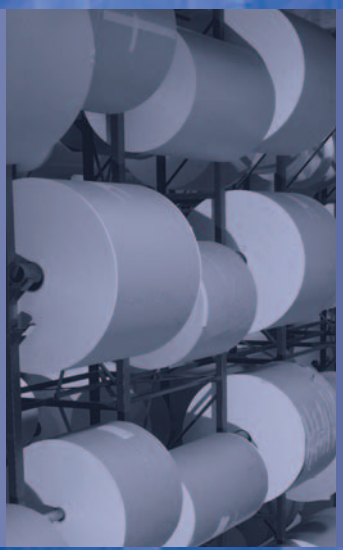
Sector Report No. 3/2006

ICT and e-Business in the

Pulp, Paper and Paper Products Industry

ICT adoption and e-business activity in 2006


e-business w@tch

European Commission

About *e-Business W@tch* and this report

The European Commission, Enterprise & Industry Directorate General, launched the *e-Business W@tch* to monitor the growing maturity of electronic business across different sectors of the economy in the enlarged European Union, EEA and Accession countries. Since January 2002, the *e-Business W@tch* has analysed e-business developments and impacts in manufacturing, construction, financial and service sectors. All results are available on the internet and can be accessed or ordered via the Europa server or directly at the *e-Business W@tch* website (http://ec.europa.eu/comm/enterprise/ict/policy/watch/index.htm, www.ebusiness-watch.org).

This document is a sector study by *e-Business W@tch*, focusing on the pulp, paper and paper products (P&P) industry. Its objective is to describe how companies in this industry use ICT for conducting business, to assess the impact of this development for firms and for the industry as a whole, and to indicate possible implications for policy. Analysis is based on literature, interviews, case studies and a survey among decision-makers in European enterprises from the P&P industry about the ICT use of their company.

Disclaimer

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information. The views expressed in this report are those of the authors and do not necessarily reflect those of the European Commission. Nothing in this report implies or expresses a warranty of any kind. Results from this report should only be used as guidelines as part of an overall strategy. For detailed advice on corporate planning, business processes and management, technology integration and legal or tax issues, the services of a professional should be obtained.

Acknowledgements

This report was prepared by empirica GmbH on behalf of the European Commission, Enterprise & Industry Directorate General. It is a deliverable in the context of *e-Business W@tch*, which is implemented by a team consisting of empirica GmbH (co-ordinating partner), Berlecon Research, Databank Consulting, DIW Berlin, Lios Geal Consultants, RAMBØLL Management and Salzburg Research, based on a service contract with the European Commission.

e-Business W@tch would like to thank Mr **Bernard Lombard** of CEPI (Confederation of European Paper Industries) and Mr **Henry Ryan** of Lios Geal Consultants, who are members of the Advisory Board in 2006, for supporting the work on this study.

Contact

For further information about this Sector Study or the *e-Business W@tch*, please contact:

empirica	e-business w@tch	
empirica Gesellschaft für Kommunikations- und Technologieforschung mbH Oxfordstr. 2, 53111 Bonn, Germany e-Mail: info@empirica.com	***e-Business W@tch*** c/o empirica GmbH Oxfordstr. 2, 53111 Bonn, Germany e-Mail: info@ebusiness-watch.org	**European Commission** Enterprise & Industry Directorate-General Technology for innovation, ICT industries and e-business e-Mail: entr-innov-ict-ebiz@ec.europa.eu

Rights Restrictions

Bonn / Brussels, 2006

Table of Contents

Executive Summary

Objectives and scope of the study

This study by *e-Business W@tch* focuses on the **pulp, paper and paper products** (P&P) industry. It describes how companies in this industry use information and communications technology (ICT) for conducting business, assesses the impact of this development for firms and for the industry as a whole, and indicates possible implications for policy. Analysis is based on literature, interviews, case studies and a survey among decision-makers in European enterprises from the P&P industry.

The sector covers the business activities specified in NACE Rev. 1.1 Division DE 21. The manufacture of pulp, paper and paperboard (NACE 21.1) is mainly an industry where large companies typically operate in a world-wide market. In the manufacture of articles of paper and paperboard (NACE 21.2), often termed the 'converting industries', companies are usually smaller and operate more on a regional or national basis. The total sector directly employs about 740,000 people in the EU-25 and has a production value of about 150 billion euros.[1]

Adoption of ICT and e-business in 2006 – survey results

Among the ten sectors studied by *e-Business W@tch* in 2006, the P&P industry is a near-perfect **yardstick for the state-of-play in ICT adoption** and e-business activity. For many of the indicators, figures for the P&P industry are very close to the all-sectors average and represent the typical situation in manufacturing industries. The P&P industry is neither among the avant-garde in ICT adoption (such as ICT-related sectors themselves), nor is it a slow ICT adopter.

Survey results show that companies within the P&P industry **use ICT** quite intensively **in all application areas along the value chain**: for procurement processes, in production, for inbound and outbound logistics, marketing and customer service. As in most manufacturing industries, improvements in supply chain management by integrating business processes with suppliers and customers is probably the main focus of all activities.

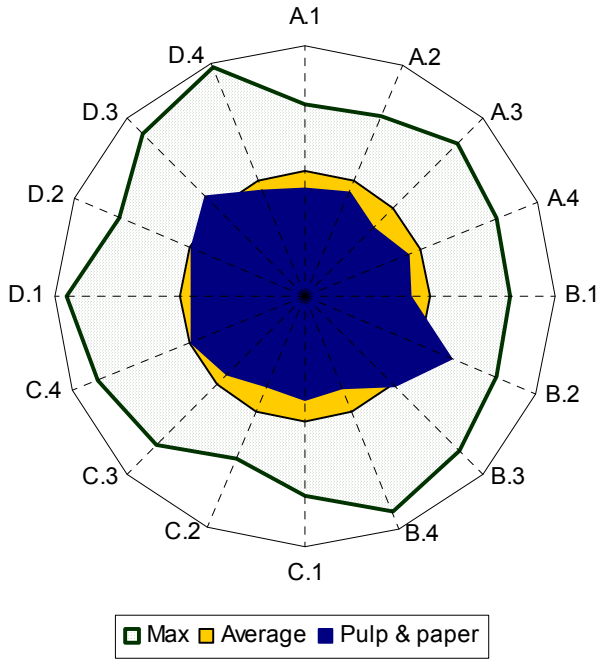
- **Enterprise Resource Planning (ERP)** systems are widespread among companies from the P&P industry, compared to most other sectors studied this year (see Section 3.4.1). These systems constitute the basis for many of the advanced forms of e-business in the sector.
- **Supply chain management**: ICT are intensively used to support logistics and supply chain integration in this sector. Emerging technologies for supply chain management such as RFID (Radio Frequency Identification) are not yet widely adopted, however, particularly in smaller companies. Among large firms, about 10% reported the usage of RFID (see Section 4.3.1).

[1] Source: Eurostat, Structural Business Statistics (Industry, Construction, Trade and Services), Annual enterprise statistics (latest figures available, i.e. for 2003). Downloaded from the Eurostat website in March 2006.

- **Online marketing is gaining momentum**: Almost 30% of P&P firms surveyed said they accepted orders online and more than 20% (by employment) reported using a Customer Relationship Management (CRM) system; this is more than on average in the 10 sectors studied and shows that e-marketing is quickly gaining momentum in the P&P industry (see Section 3.6).

e-Business Index and Scoreboard 2006 [2]

e-Business Scoreboard 2006



Component indicators
(based on data in % of firms)

A. ICT Networks
A.1 Internet connectivity (index)
A.2 LAN
A.3 W-LAN
A.4 Remote access to company network

B. e-Integrated Business Processes
B.1 Intranet
B.2 ERP systems
B.3 Online tracking of production time
B.4 e-Invoicing

C. e-Sourcing and Procurement
C.1 Firms placing orders online
C.2 Use of ICT systems for sourcing
C.3 ICT system linked with suppliers
C.4 Online inventory management

D. e-Marketing and Sales
D.1 CRM use
D.2 Firms accepting orders online
D.3 Use of ICT systems for marketing/sales
D.4 ICT system linked with customers

Source: *e-Business W@tch* (Survey 2006)

Important e-business trends and implications

In the P&P industry, the impact of ICT is mainly felt as a driver and enabler of process innovation in **business-to-business (B2B) trading processes** and **logistics**. Meeting requirements for organising trade and logistics on an international scale has been a strong driver of ICT adoption. However, the e-business activities and experience of the smaller companies in the sector are quite different from those of large companies. The **large P&P manufacturing companies are quite advanced users** of e-business, while many of the smaller companies rely on a rather simple ICT infrastructure.

papiNet® – a success story

Agreement on common standards linking disparate ERP systems between trading partners is one of the critical success factors for e-business. The P&P industry has developed and promotes the **papiNet®** standard for facilitating B2B trade processes. Despite the success of this standard in the sector, there is still considerable **scope for new implementations**, especially those involving small and medium-sized enterprises (SMEs) – see Section 4.1.

[2] See Methodology Annex for information about the structure and computation of the scoreboard.

In parallel to papiNet®, **GUSI** is being promoted by the consumer goods industry as a standard for e-business with their suppliers, including the packaging industry.

ICT as a driver of improved process efficiency

The **integration of digital information flows**, during all phases of B2B transactions (including ordering, invoicing and payments), with production management and logistics has significantly facilitated business processes between P&P producers and their suppliers and customers (see Section 4.2). Effects tend to be most significant if both trading partners have an **ERP system** as the main 'hub' for automating processes.

The **main effects** of ICT adoption with regard to process efficiency noted from case studies and interviews with companies are:

- **acceleration** of processes;
- increased **internal transparency** of processes; and
- improved **use of production capacity**.

Deployment and implications of RFID

Manufacturers of pulp and paper increasingly use RFID for **warehouse and inventory management**. Early experience of RFID implementation demonstrates that it can help companies to link ordering, production and logistics processes, thereby streamlining their supply chain and reducing lead times.

However, the benefits of the use of RFID over barcode technology, for the same purposes, are not yet obvious. In particular, the **total costs for RFID implementation** are still considerable. Therefore, adoption strategies differ: some P&P companies choose to be early adopters, while others deliberately opt for a “wait-and-see” strategy.

In the converting industry, compliance with **customer demand** (in particular from large retailers and the consumer goods industry) is the most important driver for RFID adoption (see Section 4.3).

ICT impact on paper consumption

Although, in some instances, the adoption of ICT by households and businesses leads to substitution of paper or paper-based products, the net impact of all factors that have an influence in this respect results in a continued **growth in paper demand** and consumption (see Section 4.4).

Substitution effects are most significant in the daily and weekly newspaper markets, where a large proportion of **classified advertising** is already migrating to the internet. The average volume of newspapers as well as their total circulation are decreasing. However, a projection of figures on paper consumption in Europe since the mid 1990s indicates a moderate growth even in advanced economies.

Overall business impact

Impact at company level

ICT and e-business have a considerable **impact on work processes** and on **business process efficiency** in companies from the P&P industry. Companies increasingly use

ICT for enhancing **customer service**, and also expect that this will be a major area of ICT impact in the future (see Section 5.1.1).

All evidence suggests that the powerful ICT systems and e-business solutions of the **large companies** currently allow more advanced practices, which enable greater achievements in terms of **process efficiency** and **cost savings**. Many of this sector's smaller companies, on the other hand, have only recently taken their first steps towards e-business. However, the P&P industry has good pre-prerequisites for B2B exchanges; thus, a **dynamic development** in e-business can be expected over the next 3-5 years.

Impact at industry level

Structural determinants make the P&P industry a sector with **intense competition,** mostly between well-established players. Rivalry could further increase if Asian or South-American competitors enter the European market. However, the key drivers of this competition are **not to be found in ICT** and developments in e-business. For instance, globalisation issues and the critical impact of rising energy costs (with implications on costs for raw materials such as chemicals) are not directly linked to ICT or e-business developments (see Section 5.1.2).

Policy implications

Survey results, case studies and desk research point at some issues which could be relevant for policy. The first two points concern the **acceleration of ICT adoption** among small and medium-sized P&P companies (see Section 5.2.1); the latter two points concern the objective to ensure a **favourable framework for e-business** (Section 5.2.2).

- **Large firms as multipliers**: The limited degree of B2B integration between large firms and their smaller business partners (see Sections 3.4 and 4.2) is a bottleneck for the optimal exploitation of e-business opportunities. An innovative policy approach in this context is to launch focused initiatives where large firms (and possibly the public sector) are used as a vehicle to accelerate e-business adoption among their SME suppliers.
- **Solutions for SMEs**: Recognising the importance of ERP (Enterprise Resource Planning) systems for doing e-business in this industry, it is proposed to enhance the development of solutions for SMEs. Initiatives could build on a trend that software providers are now adopting more SME-centred strategies.
- **Standards for e-business**: papiNet® and GUSI are parallel initiatives to establish e-standards in this industry (see Section 4.1). This has implications in particular for companies from the converting industry. It, therefore, deserves a closer look to assess whether there is a business case for integration and consolidation of technical components and semantic aspects of these standards.
- **Legal framework for e-invoicing**: The fast development of e-invoicing has led to some legal uncertainties with regard to taxation in certain EU Member States. Furthermore, the different approaches taken in Member States make it difficult to use e-invoicing in cross-border transactions. A consultation among stakeholders could amend this situation (see Section 5.2.2).

1 Introduction

1.1 About *e-Business W@tch*

Policy background

The European Commission launched *e-Business W@tch* in late 2001 to monitor the adoption, development and impact of electronic business practices in different sectors of the economy in the European Union.

The initiative is rooted in the **eEurope Action Plans** of 2002 and 2005. The eEurope 2005 Action Plan defined the goal "*to promote take-up of e-business with the aim of increasing the competitiveness of European enterprises and raising productivity and growth through investment in information and communication technologies, human resources (notably e-skills) and new business models*".[3] *e-Business W@tch* has been an important instrument for the European Commission to assess the developments and progress in this field.

The **i2010** policy[4], a follow-up to eEurope, also stresses the critical role of ICT for productivity and innovation, stating that "*… the adoption and skilful application of ICT is one of the largest contributors to productivity and growth throughout the economy, leading to business innovations in key sectors*" (p. 6). The Communication anticipates "*a new era of e-business solutions*", based on integrated ICT systems and tools, which will lead to an increased business use of ICT. However, it also warns that businesses "*still face a lack of interoperability, reliability and security*", which could hamper the realisation of productivity gains (p. 7).

In 2005, in consideration of globalisation and intense international competition, the European Commission launched a **new industrial policy**[5] to create better framework conditions for manufacturing industries in the coming years. Some of the policy strands described have direct links to ICT and e-business developments. One of the new sector-specific initiatives covered by the policy is the taskforce on information and communication technologies (ICT) competitiveness. The taskforce with stakeholders representatives focuses on identifying and proposing measures to remove obstacles that inhibit ICT take-up among enterprises. Another initiative is to conduct a series of competitiveness studies, to include for ICT, food, and fashion and design industries, in order to analyse trends affecting the competitiveness of these industrial sectors.

These policy considerations constitute the background and raison d'être of *e-Business W@tch* as an observatory of related issues and a core theme for the analysis. Within this broader policy context, two further important facets regarding the mission of the initiative

---

[3] "eEurope 2005: An information society for all". Communication from the Commission, COM(2002) 263 final, 28 May 2002, chapter 3.1.2

[4] "i2010 – A European Information Society for growth and employment." Communication from the Commission, COM(2005) 229 final.

[5] "Implementing the Community Lisbon Programme: A Policy Framework to Strengthen EU Manufacturing - towards a more integrated approach for Industrial Policy." Communication from the Commission, COM(2005) 474 final, 5.10.2005

are relevant. First, *e-Business W@tch* studies focus on **sectors** (and not on countries). Second, special emphasis is placed on developments and implications for small and medium-sized enterprises (**SMEs**).

e-Business W@tch is one of several policy instruments used by DG Enterprise and Industry in the field ICT industries and e-business. Other instruments include

- the e-Business Support Network (**eBSN** – a European network of e-business policy makers and business support organisations),
- the **eSkills Forum** (a task force established in 2003 to assess the demand and supply of ICT and e-business skills and to develop policy recommendations),
- the **ICT Task Force**, a group whose work is to draw together and integrate various activities aiming to strengthen Europe's ICT sector, and
- activities in the areas of **ICT standardisation**, as part of the general standardisation activities of the Commission.[6]

Focus and scope

Since its launch, *e-Business W@tch* has published e-Business Sector Studies on more than 20 sectors of the European economy, four comprehensive synthesis reports about the state-of-play in e-business in the European Union, statistical pocketbooks and various other resources, such as newsletters and special issue reports. All publications are available at www.ebusiness-watch.org ('resources').

e-Business W@tch presents a **'wide-angle' perspective** on the adoption and use of ICT in the sectors studied. The topic is not restricted to the measurement of e-commerce transactions (the volume of goods and services traded online), but also comprises an assessment of the degree to which business processes, including intra-firm processes, are electronically linked to each other and have become digitally integrated.

In essence, *e-Business W@tch* studies cover the whole field of what could be described as **collaborative commerce** (see following chapter). However, it becomes practically impossible to cover in detail all areas and facets of e-business in a single sector study. Therefore, each study focuses on a few specific issues, thus allowing the reader to zoom into these topics in more detail.

In addition to the analysis of e-business developments, the studies also provide some **background information** on the respective sectors. Readers, however, should not mistakenly consider this part of each report as the main topic of the analysis. An *e-Business W@tch* sector report is not a piece of economic research on the sector itself, but a study which focuses on the use of ICT and e-business in that particular sector. The introduction to the sector is neither intended, nor could it be a substitute for more detailed industrial analysis.

[6] The 2006 ICT Standardisation Work Programme complements the Commission's "Action Plan for European Standardisation" of 2005 by dealing more in detail with ICT matters.

Methodology

e-Business W@tch combines quantitative and qualitative research elements. The quantitative analysis of ICT and e-business adoption by firms is based to a large extent on representative **surveys** among decision-makers in European enterprises ("e-Business Survey"). Interviews are conducted by telephone, based on a standardised and computer supported questionnaire (CATI[7] method). In total, more than 25,000 enterprises were interviewed in the surveys of 2002, 2003 and 2005. The most recent survey (conducted in April/May 2006) covered more than 14,000 enterprises from 10 sectors in all EU Member States and most EEA and Candidate Countries.[8]

The *e-Business W@tch* Surveys have won recognition by the international research community as a useful instrument for **piloting** new e-business metrics. The experience gained from this piloting is used, for example, by Eurostat for planning and developing their own survey of ICT use by businesses.

e-Business W@tch complements the statistical picture by a more detailed presentation of concrete e-business activity in individual enterprises from the sectors covered, mainly in the form of brief **case studies**. About 75 case studies are conducted in 2006 adding to more than 100 case studies conducted in previous years. Evidence from the survey and case studies is backed up by **desk research** and **interviews** with industry representatives and e-business experts.

The importance of networking and debate

Since its first implementation in late 2001, *e-Business W@tch* has increasingly developed from a market observatory into a **think-tank and intermediary**, stimulating debate among stakeholders at an international level about the economic and policy implications of e-business. The positive feed-back and large uptake for the various publications and statistics provided by the *e-Business W@tch*, for example their exploitation by various research institutions, reflects the demand for sectoral e-business analysis and discussion on related issues.

e-Business W@tch uses several mechanisms for debate and networking with stake-holders. An important platform for this is the **website** (www.ebusiness-watch.org), where all reports and survey data are published. Furthermore, results are presented and discussed with industry at **workshops**, within and via the **Advisory Board**, and, lastly, through the participation of study team members in other events, such as conferences, workshops and working groups organised by third parties.

---

[7] Computer Assisted Telephone Interviews, a widely used method in representative household or decision-maker surveys.

[8] The EEA (European Economic Area) includes, in addition to EU Member States, Iceland, Liechtenstein and Norway. Candidate Countries, which are candidates for accession into the EU, are (as of May 2006) Bulgaria, Croatia, Romania and Turkey.

*The **mission** of e-Business W@tch is to monitor, analyse and compare the development and impact of e-business in different sectors of the European economy – not the sectors themselves.*

*Its **objective** is to provide reliable results, based on commonly accepted methodologies, which are not readily available from other sources and will trigger the interest of policy-makers, researchers, and other e-business stakeholders for more in depth analyses or statistical surveys.*

*e-Business W@tch has adopted a "wide-angle" perspective in its **approach**. The necessary trade-offs are transparently depicted in each of its deliver-ables.*

The definition of sectors and the adequate level of aggregation

Economic sectors constitute the main level of analysis for *e-Business W@tch*. The 2006 studies cover sub-sets of **ten different sectors** whose configuration and definition are based on the NACE Rev. 1.1 classification of business activities.[9]

Over the years since its initial implementation in late 2001, *e-Business W@tch* followed a roll-out plan in the coverage of different sectors.[10] In each new period, some new sectors (not covered in previous years) were added.

The rather broad aggregation of various business activities into sectors in earlier implem-entation periods (2002-2004) made it possible to cover a broad spectrum of the economy, but also caused challenges for the analysis of e-business developments. In cases where rather heterogeneous sub-sectors were aggregated, it was sometimes difficult to make general observations or draw conclusions for "the sector" at stake. It also turned out that industry has a clear preference for comparatively narrow sector definitions.

The approach for selecting and defining sectors which was used in 2005 and 2006 reflects these concerns. Many of the sectors studied since 2005 are sub-sectors that had been part of larger aggregations in 2002-2004. A further argument for "**zooming in**" on former sub-sectors is that the broad picture for whole sectors is already available from earlier *e-Business W@tch* studies.

The **selection** of sectors in 2006 has been made on the basis of the following considerations:

- The **roll-out plan** of 2003.
- **Policy relevance** of the sector from the Commission's perspective.
- **Interest** articulated **by the industry** in previous years on studies of this type.
- The current **dynamics of e-business** in the sector and the impact of ICT and electronic business, as derived from earlier *e-Business W@tch* sector studies.

[9] NACE Rev. 1.1 is a 4-digit classification of business activities. It is a revision of the 'General Industrial Classification of Economic Activities within the European Communities', known by the acronym NACE and originally published by Eurostat in 1970.

[10] See website: "selection of sectors" (www.ebusiness-watch.org/about/sector_selection.htm)

The 10 sectors studied in 2006

The 10 sectors which are monitored and studied in 2006 include six manufacturing sectors, construction and three service sectors. The pulp and paper manufacturing industry is a 'new' sector, i.e. it had not been covered by the *e-Business W@tch* in any earlier period of implementation; the other nine sectors have been covered in previous years, mostly as parts of aggregated sectors (see Exhibit 1-1).

Exhibit 1-1: Sectors studied by e-Business W@tch in 2006

No.	NACE Rev. 1.1	Sector	Reference to earlier (most recent) coverage
1	DA 15 (selected groups)	**Food and beverages**	2005
2	DC 19.3	**Footwear**	2003/04 (as part of the textile and footwear industry)
3	DE 21	**Pulp, paper and paper products**	--
4	DL 30, 32.1+2	**ICT manufacturing**	2004 (as part of electrical machinery and electronics)
5	DL 32.3	**Consumer electronics**	2004 (as part of electrical machinery and electronics)
6	DM 35.11	**Shipbuilding and repair**	2004 (as part of transport equipment manufacturing)
7	F 45.2+3 (selected classes)	**Construction**	2005 (in a broader aggregation, including F 45 in total)
8	H 55.1/3, I 63.3, O 92.33/52	**Tourism**	2005
9	I 64.2	**Telecommunication services**	2004 (as part of ICT services)
10	N 85.11	**Hospital activities**	2004 (as part of health and social services)

1.2 "e-Business" – the conceptual framework

Fresh momentum after the 2001 odyssey

Although the 'new economy' revolution has not taken place as it seemed for a short moment in history it might, the **evolutionary development** of electronic business does not seem to have come to an end. On the contrary, the maturity of e-business has substantially increased across sectors and regions over the past five years. It has been a quiet revolution this time, but as a result, a **new picture of the digital economy** is beginning to emerge. ICT and e-business do matter in the global economy – probably even more than during the hype of the late 1990s.

The overall economic situation and market conditions for business innovation and investment have been difficult for European companies during the last few years. Nevertheless, e-business shows a dynamic development in the European Union. Drivers are new technological developments (wireless access technologies, for example) and the increasing **competitive pressure** on companies in a global economy. Firms are in constant search for opportunities to cut costs. This has probably been the most important

promise of electronic business: cutting costs by increasing the **efficiency of business processes**, internally and between trading partners in the value chain.

