INFORMATION AND COMMUNICATION TECHNOLOGY IN THE TRANSPORT & LOGISTICS INDUSTRY

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Abstract: This paper focuses on the adoption and implications of information and communication technology (ICT) and e-business activity in the transport and logistics services industry (TLS). The study shows how companies in this sector use ICT for managing their business processes, internally and in exchange with suppliers and customers. It identifies related opportunities and drivers as well as possible barriers for ICT adoption and digital integration and assesses the impact of ICT deployment on firms and on the industry as a whole. ICT can have a significant influence on the mobility of people and goods. ICT is also a potentially important enabler of change in social and organisational practices, thus affecting the demand for transport in spatial and temporal terms. Technological trends will meet the demand for comfort, safety and speed through advances in ICT in the field of telematics. This covers systems for traffic and transport management, travel information and reservations, vehicle guidance, and mobility cards. Over the last few years firms operating in the transport and logistics sector have made significant progress in their adoption of new technologies, particularly those linked to the internet and e-business.

Key words: transport industry, logistics industry, e-business, information technology, communication technology

1. INTRODUCTION

1.1. A definition of ICT

This scientific paper examines the use of information and communication technology in European businesses. ICT is an umbrella term that encompasses a wide array of systems, devices and services used for data processing (the information side of ICT) as well as telecommunications equipment and services for data transmission and communication (the communication side) [1]. The European Information Technology Observatory structures the ICT market into four segments with an estimated total market value of about € 670 billion in 2007 (Tabel 1.).

In its widest sense, 'e-business' refers to the application of these technologies in business processes, including primary functions (such as production, inbound and outbound logistics or sales), and support functions (such as administration, controlling, procurement and human resources management). Companies in all sectors use ICT, but they do so in different ways. This calls for a sectoral approach in studies of ICT usage and impact. The following section introduces a wider framework for the discussion of e-business developments that will be used in the following analysis of the chemical, rubber and plastics industry.

When the bust phase of the previous economic cycle - commonly referred to as the 'new economy' - started in 2001, the former internet hype was suddenly replaced by a widespread disappointment with e-business strategies. Companies adopted a more reserved and sceptical attitude towards investing in ICT. Nevertheless, ICT has proved to be the key
technology of the past decade, and the evolutionary development of e-business has certainly not come to an end. The maturity of ICT-based data exchanges between businesses and their suppliers and customers, fostered by progress in the definition and acceptance of standards, has substantially increased across sectors and regions over the past five years. In parallel, recent trends such as "Web 2.0" and social networking are widely discussed in terms of their business implications and it is widely recognised that 'e'-elements have become an essential component of modern business exchanges. In short, e-business has regained momentum as a topic for enterprise strategy both for large multinationals and SMEs.

<table>
<thead>
<tr>
<th>Market segment</th>
<th>Products / services included (examples)</th>
<th>Market value for EU (2007) (EITO estimate)</th>
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<tbody>
<tr>
<td>ICT equipment</td>
<td>Computer hardware, end-user communications equipment (such as mobile phones), office equipment (such as copiers) and data communications and network equipment (such as switching and routing equipment, cellular mobile infrastructure)</td>
<td>€159 billion</td>
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<tr>
<td>Software products</td>
<td>System and application software</td>
<td>€76 billion</td>
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<td>IT services</td>
<td>Consulting, implementation and operations management</td>
<td>€140 billion</td>
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<tr>
<td>Carrier services</td>
<td>Fixed voice telephone and data services, mobile telephone services, cable TV</td>
<td>€293 billion</td>
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"Measurement of e-business is of particular interest to policy makers because of the potential productivity impacts of ICT use on business functions. However, the ongoing challenges in this measurement field are significant and include problems associated with measuring a subject which is both complex and changing rapidly." [2]

Companies use ICT in their business processes mainly for three purposes: to reduce costs, to better serve the customer, and to support growth (e.g. by increasing their market reach). In essence, all e-business projects in companies explicitly or implicitly address one or several of these objectives. In almost every case, introducing e-business can be regarded as an ICT-enabled process innovation. Understanding one's business processes and having a clear vision of how they could be improved (be it to save costs or to improve service quality) are therefore critical requirements for firms to effectively use ICT.

