of EDI is to establish universal principles for data interchange, it is therefore necessary to standardize data and telecommunications protocols. EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport) in Europe and ANSI X/12 in the United States are international languages suitable for standardizing documents exchanged by firms in electronic form. EDIFACT has its own vocabulary, grammar, directives for standard message structures and for arranging data in segments and in messages. The application of EDIFACT in western Europe is supervised by the EDIFACT BOARD, the secretariat of which is provided by the Commission in Brussels and which is supported by the national simplification bodies: DEUPRO in Germany, SIMPROFRANCE in France, SITPRO in Great Britain, etc. The main instructions are contained in the UNTDED (United Nations Trade Data Elements Directory) in the form of ISO 7372, in which each data item is numbered, and ISO 9735 which gives the rules for EDIFACT syntax. This set of standards is maintained by the Working Party for the Facilitation of International Trade Procedures at the Economic Commission for Europe and the United States (UN-ECETRADE-WP4) in Geneva.

- **Computers and facilities for retrieving and structuring data.** Basically data is first grouped together in segments, which may be assimilated to phrases in order to express a simple and homogeneous idea. Segments are arranged chronologically and may be grouped together in sets or sub-sets organized according to inter-related levels, in order to meet an information requirement that corresponds to one part of the overall message function. To take account of this function and adapt facilities to it there are internal rules for the use of the “standard” message. Some of 120 standard messages exist today or are in the pipeline. They cover commercial relations (orders, invoices, advice of dispatch).

- **Transmission networks and protocols.** An EDI data transmission transaction consists of the stages: (a) an interface for retrieving the internal application and formatting the data required for the translator to produce the standard messages, (b) a translator for translating the data from the internal application into standard messages before sending them via communications module (c) a communications module managing transmission either over a Value Added Network (VAN) which sends a message to a mail box of the recipient on the basis of the latter’s “electronic address”, or via another type of network, the nature of which has to be agreed among the partners concerned, (d) the reserve process at the receiver end where the message elements are transmitted to the appropriate data bases in a form enabling them to be immediately exploited by the applications.

EDI implementation

1. **Guidelines for a successful and efficient EDI system.**

   EDI software for users must be developed and provided by EDI network operation companies, as has been done in Europe, so that a consistent and specialized system can be maintained, rather than independent, in-house systems with different objectives and operating parameters.
• Before starting, EDI managements should be aware of technical problems and organizational changes that go together with its implementation. Therefore the decision to full implementation of EDI requires that the pilot projects were successful both in operating and financial terms.

• EDI development should be associated with staff training and awareness courses because, as with the introduction of other advanced communication technologies, the development and use of EDI can suddenly accelerate and, in such a situation, it can deviate from the route it should follow, unless there is a well prepared and understood EDI objective and strategy.

• Design parameters for the system must take into account the requirements of all users, including customs, forwarders and cargo receivers and shippers.

• The sharing system of cargo data must be integrated into the framework of EDI, in order to enhance its benefits of cost saving and efficiency. The full benefits only accrue if EDI is viewed as an integral part of a complete system rather than just as a peripheral communication.

• To facilitate communication between trading partners and haulers, both national and international, it is essential to adopt a standard global message such as UN/EDIFACT.

• The government should play a crucial role in co-ordination and stimulation in the areas of data communication, standardization and legislation.

2. Barriers to EDI implementation and strategies to overcome them

Although there was strong agreement about the motives for EDI adoption, there are several barriers to implementation, the most important of these are [7], [8]:

• The lack of corporate interest. This is due partly to management’s lack of understanding of the real benefits of EDI, and consider it to be a computer tool and therefore, place it under the control of an operational MIS.

• Current system inefficiencies, lack of centralization, dual system maintenance, and fear of power and status loss by top management. Many large organizations have mainframe systems with terminals, but they do not have the efficient infrastructure necessary to communicate with their trading partners electronically. Implementing an EDI system may require changing the data processing systems within the firm or writing translations of software to make the firm’s and EDI systems compatible. This barrier can be costly and time-consuming.