From e-Commerce to e-Business

As part of this maturing process, electronic business has progressed from a rather specific to a very broad topic over the past 10 years. Initially, however, particularly in the mid 1990s, the policy and research focus was very much on **e-Commerce**, which can be defined as online commercial transactions.

The term **'transactions'** refers to 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. In the context of this study on e-business, transactions are predominantly commercial business transactions (see boxes for definitions).

Glossary

Definitions by standardisation groups (ISO, ebXML)

The term "business transaction" is a key concept underlying the development of e-standards for B2B exchanges. Therefore, definitions have been developed by the various standards communities as an underpinning for their practical work. Examples are:

- ***Business**: "a series of processes, each having a clearly understood purpose, involving more than one party, realized 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]*

If transactions are conducted electronically ('**e-transactions**'), this constitutes e-Commerce. Transactions can be broken down into **different phases** and related **business processes**, each of which can be relevant for e-Commerce. The pre-sale (or pre-purchase) phase includes the presentation of (or request for) information about the offer, and the negotiation about the price. 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).

Exhibit 1-2: Process components of transactions

Pre-sale / pre-purchase phase	Sale / purchase phase	After sale / purchase phase
Information about offer	Placing an order	Customer service
Price comparisons	Invoicing	Guarantee management
Negotiations between seller and buyer	Payment	Credit administration
	Delivery	Handling returns

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 this context, during 2000 the OECD proposed broad and narrow definitions of electronic commerce both of which are still valid and useful:[11] While the narrow definition focuses on 'internet transactions' only, the broad definition defines e-Commerce as "*the sale or purchase of goods or services, whether between businesses, house-holds, 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"* (OECD, 2001).

Glossary

Definition of key terms for this study

- ***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****: Electronic Commerce. The sale or purchase of goods or services, whether between businesses, house-holds, individuals, governments, and other public or private organisations, conducted over computer-mediated networks. (OECD)*
- ***e-Business****: Electronic Business. Automated business processes (both intra- and inter-firm) over computer mediated networks. (OECD)*
- ***e-Interactions****: Electronic Interactions include the full range of e-Transactions, and in addition collaborative business processes (e.g. collaborative design) which are not directly transaction focused.*

The addendum regarding payment and delivery is an important part of the definition, but can be debated. The difficult question is which processes along the different transaction phases constitute e-Commerce and which do not (see Exhibit 1-2). The OECD definition

[11] 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.

excludes the pre-sale or purchase phase and focuses on a specific part of the sale / purchase phase, namely the ordering process. *e-Business W@tch* follows the OECD position on this issue.[12]

e-Commerce, defined in this way, is a key component of **e-business**, but not the only one. In recent years, it has been increasingly acknowledged among policy and research communities that the focus on e-commerce transactions may be too narrow to capture the full implications of e-business. A wider, business process oriented focus has been widely recognised. Reflecting this development, the OECD WPIIS[13] proposed a (broader) definition of 'e-business' as "*automated business processes (both intra-and inter-firm) over computer mediated networks*" (OECD, 2004, p. 6). In addition, the OECD proposed that e-business processes should integrate tasks and extend beyond a stand-alone or individual application.

This definition reflects an understanding of e-business that encompasses more than e-commerce transactions. The broad concept of e-business also includes the digitisation of **internal business processes**, as well as **cooperative** or **collaborative processes** between companies which are not necessarily transaction-focused. Collaborative e-design processes between business partners are a typical example from industrial engineering. The OECD definition implicitly indicates that the focus and main objective of electronic business is to be found in business process automation and integration, and the impacts thereof.

To bridge the gap between 'e-Commerce' and 'e-Business', it was proposed in earlier years (mainly around 2000) to use the term '**c-Commerce**' (collaborative commerce). Although this concept was rather abandoned when the new economy bubble burst, it has some value as it stresses the role of ICT for cooperation among enterprises. If web service and other emerging technologies (e.g. RFID, mobile applications) hold their promise, the digital integration of B2B trading processes could be taken to a new level, possibly with a considerable impact on industry structure. If so, it could be worth revisiting the former 'c-Commerce' concept.

e-Business and the company's value chain

Given the broad concept of e-Business applied for this study, which concentrates on business processes and a company's interactions with its environment, some further structuring and mapping of processes is necessary. Michael Porter's framework of the company value chain and value system between companies (Porter, 1985) is still valid and useful in this context, although dating back 20 years to the pre-e-business era.

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*" (p. 48). These linkages can lead to competitive advantage through optimisation and coordination. In fact, it is exactly here that ICT

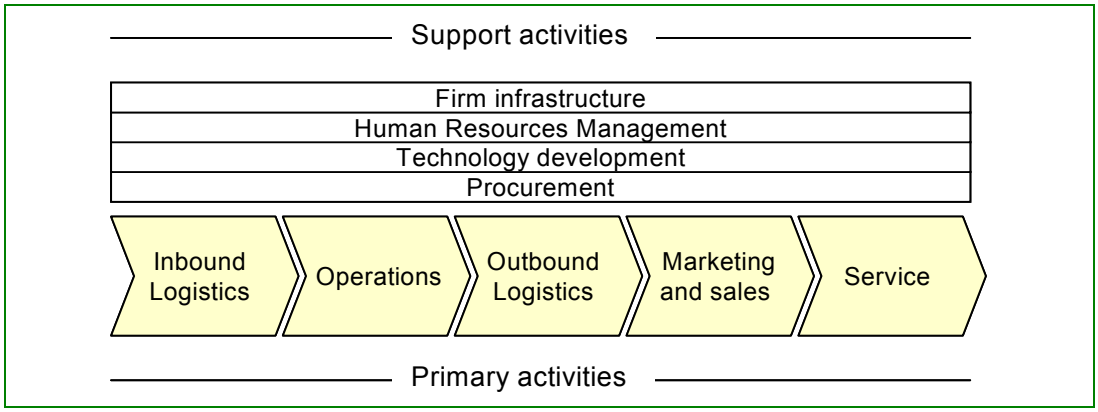
[12] This is reflected in the updated wording of the respective survey questions in 2006, when for "placing / accepting online orders" was asked instead for "purchasing / selling online".

[13] Working Party on Indicators for the Information Society

have a major impact, as they are a key instrument to **optimise linkages** and thus increase the efficiency of processes.

The **value system** expands this concept by extending the perspective beyond the single company. The firm's value chain is linked to the value chains of (upstream) suppliers and (downstream) buyers, resulting in a larger set of processes – the value system. e-Commerce, i.e. electronic transactions, occurs within this value system.

Exhibit 1-3: Value chain framework of a company by Michael Porter



Source: Adapted from M.E. Porter (1985) – simplified presentation

Key dimensions of this 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.[14] The analysis of the digital integration of supply chains in various industries has been an important theme in sectors studies previously prepared by *e-Business W@tch*.

e-Business and innovation

A very important aspect for *e-Business W@tch* studies is the link between ICT and innovation. The European Commission places great emphasis on the **critical role of innovation** for European businesses in order to stay competitive in the global economy.[15] On the other hand, a strong competitive pressure provides powerful incentives for companies to continuously engage in innovation and R&D. Thus, innovation, competition and competitiveness are closely intertwined.

ICT have been identified and widely recognised as a major **enabler of innovation**, in particular for **process innovation**. According to the *e-Business W@tch* survey 2006, 75% of those companies that had introduced new business processes in 2005 reported that this innovation was directly related to or enabled by ICT.

---

[14] cf. SCOR Supply-Chain Council: Supply-Chain Operations Reference-model. SCOR Version 7.0. Available at www.supply-chain.org (accessed in March 2006).

[15] See, for example, "An innovation-friendly, modern Europe". Communication from the Commission, COM(2006) 589, 12 October 2006.

In many cases, the implementation of **e-business processes** in a company will constitute a process innovation in itself. In **manufacturing** sectors, e-business has triggered significant innovation inside the companies, notably in supply chain and delivery processes, such as automatic stock replenishing and improved logistics. In **service** sectors such as tourism, the innovative element is more evident in the way that external transactions are accomplished. For example, if a company starts to sell its services online, this can imply innovation in the service delivery process and in customer communication.

In some sectors, particularly in ICT manufacturing, consumer electronics and telecommunications, ICT are also highly relevant for **product innovation**.

However, as more companies strive to exploit the innovation potential of ICT, it becomes more difficult for the individual company to directly gain competitive advantage from this technology. e-Business is becoming a necessity rather than a means to differentiate from competitors.[16] In addition, the introduction of innovation can cause **substantial costs** in the short and medium term, as it may take time before the investments pay off. This causes challenges in particular for small and medium-sized companies. It is one of the reasons why *e-Business W@tch* focuses on such challenges in its sector studies (see also 'Policy Background' in chapter 1.1).

[16] Cf. Carr, Nicholas (2003). "IT Doesn't Matter". In: Harvard Business Review, May 2003.

2 Industry Context and Background

2.1 Sector definition

Business activities covered

The manufacture of pulp, paper and paper products industry covers the business activities specified in NACE Rev. 1.1 Division DE 21.[17] This includes two relatively diverse sub-sectors:

- The **manufacture of pulp, paper and paperboard** (NACE 21.1), which is a highly concentrated industry where companies typically operate in a world-wide market.
- The **manufacture of articles of paper and paperboard** (NACE 21.2), the so called 'converting industries', where companies are usually smaller and operate more on a regional or national basis, or specialise as international leaders within selected niches.

Exhibit 2-1: Business activities covered by the pulp and paper industry (NACE Rev. 1.1)

NACE Rev. 1.1		Business activities
Division	Group(s)	
DE 21		Manufacture of pulp, paper and paper products
	DE 21.1	Manufacture of pulp, paper and paperboard
	DE 21.2	Manufacture of articles of paper and paperboard

For simplicity, the term "pulp & paper industry" (P&P industry) will be used in this study, if the whole sector is concerned, i.e. the acronym P&P also includes the converting industries. If the analysis concerns specific sub-sectors only, a more specific reference will be used such as, for example, "the manufacture of pulp".

"Neighbouring" industries

Industries in the sub-sector groups NACE 21.1 and NACE 21.2 of the P&P industry are very inter-dependent with suppliers from the **forestry and woodworking** industries. Forestry and logging (NACE Rev. 1.1 A 02) constitutes the first activity in the value network of the wider P&P cluster. The next step in wood processing features the **saw-mills** (NACE DD 20.1), another important cluster player with direct interfaces to the P&P industry.

Producers of newspapers and magazines are important downstream customers in the value network of the **publishing** and **printing** industries (NACE DE 22.1 and 22.2).[18] Companies from the P&P industry often use the term "printing" for the activity of producing paper(board) packaging solutions (containers, boxes), which is covered by NACE 21.2. In fact, there is probably a significant overlap between the two sub-sectors in

[17] NACE Rev. 1.1 is a 4-digit classification of business activities. It is a revision of the 'General Industrial Classification of Economic Activities within the European Communities', known by the acronym NACE and originally published by Eurostat in 1970.

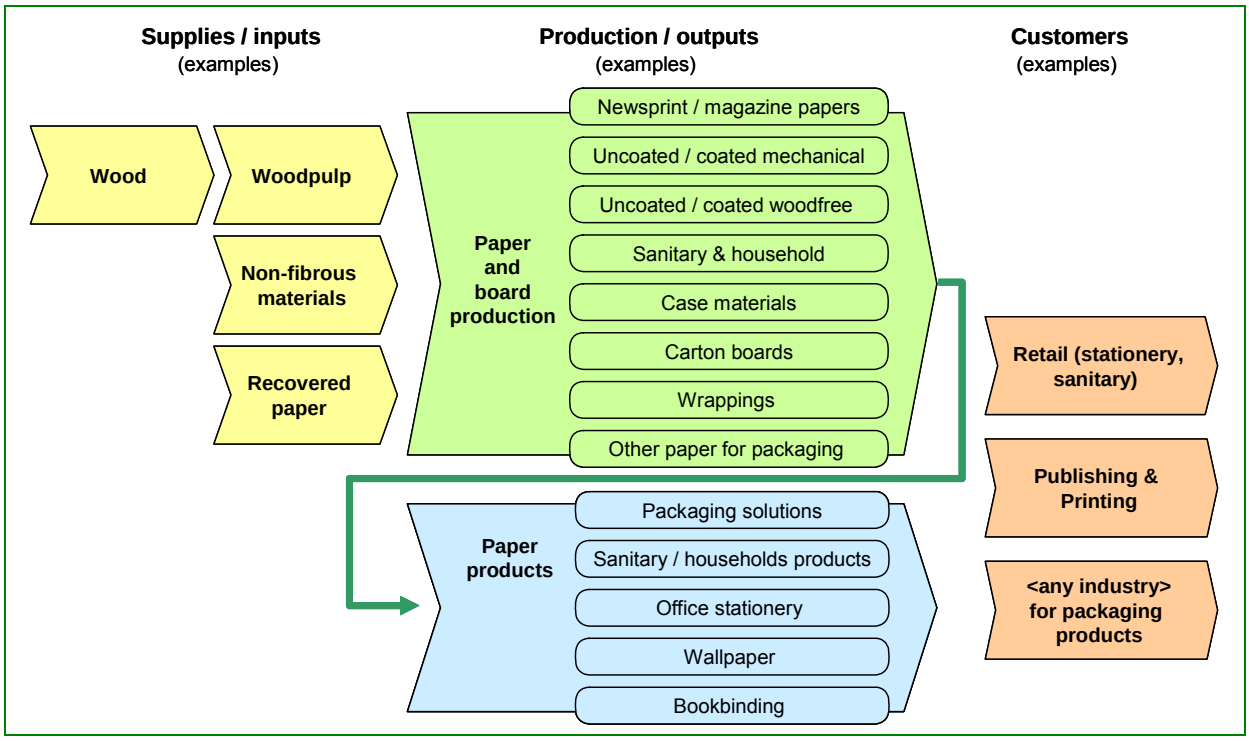
[18] *e-Business W@tch* sector published two sector studies on the publishing and printing industry in 2005. See www.ebusiness-watch.org ('resources').

terms of players, as many companies are active in both business fields, e.g. service providers for the printing of magazines, brochures and other newsprint, that also print, cut and fold the cardboard material for packaging products.

The value system of the industry

Exhibit 2-2 depicts in a simplified way the main inputs and outputs of the industry and the main customer segments to which the industry caters. Inputs and outputs are briefly described in the following sections.

Exhibit 2-2: Value system of the P&P industry (simplified)



Source: *e-Business W@tch* (2006)

Inputs: raw materials used by the P&P industry

The raw materials used for the production of pulp or paper are usually characterised as being either **fibrous** or **non-fibrous** materials. In total, about 42% of raw materials (in terms of tonnes) are woodpulp, recovered paper also accounts for about 42%, and non-fibrous materials for 15%. The remaining 1% is pulp from sources other than wood (CEPI 2005, p. 14).

Pulps constitute a major input for the manufacture of paper and paper products (the converting industries). They include woodpulp, mechanical and semi-chemical pulp, and chemical pulp. Pulps are used to produce printing and writing papers, tissue and towelling, packaging, and absorbent hygiene products.

- **Recovered paper**. As in the case of new papers, recovered papers can be classified in different grades, which partly determines their ultimate use. The major utilisation of recovered paper is for newsprint and for packaging case materials.
- **Non-fibrous material**. These include clays, calcium carbonate (both used for coating and filling), mineral pigments and starches.

Outputs of the P&P industry

The **paper and paperboard industry** converts inputs (raw materials) from forestry and from the chemical industry into papers of different grades. These are used by other industries for various purposes or go directly to consumers via retail distribution. Paper grades are classified, for paper manufacturing purposes, into the following product categories:[19]

- **Newsprint and magazine papers**. Paper used for printing newspapers is mainly made from mechanical pulp and/or from recovered paper. Magazine paper is typically uncoated mechanical paper, where less than 90% of the fibre furnish consists of chemical pulp fibres.
- **Printing and writing papers**. Many[20] printing papers are coated, either on one or on both sides, with minerals such as china clay (kaolin) or calcium carbonate. Writing paper, in contrast, is typically uncoated woodfree paper, defined as paper where at least 90% of the fibre furnish consists of chemical pulp fibres. Both types of paper are suitable for printing or other graphic purposes.
- **Sanitary and household products**. This category covers a wide range of tissue and other hygienic papers for use in households or in commercial and industrial premises e.g. toilet paper and facial tissues, kitchen towels, hand towels and industrial wipes.
- **Paper-based packaging materials and products**. This category includes case materials (paper and board mainly used in the manufacture of corrugated board); folding boxboard (carton board, coated or uncoated); wrappings (paper whose main use is wrapping or packaging); and other papers mainly used for packaging purposes (other than the above).
- **Other specialised products**. This category includes other paper and board for industrial and special purposes, such as cigarette papers and filter papers, and special papers for waxing, insulating, roofing.

Users of these materials also include the **converting industries** (manufactures of articles of paper & paperboard). Outputs of this sub-sector include a large range of product categories, the most important of which are packaging solutions representing about 40% of all paper and board production.[21] Other categories include sanitary and household products, office stationery, wall paper and bookbinding.

[19] The classification follows the one proposed by www.paperonline.com, the educational online portal provided by CEPI.

[20] See www.paperrecovery.org/files/Guidelines-165257A.pdf

[21] Source: CITPA, the International Confederation of Paper and Board Converters in Europe

2.2 Industry background

Introduction

The manufacture of paper is an ancient craft business, dating back several thousand years to the ancient Egyptians.[22] For the largest part of this long history, hand-made production methods dominated. Paper production became industrialised only as recently as the 19th century. As the rapid progress in technology and science has shortened innovation cycles, the nature of the business is set to change again. This time, the most significant expected changes are directly linked to the use of information and communication technologies (ICT).

For the P&P industry, ICT impact in several different ways. First, the replacement of formerly paper-based communication and documentation processes by electronic equivalents could negatively affect the demand for paper and paper products in the long run. This effect is directly countered, however, by the fact that the very same technologies facilitate the printing of documents, and create demand for new specialist magazines and other publications, which are still predominantly consumed as 'traditional' printed magazines.

Second, as in other manufacturing industries, ICT are changing the ways in which companies conduct trade with each other. The high level of structural division in this industry, between very large manufacturers on the one hand and their SME suppliers and customers on the other, coupled with a relatively conservative attitude towards technological innovation among the smaller firms, creates special circumstances for e-business developments. This section explores in some more detail the background and structure of this industry, which is a necessary basis to understand the deployment and impact of ICT.

2.2.1 The European pulp & paper industry

Figures presented in this section are mostly based on information from **Eurostat** and from the European industry federations. A major source from within the industry is **CEPI**, the Confederation of European Paper Industries. CEPI represents the pulp and paper industries of 20 European countries.[23] A major source for data on the converting industries is **CITPA**, the International Confederation of Paper and Board Converters in Europe, which represents both branch members (e.g. carton makers associations) and national member organisations.

Industry structure and employment

The manufacture of pulp and paper is a capital intensive business, dominated by very large companies that typically operate internationally. CEPI reports that the industry in its

[22] The term "paper" is derived from "papyrus", the material used by the ancient Egyptians, Greeks and Romans.

[23] The Confederation of European Paper Industries (CEPI) has as members the national industry federations from all former EU-15 countries except Luxembourg, as well as from CZ, HU, NO, PO, SL and CH. According to CEPI estimates, these 20 countries account for about 90% of total European paper production and 85% of total pulp production.

20 member countries is composed of 850 paper producing companies and 1,250 mills. Together, these companies employ about 275,000 people in the CEPI member countries. Total employment has constantly decreased from close to 400,000 in 1991 (CEPI, 2006). These figures are largely confirmed by data from Eurostat Structural Business Statistics (SBS), which show that about 254,000 people were employed in the P&P manufacturing industry (DE 21.1) in 2002/03 in the EU-25. According to Eurostat, the sector is composed of about 2,270 enterprises (see Exhibit 2-3).

In contrast to paper manufacturing, the converting industries cover a larger number of enterprises, but these are typically much smaller firms. CITPA represents "*about 5,000 mostly small and medium-sized firms with about 380,000 employees*" in Europe.[24] The total sub-sector (DE 21.2) includes about 16,100 enterprises in the EU-25 and provides jobs for about 490,000 people (Eurostat SBS).

Exhibit 2-3: The manufacture of pulp, paper and paper products in the EU-25 (2002/03)

NACE Rev. 1.1	Activity	Enter-prises	Production value	Value Added at Factor Cost	Persons employed
		Number	million euros		Number
DE 21	Manufacture of pulp, paper and paper products	18,399	149,986	47,146	743,300
DE 21.1	Manufacture of pulp, paper and paperboard	2,266	-	23,441	253,700
DE 21.2	Manufacture of articles of paper and paperboard	16,132	-	23,706	489,600

Source: Developed from Eurostat Structural Business Statistics (SBS)

Thus, total direct employment in the P&P industry is about 743,000 people. Indirectly, the industry is estimated to provide jobs for about 2.0 million people, if the closely related industry of wood and wood products (NACE Division DE 20) is included. From a larger perspective, the P&P industry forms part of the forest-based industries, which include forestry, woodworking and printing.[25] This cluster of industries together employs about 3 million people and thereby constitutes a very important industry sector in the European Union.

About 50% of people directly employed in the P&P industry work in SMEs and the other 50% in large firms with 250 employees or more (Eurostat SBS). Large firms account for about 3% of all enterprises, medium-sized ones for about 11%.

Production value, turnover, output

The total production value of the P&P industry (NACE DE 21) was 147 billion euros in 2002/03 (Eurostat SBS) with a value added of about 47 billion euros (see Exhibit 2-3).

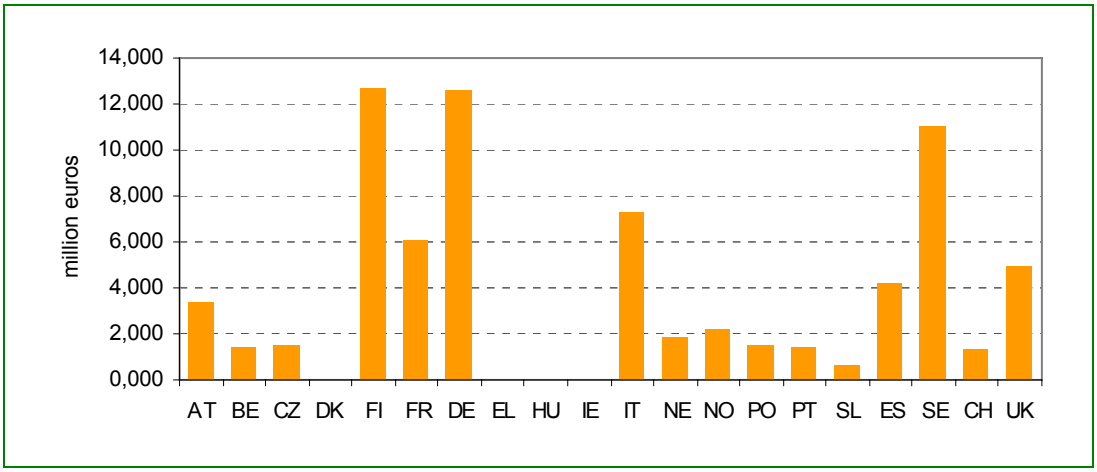
More recent figures represented by CEPI for the European paper industry (DE 21.1) as indicate a turnover of about 75 billion euros and a value added of 25 billion euros in 2004

[24] Cf. www.citpa-europe.org (organisation), accessed in March 2006

[25] The aggregation of these sectors into the "forest-based industries" is also applied by the Enterprise and Industry DG of the European Commission, cf. "Forest-Based Industries" at http://www.europa.eu.int/comm/enterprise/forest_based/fbi_en.html (March 2006)

(CEPI, 2006). Major paper producers are Germany, Finland, Sweden, Italy and France (see Exhibit 2-4). These five countries account for about two thirds of total turnover and paper production. Pulp production is concentrated in Finland and Sweden, which together account for about 60% of the total EU production.

Exhibit 2-4: The European paper industry – turnover in CEPI countries (million euros, 2004)



Source: CEPI 2006

In 2004, the forest-based industries had a total turnover of about 375 billion euros, i.e. 6.5% of the European manufacturing industries' annual turnover.