The increasing competitive pressure on companies, many of which operate in a global economy, has been a strong driver for ICT adoption. Firms are constantly searching for opportunities to cut costs and ICT holds great promise in this respect as it increases the efficiency of a firm's business processes, both internally and between trading partners in the value chain. While cutting costs continues to motivate e-business activity, innovative firms have discovered and begun to exploit the potential of ICT for delivering against key business objectives. They have integrated ICT into their production processes and quality management and, most recently, in marketing and customer services. These last sectors are widely considered key to improve competitiveness in the current phase of development of European economies. Competing in mature markets requires not only optimised cost structures,
maximal efficiency, and products or services of excellent quality but also the ability to communicate effectively and cooperate with business partners and potential customers.

1.2. A definition of e-business

As part of this maturing process, electronic business has progressed from a specific to a very broad topic. A central element is certainly the use of ICT to accomplish business transactions, i.e. exchanges between a company and its suppliers or customers. These can be other companies (’B2B’ - business-to-business), consumers (’B2C’ - business-to-consumers), or governments (’B2G’ - business-to-government). In the broad sense, transactions include commercial as well as other exchanges such as sending tax return forms to the tax authorities.

If transactions are conducted electronically (’e-transactions’), they constitute e-commerce. Transactions can be broken down into different phases and related business processes, each of which can be relevant for e-commerce (Tabel 2.). The pre-sale (or pre-purchase) phase includes the presentation of (or request for) information on the offer, and negotiations over the price [3]. The sale/purchase phase covers the ordering, invoicing, payment and delivery processes. Finally, the after sale/purchase phase covers all processes after the product or service has been delivered to the buyer, such as after sales customer services (e.g. repair, updates).

<table>
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<th>Tabel 2. Process components of transactions</th>
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<tr>
<td><strong>Pre-sale / pre-purchase phase</strong></td>
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<tr>
<td>- Request for offer/proposal</td>
</tr>
<tr>
<td>- Offer delivery</td>
</tr>
<tr>
<td>- Information about offer</td>
</tr>
<tr>
<td>- Negotiations</td>
</tr>
</tbody>
</table>

The term 'business transaction' is a key concept underlying the development of e-standards for B2B exchanges. Therefore, definitions have been developed by standards communities to underpin their practical work. Examples include:

- **Business**: "a series of processes, each having a clearly understood purpose, involving more than one party, realised through the exchange of information and directed towards some mutually agreed upon goal, extending over a period of time" [ISO/IEC 14662:2004]

- **Business transaction**: "a predefined set of activities and/or processes of parties which is initiated by a party to accomplish an explicitly shared business goal and terminated upon recognition of one of the agreed conclusions by all the involved parties even though some of the recognition may be implicit" [ISO/IEC 14662:2004]

- **e-Business transaction**: "a logical unit of business conducted by two or more parties that generates a computable success or failure state" [ebXML Glossary]

Practically each step in a transaction can either be pursued electronically (online) or non-electronically (offline), and all combinations of electronic and non-electronic implementation are possible. It is therefore difficult to decide which components actually have to be conducted online in order to call a transaction (as a whole) 'electronic'.

In 2000, the OECD proposed broad and narrow definitions of electronic commerce, both of which remain valid and useful today. (In 1999, the OECD Working Party
on Indicators for the Information Society (WPIIS) established an Expert Group on Defining and Measuring Electronic Commerce, in order to compile definitions of electronic commerce which are policy-relevant and statistically feasible. By 2000, work of the Group had resulted in definitions for electronic commerce transactions.) While the narrow definition focuses on 'internet transactions' alone, the broad definition defines e-commerce as "the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over computer-mediated networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the goods or service may be conducted on- or offline". The addendum regarding payment and delivery illustrates the difficulty mentioned above to specify which of the processes along the transaction phases constitute e-commerce (Tabel 2.). The OECD definition excludes the pre-sale/pre-purchase phase and focuses instead on the ordering process. We follow the OECD position on this issue, while fully recognising the importance of the internet during the pre-purchase phase for the initiation of business. Definition of key terms for this paper:

- **e-Transactions**: commercial exchanges between a company and its suppliers or customers which are conducted electronically. Participants can be other companies ('B2B' - business-to-business), consumers ('B2C'), or governments ('B2G'). This includes processes during the pre-sale or pre-purchase phase, the sale or purchase phase, and the after-sale / purchase phase.

- **e-Commerce**: the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over computer-mediated networks.

- **e-Business**: automated business processes (both intra- and inter-firm) over computer mediated networks.