• Labor force reduction. Although one basic benefit of EDI is to reduce cost through labor reduction, managers with large staff have power, status, and large operating budgets, so that labor force reductions drastically reduce managers’ corporate position and power.

From the above analysis we can conclude that the key strategies to overcoming implementation barriers are education and presentation of EDI benefits. It was suggested that when top management was made aware of the benefits to be derived from EDI, it tended to become more interested in EDI adoption and more supportive of its implementation. Fear that makes managements aware that if they don’t became innovative and adopt EDI, they will then have lost business, is also one of the basic strategies to
overcome implementation barriers. In some industries EDI is so widely used that by delaying implementation the firm could lose customers or its position in the marketplace. Use of these strategies often may allow managers to see EDI as a method of gaining or maintaining profitability and market share. Agents whose small company cannot afford the hardware or the change of attitude necessary to adapt to the new information technology are being ruined by the competition of EDI.

Many examples of resistance to change can be described from all developed and developing countries. However, it has been observed [6] that the intensity and rigidity of such resistance varies considerably, usually directly related to the degree of relative backwardness of the country concerned. Thus, EDIsation in developing countries might be achieved more rapidly than in advanced countries. This can be suggested, because, due to the low level of the technology of these countries, neither private entrepreneurial activities nor EDI networking are sufficient, so that the patterns of their EDIsation change according to the degree and the willingness of the government to become involved in modern technology. The state also contributes to removing institutional obstacles to EDIsation through strong policies or ideology, and organizing national resources in an efficient and effective way.

3. A model of EDI implementation

A model that attempts to systematize EDI adoption and its implementation process is presented in Figure 3. In this model the following successive stages are distinguished [7]:

![Figure 3 EDI adoption and implementation](image)
• **The awareness stage**, where firms became aware of EDI and its benefits to their organization, usually as a result of a search to find new alternatives to organizational problems. The research suggests that this awareness stage takes place in the purchasing and transportation departments with shipper organizations. Carrier organizations, however, typically initiate EDI in their accounting departments.

• **The adoption decision**, which involves some level of commitment to continue EDI, even if it means continued investigation or pilot testing. Adoption does not necessarily mean commitment to fully implement EDI; a firm can stop implementing EDI while maintaining initial commitment to the technology.

• **The planning stage**, during which the firm evaluates which department should implement EDI, the external partners that should be involved, and the internal system capabilities. In addition, the firm considers the cost involved, the training required, the process re-engineering that will result, and the time and commitment necessary for successful implementation.

• **The pilot stage**, where the firm implements EDI on a limited trial basis. During that time, the internal departments, external trading partners, and systems capabilities are tested. In the pilot stage, barriers can be extremely formidable because of the difficulty involved in implementation.

• **The full implementation stage**, where the firm is fully on-line with EDI and can benefit from supply chain management, improved customer responsiveness, and reduced inventory levels.

**Conclusions**

As this paper has illustrated, the transportation sector in order to maintain profitability and market share must be organized from an EDI standpoint into communities with specific standard messages to simplify data interchange. Due to the trend towards worldwide economic exchanges, these communities are gradually spreading across individual continents (Europe, North America, Asia, etc.). Given its heterogeneous nature the organization of the transport sector into an EDI Community is very difficult. Where internal data interchange in the railway sector is concerned, largely in respect of train movements, the railway community has produced technical message based on proprietary standards such as EDIFACT. Internationally, data interchanges among transport partners – consignee, consignor, railways, motor operators, customs, etc. - are based on the international consignment note. The consignment note is governed by the International Convention on Freight Transport (CIM) under the auspices of OCTI (Central Office for International Rail Transport) and the CIT (International Rail Transport Committee) with headquarters in Bern.

Thus, irrespective of the problems such as, the time-consuming, intrinsic complexity of the consignment note, by virtue of its wide international acceptance and its multifunctional nature, the railways now have a basis for gradual and pragmatic introduction of an EDI policy. Standard messages will form the backbone of the railway EDI community. This community consists of all those railways that wish to and are interested in developing EDI. Three main tasks to be fulfilled: to standardize, to promote standards, and to implement interchanges.

**References**