That year, the paper industry produced an output of about 100 million tonnes of paper and about 43 million tonnes of pulp. The production of paper and board in CEPI countries increased by 4.5% in 2004. Demand grew by 2.4%. Growth in production was higher than in the countries of major competitors, such as Japan (1.4%), Canada (2.3%) or the USA (3.5%). Over the long term, output of paper and board have increased by 3.2% p.a. since 1991. Pulp production increased by 4.1% in 2004. The average annual production growth since 1991 was somewhat lower, however (1.9%). (CEPI 2004)

Regional perspective on production and consumption

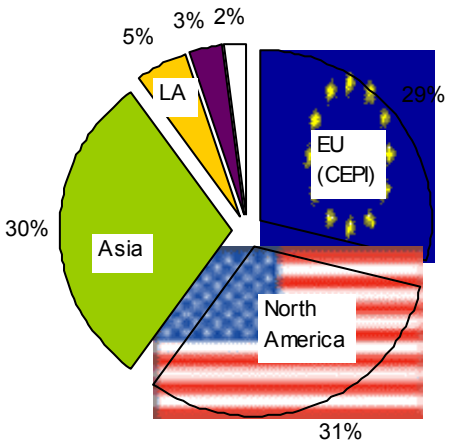
European companies account for about 30% of the worldwide paper production, with approximately similar percentages accounted by each of North America (i.e. USA and Canada) and Asia. 90% of the European production is from countries represented by CEPI. The global distribution of the production value is very similar to the one for consumption of paper.

North America is the leading manufacturer of pulp, accounting for more than 40% of worldwide production. European and Asian companies each account for about 22% of production.

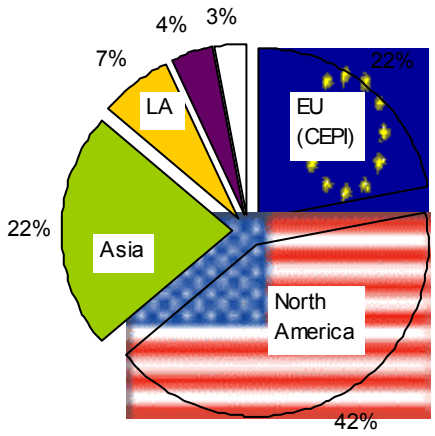
Exhibit 2-5: Pulp and paper production and consumption by region (2004)

	Paper		Pulp	
	Production	**Consumption**	**Production**	**Consumption**
Europe (CEPI countries)	29%	26%	22%	25%
Non-CEPI Europe	3%	3%	4%	3%
North America	31%	30%	42%	37%
Asia	30%	33%	22%	28%
Latin America	5%	6%	7%	5%
Other	2%	2%	3%	2%

Share of worldwide paper production (2004)



Share of worldwide pulp production (2004)



Source: Developed from CEPI (2004)

Exports and imports

While the **trade balance** for paper is positive, European countries (CEPI members) import more pulp than they export outside CEPI. In the paper industry, exports in terms of tonnes of paper represent about 350% of imports; in the pulp industry, exports only represent about 20%. In 2004, the paper industry shipments to Asian markets accounted for about 36% of exports. This is an increase of 58% since 2001.

The recent **positive development** of the trade balance, both for pulp and paper, indicates that European companies are highly competitive in the international market-place. While deliveries of paper to non-CEPI countries increased for the second year running (by 13% in 2004), imports from outside CEPI fell by 5.1%. Similarly, delivery of pulp to non-CEPI countries increased by 14%, while imports only grew by 1.9%. While imports from North America (accounting for 42% of imports in paper) are decreasing, imports from Latin America have increased for the fourth consecutive year.

2.2.2 Trends and challenges

Some key challenges which affect the P&P industry are the increasing ecological pressure, the complexity of compliance with regulations (which also include environmental issues), and – on the supply side – the increase in energy costs.

Coping with ecological pressure

Paper manufacturers still have to cope with a rather negative reputation as a prime polluter of water. A coalition of 50 NGOs has recently presented "A **Common Vision for Transforming the European Paper Industry**" at the Paper World 2006, the international trade fair for the paper industry, in Frankfurt. The document calls for "*a future Europe that consumes dramatically less paper than at present, with all that paper made by an industry that is less reliant on virgin tree fibres, maximises use of recycled materials, respects local people's land rights, provides employment and has social impacts that are beneficial, conflict-free and fair.*"[26] A key stipulation is that paper should be made from "responsibly and sustainably sourced" fibres, using entirely renewable energy. Thus, water should be "as clean after paper production as before".

However, players in the industry eagerly confirm their commitment towards environmental goals, and progress has been achieved – at least in Europe – over the past 20 years. The International Council of Forest and Paper Associations (ICFPA) announced in 2006 the signing of an "historic agreement" by its global member companies:[27] a **leadership statement on sustainability** was signed by 59 company CEOs and association presidents, representing some of the largest pulp, paper and wood companies in the world, during the second meeting of the ICFPA Global CEO Roundtable. The industry committed itself to continuously improve its sustainability performance through action in core areas, such as sustainable forest management, action to combat illegal logging, promoting the recovery of pre-and post-consumer paper, and a commitment to promote innovative energy solutions.

Ecological issues also concern forestry; in some places (notably in the tropics, rather than in Europe), ecosystems are being cleared for conversion to plantations with very limited ecological value. This is a truly global issue, considering the importance of forests for the Earth's climate.

Eurostat's "European Business" (2005) points at the importance of **sustainability in forestry** and the importance of the P&P industry in that respect: "*Related issues include sustainable development initiatives that aim to ensure that forestry stocks are managed in a responsible manner, and recycling initiatives for both wood and paper that may provide alternative inputs.*" (Section 6, p. 115).

In this context, **recycling** of paper is often mentioned as a step towards sustainability. In 2004, according to CEPI (2004), some 54% of the paper and board consumed was

[26] "A Common Vision for Transforming the European Paper Industry", Vision paper signed by 50 NGOs on 27 Jan. 2006, Frankfurt. See: www.taigarescue.org (accessed in April 2006)

[27] ICFPA members are the trade associations of 43 countries. A full copy of the statement can be requested from ICFPA via its website at www.fpac.ca/en/who_we_are/media_centre/press_releases/2006/2006-06-09_ceoLeadershipStatement.php

recycled. Around 50% of the fibre mass used in paper production within the EU consisted of recycled fibres. Recycling of waste paper has increased from 25% in 1991 to 54% in 2004.

However, as a report by the European Environment Agency shows, scientific studies differ in their assessment of the ecological value of recycled paper.[28] Studies using the Life Cycle Assessment (LCA) technique tend to conclude that recycling of paper has lower environmental impacts than the alternative options of landfill and incineration. Studies using Cost-Benefit Analysis (CBA) technique have mixed results whether the socio-economic benefits gained from recycling are higher than those of incineration, landfill or other options.

Compliance with international regulation

In an increasingly global economy, businesses have access to international markets from which they source their goods and services, and to export their finished products. This applies to the paper and cardboard industry, where large companies already operate worldwide and now expect increased competition from emerging markets (see section 2.2.3). Notable examples are the European REACH regulation for chemicals (which is also highly relevant for P&P manufacturers) and the Emissions Trading Scheme.

However, many challenges for businesses come along with the access to this world market. A critical factor that adds to the complexity of doing business internationally is compliance with an expanding number of regulations and mandates from a governance, industry and privacy perspective, both on the national and the international level. For pulp and paper producers, compliance with environmental regulations is particularly critical.

Increased cost for energy

Finally, an important challenge for the P&P industry is the rise in energy costs. Although this affects all manufacturing industries, energy demand in P&P production is particularly high. In Europe, pulp and paper making is estimated to be responsible for almost 2% of the total primary energy consumption (Worrell et al. 1994). In the Nordic countries, this share is even higher due to the much larger importance of the P&P industry there.

A US study from 1996 on "Energy Efficiency and the Pulp and Paper Industry" (Nilsson et al.) argues that the paper and allied products industry was the second most energy-intensive industry group in the manufacturing sector, measured in terms of energy used per dollar value of shipments. As a result, rising energy prices are having a significant negative impact on pulp and paper mill profitability, particularly in North America, but also in Europe. In the meantime, energy prices have considerably increased, and are much higher in the EU than in North-America. The industry itself regards energy as a key issue for competitiveness, possibly even as *"the deciding factor in European paper industry competitiveness"*: *"Dramatic increases in energy costs in Europe have placed the European paper industry at a competitive disadvantage in relation to most of its global*

[28] European Environment Agency (2006): Paper and cardboard — recovery or disposal? Review of life cycle assessment and cost-benefit analysis on the recovery and disposal of paper and cardboard. EEA Technical report No 5/2006.

competitors. Consequently, industry is not only losing profitability, but also potential investments to other regions."[29]

On the other hand, it must also be taken into account that the chemical pulp industry (which constitutes the majority of the pulp industry) is to large extent energy self-sufficient. Many of the mills are even selling excess electricity and heat to their local municipalities. Thus, although the industry is certainly energy intensive, it provides a large part of the energy itself within the value system. In total, about 40% of electricity used is produced on site. Innovation in production facilities can help to further reduce energy demand. As in most industries, new or modernised plants typically use less energy than old ones. The US study quoted above (Nilsson et al.) found that European factories, in particular Scandinavian paper and pulp mills, were significantly less energy-intensive then their US counterparts already in the mid 1990s. The sector has further improved on energy efficiency since then.

2.2.3 International competition

Globalisation

Increasing demand for paper and paper products, above all in developing economies, and trends in chemical pulp prices, are again raising the capital intensity of this industry and thus encourage the formation of big company groups with international operations. However, at the same time, there are definite opportunities for smaller, local firms satisfying specific needs.[30]

An important impact of globalisation is that European companies in the sector tend to make their investments into new production capacities in South America and South-East-Asia rather than in Europe itself.

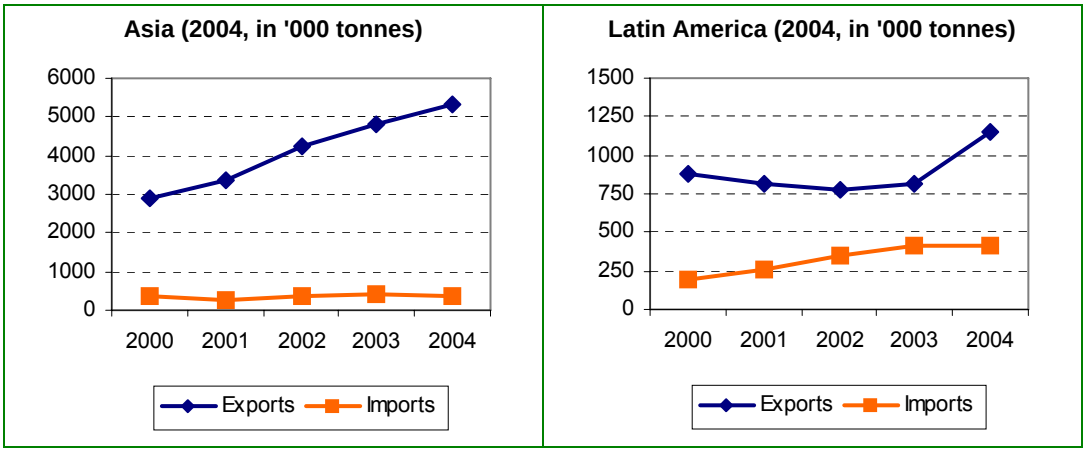
Increasing competition with Asia

A major issue in international trade, from a European perspective, is that paper and cardboard producers expect a sharp increase in competition with Asian producers. This does not show up in the industry's trade balance with Asia yet (see Exhibit 2-6). Currently, Asian countries are still an important export market for European manufacturers. The volume of paper exports has even substantially increased over the past few years, because of the massive growth in demand for pulp and paper due to the overall economic growth and industrialisation in these countries.

[29] CEPI: "Competitiveness and Europe's Pulp & Paper Industry: The State of Play", p. 2

[30] Cf. www.paperonline.org, the educational resource provided by CEPI (Mar. 2006)

Exhibit 2-6: Exports and imports of paper from CEPI countries to Asia and Latin America



Source: CEPI (2004)

The main reason why trade flows are still predominantly one-way (from Europe to Asia) in this industry is that most Asian producers cannot yet match the quality of paper and paper products manufactured by European (or US) companies. However, industry experts forecast a steep learning curve; interviewees for this report confirmed that they are certain of the soon arrival of competition from Asia. The effect will be twofold: first, Asian manufacturers will start to cater for customers in their own countries, thus challenging European exports; second, in a not too distant future, Asian companies will try to expand their activities into foreign markets, including Europe.

An increase in competition can also be expected with producers from Latin America. Imports of pulp and paper from Latin America have increased for the fourth consecutive year (see above). Competition with North American companies, on the other hand, is not regarded as a major global trade issue for the near future (although imports from North America still account for 42% of total imports in paper), at least in comparison to the 'awakening' of the emerging markets in Asia and Latin America. US and Canadian producers are likely to face the same challenges as European manufacturers in this regard.

3 Adoption of ICT and e-Business in 2006

Background information about the e-Business Survey 2006

e-Business W@tch collects data on the use of ICT and e-business in European enterprises by means of representative telephone surveys. The e-Business Survey 2006 was the fourth survey after those of 2002, 2003 and 2005. It had a scope of **14,081 interviews** with decision-makers in enterprises from 29 European countries.[31]

Most of the tables in this report feature a breakdown of the population of enterprises based on the aggregate of 10 EU countries – **the "EU-10"**.[32] In these countries the survey covered all 10 sectors (at least to some extent) and therefore comparability of the sample across sectors is given. The EU-10 represent more than 80% of the total GDP and inhabitants of the EU-25 and are thus to a large extent representative for the whole EU.

In the **P&P industry** 1158 interviews were conducted; out of these, 964 with companies from the EU-10. Some of the data are broken down into the two main **sub-sectors** of the P&P industry, i.e. NACE 21.1 (Manufacture of pulp, paper and paperboard) and NACE 21.2 (Manufacture of articles of paper and paperboard). It could be assumed that the structural differences between the two sub-sectors (see Chapter 2) translate into differences in ICT adoption, use and impact; figures provide strong evidence, however, that structural differences are not reflected in the use of e-business in most areas.

The survey was carried out as an **enterprise survey**, i.e. focusing on the enterprise as a business organisation (legal unit) with one or more establishments. Similarly to 2005, the 2006 survey also included only **companies that use computers**. The configuration of the survey set-up (e.g. sampling) reflects the mandate of *e-Business W@tch* to **focus on sectors** and **SMEs**. As a result, comparisons should mainly be made between sectors and between size-bands of enterprises. Breakdowns by country are also possible, but should be treated cautiously, for several reasons (see Annex I).

More detailed information about the survey methodology, including information about sampling and the business directories used, the number of interviews conducted in each country and sector, and data on non-response rates, are available in **Annex I** and on the website of the *e-Business W@tch.*

[31] The survey was conducted in March-April 2006 using computer-assisted telephone interview (CATI) technology. Field-work was co-ordinated by the German branch of Ipsos GmbH (www.ipsos.de) and conducted in co-operation with their local branches and partner organisations. The countries covered include EU Member States, Acceding and Candidate Countries, and countries of the European Economic Area (EEA).

[32] The EU-10 cover the Czech Republic, Germany, Spain, France, Italy, Hungary, the Netherlands, Poland, Finland and the UK.

3.1 Use of and Access to ICT Networks

Internet access

Basic **internet connectivity** of companies from the P&P industry is very much in line with the weighted average for the 10 sectors covered by the e-Business Survey 2006. Nearly all companies which use computers and have at least 10 employees said that they are connected to the internet; only among micro-firms, a minority of 6% responded that they have no internet connection. By share of employment, companies representing 99% of the sector's workforce are connected to the internet (see Exhibit 3-1).

Exhibit 3-1: Internet access and remote access to company network

	Companies with internet access		Companies with broadband internet access		Share of employees with internet access		Remote access to company network	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**99**	**94**	**80**	**68**	**32**	**40**	**56**	**21**
Micro (1-9 empl.)		91		60		49		9
Small (10-49 empl.)		99		77		29		27
Medium (50-249 empl.)		100		80		29		55
Large (250+ empl.)		100		86		36		85
NACE 21.1 (p&p man.)	99	92	79	67	33	33	61	25
NACE 21.2 (converting)	99	95	81	68	31	42	54	20
All 10 sectors (EU-10)	**95**	**93**	**76**	**69**	**40**	**43**	**35**	**16**
Micro (1-9 empl.)		89		62		51		12
Small (10-49 empl.)		98		75		29		22
Medium (50-249 empl.)		99		83		33		43
Large (250+ empl.)		99		84		44		60
Food & beverages	95	88	72	64	27	25	35	14
Footwear	96	89	75	62	19	28	17	10
Pulp & paper	99	94	80	68	32	40	56	21
ICT manufacturing	100	99	84	79	56	74	69	35
Consumer electronics	98	97	87	74	56	80	51	32
Shipbuilding & repair	100	100	87	86	29	30	41	27
Construction	95	90	72	64	39	47	25	13
Tourism	93	90	72	68	42	53	38	13
Telecommunication	100	99	88	85	80	90	74	46
Hospital activities	100	98	85	78	41	41	39	34
Base (100%)	firms using computers		firms using computers		firms with internet access		firms using computers	
N (for sector, EU-10)	964		964		924		964	
Questionnaire reference	A1		A3		A2		A5	
* Data only indicative due to low number of observations (N ~ 25-50).								

Source: *e-Business W@tch* (Survey 2006)

The deployment of **broadband access** is also well aligned with the average of the 10 sectors studied. P&P companies representing 80% of the sector's employment said that they use an internet connection technology which can be classified as broadband (either a DSL connection, cable, direct fibre connection or wireless broadband). Even among micro and small firms, more than 60% of all companies are broadband users.

However, a close look at the figures reveals that there are differences between manufacturing sectors in terms of how many employees use the internet as part of their day-to-day work. In P&P companies, the **average share of employees with internet access** at their workplace is about 40%. This figure is lower than in firms from ICT-related industries (ICT manufacturing, consumer electronics, telecommunications). On the other hand, the figure is higher than in sectors such as food and beverages, footwear or shipbuilding.

The share of employees with internet access is an indicator for the "**informatisation" of work and production processes** in manufacturing. In sectors where traditional, manual work is still important (e.g. footwear), fewer workers need ICT to perform their tasks. In other sectors, by contrast, ICT are increasingly used to manage and control production processes; the P&P industry is a good example – both in pulp and paper production and in the converting industries (products of paper and paperboard), ICT plays a significant role (see Section 4.2). Against this background, the percentage of workers with internet access could have been expected to be even higher. However, computer assisted production technologies such as CAD/CAM[33] are not the same as internet access, which is more important for information retrieval and communication than for production itself.

In the assessment of the share of employees with internet access in the P&P industry, it has to be considered that many smaller firms in the sector have taken the first steps to connect to the internet rather late. This cannot be evidenced from the survey results; but in interviews conducted for case studies, representatives of paper manufacturers mentioned that many of the small companies from the converting industries (i.e. their customers) started with only **one central e-mail** address for the whole company. At this stage of development, incoming e-mails would typically be printed out by a secretary (if it is not a one-person-company) and be handed (in paper-format) to the receiver, who will then instruct the secretary how to reply. In many cases, this is sub-optimal, since direct communication with the specific target person in the company would be more efficient for the communication with customers or suppliers.

Comparisons with specific sectors show that network access and usage in the P&P industry is mostly above the average of the 10 sectors and also above some of the other manufacturing industries, but lower than in ICT-related sectors. A good example for this general assessment is the share of companies that enable **remote access** to their computer network. Remote access means that employees can access data from the company's computer system remotely, e.g. when working from home or traveling. In the P&P industry, about 20% of firms (comprising about half of the sector's employment) enable remote access. This is an average figure for manufacturing sectors. Thus, in

[33] CAD/CAM ("computer-aided design / computer-aided manufacturing") are software programmes used to support the design and manufacture of products. CAD software is used, for example, by architects and engineers to create precision drawings or technical illustrations.

many ways, the P&P industry represents the typical situation ("state-of-the-art") in terms of ICT usage in manufacturing; a similar observation was made for the machinery & equipment manufacturing industry in sector studies 2005. It appears that structural similarities between these two traditional manufacturing industries (i.e. P&P and M&E) is mirrored by a similar state of e-business adoption.

Remote access is no longer a sophisticated functionality. Thus remote access is quite common among large firms (85%) and medium-sized ones (55%), but surprisingly is not yet widely used by small firms (25%). Although this functionality is not absolutely key to the competitiveness of a P&P company, it strongly indicates the different stage of ICT architecture maturity levels of companies from different size-bands.

Use of internal computer networks

The use of ICT to connect computers internally to a company network (Local Area Networks – LAN, and Wireless LAN) increases, of course, with company size. **LAN** is widely deployed among companies which have at least a few computers, even about two thirds of small companies (with 10-49 employees) operate a LAN (see Exhibit 3-2). **Wireless-LAN technology** is already used by about 50% of large firms from the P&P industry, and about a third of all medium-sized companies. The deployment of W-LAN corresponds very closely to the average for the 10 sectors – here again, the P&P industry appears to be representative of the typical state of adoption.

Exhibit 3-2: Networks and protocols used

	LAN		W-LAN		Use Voice-over-IP		Use VPN for remote access	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**83**	**51**	**33**	**15**	**13**	**12**	**68**	**44**
Micro (1-9 empl.)		35		10		12		10
Small (10-49 empl.)		67		15		12		39
Medium (50-249 empl.)		84		33		14		67
Large (250+ empl.)		98		49		19		81
NACE 21.1 (p&p man.)	84	56	35	12	12	10	68	45
NACE 21.2 (converting)	82	49	33	15	13	13	68	44
All 10 sectors (EU-10)	**65**	**46**	**32**	**16**	**16**	**13**	**57**	**26**
Micro (1-9 empl.)		35		12		14		20
Small (10-49 empl.)		59		21		11		32
Medium (50-249 empl.)		84		37		13		57
Large (250+ empl.)		96		47		22		79
Base (100%)	firms using computers		firms using computers		firms using computers		firms enabling remote access	
N (for sector, EU-10)	964		964		964		328	
Questionnaire reference	A4a		A4b		A4c		A6d	

Source: *e-Business W@tch* (Survey 2006)

For most of these ICT infrastructure indicators (internet access, LAN / W-LAN, remote access), there is little difference between the two sub-sectors (the manufacture of pulp & paper, and the converting industries, i.e. the manufacture of paper products). Although there are many more SMEs in the paper converting industry, this structural difference does not show up in survey results on ICT infrastructure adoption.

Voice-over-IP

The use of telephony services over internet networks, by means of digitised voice transfer technology, has gained momentum over the past few years. Established as well as new telecommunication service companies and internet service providers offer new services based on this technology which can yield user companies cost saving potentials.

These services are commonly referred to as "Voice-over-IP" (VoIP) services, as they have in common that they use the Internet Protocol (IP) to transfer voice calls. However, there are many ways for VoIP to be implemented. For example, calls can be initiated and terminated via a computer or a VoIP-enabled phone. The provision of VoIP is driven by increasing broadband penetration.

Private users typically encounter VoIP services as an internet-based Peer-to-Peer network service (for example Skype or Google Talk). But from the perspective of corporate users, there are more usage scenarios. Corporate users can generally follow **two paths** if they want to benefit from VoIP. They can use either **hybrid solutions** or pure **IP-based networks**.[34]

Voice-over-IP is already quite widely used, even in those sectors such as the P&P industry which are not typical early adopters of ICT. In 2006, 12% of all companies in the sector said that they used Voice-over-IP services (see Exhibit 3-2). There is not much of a difference between firm sizes or sub-sectors; only among large firms is diffusion slightly more advanced (about 20%). Again, figures are well aligned with the average adoption in the 10 sectors studied. It can be expected that usage will increase quickly over the next few years; eventually, as a common scenario depicts, all fixed network voice telephony could be converted to internet protocol. "Voice-over-IP" would then no longer be an issue, having become the standard technology for telephony.

[34] See *e-Business W@tch* Sector Study on the Telecommunications Industry, 2006. Available at www.ebusiness-watch.org ('resources').

3.2 ICT Skills, Outsourcing and ICT Budgets

3.2.1 Demand for ICT skills and skills development

Improving e-business skills, especially among SMEs, has been identified as a relevant **concern for policy** in several sector studies by *e-Business W@tch* in the past. Notable examples from 2005 are the sector studies on construction, on the textile and clothing industry and on the publishing and printing industry.[35] In these sectors, however, small enterprises play a dominant role (and skills issues are typically SME related). This is not the case in the P&P industry, at least not to the same extent. In paper manufacturing, large firms dominate. In fact, results of the e-Business Survey 2006 regarding the demand for ICT skills and ICT practitioners do not point at a shortage of ICT skills, at least at the level of ICT practitioners.