- **e-Interactions**: covers the full range of e-transactions as well as collaborative business processes, such as collaborative online design processes which are not directly transaction focused.

Using the OECD definition, e-commerce is a key component of e-business but not the only one. A wider focus orientated on business processes has been widely recognised. This vision of e-commerce also covers the digitisation of internal business processes (the internal processing of documents related to transactions) as well as cooperative or collaborative processes between companies that are not necessarily transaction-focused (for example industrial engineers collaborating on a design in an online environment).

The OECD WPIIS proposes a definition of e-business as "automated business processes (both intra-and inter-firm) over computer mediated networks". In addition, the OECD proposed that e-business processes should integrate tasks and extend beyond a stand-alone or individual application. 'Automation' refers here to the substitution of formerly manual processes. This can be achieved by replacing the paper-based processing of documents by electronic exchanges (machine-to-machine) but it requires the agreement between the participants on electronic standards and processes for data exchange.

### 2. E-BUSINESS AND A COMPANY’S VALUE CHAINS

In some contexts, the term c-commerce (collaborative commerce) is used. Although this concept was mostly abandoned when the 'new economy' bubble burst in 2001, it had the merit of pointing towards the role of ICT in cooperations between enterprises...
and the increasing digital integration of supply chains. These developments go beyond simple point-to-point exchanges between two companies. Despite dating back 20 years to the pre-e-business era, Michael Porter's framework of the company value chain and value system between companies [4] remains useful to understand the relevance of e-business in this context.

A value chain logically presents the main functional areas ('value activities') of a company and differentiates between primary and support activities. However, these are "not a collection of independent activities but a system of interdependent activities", which are "related by linkages within the value chain" [4]. These linkages can lead to competitive advantage through optimisation and coordination. This is where ICT can have a major impact, in the key role of optimising linkages and increasing the efficiency of processes.

The value system expands this concept by extending its scale beyond the single company. The firm's value chain is linked to the value chains of (upstream) suppliers and (downstream) buyers; the resulting larger set of processes is referred to as the value system. All e-commerce and therefore electronic transactions occur within this value system.

Key dimensions of Porter's framework (notably inbound and outbound logistics, operations, and the value system) are reflected in the Supply Chain Management (SCM) concept. Here, the focus is on optimising the procurement-production-delivery processes, not only between a company and its direct suppliers and customers, but also aiming at a full vertical integration of the entire supply chain (Tier 1, Tier 2, Tier n suppliers). In this concept, each basic supply chain is a chain of sourcing, production, and delivery processes with the respective process interfaces within and between companies.

Analysing the digital integration of supply chains in various industries has been an important theme in most sector studies.

3. APPLYING THE CONCEPT TO THE TLS INDUSTRY

The conceptual framework outlined is mostly applicable to e-business in the transport and logistics services industry. However, as this broad sector covers diverse segments such as freight transport and passenger transport, the focus of ICT usage and e-business differs between the sub-sectors.

In freight transport and logistics, the management of logistics services is the vary nature of the business activity; ICT are mainly used to support the management of complex logistical processes (e.g. for fleet control in larger transport firms with a large fleet of vehicles). In passenger transport, by contrast, online passenger services are a key issue in this sector, notably the online provision of tickets [3].

Although the key applications differ between the various sub-sectors, all basic goals of e-business are relevant: reducing costs by increasing the efficiency of processes (notably in logistics), optimally serving the customer (relevant in all sectors, but in particular in passenger transport), and enabling growth and expansion by increasing the market reach. This study shows how various e-business applications contribute to these goals in the different segments of this industry.

4. CONCLUSIONS

The continuous improvement of the basic ICT infrastructure in the TLS sector has allowed companies to embrace opportunities to substitute paper-based and manual processes by electronic exchanges, thus optimising the flow of information and documents in and between companies, taking advantages of the increased diffusion of advanced e-business software systems.
ERP (Enterprise Resource Planning) systems are one of the main platforms to enable this goal. If a customer or supplier has an ERP system, data related to orders (received or placed) is typically exchanged in a paper-less way between the ERP systems of the two companies trading with each other. However, there is still a considerable gap in the diffusion of ERP systems between micro and small firms on the one hand and the medium-sized and large firms on the other. The relatively high implementation costs for ERP systems remain a critical challenge for SMEs.

5. REFERENCES