Employment of "ICT practitioners"

A clear distinction has to be made in this context between companies that can afford **employing ICT practitioners** (i.e. staff with the specialised skills and tasks of planning, implementing and maintaining ICT infrastructure[36]) and companies that do not employ practitioners.

The critical divide here is between small and medium-sized firms. In total, about **16%** of P&P companies said that they employ ICT practitioners (see Exhibit 3-3), which again is very close to the average figure for the 10 sectors this year by *e-Business W@tch*. Among medium-sized firms, nearly 40% of firms have specialists for ICT tasks; among large firms, about every second company employs practitioners.

If employing practitioners is used as a proxy for having an IT department, it may come as a surprise that 'only' 50% of large companies report that they employ ICT practitioners. Assuming that most companies with 250 or more employees have some sort of IT department with at least 1-2 people mainly charged with IT-related tasks, why then does every second enterprise appear to have the perception that it does not employ ICT practitioners? Maybe the term "ICT practitioner" in itself can be misleading in time-constrained telephone interviews, and some companies do not count their PC and network administrator(s) in, although they are mainly charged with ICT tasks.

[35] All sector studies can be downloaded from the *e-Business W@tch* website at www.ebusiness-watch.org ('resources'). The conclusions on policy implications are presented in a specific chapter, as in this report.

[36] The European eSkills Forum, established by the EC in March 2003, defined "ICT practitioner skills" as the "capabilities required for researching, developing and designing, managing, producing, consulting, marketing and selling, integrating, installing and administrating, maintaining, supporting and service of ICT systems." Cf. eSkills For Europe: The Way Forward", Synthesis Report by the eSkills Forum, September 2004.

Exhibit 3-3: Demand for ICT skills and skills development

	Companies employing ICT practitioners		Regular ICT training of employees		Companies with hard-to-fill vacancies for ICT jobs in 2005		Companies using e-learning	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**35**	**16**	**29**	**12**	**3**	**1**	**21**	**13**
Micro (1-9 empl.)		10		6		0		11
Small (10-49 empl.)		17		16		1		13
Medium (50-249 empl.)		38		28		3		21
Large (250+ empl.)		50		49		8		27
NACE 21.1 (p&p man.)	37	23	33	19	2	1	28	9
NACE 21.2 (converting)	35	14	28	10	4	1	18	14
All 10 sectors (EU-10)	**27**	**14**	**22**	**13**	**2**	**1**	**21**	**11**
Micro (1-9 empl.)		12		9		2		12
Small (10-49 empl.)		15		16		0		11
Medium (50-249 empl.)		29		28		2		19
Large (250+ empl.)		59		41		6		35
Base (100%)	firms using computers		firms using computers		firms using computers		firms using computers	
N (for sector, EU-10)	964		964		964		964	
Questionnaire reference	B1		B4		B2		B5	
* Data only indicative due to low number of observations (N ~ 25-50).								

Source: *e-Business W@tch* (Survey 2006)

No shortage in the supply of ICT practitioners

Some of the other results regarding the demand for ICT skills have to be assessed on the basis of this low overall reported employment of ICT practitioners. For example, **only about 1% of all firms** reported that they had had **hard-to-fill vacancies** for ICT jobs in 2005. This figure appears to be surprisingly low, considering the attention which policy is paying to the presumed ICT skills gap.

Two conclusions are possible: first, that the skills gap is commonly overestimated, at least when looking at most of the sectors, including the P&P industry (only the telecommunication and the ICT manufacturing industry reported a more significant skills gap). Second, a normative assessment could be favoured in the sense that many companies are not aware that they should actually upgrade their ICT skills by hiring qualified people. Even among large firms, which have a wider demand, 'only' about 8% of companies reported difficulties in finding and hiring qualified personnel for ICT jobs.

This evidence is supported by interviews conducted for case studies, which indicate that a lack of ICT and e-business skills is not perceived as a major concern among large firms. For example, neither *VPK Packaging* (see Section 3.5.2) nor *Mayr-Melnhof Cardboard Group* (see Section 4.2.3) said that they had experienced a lack of ICT skills

as a critical issue during their recent e-business initiatives. One firm (see case study "ICT for production tracking", Section 4.2.4) reported "*a noticeable impact on increased specific skills requirements for workers*" when introducing an RFID system in warehousing, but did not observe a shortage or lack of such skills as a problem.

ICT training for employees

Companies representing about 30% of employment in the sector said that they regularly send employees to **ICT training programmes**. The figure roughly doubles by size-band, from about 15% of small firms to 30% of medium ones and 50% of large firms. Training activities do not only concern ICT practitioners that run the systems, but also **ICT users** among the workforce. The share of active companies in that respect corresponds to the average of the other industries, but – as can be expected for obvious reasons – is lower than in ICT-related industries. The required ICT skills depend on the typical daily work routine of employees. For example, the low degree of training activity in many footwear companies indicates that production in this sector is not (yet) as much ICT based as in other manufacturing industries.

e-Learning, which means supporting training with learning material in electronic format, for example material that is available on an intranet or the internet, is used by about 13% of firms, but increases by firm-size. e-Learning applications can be used for ICT-related training, but also for other sector-specific or even company-specific training sources (e.g. about raw materials or manufacturing methods).

"e-Skills" – a managerial issue

In summary, evidence suggests that, in the P&P industry, ICT skills are more of an **issue on the managerial level**, i.e. how to use e-business to support the company strategy. ICT skills gaps on the level of the individual workers are possibly not so much of a concern, not even in consideration of the high degree of technology used in production processes.

However, this is admittedly a debatable issue. The authors of a recent related *e-Business W@tch* sector study on the publishing and printing industry (2005) arrived at a different conclusion. There, changing skills requirements were identified as a key issue, not only on the managerial level regarding business models, but also in the day-to-day routines of workers: in printing, *"… many jobs have been transformed from formerly typical "blue collar" jobs to positions where operating complex computer systems requires a sound technical qualification."*[37] It remains to be seen whether the P&P industry will experience a similar development in some business areas, for example if RFID based systems become widespread in inventory and supply chain management.

[37] See *e-Business W@tch* Sector Study on the Publishing and Printing Industry, September 2005, p. 17. Available at www.ebusiness-watch.org ('resources').

3.2.2 Outsourcing of ICT services and ICT investments

Outsourcing

Firms were asked whether they had **outsourced** any of their ICT services to external service providers **in 2005** which they had previously conducted in-house. In the P&P industry, this is the case for about 15% of companies, with a slight increase by firm-size (see Exhibit 3-4). There is also a slight difference between the two sub-sectors in that respect: relatively more companies from NACE 21.1 (pulp and paper production) outsourced services in 2005 than from NACE 21.2 (paper converting industries). Once again, figures for the P&P industry are a close match to the average of the 10 sectors.

Exhibit 3-4: Outsourcing and spending on ICT

	Have outsourced ICT services in 2005		**Share of ICT budget as % of total costs**		**Have made ICT investments in 2005**		**Difficulty to draw funds for investments**	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**17**	**14**	**5**	**4**	**77**	**54**	**12**	**29**
Micro (1-9 empl.)		12		4		44		58*
Small (10-49 empl.)		16		5		63		21*
Medium (50-249 empl.)		18		5		79		7*
Large (250+ empl.)		17		5		87		0*
NACE 21.1 (p&p man.)	20	21	6	3	78	55	**	**
NACE 21.2 (converting)	16	12	5	5	77	53	15	33
All 10 sectors (EU-10)	**19**	**14**	**6**	**5**	**65**	**50**	**19**	**15**
Micro (1-9 empl.)		8		5		39		25
Small (10-49 empl.)		21		5		60		3
Medium (50-249 empl.)		21		6		78		6
Large (250+ empl.)		31		6		86		29
Base (100%)	firms using computers		all firms (excl. "don't know")		firms using computers		Firms with external funding sources for their ICT investments	
N (for sector, EU-10)	964		624		964		40	
Questionnaire reference	B6		C1		C3		C5	

* Data are not displayed because the number of observations in individual countries is too low for this indicator.

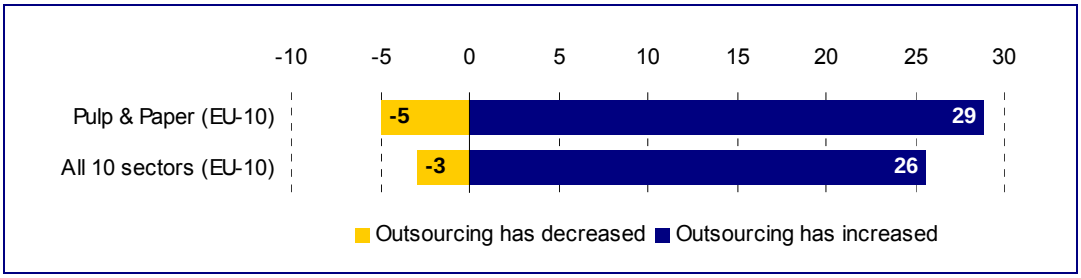
** Data only indicative due to low number of observations (N ~ 25-50).

Source: *e-Business W@tch* (Survey 2006)

It is interesting to compare these figures with those from the e-Business Survey 2005, where a different question was asked. In 2005, the question was whether companies had outsourced *any* ICT services, not necessarily in the previous year. About 60% of the small firms and about 80% of the medium-sized and large firms had replied that they had outsourced ICT services. Assuming that the picture would be quite similar in the P&P industry, this means that about **one in five** companies (out of those that use outsourcing in general) **outsourced additional ICT services** in 2005.

The overall trend appears to be that **more services will be outsourced** in the future. Asked whether outsourcing would increase, decrease or remain the same in 2006/07 (compared to 2005), about 30% of companies from the P&P industry anticipated an increase, and only very few companies (5%) said that outsourcing would rather decrease.

Exhibit 3-5: Outsourcing trend: percentage of companies that have increased / decreased their outsourcing activities in 2005



Base (100%): Companies that have outsourced ICT services. N (for sector, EU-10) = 145.
Weighting: in % of firms. Questionnaire reference: B7

Source: *e-Business W@tch* (Survey 2006)

ICT expenditure and investments

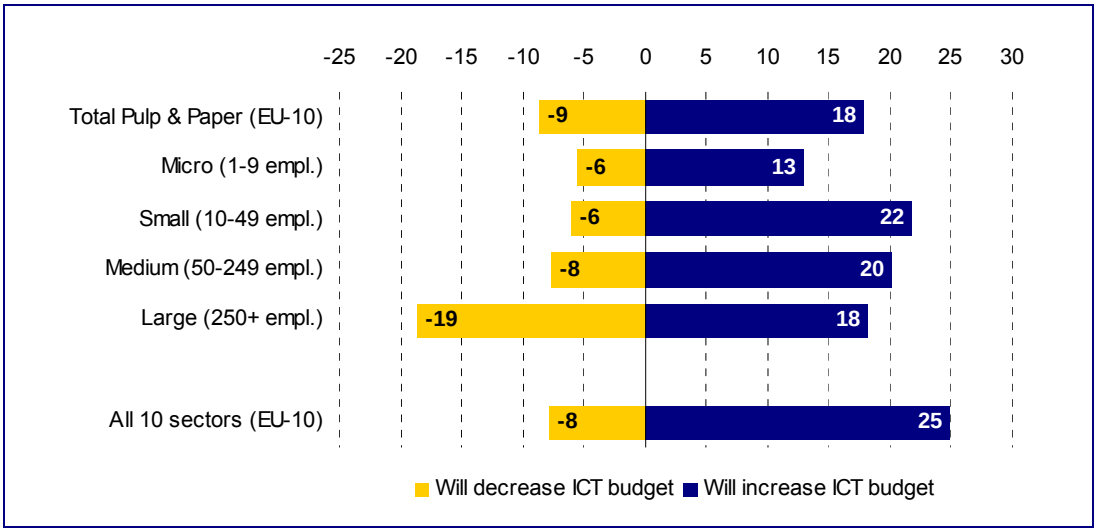
The **average ICT budget** of a company in the P&P industry, including hardware, software, services and personnel, corresponds to about 5% of total company costs (see Exhibit 3-4 above). Close to 20% of all firms in the P&P industry plan to further **increase their ICT budgets** in 2006/07, compared to the current budget. About 10% say that they will cut down on their budgets (see Exhibit 3-7). A majority of about 70% say that they will maintain their current level of spending.

Large firms in the sector appear to be significantly more **inclined to cut down on their ICT budgets** than smaller firms. Close to 20% of the large companies said that they would decrease budgets; this is twice as much as on average in the 10 sectors studied this year by *e-Business W@tch* – in total, about 10% of the large firms plan budget cuts. Moreover, the share of large companies with an expansive ICT strategy (at least in terms of budgets) is also lower than on average.

Although results should not be over-emphasised, since the number of cases on which this observation is based is rather low (N = 66), it is still significant as a probable trend. There is no easy explanation why large players from the P&P industry appear to act against the overall trend. On the contrary, new developments, e.g. in RFID technology and e-marketing, and the increasing use of ICT for quality assurance and in production processes (see case studies in this report) could rather signal demand for investments and extended budgets. On the other hand, some investments in e-business technologies have reached a mature status in large firms (e.g. ERP implementation and system integration) and this may lead to reduced budgetary requirements. Another possible reason is that ICT services are increasingly concentrated in headquarters, which enables large companies to reduce costs.

The P&P industry is not the only sector, though, where a trend towards downsizing ICT budgets among large companies can be found. It is also observed in the footwear industry. The extreme pressure on companies to cut costs in an increasingly international competition is certainly a strong driver to cut down on ICT spending in both sectors, even if the detailed competitive scenarios are quite different.

Exhibit 3-6: ICT budget trend: percentage of companies that plan to increase / decrease their ICT budgets in 2006/07



Base (100%): Companies using computers (excl. "don't know"). N (for sector, EU-10) = 910.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: C2

Source: *e-Business W@tch* (Survey 2006)

No figures are available on the absolute **size of investments**; as a proxy, results for the machinery and equipment industry from the e-Business Survey 2005 could be used.[38] Companies from the machinery and equipment industry reported annual average investments in ICT infrastructure and software of about 18,000 EUR for a small company with 10-49 employees (in 2004); medium-sized firms invested about 80,000 EUR, and large enterprises with more than 249 employees about 570,000 EUR.[39]

In 2006, *e-Business W@tch* asked companies instead about the **major source** from which they finance their ICT investments[40], and whether they experienced any difficulties in receiving funds from this source (in case of external financing sources). In each of the 10 sectors surveyed, **self-financing** (out of the cash-flow generated) is the dominant

[38] based on the structural similarity between these industries and the observation that they tend to show similar ICT adoption rates, representing the manufacturing average

[39] See *e-Business W@tch* Sector Study on the Machinery and Equipment Industry, September 2005. Available at www.ebusiness-watch.org ('resources').

[40] Ideally, a question about the percentage of particular investments funded by the different financing sources would be asked; however, only few interviewees would be in a position to spontaneously answer this question on the telephone; furthermore, such a question would be extremely time-consuming. Thus, the only feasible solution was to ask for the *major* source for investments in general.

source of financing for ICT investments. In the P&P industry, 80% of firms said that this is their major source. **Bank loans** are typically used for larger ICT investments; they are the major financing source for about 5% of firms. Interestingly, none of the large firms reported the use of bank loans. **Venture capital** is insignificant compared to the other sources: only about one in a hundred firms said that this is their major source for ICT investments. The situation for public funds is nearly the same (1-2%), while a larger share of firms (about 8%) reported using other sources for their investments.

Exhibit 3-7: Major source for investments in ICT

	Cash-flow financing		Bank loans		Venture capital		Public funds and other	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**72**	**80**	**4**	**5**	**3**	**1**	**9**	**10**
Micro (1-9 empl.)		86		3		0		11
Small (10-49 empl.)		80		8		1		9
Medium (50-249 empl.)		66		6		4		11
Large (250+ empl.)		73		0		1		9
NACE 21.1 (p&p man.)	70	78	2	5	0	0	13	10
NACE 21.2 (converting)	73	81	4	5	4	1	6	9
All 10 sectors (EU-10)	**74**	**82**	**5**	**7**	**1**	**1**	**9**	**7**
Micro (1-9 empl.)		82		8		1		2
Small (10-49 empl.)		81		6		1		2
Medium (50-249 empl.)		70		8		1		2
Large (250+ empl.)		67		2		1		8
Base (100%)	firms that have made investments in ICT							
N (for sector, EU-10)	592		592		592		592	
Questionnaire reference	C4		C4		C4		C4	

Source: *e-Business W@tch* (Survey 2006)

3.3 Standards, Interoperability and ICT Security Issues

A "standard", used as a technical term, is "*a technical specification approved by a recognised standardisation body for repeated or continuous application, with which compliance is not compulsory*".[41] There are national, European and international technical standards. In addition to such formal standards there are also industry specifications which result from collaboration, in consortia or smaller partnerships, subject to differing levels of openness and participation. Whatever the source, agreement on shared technical standards is an instrument to achieve interoperability between different systems. Without interoperability of ICT systems, which requires standards and compatibility between standards, advanced forms of e-business (such as the digital integration of systems in B2B exchanges) are hardly possible.

3.3.1 Types of e-standards used

papiNet® usage

The paper industry has established the papiNet® standard[42] as a single, complete standard for e-trade within the industry supply chain. papiNet® is an industry e-business initiative, coordinated by a not-for-profit cooperative international initiative. The development and prospects for this standard are described in detail in Section 4.1. It is concluded, in broad agreement with stakeholders interviewed for this analysis, that papiNet® is a success story, although *"… there is still a lot of scope for new implementations, especially for those involving SMEs."*

This assessment is confirmed by the survey results, which show that actually only a small percentage of companies appear to use papiNet® (or is actually aware of using it). The standard is mainly used by **larger enterprises** (with at least 250 employees), and mainly by companies from **NACE 21.1** (the manufacture of pulp & paper). In total, only 2% of all companies interviewed reported the use of this industry standard. Among large firms, EDI-based and proprietary standards are used by about three times as many firms as papiNet®. Other XML-based standards are used by twice as many firms.

The survey data are difficult to link to those reported by papiNet® (see Section 4.1.4). A user survey concluded that about **310 companies** at around 600 sites worldwide had implemented the papiNet® standard by the end of 2005. About three quarters of all B2B messages based on this standard involved European companies. NACE 21.1 (manufacture of pulp, paper and paperboard) comprises about 2,270 firms in the EU-25. If 3% of those firms use papiNet® (as found by the *e-Business W@tch* survey, see Exhibit 3-8), only about 70 companies would use this industry specific standard in Europe. However, the comparison is indicative at best since the e-Business Survey also included micro and small firms. Moreover, the number of "messages used" (user survey) is not necessarily correlated with the number of companies (*e-Business W@tch* survey).

---

[41] Directive 98/34/EC of the European Parliament and the Council of 22 June 1998, laying down a procedure for the provision of information in the field of technical standards and regulations, see http://europa.eu.int/eur-lex/pri/en/ oj/dat/1998/l_204/l_20419980721en00370048.pdf

[42] papiNet® is a registered trademark of the European Union and United States.

In any case, both figures are of a similar magnitude. They demonstrate that papiNet® derives its importance not from the *number of enterprises* that use it, but from the fact that it is used by the *large players*, and – as a result – the value of the transactions that is accomplished electronically on the basis of this standard. From this perspective, the assessment that papiNet® is a good practice example is not in contradiction with the apparently low deployment among companies.

Exhibit 3-8: Use of e-standards

	EDI-based standards		XML-based standards		Proprietary standards		papiNet	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**20**	**6**	**15**	**5**	**19**	**15**	**7**	**2**
Micro (1-9 empl.)		3		2		12		1
Small (10-49 empl.)		5		5		19		3
Medium (50-249 empl.)		15		12		16		1
Large (250+ empl.)		36		23		28		11
NACE 21.1 (p&p man.)	26	8	18	5	18	16	13	3
NACE 21.2 (converting)	18	5	14	5	20	14	4	2
All 10 sectors (EU-10)	**9**	**3**	**11**	**5**	**19**	**12**	**n.a.**	**n.a.**
Micro (1-9 empl.)		2		6		10		n.a.
Small (10-49 empl.)		4		5		13		n.a.
Medium (50-249 empl.)		10		10		24		n.a.
Large (250+ empl.)		29		27		31		n.a.
Base (100%)	firms using computers		firms using computers		firms using computers		firms using computers	
N (for sector, EU-10)	964		964		964		964	
Questionnaire reference	G1a		G1b		G1c		G1d	

Source: *e-Business W@tch* (Survey 2006)

GUSI - Global Upstream Supply Initiative

In the **paper converting sector** (NACE 21.2), i.e. for use in direct communication between packaging suppliers and their customers, the standard approach to e-business most equivalent to papiNet® in its comprehensive cover of a full sub-sector is probably the **GUSI** (Global Upstream Supply Initiative) of GCI (Global Commerce Initiative).[43]

GUSI is a consumer oriented standard for processes and XML-messages and was developed by the consumer goods industry together with their suppliers. The GUSI group started informally in January 2003 and was integrated into GCI in November 2004. Significant efforts are being made to further establish and promote the GUSI standard. An implementation guide was published in April 2006 and over 150 B2B pilots are planned in approximately 20 countries world-wide for 2006. This is a significant increase from the six pilots which were conducted in 2005.

[43] For more information, see www.gci-net.org (June 2006)

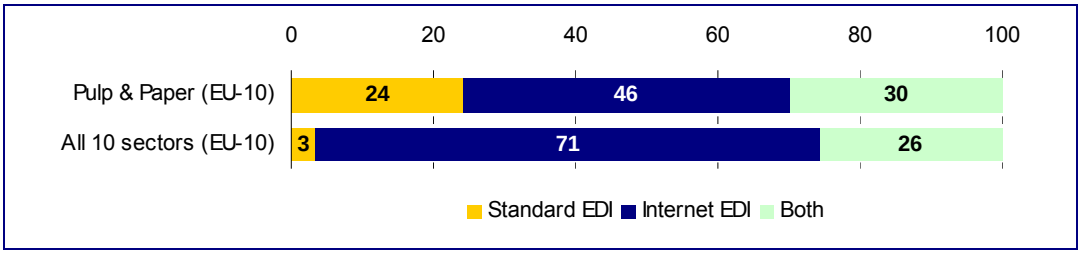
papiNet® and GUSI therefore currently **co-exist** and respectively constitute the main standards for e-business (i.e. automated B2B processes) in the two sub-sectors of the P&P industry that are the subject of this study. The wider deployment of each individually or together will further enhance B2B integration across this industry's value system. In an optimistic scenario, each will become the dominant standard in their sub-sectors: papiNet® will be used between paper manufacturers and the paper converting sector, and GUSI will be used in the exchanges between the converters and their customers (retailers, producers of packaged consumer goods). An interesting question for the future which cannot be answered by this study is **whether there is a business case for integration** and consolidation of common technical components and semantic aspects of the two standards (see Section 5.2.2).

EDI usage

EDI (electronic data interchange) is still the preferred messaging standard among medium-sized and large firms in the P&P industry. About 15% of medium-sized companies and more than a third of large firms report that they use EDI. Only 5% of small companies use EDI. Within the family of EDI based standards, there are several specific EDI standards for applications in the paper based industries.

Out of those companies that use EDI in the P&P industry, the majority uses internet based EDI (about 45%); however, standard EDI is still used by about 24% of EDI-users, which is significantly more than in most other sectors; about 30% report the usage of both internet and standard EDI (see Exhibit 3-9).

Exhibit 3-9: Types of EDI used



Base (100%): Companies using EDI. N (for sector, EU-10) = 77.
Weighting: in % of firms. Questionnaire reference: G3

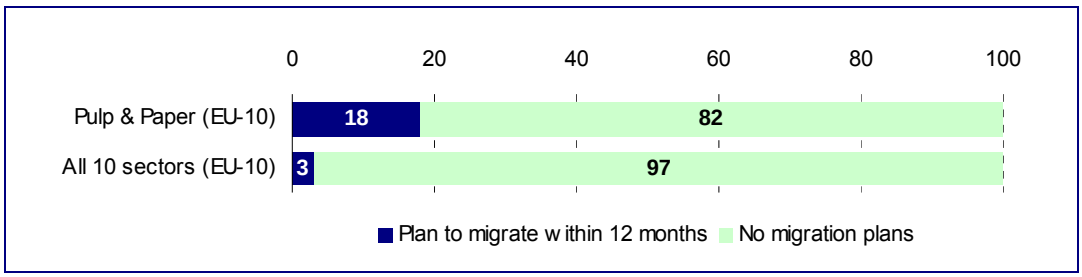
Source: *e-Business W@tch* (Survey 2006)

Among users of standard EDI, a majority of 80% have no migration plan to switch from standard to internet EDI (see Exhibit 3-10). This demonstrates that legacy systems for e-business can be quite stable and constitute a barrier for the adoption of new technologies. EDI implementations are a good example; the set-up of an EDI infrastructure, which typically includes point-to-point connections between specific enterprises, is quite costly. Companies that have invested a lot of money in this infrastructure will therefore be inclined to use it as long as possible. The automotive industry is a prime example of this situation,[44] but it also applies to the P&P industry.

[44] See *e-Business W@tch* sector reports on the Automotive Industry (2003, 2004, 2005). Available at www.ebusiness-watch.org ('resources').

Thus, EDI based standards will continue to play an important role for e-business messaging in manufacturing industries in the near future.

Exhibit 3-10: Companies planning to migrate from EDI to XML based standards



Base (100%): Companies using EDI. N (for sector, EU-10) = 71.
Weighting: in % of firms. Questionnaire reference: G4

Source: *e-Business W@tch* (Survey 2006)

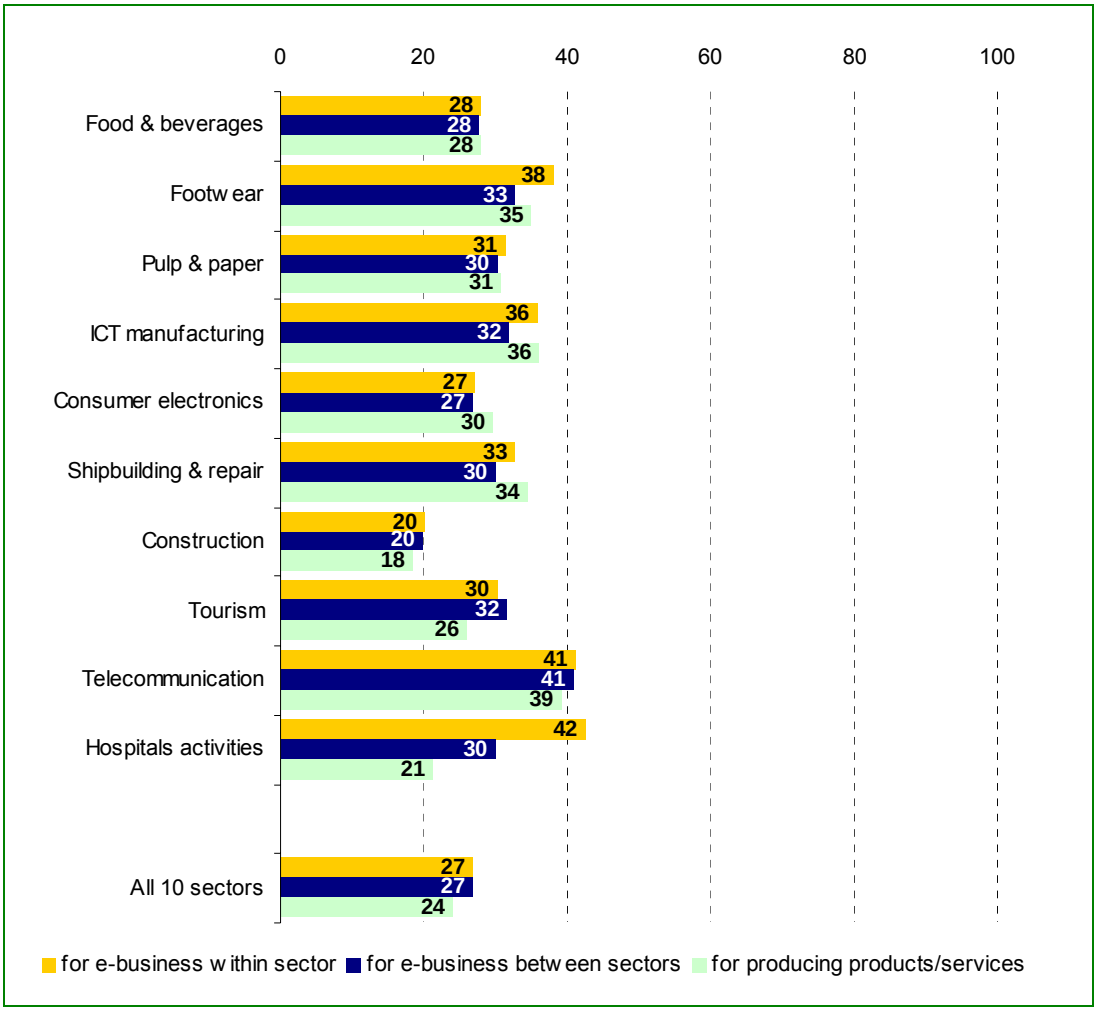
3.3.2 Interoperability challenges

Interoperability refers to the "*ability of two or more systems to exchange data, and to mutually use the information that has been exchanged*."[45] *e-Business W@tch* asked companies whether they regard interoperability as critical for conducting e-business with companies from their own sector, from other sectors, and for producing their products or services. Results are fairly consistent with those obtained from a similar question in 2005 and do not show any pronounced differences between sectors (see Exhibit 3-11), with the possible exception of the telecommunications and construction industries.

In the P&P industry, about 30% of all companies see **interoperability as critical** in each of the three categories asked. This finding must be put into perspective, however, since only about two thirds of all firms say that e-business constitutes a "significant part" or "some part" of the way they operate. Thus, about 45% of those companies for whom e-business plays a role in their day-to-day routines are aware of the critical role of interoperability. The perceived importance of interoperability increases slightly by company size.

[45] Definition by IEEE and ISO, cf. *e-Business W@tch* Special Study on e-Business Interoperability and Standards, September 2005, p. 14. Available at www.ebusiness-watch.org ('resources').

Exhibit 3-11: Perceived importance of interoperability: percentage of companies saying that interoperability is critical …



Base (100%): Firms using computers. N (for sector, EU-10) = 769.
Weighting: in % of firms. Questionnaire reference: G5a-c

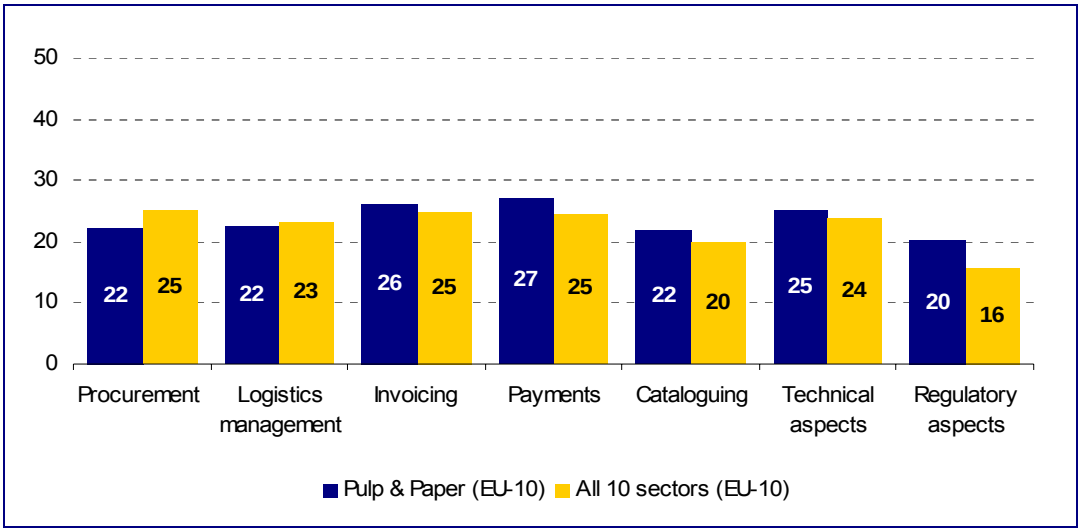
Source: *e-Business W@tch* (Survey 2006)

e-Business W@tch also asked companies whether they experience any **difficulties** stemming from a **lack of interoperability**. Only those firms were asked which said that interoperability was critical for e-business and/or producing the products; seven potential problem areas were suggested. In each of the suggested areas, about 20-25% of the firms said they were experiencing difficulties stemming from a lack of interoperability.

Again, sector results are very much in line with the average picture from the 10 sectors studied (see Exhibit 3-12). The business functions where most companies experience interoperability challenges are invoicing and payments. This indicates that electronic **processing of payments** between companies is increasing fast, even in sectors with a comparatively low use of ICT, and that there are still unsolved problems with regard to the compatibility of systems and standards. This was also found for other sectors studied this year by *e-Business W@tch*, e.g. the footwear industry. Results support the case of some recent policy initiatives by DG Enterprise and Industry, which aim at creating a

favourable framework in the EU Member States for the use of e-invoicing; addressing barriers such as a lack of interoperability is one of the issues on the agenda.[46]

Exhibit 3-12: Problems due to a lack of interoperability: firms experiencing difficulties in …



Base (100%): Firms that say that interoperability is critical for their e-business.
N (for sector, EU-10) = 388. Weighting: in % of firms. Questionnaire reference: G6

Source: *e-Business W@tch* (Survey 2006)

3.3.3 Use of Open Source Software

The open source model

Open source software (OSS) refers to computer software under an open source license. An open-source license is a copyright license for software that makes the source code available and allows for modification and redistribution without having to pay or seek permission from the original authors. In the past years, the public awareness of OSS has grown steadily, with the operating system Linux (an alternative to proprietary operating systems such as Windows) being the best-known project. Besides Linux, other OSS such as the database mySQL or the Internet browser Firefox (a Mozilla browser spin-off) have each achieved significant market shares.

Policy is interested in monitoring OSS developments and the uptake among companies for several reasons. There is some debate and different views on whether the use of OSS based operating systems could possibly reduce ICT costs for SMEs, at least in the long run. Another aspect is whether OSS systems may help to "unlock" companies from specific ICT service providers in the future.

[46] For more information, see website the European e-Business Support Network, a network for policy makers coordinated by DG Enterprise and Industry (www.e-bsn.org)

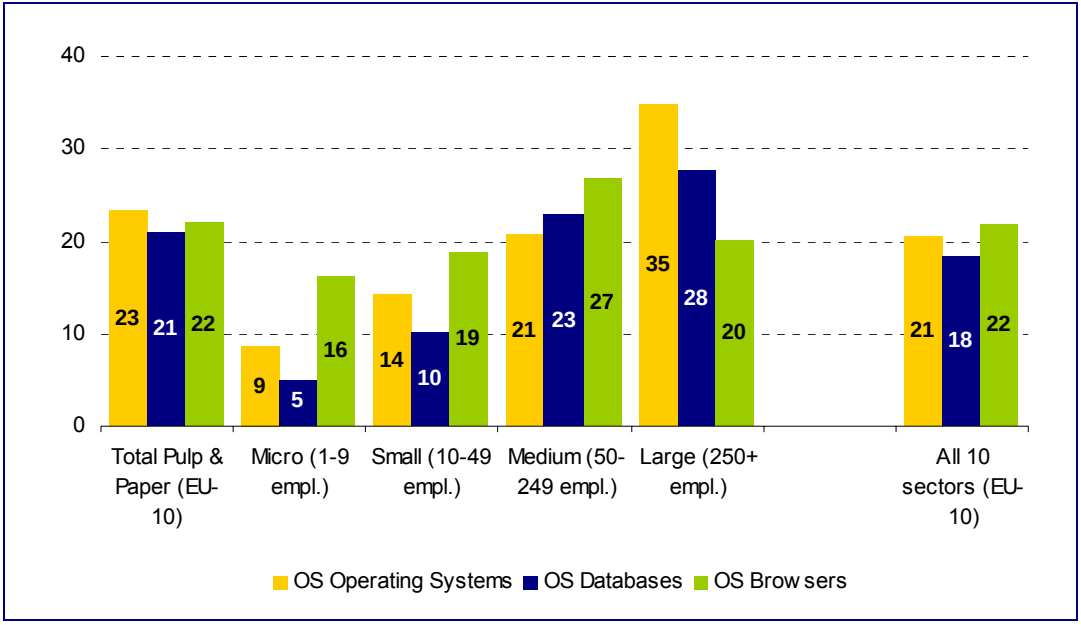
Deployment of Open Source Software

Against this general interest on the issue in policy and industry, companies were asked whether they used OSS, either in operating systems, databases or browsers. Results for the P&P industry show that **use of OSS** clearly **increases by firm size**, with considerable gaps between the small firms (with up to 49 employees) and the medium-sized ones, and again between the medium and large ones. This is fully in line with findings of the e-Business Survey 2005.

In particular, **operating systems** (including Linux) based on OSS are quite widely used by large companies from the P&P industry (35%). However, this is less than in other sectors; among large firms, nearly 50% of large companies from the sample of the 10 sectors studied said they use OS operating systems. For other enterprise size-bands, data are similar to the ones for most other sectors.

In total, companies representing about 20-25% of employment in the P&P industry reported using OSS for one or more of the applications asked (operating systems, databases and browsers).

Exhibit 3-13: Companies using Open Source (OS) Software



Base (100%): Companies using computers. N (for sector, EU-10) = 964.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: G8

Source: *e-Business W@tch* (Survey 2006)

3.3.4 ICT security measures

e-Business W@tch analysed security controls and other measures applied by European enterprises to counter security threats in detail in its survey of 2005. Results, which were presented in a special report,[47] indicated that basic components such as firewalls and secure servers – for those enterprises requiring these – already exhibited high levels of penetration. As a follow-up to this study on ICT security, questions on selected security measures which were of particular interest to policy were also included in the e-Business Survey 2006.

Secure Server Technology and Firewall

"**Secure server technology**" means that data exchange between computers is based on certain technical standards or protocols, for example "Secure Sockets Layer" (SSL); this is a widely used[48] protocol for managing the security of a message transmission on the internet. Transport Layer Security (TLS), which is based on SSL, is an emerging successor. In the P&P industry, more than 20% of all firms report use of Secure Server Technology (see Exhibit 3-14). Figures largely correspond to the average situation across the 10 sectors. SSL is most widely used by medium-sized and large firms (about 45-50%).

Exhibit 3-14: ICT security measures used by enterprises

	Secure Server Technology		Digital Signature or Public Key Infrastructure		Firewall	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**40**	**21**	**24**	**15**	**86**	**64**
Micro (1-9 empl.)		15		11		56
Small (10-49 empl.)		24		19		68
Medium (50-249 empl.)		44		24		90
Large (250+ empl.)		48		34		93
NACE 21.1 (p&p man.)	45	22	24	15	85	62
NACE 21.2 (converting)	38	21	24	15	87	65
All 10 sectors (EU-10)	**36**	**20**	**21**	**15**	**78**	**62**
Micro (1-9 empl.)		16		13		56
Small (10-49 empl.)		23		17		73
Medium (50-249 empl.)		36		25		84
Large (250+ empl.)		64		39		94
Base (100%)	firms using computers		firms using computers		firms using computers	
N (for sector, EU-10)	964		964		964	
Questionnaire reference	G9a		G9b		G9c	

Source: *e-Business W@tch* (Survey 2006)

[47] See *e-Business W@tch* Special Study on ICT Security, e-Invoicing and e-Payment Activities in European Enterprises, September 2005. Available at www.ebusiness-watch.org ('resources').

[48] Cf. Whatis.com (http://searchsecurity.techtarget.com)

Secure server technology is normally closely linked with **e-commerce** activity. However, figures for the diffusion of SSL in the P&P industry do not fully correspond to the percentage of firms that say that they receive orders from customers online. The percentage of medium-sized and large firms that report use of SSL is much larger than the share of companies that enable customers to order online (see Section 3.6.1). This shows that secure servers are used to a greater extent for purposes other than managing online sales in larger than in smaller companies.

As can be expected, firewalls are widely used by companies from each of the 10 sectors studied; there is still a gap, though, between the small firms and the medium-sized and large ones. In total, about 65% of all firms from the P&P industry said that they use a firewall to protect their computer system from malicious e-mail and unauthorised access; these companies represent about 85% of sector employment (see Exhibit 3-13).

Digital signature

An **e-signature** is an electronic information file attached to or associated with a contract or another message used as the legal equivalent to a written signature. Electronic signature is often used to signify either a signature imputed to a text via electronic means, or by cryptographic means to add non-repudiation and message integrity features to a document. **Digital signature** usually refers specifically to a cryptographic signature, either on a document, or on a lower-level data structure. The rationale for measuring the adoption of digital signatures is that it is an important step for the integration of business processes between different enterprises, specifically for the legal recognition of documents sent electronically, as is the case with **invoices**.[49]

In 2005, *e-Business W@tch* had asked companies whether they had "*rules that specify the use of digital signature or Public Key Infrastructure*", as part of a question on the use of ICT security measures. In total, about 11% of firms (accounting for 20% of employment) reported that they had such rules. Figures in 2006 appear to be slightly higher; the adoption of e-invoicing may be a key driver here. In the P&P industry, 15% of firms reported the use of digital signature / public key infrastructure (see Exhibit 3-13). The use increases almost linearly with company size. About 25% of medium-sized companies and 35% of large firms say they use digital signature. Figures are very similar to the average of the 10 sectors.

In general, the yet rather low levels of deployment of digital signature / public key infrastructure could represent an obstacle in the evolution of interoperable solutions for many e-business processes, particularly those with strong contractual content such as the transfer and agreement of large liabilities. On the other hand, the issue is very complex, as there are many ways of using digital signature in invoicing processes, with some legal uncertainty as to which practices will be accepted for pre-tax deduction in future audits (see Section 3.4.3 on e-invoicing and Section 5.2.2 with a policy recommendation on this issue).

[49] To this end, the European Parliament and the Council issued in 1999 the "e-Signature Directive" (Directive 1999/93/EC, of 13 December 1999) - see http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_013/l_01320000119en00120020.pdf.

3.4 Internal and External e-Integration of Processes

The use of ICT and e-business to support and optimise intra-firm processes has become increasingly important, particularly in manufacturing. By **digitisation of formerly paper-based processes**, information and documents related to incoming or outgoing orders can be **seamlessly processed** along the company's value chain; orders can be linked with production and inventory management, and the underlying software systems support controlling and management by enabling full transparency of all business processes. Furthermore, **collaborative** processes within and between companies are supported, such as information sharing among employees (for example by use of an intranet), planning and demand forecast, organising and archiving documents, and human resources management. In general, ICT applications for these purposes are predominantly used initially by large companies, and eventually also by medium-sized firms.

How companies from the P&P industry make use of ICT as a driver of process efficiency is explained and discussed in detail in section 4.2. This section describes the diffusion of specific applications in this field.

3.4.1 Use of software systems for internal process integration

In the P&P industry, only about one in four companies interviewed said they used an **intranet**. This facility can be a useful platform for the secure exchange of information within a company and, possibly, the implementation of internal training programmes (see Exhibit 3-15).

Exhibit 3-15: Use of ICT systems for internal process integration

	Intranet		Accounting software		ERP system		Document Management system	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**53**	**24**	**79**	**66**	**45**	**16**	**16**	**10**
Micro (1-9 empl.)		14		58		8		9
Small (10-49 empl.)		29		80		18		11
Medium (50-249 empl.)		53		83		45		12
Large (250+ empl.)		74		86		70		25
NACE 21.1 (p&p man.)	60	28	80	76	46	18	20	14
NACE 21.2 (converting)	50	23	79	63	45	16	14	9
All 10 sectors (EU-10)	**42**	**23**	**70**	**57**	**19**	**11**	**19**	**13**
Micro (1-9 empl.)		19		50		7		11
Small (10-49 empl.)		28		70		16		13
Medium (50-249 empl.)		43		85		25		19
Large (250+ empl.)		76		88		45		42
Base (100%)	firms using computers		firms not using an ERP system		firms using computers		firms using computers	
N (for sector, EU-10)	964		705		964		964	
Questionnaire reference	D1a		D1e		D1d		D1c	

Source: *e-Business W@tch* (Survey 2006)

The value of an intranet for facilitating access to company information (guidelines, process and technical documentation, archives) increases by firm-size. Accordingly, nearly three out of four large firms in the P&P industry said that they had an intranet, while only about 30% of small firms and 50% of medium-sized ones reported adoption.

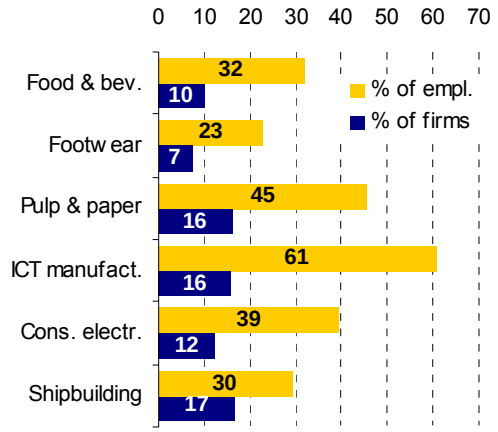
Enterprise Resource Planning (ERP) systems are software systems that help to integrate and cover all major business activities within a company, including product planning, parts purchasing, inventory management, order tracking, human resources, projects management, and finance. Ideally, they link business processes electronically across different business functions and thus help to improve efficiency in operating those processes. In addition, ERP systems can play an important role in supporting connectivity between enterprises.

For manufacturing companies, ERP systems are an important "hub" for much of their e-business activities with other companies. This applies certainly to the P&P industry, where B2B data exchanges as well as planning and controlling processes are largely based on functionalities provided by ERP systems (see Section 4.2.2 for a detailed discussion).

ERP systems are widespread among companies from the P&P industry, compared to most other sectors studied this year by *e-Business W@tch*. In total, companies representing 45% of employment in this sector said they operated an ERP system; the ICT manufacturing industry is the only one among the other sectors with an even higher adoption rate (61%).

However, there is still a considerable gap in ERP adoption between small firms and larger ones in the P&P industry (see Exhibit 3-15). This hampers the further uptake of more sophisticated forms of e-business (see policy implications, Section 5.2).

Exhibit 3-16: Companies with an ERP system



Base (100%): Companies using computers.
N (for sector, EU-10) = 964.
Questionnaire reference: D1d

Source: *e-Business W@tch* (Survey 2006)

In the 2006 survey, *e-Business W@tch* asked – for the first time – those companies that do not use and ERP system whether they use a special **accounting software** (other than just spreadsheet programmes, such as Microsoft Excel). In smaller companies, accounting software typically substitutes to some extent the functionality which ERP software has in larger firms, although on a much simpler level and with a lower potential for automating order-related document flows.

Results show that a great majority of firms in all sectors (about 70% in terms of their employment share), and particularly in the P&P industry (about 80%) use at least some type of accounting software, in case they do not have an ERP system (see Exhibit 3-15). Only among micro enterprises, a notable group of about 40% says that they have neither

an ERP system nor a special accounting software. Very small companies often handle their accounting and planning by means of self-created spreadsheet solutions. It is hard to explain, however, why 10% of medium-sized and even 4% of large firms report neither using an ERP system nor an accounting software.

Special software systems for EDM (**electronic document management**) are rarely used in the P&P industry, as in most of the other sectors. These software systems are typically used to archive and manage documents of any type in digital format; this is highly relevant for example in the insurance industry (management of insurance policies), and to a lesser extent in manufacturing enterprises.

However, EDM is an important and growing product segment within the software industry, which is also increasingly developing industry specific solutions, also for manufacturers. The main software applications in this field can be grouped as **DMS and ECM systems**. The more traditional DMS (Document Management Systems) are used for systematically archiving documents. The more recent concept of ECM (Enterprise Content Management) goes beyond DMS, as it also covers information objects (e.g. database systems) and not only individual documents. In manufacturing and retail sectors, document management can be important fort he digital integration of ordering and sales processes. Typically, EDM systems are integrated into ERP systems in form of sector specific modules.

3.4.2 Use of ICT for cooperative and collaborative business processes

ICT tools can support the cooperation of companies in supply chain processes; both cooperation in production processes within the same link of the supply chain, and at the interface between different links. The **value system** in the P&P industry involves companies from the forestry and woodworking industries, sawmills, pulp and paper manufacturers, paper converting companies and the publishing and printing industry. Supply chain processes consists of discrete value adding activities that are increasingly organised in integrated production networks within this industry cluster (see also Exhibit 2-2 in section 2.1).

The diffusion of ICT tools for online cooperation and collaboration[50] in the P&P value system compares favourably to the situation in other manufacturing industries. About 10% of all P&P firms say they use online tools for collaborative design ("**e-design**") with other companies. Among large firms, the figure goes up close to 30% (see Exhibit 3-17). In most other manufacturing sectors, figures are quite similar. There is some doubt, however, whether collaborative e-design activities are really so widely diffused in various industries; it is difficult to draw a clear borderline here as to which software applications and which practices are included or not. The same applies to some of the other applications presented here; figures should therefore be used indicatively.

[50] "Cooperation" means splitting a common, centrally managed task into sub-tasks which are performed by different partners of the cooperation. "Collaboration" means that several partners work together on the same task at the same time.

Exhibit 3-17: Online cooperation and collaboration within the value system

	Share documents in collaborative work space		Manage capacity / inventory online		Collaborative design processes		Collaborative forecasting of demand	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**27**	**17**	**32**	**13**	**16**	**11**	**19**	**12**
Micro (1-9 empl.)		12		6		11		9
Small (10-49 empl.)		21		19		10		13
Medium (50-249 empl.)		26		29		13		18
Large (250+ empl.)		39		48		28		27
NACE 21.1 (p&p man.)	23	15	33	14	15	9	16	11
NACE 21.2 (converting)	29	17	31	13	17	12	21	12
All 10 sectors (EU-10)	**27**	**14**	**22**	**10**	**15**	**7**	**20**	**11**
Micro (1-9 empl.)		10		8		5		10
Small (10-49 empl.)		19		14		8		13
Medium (50-249 empl.)		31		21		13		19
Large (250+ empl.)		47		41		25		41
Base (100%)	firms with internet access		firms with internet access		firms with internet access		firms with internet access	
N (for sector, EU-10)	934		934		934		934	
Questionnaire reference	D5a		D5e		D5d		D5c	

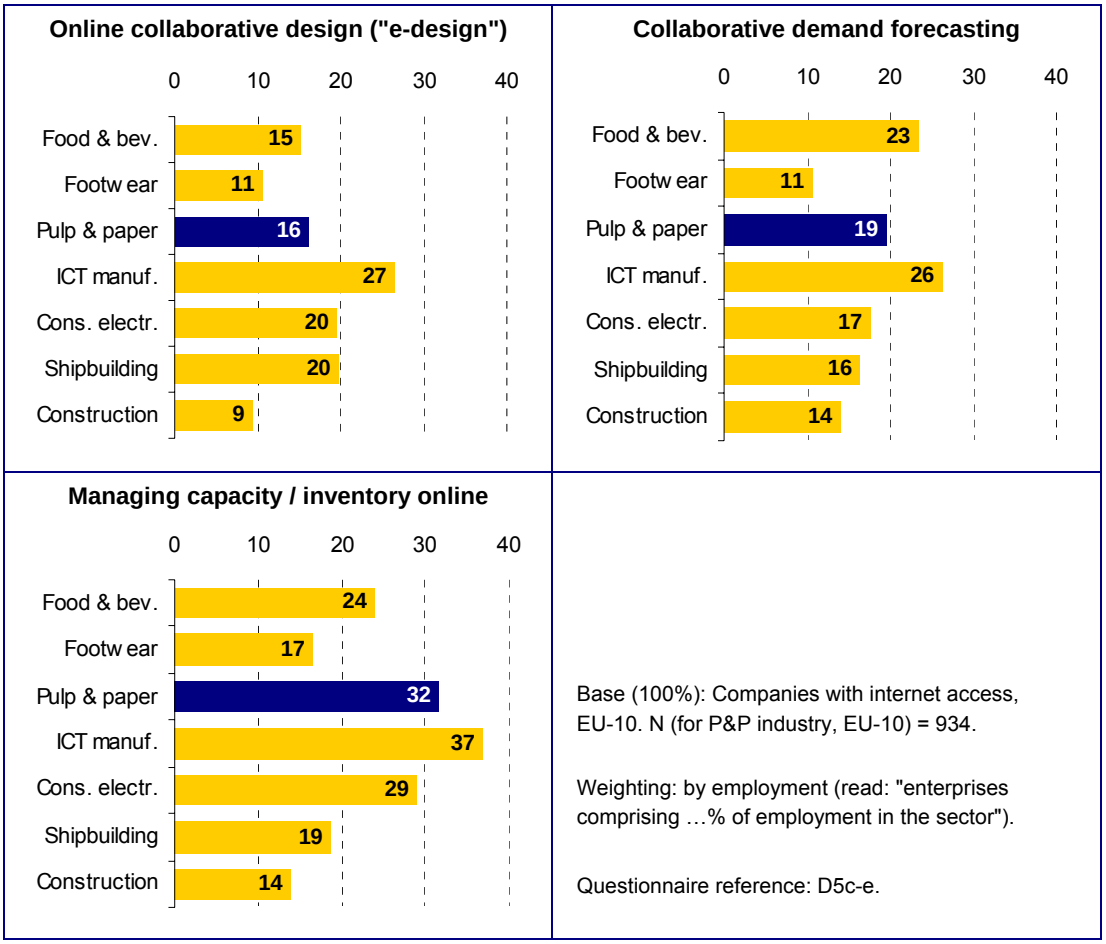
Source: *e-Business W@tch* (Survey 2006)

Collaborative **forecasting of demand** is another example. There are quite sophisticated tools for calculating demand, determining the amount and time of production and thus the demand for various inputs (supply goods), storage capacity and other services. Again, figures for the adoption of related systems in the P&P industry are similar to those reported from other manufacturing industries (see Exhibit 3-18), and to those for collaborative design. As a rule of thumb, companies representing about 20% of employment in a manufacturing sector report the use of these applications. In construction, for comparison, the adoption rate is about 10-15%.

Systems for **managing capacity and inventory** online tend to be more widely diffused than those for e-design and demand forecasting. In particular in sectors where logistics is an important cost factor and service criteria, e.g. in the P&P industry, the adequate use of ICT to support logistics processes can be an important strategic issue.[51]

[51] Implications of the latest developments of RFID technology in this context are discussed in detail in section 4.3.

Exhibit 3-18: Diffusion of ICT tools for online cooperation in the value system – manufacturing and construction sectors in comparison



Source: *e-Business W@tch* (Survey 2006)

3.4.3 Deployment of e-invoicing

Introduction

In the e-Business Survey 2006, special attention was paid to the issue of electronic invoicing (e-invoicing). e-Invoicing is a computer-mediated transaction between a seller / biller (invoicing entity) and a buyer / payer (receiving entity), which **replaces traditional paper-based invoicing processes**. In e-invoicing, the invoice is electronically generated and sent by the biller, and electronically received, processed and archived by the payer. In practice, e-invoicing typically goes hand in hand with making payments electronically.[52]

It is widely recognised that the use of e-invoicing promises rather easy-to-achieve cost savings for both parties involved (invoicing entity and receiving entity), because processing invoices in a standardised, electronic format can be accomplished much

[52] For more background information on e-invoicing activities of enterprises, see *e-Business W@tch* Special Report "ICT Security, e-Invoicing and e-Payment Activities in European Enterprises" (September 2005). Available at www.ebusiness-watch.org ('resources').

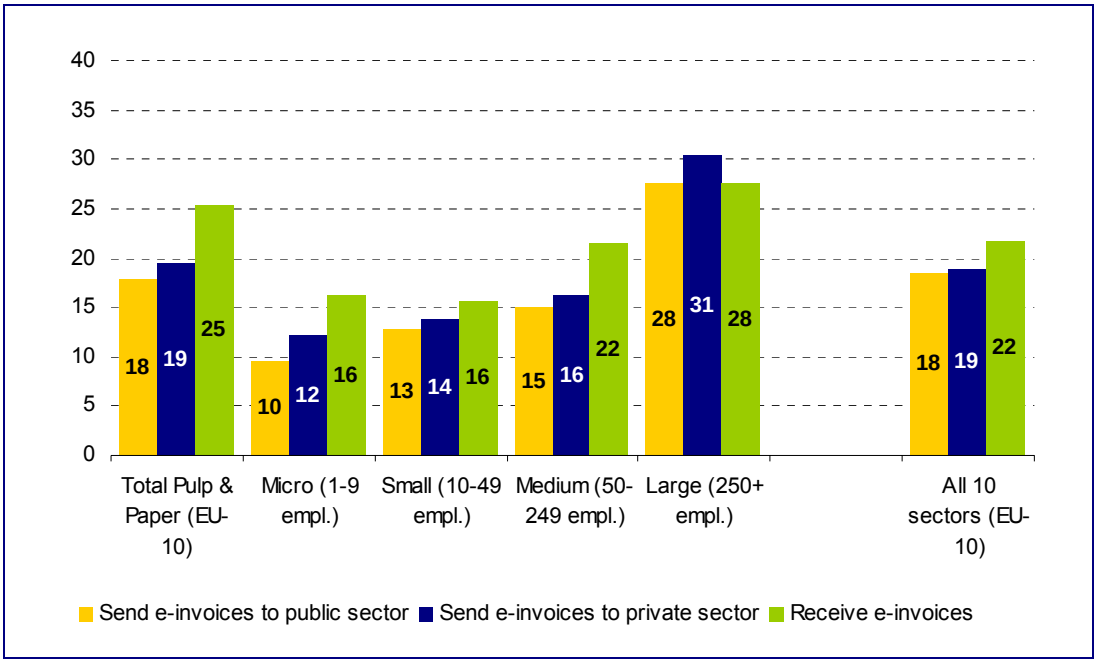
faster compared to the often cumbersome handling of printed invoices. The cost saving potential obviously depends on the number of invoices that have to be processed; companies and sectors differ widely in this respect.

Current state of adoption

e-Invoicing can either be accomplished in a **web-based** environment, or processes can be integrated with the **ERP** system of a company. ERP-based systems (which are used in B2B e-invoicing) promise the highest cost-saving potential for companies. The broad installed base of ERP systems in the P&P industry could thus provide a solid basis for wide adoption of e-invoicing, at least among medium-sized and large firms.

The survey results partially confirm this assumption. e-Invoicing is used about as much as in most other manufacturing sectors with a similar ERP adoption rate. In the P&P industry, firms representing close to 20% of employment are now sending e-invoices (either to customers in the public sector and / or in the private sector), and 25% say that they receive e-invoices from suppliers (see Exhibit 3-19). Findings are very similar for food and beverages, ICT manufacturing and for the shipbuilding and repair industry (see Exhibit 3-20). This is another example confirming the overall impression arising from this survey that there is a certain alignment of most of the manufacturing industries as regards the state of play in e-business. The P&P industry is in many ways the perfect yardstick of what constitutes state-of-the-art ICT use in manufacturing.

Exhibit 3-19: Adoption of e-invoicing in the P&P industry

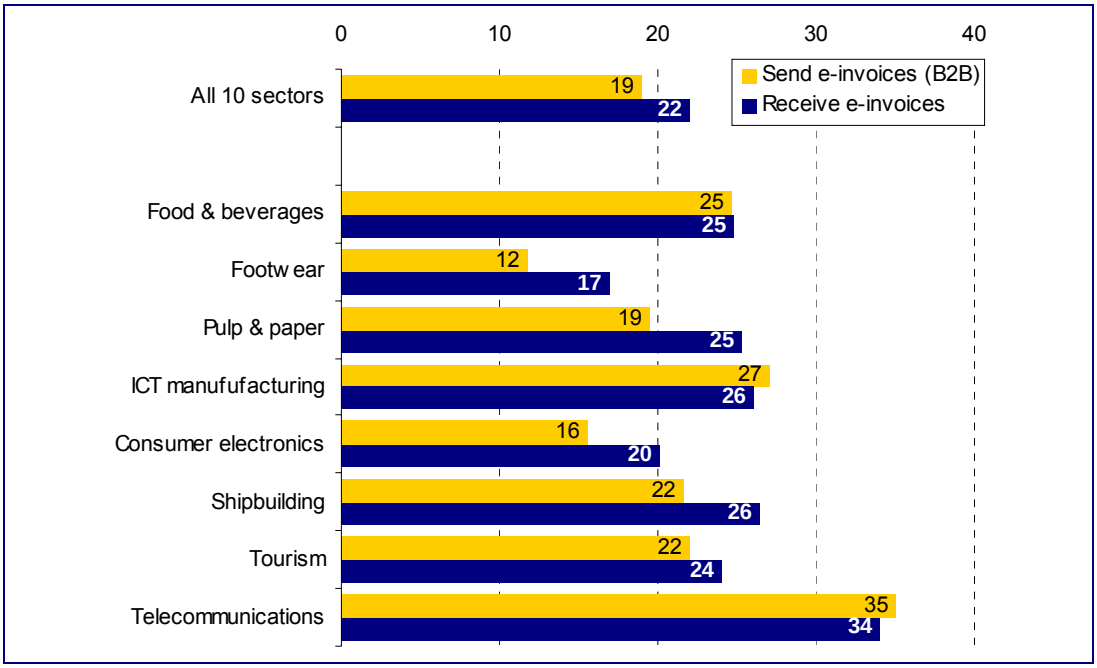


Base (100%): Companies with internet access. N (for sector, EU-10) = 934.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: D5f-h

Source: *e-Business W@tch* (Survey 2006)

Exhibit 3-20: Adoption of e-invoicing by sector



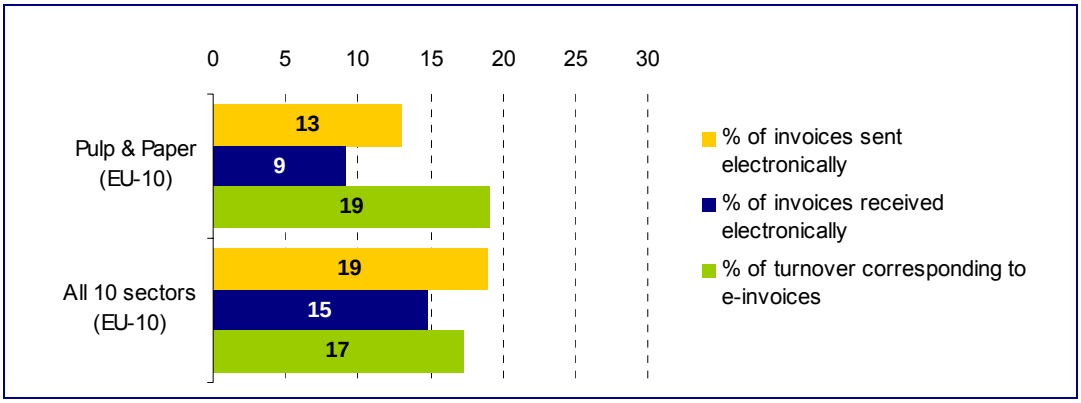
Base (100%): Companies with internet access. N (for sector, EU-10) = 934. Weighting: by employment (figures should be read as "enterprises comprising …% of employment in the sector". Questionnaire reference: D5

Source: *e-Business W@tch* (Survey 2006)

For this indicator, there is hardly a difference between micro, small and medium-sized firms in the P&P industry. The **large firms** lead the development here (about 30% send or receive e-invoices). This picture is confirmed in interviews and case studies (see section 4.2).

When only looking at those companies that actually use e-invoicing, the **average share of e-invoices** (measured as percentage of a company's total invoices sent or received) is slightly lower in the P&P industry than on average in the 10 sectors. Companies that practise e-invoicing report that about 13% of invoices sent are e-invoices, and about 9% of invoices received (see Exhibit 3-21).

Exhibit 3-21: Share of e-invoices as % of total invoices



Base (100%): Companies sending/receiving e-invoices (without "don't know"). N (for sector, EU-10) = 149/161. Questionnaire reference: D6, D7, D8

Source: *e-Business W@tch* (Survey 2006)

This (minor) difference is plausible, because many of the smaller companies start with issuing and sending e-invoices; this can be done in a web-based environment, often supported by their bank or other financial institutions, or by adding a module to the accounting software, similarly as for online banking. Adapting the deployed software systems to receive invoices electronically can be more complicated.

3.5 e-Procurement and Supply Chain Management

Introduction

Efficient management of procurement is a fundamental activity in most manufacturing industries, since value chains tend to be complex and fragmented. The larger the number of transactions, the more will even slight improvements in this domain produce significant overall **cost savings**. Online procurement can be carried out regardless of a real integration of systems with suppliers, for instance by placing orders via a supplier's website. This is often the first step towards a more comprehensive and integrated use of ICT in business processes.

Inputs that can be sourced and procured online from suppliers are mainly raw materials. For paper producers, important **raw materials** are recovered paper (accounting for almost 50% of fibres used) and woodpulp (mechanical, semi-mechanical and chemical pulp); for the converting industry, paper and cartonboard are the most important input. All these products can theoretically be procured online; many products, such as grades of paper and cartonboard are well suited to be catalogued in a standardised way (see, as an example, the online products catalogue "Cartonette" in the case study on *Mayr Melnhof Cartonboard Group*, Section 4.2). In the converting / packaging industry, particularly for special packaging solutions, online procurement of ready made components may also be needed, e.g. plastic components or buttons.

For many products, the quality of the raw material is very important; often, customers order only paper or cartonboard from specific mills, as they know the quality from these mills suits their demands. Longstanding, trusted business relations within the industry are therefore quite common in this industry. Thus, buyers will not easily switch their suppliers by means on e-procurement only on the basis of cost considerations. Depending on the product, quality can be equally or even more important.

3.5.1 B2B online trading: companies placing orders online

Online orders and the average share of e-procurement

About 50% of all firms active in the P&P industry said that they place at least some orders to suppliers online.[53] The incidence increases by firm size (see Exhibit 3-22). Once again, the P&P industry is a near-perfect yardstick for the overall adoption, as figures are almost identical with the 10 sector total..

Exhibit 3-22: Companies ordering supply goods online

	Place orders online		Place 1-25% of orders online		Place more than 25% of orders online		Use specific ICT solutions for e-sourcing	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**59**	**49**	**81**	**75**	**19**	**25**	**14**	**8**
Micro (1-9 empl.)		42		70		30		5
Small (10-49 empl.)		55		82		18		8
Medium (50-249 empl.)		62		75		25		13
Large (250+ empl.)		68		91		9		30
NACE 21.1 (p&p man.)	52	42	87	86	13	14	10	5
NACE 21.2 (converting)	62	50	80	73	20	27	17	8
All 10 sectors (EU-10)	**57**	**48**	**74**	**75**	**26**	**25**	**16**	**9**
Micro (1-9 empl.)		44		73		27		7
Small (10-49 empl.)		54		80		20		10
Medium (50-249 empl.)		60		76		24		16
Large (250+ empl.)		68		75		25		29
Food & beverages	54	39	86	91	14	9	14	5
Footwear	35	29	83	87	17	13	9	5
Pulp & paper	59	49	81	75	19	25	14	8
ICT manufacturing	72	69	67	49	33	51	20	10
Consumer electronics	70	71	60	47	40	53	16	9
Shipbuilding & repair	62	53	78	69	22	31	18	12
Construction	53	51	74	72	26	28	12	6
Tourism	60	39	77	72	23	28	20	12
Telecommunication	78	77	54	49	46	51	26	12
Hospital activities	67	67	71	73	29	27	19	12
Base (100%)	firms using computers		firms placing orders online		firms placing orders online		firms using computers	
N (for sector, EU-10)	964		511		511		964	
Questionnaire reference	E1		E3		E3		E7	
* Data only indicative due to low number of observations (N ~ 25-50).								

Source: *e-Business W@tch* (Survey 2006)

[53] The underlying question in the e-Business Survey 2006 was changed compared to previous years. In 2006, companies where asked whether they "use the internet or other computer-mediated networks *to place orders* for goods or services online". In previous surveys, the question was whether they "use the internet or other computer-mediated networks *to purchase* goods or services online". Thus, a direct comparison of figures, e.g. with those for the publishing & printing industry in 2005, is not recommended.

Among ICT-related manufacturing sectors, however, even more companies placed orders online: about 70% (by employment) in the ICT manufacturing and consumer electronics industries

In previous surveys, the relatively high adoption rates of online purchasing/ordering always had to be qualified in terms of the **share of e-procurement** as percentage of the total procurement volume.[54] A significant percentage of firms that purchased online said that these purchases account for less than 5% of their total procurement. Obviously, many companies only occasionally ordered products or services from suppliers online (e.g. for office supplies), rather than practising e-procurement in a regular and systematic way.

In the P&P industry, as in other sectors, a majority of about 75-80% of those companies that place orders online said that these orders account for up to 25% of their total procurement (see Exhibit 3-22). Again, the relative share of goods procured online is somewhat higher in ICT related sectors, including the telecommunications industry.

Main type of supply goods ordered online

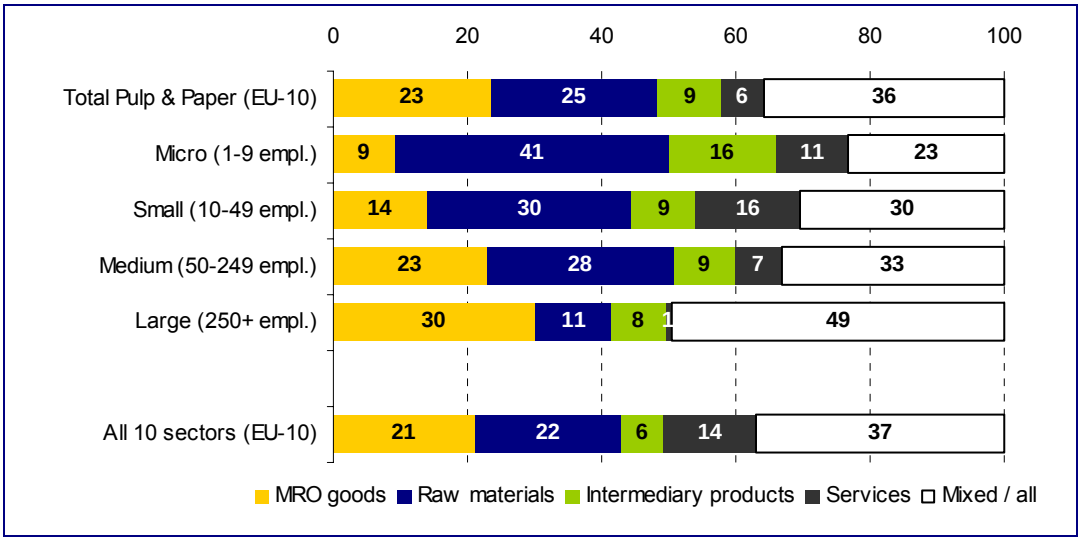
Online sourcing and procurement can relate to different types of inputs. These include MRO goods,[55] raw materials, intermediary products and services. As indicated in the introduction to this section, the survey confirms that **raw materials** (such as recovered paper and woodpulp) have the highest importance for pulp and paper manufacturers in their e-procurement strategy. About 25% of firms that place orders online say that these orders are *mainly* for raw materials (see Exhibit 3-23). In particular, SMEs buy mainly raw materials online; this comes as a surprise, as previous studies by *e-Business W@tch* indicated that smaller companies would typically start with buying MRO goods from the website of suppliers, rather than focusing on the core inputs for their production.

Among large companies, procurement schemes are rather all-encompassing. A majority of 50% say that their e-procurement activity is not directed towards a certain type of good or service, but that it is "mixed" (i.e. including many different kinds of supplies). In general, raw materials are of course mostly relevant for manufacturing companies and industries such as construction. In service sectors, MRO goods and services are more important types of supplies.

[54] Companies are asked to estimate how large a share of their total purchases (2003, 2005) / orders (2006) is conducted online.

[55] MRO goods are maintenance, repair, and operating supplies. This category typically includes office supplies and diverse other items which are not materials or components directly used for the products or services which a company produces.

Exhibit 3-23: Main type of supply goods ordered online



Base (100%): Companies placing orders online (without "don't know"). N (for sector, EU-10) = 522.
Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: E4

Source: *e-Business W@tch* (Survey 2006)

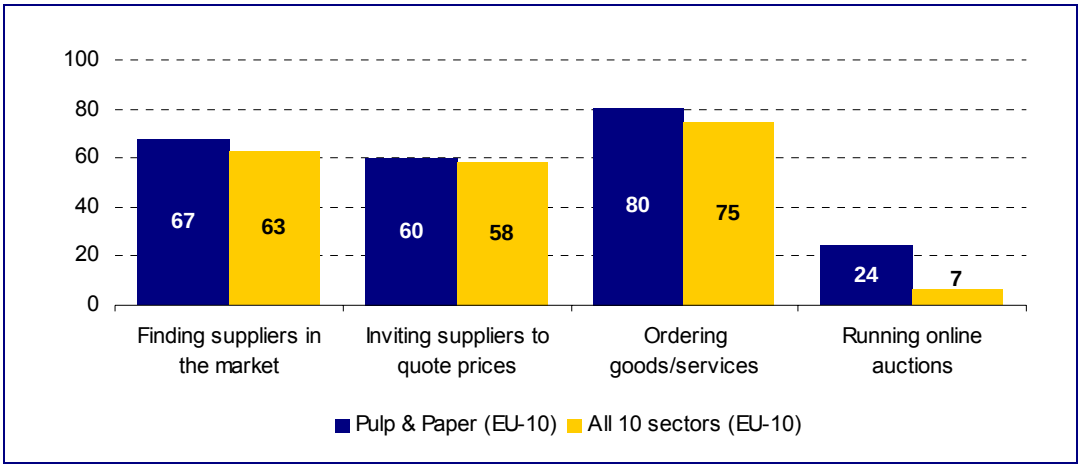
Use of ICT for e-procurement processes

As in 2005, *e-Business W@tch* asked companies whether they "*support the selection of suppliers or procurement processes by specific ICT solutions*." The rationale for this question was to further test whether electronic procurement is in fact a systematic and **digitally integrated** process in a firm, or rather an occasional business activity without much significance for the overall business.

In 2006, only about **8% of firms** (representing about 14% of sector employment) in the P&P industry reported the use of software solutions or internet-based services for e-procurement (see Exhibit 3-22). This shows that there is a massive gap between the percentage of companies placing at least some orders online (~50%) and those that use special software for this (~8%). It can be assumed that companies without such software place orders mainly through websites or extranets of suppliers, which does not require any special e-procurement system. The digital back-office integration of procurement related processes (all the way from ordering to the receipt of goods / services) is probably not in advanced state in these cases.

It is interesting to observe that the percentage of firms with special ICT systems for e-procurement equals about half of those firms with an ERP system, throughout the size-bands. It appears that about every second firm with an ERP system has taken the next step to add a module or interface for B2B integration with suppliers.

Exhibit 3-24: Sourcing and procurement processes supported by specific ICT solutions



Base (100%): Companies using specific ICT solutions for e-procurement. Weighting: in % of firms.
N (for sector, EU-10) = 105. Questionnaire reference: E8

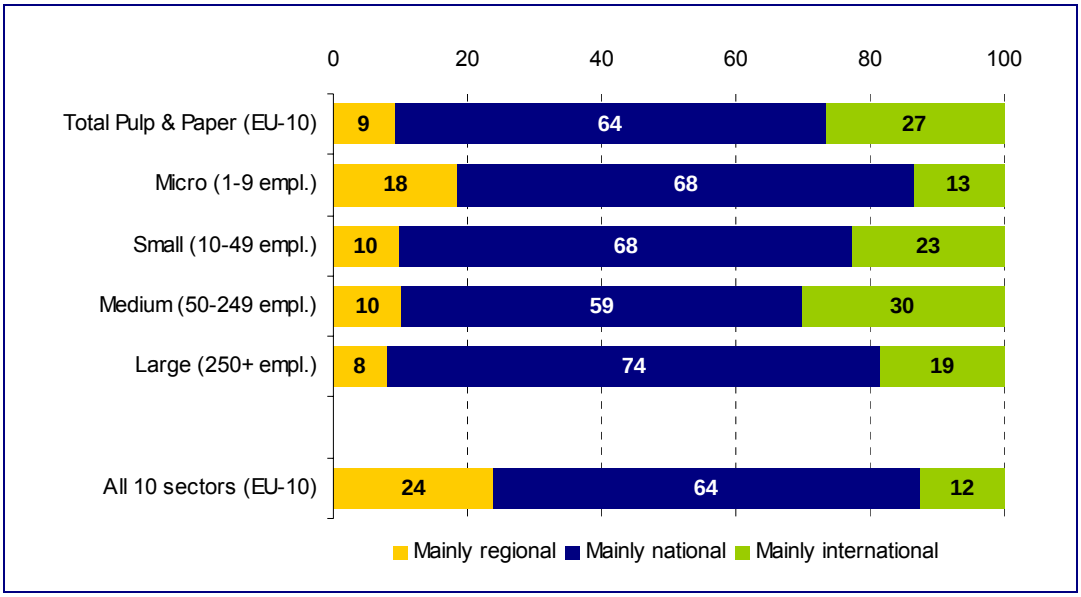
Source: *e-Business W@tch* (Survey 2006)

Those companies which have procurement systems in place tend to use them for several functions, but in practice mainly for actually placing orders (80%) and for finding suppliers in the market (67%). These findings are quite in line with the picture in most other sectors (see Exhibit 3-24). About one out of four companies with special ICT systems says it runs online auctions among suppliers. This is a higher incidence than in most other sectors (7% on average).

Main location of suppliers in e-procurement

Most companies in the P&P industry reported that they ordered online mainly from suppliers in their own country, although not being focused on their own region. More than 70% of those companies that order online reported either **regional or national suppliers** as their main geographic market for procurement activities (see Exhibit 3-25). About 25-30% said that their procurement activities were truly international, i.e. they buy goods or services online mainly from international suppliers. Thus, the share of P&P firms with an international procurement scheme is higher than on average (12%) in the 10 sectors studied this year by *e-Business W@tch*, while in other industries more companies order predominantly from regional suppliers.

Exhibit 3-25: Main location of suppliers in e-procurement



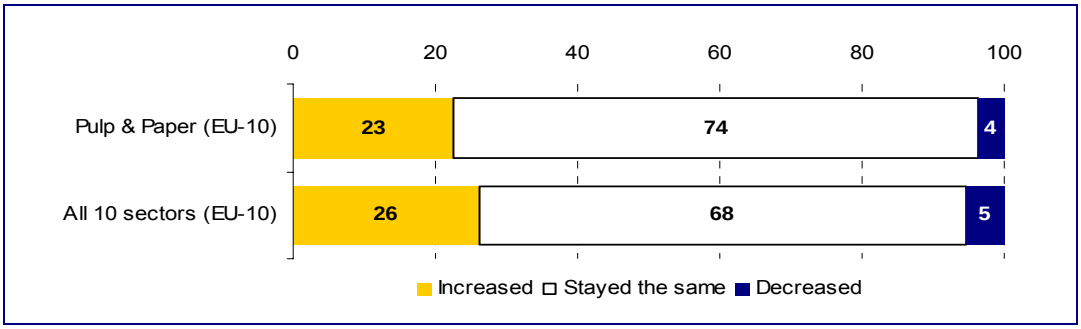
Base (100%): Companies placing orders online (without "don't know"). N (for sector, EU-10) = 522.
Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: E5

Source: *e-Business W@tch* (Survey 2006)

Impact of e-sourcing on supplier selection

As in previous years, *e-Business W@tch* asked companies that use e-procurement whether this has had an impact on the selection of suppliers, i.e. whether the number of suppliers had rather increased or decreased due to their e-procurement strategy, or whether this was without impact on the number of suppliers. A majority of companies from the P&P industry, as in most sectors, reports that e-procurement is **without an effect on the number of suppliers** (about 75%). More than 20% said that the number had increased, probably because e-sourcing had helped to find new suppliers in the market. Only a minority of 4% said that they had consolidated their supplier base by means of e-procurement (see Exhibit 3-26).

Exhibit 3-26: Impact of e-sourcing and e-procurement on the number of suppliers



Base (100%): Companies placing orders online (without "don't know"). N (for sector, EU-10) = 506.
Weighting: in % of firms. Questionnaire reference: E9

Source: *e-Business W@tch* (Survey 2006)

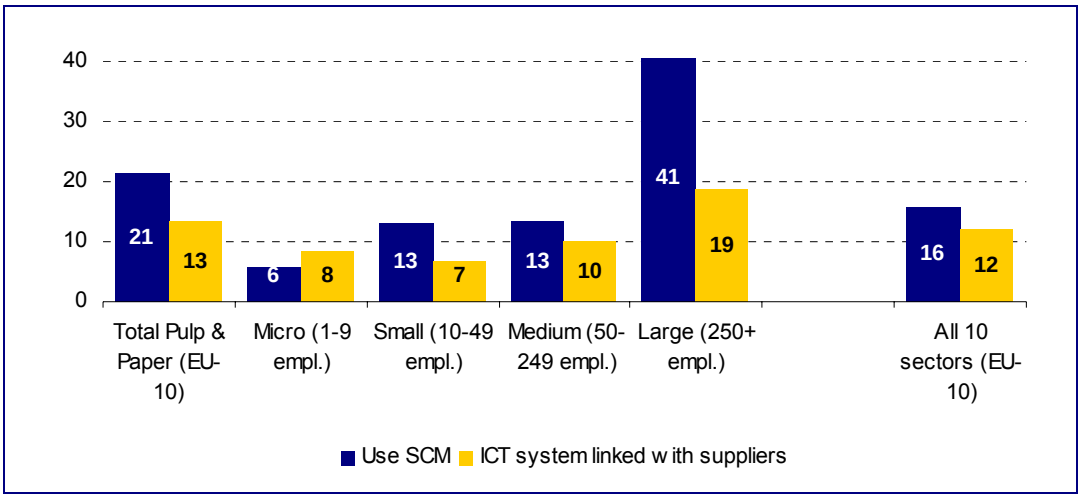
This finding is somewhat in conflict with the fact that many large firms that have established (or are establishing) sophisticated e-procurement schemes have the explicit target to **streamline their supplier base**. ICT empowers them to bundle procurement activities of different establishments or even branches in order to exploit economies of scale. However, previous sector studies by *e-Business W@tch* have already shown that it is hardly possible to support this evidence by data from the e-Business Survey. The main reason is that supplier consolidation is a strategy which is mainly used by the largest firms; thus, results do not really show up in this SME-focused survey. However, effects have clearly an economic impact.

3.5.2 e-Integrated supply chains: SCM, financial e-processes and ICT links with suppliers

SCM – Supply chain management

Supply chain management (SCM) software can help companies from the P&P industry to match supply and demand through integrated and collaborative interaction tools. SCM provides an oversight of the flows of products/materials, information and finances, as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. SCM coordinates and integrates these flows both within and among companies. One of the key objectives of any effective SCM system is to reduce inventory (with the assumption that products are available when needed).[56]

Exhibit 3-27: Supply chain integration: use of SCM and ICT links with suppliers



Base (100%): Companies using computers. N (for sector, EU-10) = 964

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: D1f, F13a

Source: *e-Business W@tch* (Survey 2006)

[56] Cf. www.mariosalexandrou.com/definition/scm.asp: "Definition of Supply Chain Management"

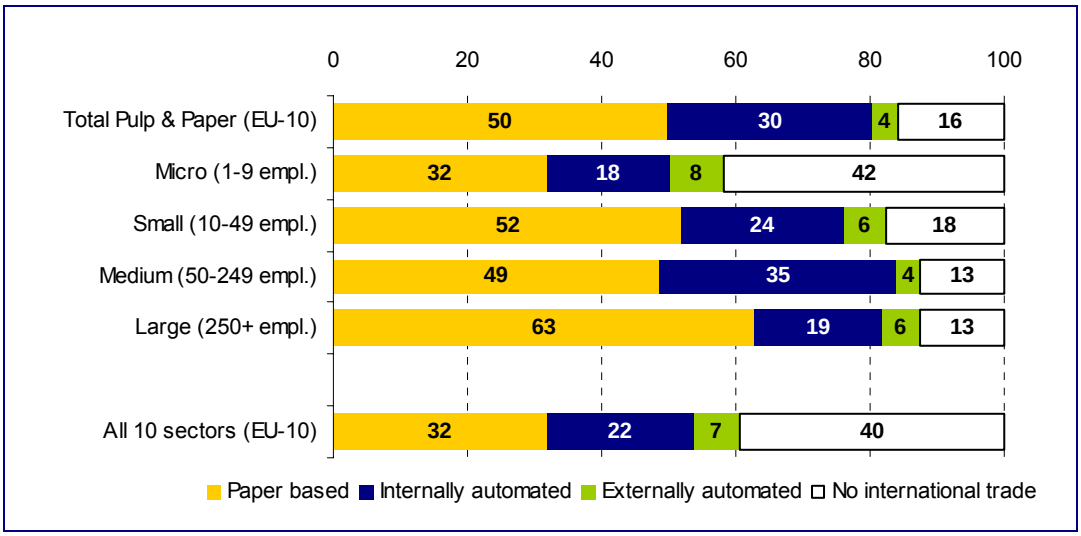
In the P&P industry, enterprises representing about 20% of employment say they have an SCM system (see Exhibit 3-27). The use of SCM systems is clearly a domain of the large firms: while only about 10-13% of SMEs said they had adopted a SCM system, about 40% of large firms did so. Thus, the P&P industry is among the leading SCM-using sectors.

e-Business W@tch also asked companies whether their **ICT system** was **linked to that of suppliers**. Interestingly, only about half as many firms report ICT links with suppliers compared to the share of firms with an SCM system (see Exhibit 3-27). This is somewhat in contradiction to the idea of SCM where some form of linking ICT with suppliers can be regarded as prerequisite. Thus, the proportion of companies with ICT links to those with an SCM system could have been expected to be the other way round. A possible explanation, however, is that many companies have software for managing their inventory and supplies internally, without really integrating suppliers directly through the system. Thus, they use a form of SCM which is not interactive between different companies; they just automate the internal flows of materials and information, and use other means to communicate their demand to suppliers.

Integration of financial processes in international trade

A new question in 2006 was whether the financial processes in trading with international suppliers were mainly paper based, internally automated or externally automated. It is acknowledged that this question was and remains a bit vague, as the difference between "internally integrated" and "externally integrated" is rather tentative, and because a telephone interview situation does not allow to go into a lengthy discussion of these issues. Even so, it gives an idea of the back-office integration of financial processes in international business.

Exhibit 3-28: Integration of financial processes in international e-trade



Base (100%): Companies placing orders online (without "don't know"). N (for sector, EU-10) = 505.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: E6

Source: *e-Business W@tch* (Survey 2006)

Results for the P&P industry show that paper-based processes still dominate financial flows, even among large firms. In total, about 50% of firms that trade with international suppliers say that processes are "best described as paper-based", while about 30% report that these processes are internally integrated. Only few companies (about 5%) see their financial processes with international suppliers as integrated (see Exhibit 3-27).

A concrete example of SCM

The following **case study** presents a concrete example of ICT-supported supply chain management in the paper industry. It shows how a large manufacturer (*VPK Packaging Group*) has successfully implemented a SCM system in a way that it benefits both the company itself and its customers, many of which are smaller firms. The case illustrates how vendor managed inventory (VMI) works in practice, and how this concept can help to improve logistics, for example by decreasing the incidence of rush orders. Due to the implementation of the SCM system, stock rotation periods at *VPK* have gone down from more than 8 weeks to 2-4 weeks, since the need for storage capacity decreased.

CASE STUDY: SUPPLY CHAIN INTEGRATION AT VPK PACKAGING GROUP, BELGIUM

This case study shows how VPK Packaging Group uses ICT and e-business to support its core business objective of developing and maintaining lasting business relations with its customers. To support this objective, the company lays emphasis on customer-sized solutions. The focus is on the implementation of the Forward Logistic Integration (FLI®) concept as an instrument to optimise the supply chain with benefits both for VPK and its customers. In the past, rush orders had caused major logistic problems; therefore, order placement and order management seriously needed improvements. The case study illustrates how these B2B processes are facilitated by a detailed and open exchange of information between trading partners.

Case study fact sheet

Full name of the company:	*VPK Packaging Group*
Location (HQ / main branches):	*Headquartered in Erembodegem (BEL), VPK Packaging Group has more than 20 factories and a dozen trading and service companies in Belgium, The Netherlands, France, Germany, Poland and the U.K.*
Sector (main business activity):	*Paper and packaging*
Year of foundation:	*1935 (publicly held in 1999)*
Number of employees:	*about 2,600 in ten European countries (about 1,000 employees in Belgium)*
Turnover in last financial year:	*about 445 million euros (2005)*
Primary customers:	*Producers of fast moving consumer goods, mainly for the food industry, pharmaceuticals, healthcare products and cosmetics, agriculture industry*
Most significant market area:	*Benelux countries, North of France, UK*
Focus of case study:	*Supply chain management*
Key words:	*SCM, business process transparency, stock management, just-in-time delivery, VMI (Vendor Managed Inventories)*

Background and objectives

VPK Packaging Group (VPK) is a rapidly growing, integrated industrial group, with a strong base in the West-European market and active in paper and recycled paper production, corrugated board, solid board packaging, tubes/cores and edge protectors.

VPK is listed on the Euronext Brussels Exchange, employs about 2,600 people over ten European countries and has mills and trade- and service companies in Belgium, the Netherlands, France, Germany, Poland and the U.K.

The company has four divisions: Paper, Packaging, Waste Paper and Trade and Services. The Paper Division produces paper for packaging based on waste paper. Three specialised paper machines make corrugated paper, liner paper, tubes and core paper. The Packaging Division produces corrugated board, solid board, tubes and cores. In the Waste Paper Division, the waste paper is recycled to make new paper. The Trade and Services division caters for specialist niches in the packaging market e.g. flowers, bulbs and standard boxes.

The customers of VPK Packaging Group are producers of fast moving consumer goods within the food industry, pharmaceuticals and cosmetics, and the agriculture industry.

Business goals and strategy

VPK Packaging Group aims at maintaining and even expanding its position as an important player in an increasingly competitive environment. To this end, the company is committed to exploit opportunities for further growth in its core business, by acquisitions as well as by expanding its market shares in Europe.

A few years ago, the company adjusted its strategy to encompass not only the production of packaging, but also a range of **value-added services** around those materials. VPK Packaging Group wanted to move from just providing commodity products to focusing more on the service they provide to customers. In addition to producing paper or corrugated board, this requires the ability to deliver products at the right moment, in the right amounts, based on the customer's needs. This holistic, service-oriented approach is known internally as the VPK Packaging Solutions concept®.

To support that strategy, VPK Packaging Group needed to cut costs while at the same time increasing speed and accuracy in its operations – a challenging task. The company as a whole had grown over the years through some 30 acquisitions, leaving it with a wide variety of software spread across its various units; this made it difficult to get an integrated view of the business. Moreover, supply chain processes in its paper division – which manufactures products for use in VPK's other divisions and for sale on the open market – were fragmented, driving up costs and delays. The use of ICT and e-business by VPK Packaging Group is therefore aimed to solve problems of fragmentation and to give customers a good service, while being fully embedded within the business strategy of VPK Packaging Group.

e-Business activities

The challenge: managing the move from a seller to a buyer market

VPK Packaging Group has always focused on meeting customer expectations. However, in the past decades, customer expectations as well as customers themselves have considerably changed. Customers now tend to be more marketing driven, with dynamically evolving requirements, which requires a higher service level (e.g. in terms of variety in products, just-in-time delivery, and smaller lots).

It was clear that customer-sized solutions would become an important leverage for VPK to stay competitive with other major players in the pulp and paper industry.

The evolution from seller-markets to buyer-markets, however, brought some challenges and had important implications for VPK Packaging Group. The company was confronted with the need for:

- a shorter lifecycle for its products
- a higher variability in demand
- shorter lead-times, as customers no longer accepted a wait for product deliveries.

At first, VPK reacted to this challenge by introducing many flexibility measures in its production process including blind stock buffering, resulting in huge holding costs, high administration costs and, more often than not, in investments in the wrong stock. Moreover, the high number of rush orders did not fade away. As a result, VPK Packaging performed poorly in the eyes of the customer.

The strategic response: Forward Logistic Integration

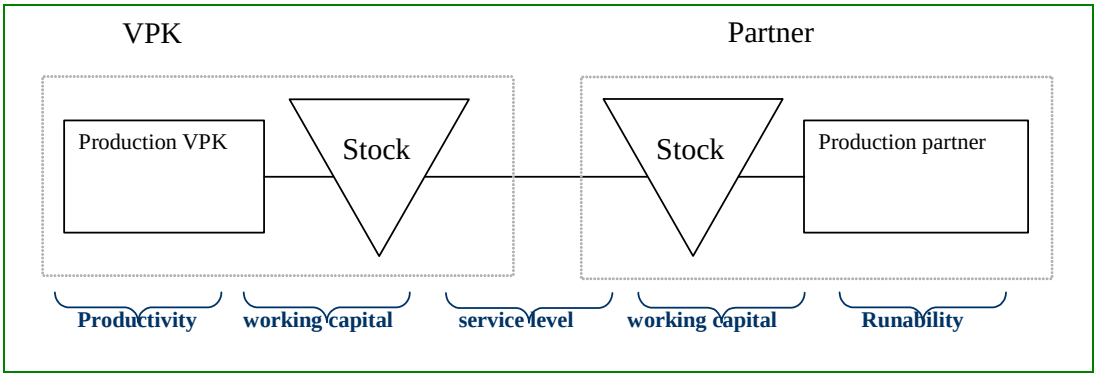
To overcome this crisis, VPK decided in 2000 to make a substantial investment in improving its supply chain management and to launch Forward Logistics Integration (FLI®) for this purpose.

Forward Logistic Integration is a trademarked service VPK is offering to its customers, whereby it is intended to attain a strategic collaboration with the customer by the exchange of information. The concept fits perfectly into the business strategy of VPK to move from a product-oriented to a customer-oriented approach. FLI® service includes the following aspects:

- detailed tracking of customer's specific stock holdings (in-house and with the customer, better known as Vendor Managed Inventories)
- optimising customer's orders
- order planning for the customer
- periodic analysis of stock needs evolution

By exchanging information with respect to the planning and stock level, VPK aims at optimising both their own supply chain and that of their customers (mostly B2B). In essence, FLI® creates a virtual organisation, characterized by openness on the supply chain from both sides (see Exhibit 1).

Exhibit 1: FLI® scheme

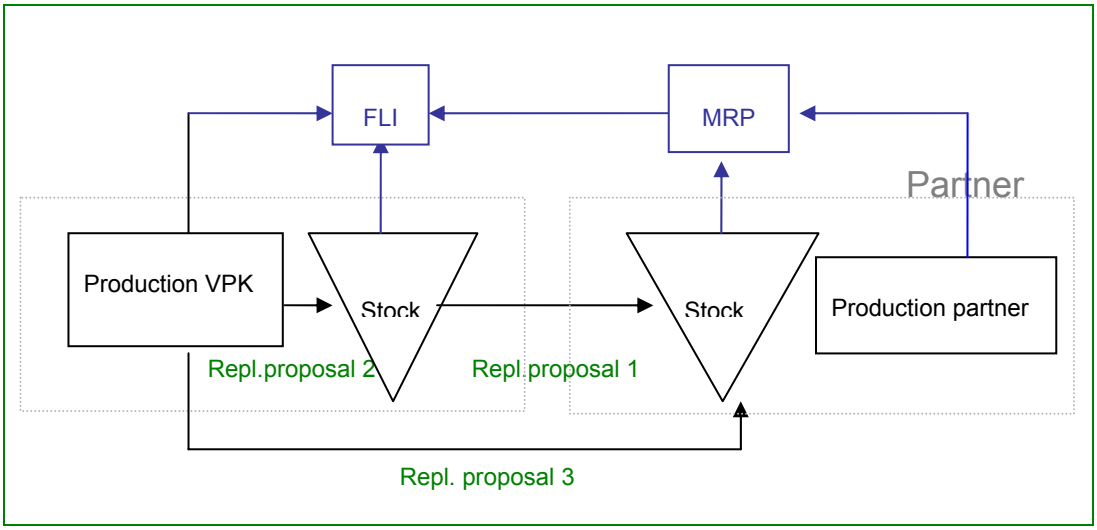


To make FLI® work, a trusted, open relationship between the company and its customers is needed whereby information can be shared in both directions. More concretely, VPK needs data on the customer's MRP (material requirement planning), covering previous two weeks, a forecast of the coming 13 weeks and the amount of items in stock. In exchange, VPK promises to optimise the customer's stock and demand, while improving the delivery reliability.

MRPs, reflecting the customer's needs for the coming weeks with respect to all the products VPK is offering, are sent online to VPK Packaging on a daily basis. VPK then processes the incoming MRPs and thus constantly improves the match between orders, production and stock levels.

On the basis of this data exchange, the supply chain of VPK is appropriately activated. First, the company responds to the short term needs of customers with products available in stock (Replenishment Proposal 1). Second, to avoid shortages, the production division of VPK brings the stock back to its prior level (Replenishment Proposal 2). Finally, production takes care of the long term needs of VPK customers, based on forecasting.

Exhibit 1: Supply chain management based on FLI®



An important advantage of the FLI® concept is the agreement on common standards between the client and VPK Packaging Group. Both sides communicate in MRP files. From early 2007 onwards, the exchange of information between customer and VPK Packaging Group will take place via a portal website, where customers can log in and place their orders online.

The implementation process

The **preparation phase** took about a year (2000/01) and included planning and working on proposals for how the FLI concept should look and when it could be operational.

In 2001, a **pilot project** was set-up to test the FLI concept, involving the paper division of VPK Packaging and Campina, one the largest diary companies in Europe and one of VPK's major customers. Periodic evaluations (every three months) were made to reveal possible weaknesses of the system and to suggest improvements.

The Campina pilot was successful. After a year, the number of rush orders had been reduced, while the level of accuracy with respect to production and deliveries had increased. Moreover, instead of placing separate orders for each of more than 100 different VKP products, Campina only had to send an updated version of its MRP to VPK Packaging. Stock administration on both sides became more simplified, especially for the customer. Apart from some communication problems at the beginning of the pilot project, no serious difficulties emerged during the implementation process. Both VPK Packaging

Group and Campina were very pleased with this new way of working and decided to continue the project.

After the successful start-off, VPK exported the FLI concept gradually to other divisions within VPK Packaging and the number of customers that became involved into the FLI® project grew. VPK adopted a step-by-step approach to this expansion instead of pursuing a "shock-and-awe" strategy.

Impact

VPK reports that the advantages which the FLI® concept was expected to offer have become a reality. The introduction of FLI® has achieved benefits for VPK Packaging Group in the areas of work organisation, production processes and business relationships with customers.

Benefits of FLI®

The Forward Logistic Integration concept creates a win-win situation for both parties. VPK highlights significant benefits the company has experienced, most importantly:

- Reduced need for working capital because of optimised order management and a decrease in stock value
- Lower operating costs from simplified administrative procedures
- Enhanced views of order history
- Fewer rush orders
- Increased visibility
- Increased delivery reliability
- Reduced stock shortages

Forward Logistic Integration has helped to reduce the complexity in planning production processes and linking them with the supply chain. Production divisions are now facing fewer rush orders. The number of stock shortages decreased, which means that delivery reliability increased. "*Stock rotation periods have gone **down from more than 8 weeks to 2-4 weeks**, since the need for storage capacity decreased. Holding costs have decreased and working capital requirements have dropped **more than 30%**",* says David Wellens, supply chain integrator at VPK Packaging Dendermonde.

Although now maintaining less stock, the company has improved service levels. **Delivery reliability** (time and quantity) increased in some divisions **from 95% to 99.5%**, according to David Wellens. Thus, for VPK Packaging, FLI® has become a key variable in building long-lasting relationships with customers.

Furthermore, the described e-business activity of VPK **decreased administrative burdens by about 15%** and resulted in a more streamlined and responsive administration.

The overall cost for implementing FLI® is small relative to total company costs. In addition, VPK reports that their overall IT total cost of ownership (TCO) has decreased from more than 1% to less than 1% of revenue. This is believed to be very good in comparison with the TCO performance of other companies within the P&P industry.

Outlook

The case study of VPK Packaging Group illustrates the potential of ICT and e-business-solutions to improve supply chain management through a trusted, open exchange of data with customers via the internet.

However, the ICT landscape is changing continuously; this forces VPK Packaging Group to rethink again their actual way of working. In particular, the advantages which fully-fledged ERP systems offer to companies makes them think intensively about new ICT solutions. A pilot project concerning the implementation of an ERP system (with SAP software) is currently running within their paper division. If the pilot is positively evaluated, it is very likely that in 2007, together with the web-portal referenced earlier, all divisions within the company will be running on an ERP system.

References

Research for this case study was conducted by Steven Bulté, Ramboll-Management Brussels, on behalf of e-Business W@tch. Sources and references used:

- *Interviews with Jan Willaert, Manager Logistics at VPK Packaging Group, and David Wellens, supply chain integrator at VPK Packaging Group, in September 2006*
- *VPK Packaging Group Annual Reports 2002 and 2005*
- *Websites: www.vpkgroup.com*

3.6 e-Marketing and Sales

ICT, and in particular the internet, can be used in various ways to support marketing activities, including the communication with customers, offering products for sale, and developing new marketing strategies. Manufacturers of pulp and paper typically do not directly sell to end consumers, but to intermediaries (wholesalers, retailers) or to the paper converting industry (mainly to packaging producers). The packaging industry is also B2B oriented and has its customers, for example, in the food and beverages, the pharmaceutical and cosmetics industries. Although companies may recognise the potential of ICT for marketing and sales, the migration towards web-based sales activities is only gradually taking place.

3.6.1 Companies receiving orders from customers online

Online orders from customers

Close to 30% of all firms active in the P&P industry said that they **enabled customers to order products online**. There is practically no difference between companies from the various size-bands in this respect (see Exhibit 3-29); and this observation holds true for most sectors.

At first sight, 30% appears to be quite a high figure when making comparisons to previous surveys *by e-Business W@tch*. However, due to a change of the survey question from 2005 to 2006,[57] results are not directly comparable to the ones from previous surveys on "online selling".

Furthermore, findings are put into perspective by the relative share of customer orders received online (as percent of the total order volume).[58] In the P&P industry, a majority of close to 80% of those companies that enable customers to order online say that these orders account for **up to 25% of their total orders** received (see Exhibit 3-29). Only about 20% receive more than a quarter of their orders online. The situation is quite similar in other manufacturing sectors. The e-commerce share is higher in ICT industries (ICT manufacturing, telecommunications) and in tourism.

[57] The underlying question in the e-Business Survey 2006 was changed compared to previous years. In 2006, companies where asked whether they "allow customers *to order goods* or book services online from the website or through other computer-mediated networks". In previous surveys, the question was whether they "use the internet or other computer-mediated networks *to sell* goods or services online". Thus, a direct comparison of figures, e.g. with those for the publishing & printing industry in 2005, is not recommended.

[58] Companies are asked to estimate how large a share of their total sales to customers (2003, 2005) / orders from customers (2006) is conducted online.

Exhibit 3-29: Companies receiving orders from customers online

	Accept orders from customers online		Receive 1-25% of orders online		Receive more than 25% of orders online		Use specific ICT solutions for e-selling	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**26**	**28**	**78**	**77**	**22**	**23**	**19**	**11**
Micro (1-9 empl.)		30		75		25		9
Small (10-49 empl.)		26		80		20		12
Medium (50-249 empl.)		24		77		23		15
Large (250+ empl.)		26		84		16		24
NACE 21.1 (p&p man.)	18	19	77	81	23	19	20	14
NACE 21.2 (converting)	29	31	78	73	22	27	18	11
All 10 sectors (EU-10)	**35**	**25**	**73**	**75**	**27**	**25**	**18**	**9**
Micro (1-9 empl.)		23		79		21		6
Small (10-49 empl.)		26		76		24		12
Medium (50-249 empl.)		29		75		25		16
Large (250+ empl.)		26		74		26		27
Base (100%)	firms using computers		firms accepting orders online		firms accepting orders online		firms using computers	
N (for sector, EU-10)	964		271		271		964	
Questionnaire reference	F4		F6		F6		F10	

* Data are not displayed because the number of observations in individual countries is too low for this indicator.
** Data only indicative due to low number of observations (N ~ 25-50).

Source: *e-Business W@tch* (Survey 2006)

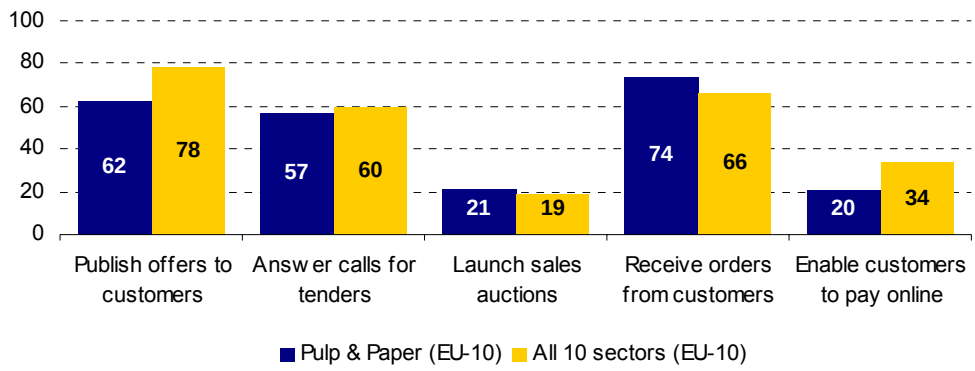
As in 2005, *e-Business W@tch* asked companies whether they "*support marketing and sales processes by specific ICT solutions*." The rationale for this question is to further test to what extent their e-commerce activities are **digitally integrated** processes, or whether they use rather "simple" forms of e-commerce, such as receiving orders by e-mail without any system integration of the related information and document flow.

In the P&P industry, more than **10% of firms** (representing close to 20% of sector employment) reported the use of software solutions or internet-based services for their marketing and sales activities (see Exhibit 3-29). This shows that, in fact, there is a considerable gap between the percentage of companies receiving at least some orders online (~30%) and those that have special software for doing so (~10%). The percentage is much closer to the one for ERP adoption (16%). In essence, the systematic management of online orders will in many cases be conducted via the ERP system of a company.

Those companies which have specific sales systems in place tend to use them mainly for the core functions of **publishing offers** to customers (62%), for enabling **customers to place orders** (74%) and also for answering calls for tender (57%). Only one in five companies with such systems also enable customers to actually pay online for the goods which they have ordered. The latter incidence shows how important it is to make a difference between the various phases in e-commerce transactions when analysing this topic. Enabling customers to place an online order is in many cases still separated from

the payment for this order. Payment is then accomplished in traditional ways, e.g. by bank transfer upon receipt of an invoice for the respective order.

Exhibit 3-30: Marketing and sales processes supported by specific ICT solutions



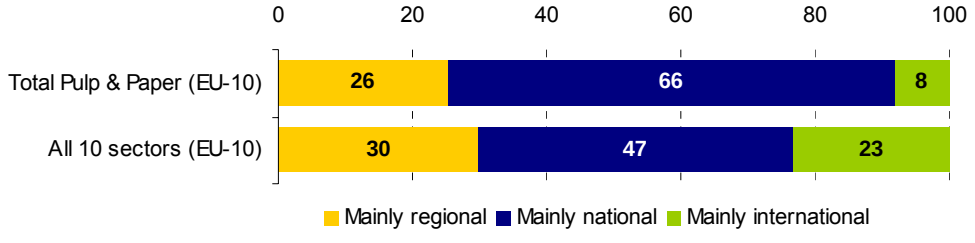
Base (100%): Companies using specific ICT solutions for marketing / sales.
N (for sector, EU-10) = 129. Weighting: in % of firms. Questionnaire reference: F11

Source: *e-Business W@tch* (Survey 2006)

Location and type of customers placing online orders

Most P&P companies report that they receive online orders mainly from customers in their own country, while not being focused on their own region. More than 90% of those companies that accept online orders from customers report either **regional or national customers** as their main geographic e-commerce market (see Exhibit 3-30). Less than 10% of firms said that orders were truly international, i.e. they receive orders mainly from an international customer base. This is a lower incidence of international trade than on average in the other sectors, where close to 25% of companies with e-commerce reported an international focus.

Exhibit 3-31: Main location of customers that order online



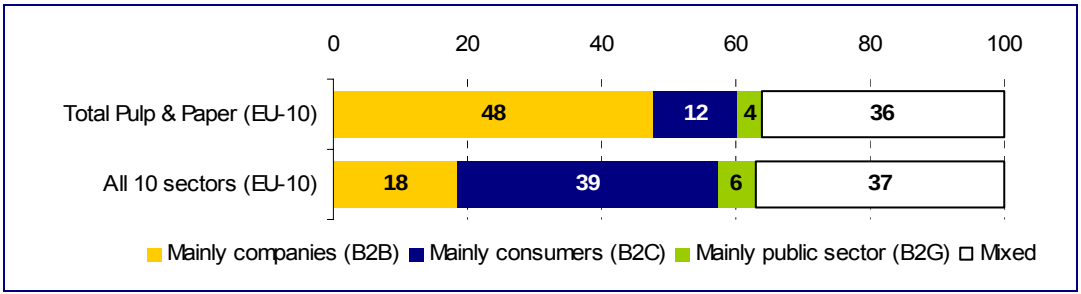
Base (100%): Companies accepting orders online (without "don't know").
N (for sector, EU-10) = 276. Weighting: in % of firms. Questionnaire reference: F7

Source: *e-Business W@tch* (Survey 2006)

However, the figure for the P&P industry is primarily determined by the small companies, where only 5-6% reported having mainly international customers in e-commerce. Among medium-sized and large companies, more than 20% said that their e-commerce activity was mainly international.

As can be expected, much of the e-commerce activity in the P&P industry is either focused on B2B or is mixed. Close to 50% of those companies that accept online orders said that these were mainly from other companies (see Exhibit 3-32). 12% said that orders were mainly from consumers; this indicates that some specialised producers of paper or paper products sell directly to consumers via online channels rather than going through wholesale and retail intermediaries. Although this is certainly not the typical distribution strategy in the P&P industry, it shows that manufacturers have different business models in terms of sales channels.

Exhibit 3-32: Main type of customers that order online (B2B / B2C / B2G)



Base (100%): Companies accepting orders online (without "don't know").
N (for sector, EU-10) = 183. Weighting: in % of firms. Questionnaire reference: F8

Source: *e-Business W@tch* (Survey 2006)

3.6.2 e-Integration of marketing processes: CRM and ICT links with customers

An ICT application which can help companies to improve the distribution of their products is **Customer Relationship Management** (CRM) for business intelligence purposes. CRM systems promise a company the ability to systematically increase knowledge about its customers and their profitability, as well as to build and adapt marketing strategies on the basis of this intelligence.

CRM is a term that refers to a broad range of methodologies and software applications that help an enterprise manage customer relationships in an organised way. Normally, this will be based on some kind of database with systematic information about customers and the business record the company has with them. Ideally, this information will support management, sales' people, people providing service, and possibly the customers themselves in their tasks, for example by matching customer needs with product plans and offerings, and by reminding customers of service requirements. Three levels of application of CRM are commonly distinguished:[59]

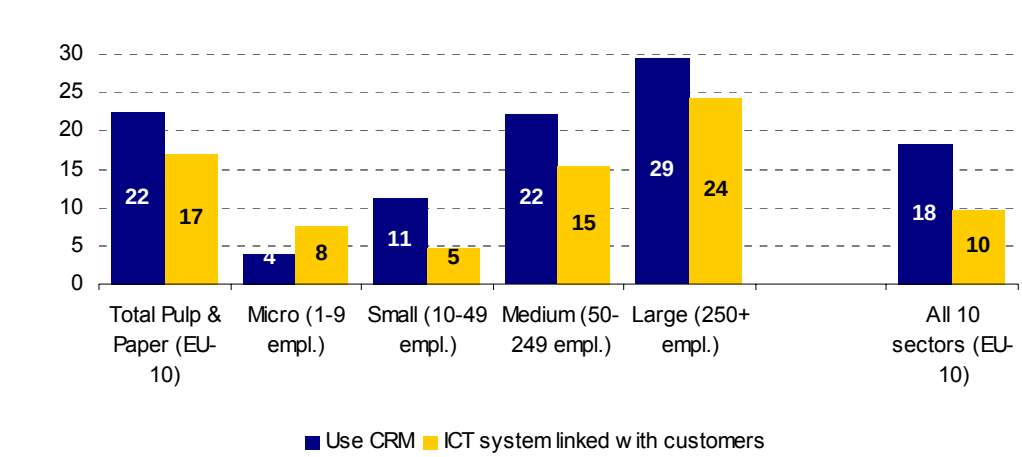
[59] Cf. www.mariosalexandrou.com/definition/crm.asp: "CRM Definition"

- **Operational CRM**: supporting front-office work by storing basic data on customers (e.g. addresses, track record of contacts); front-office enters new data as part of their work;
- **Analytical CRM**: analysis of data gathered through operational CRM in order to segment customers;
- **Collaborative CRM**: facilitates interactions with customers through all channels (personal, letter, web, e-mail) and supports co-ordination of employee teams.

CRM is quite widely diffused in the P&P industry. In 2006, about 17% of enterprises reported the use of CRM (see Exhibit 3-32). As in practically all sectors studied by *e-Business W@tch* in 2006, there is a pronounced gap between the small P&P firms on the one hand, and the medium-sized and large ones on the other: CRM is mainly used by companies with at least 50-100 employees.

CRM software suites can be quite expensive and require a lot of organisational preparatory work to be effectively introduced in a company; this hampers adoption among smaller firms. Moreover, companies from the paper converting industry often work predominantly for a small number of large clients (e.g. from the consumer goods industry). Thus they may not have the same demand for CRM systems as, for example, retail or service companies, with a large number of customers.

Exhibit 3-33: Use of CRM and integration of ICT systems with customers



Base (100%): Companies using computers. N (for sector, EU-10) = 964

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: F2, F13b

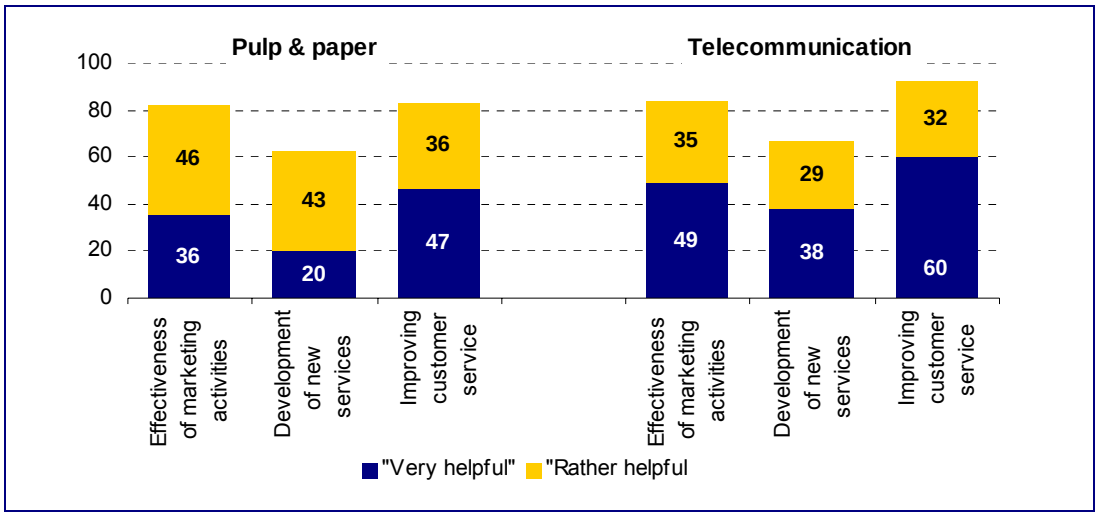
Source: *e-Business W@tch* (Survey 2006)

CRM is a key application for many of the larger companies in some of the service sectors studied in 2006, in particular telecommunications (48%) and the tourism industry (23%). However, CRM is also used by manufacturing companies, as the example of the P&P industry demonstrates. Here too, close to 30% of the firms reported having a CRM system.

e-Business W@tch also asked companies whether their ICT system had links to that of customers. About 15% of medium-sized and 25% of large firms in the P&P industry said that they had established such links. This need not be directly related with collaborative CRM, however. It is also possible, that these links are part of an integrated e-commerce scheme between companies, e.g. via dedicated EDI connections.

A majority of those companies that use a CRM system reported that it had been "*very helpful*" or "*rather helpful*" in marketing (82%), for developing new products/services (63%) and for improving customer service (83%). These figures are quite similar to those for the telecommunications industry, a prime user of CRM (see Exhibit 3-34). However, the comparison also shows that telecommunication companies are slightly more 'enthusiastic' about CRM: the percentage of companies that find CRM "*very helpful*" is significantly higher than in the P&P industry, where more companies feel it is merely a "rather helpful" tool.

Exhibit 3-34: Perceived usefulness of CRM systems – a comparison between the P&P and the telecommunications industry



Base (100%): Companies using a CRM system, without "Don't know". N (for P&P industry, EU-10) ~ 135
Weighting: in % of enterprises. Questionnaire reference: F3a-c.

Source: *e-Business W@tch* (Survey 2006)

3.7 ICT and Innovation

The **capability for innovation** is considered quite important by European companies in the P&P industry in order to face global competition and to keep their position in higher market segments, which rely on differentiation and quality. It is largely recognised that both product and process innovation (e.g. automation, flexible re-organisation) are key instruments to support this strategy. This can only be achieved by a large-scale deployment of leading-edge research results, a highly efficient process organisation and chain management, and a highly qualified work-force.

This competitive scenario pushes companies towards the usage of technologies to innovate products, to enhance quality and broaden applicability of materials. **Process innovation** is centred on production processes, such as automated and computer-based manufacturing systems, or processes aimed at manufacturing products that can combine costs of mass production with differentiation of customised, optimisation of the value chain.

In this context, *e-Business W@tch* asked companies whether they had launched any new or substantially improved products or services during the 12 months prior to the interview, and if they had introduced new or significantly improved internal processes in the same period of time. Companies that indicated that they have introduced innovations were then asked follow-up questions on the role of ICT for their innovation activity.

About 30% of enterprises in the P&P industry said that they had launched new (or improved) products in 2005/06. About a third of these product innovations had been directly related to or enabled by ICT (see Exhibit 3-35). Thus, the incidence of **product innovation** is slightly higher than on average in the 10 sectors studied this year by *e-Business W@tch*, but the share of ICT-enabled product innovations is relatively lower (45-50% on average). This is plausible, as ICT is of course more important for products in ICT-related sectors. However, even the share of about a third of all innovations being ICT-enabled is considerable and demonstrates the important role of ICT for manufacturing purposes.

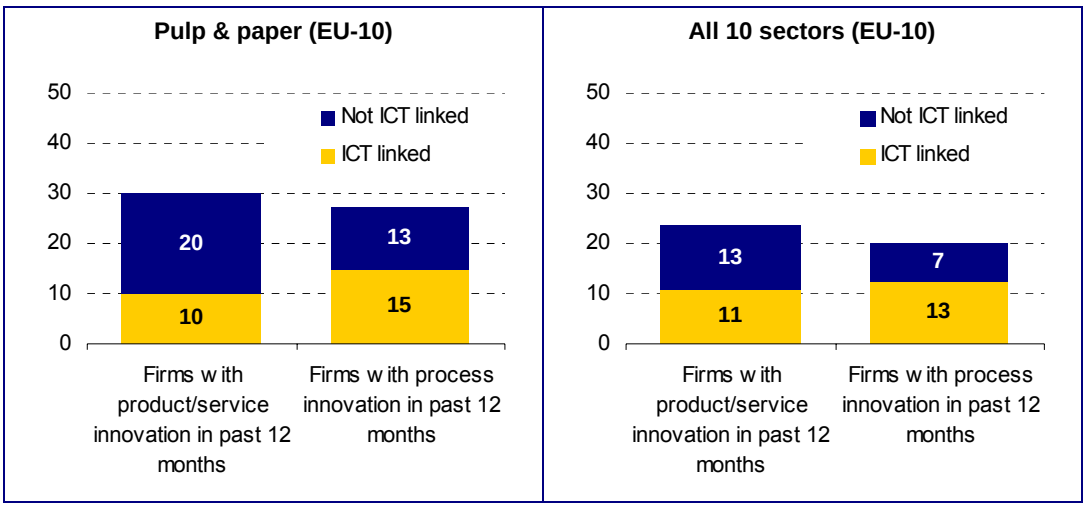
A similar picture can be found for **process innovations**. While the overall propensity towards innovation is above average in the P&P industry, survey findings indicate a higher share of non-ICT related innovations in this industry than in many other sectors. In total, companies representing about 45% of employment in the P&P industry said that they had introduced process innovations in the 12 months prior to the interview. More than half of these innovations are regarded as ICT-enabled. Among larger firms, the role of ICT for process innovation increases; about two thirds of all process innovations among medium-sized and large companies are ICT-enabled.

Exhibit 3-35: ICT and Innovation activity

	Companies with new product innovation in 2005		Share of ICT-enabled product innovations		Companies with process innovation in 2005		Share of ICT-enabled process innovations	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**42**	**30**	**34**	**33**	**45**	**27**	**59**	**54**
Micro (1-9 empl.)		25		32		21		49
Small (10-49 empl.)		33		35		30		52
Medium (50-249 empl.)		44		34		48		67
Large (250+ empl.)		50		36		53		65
NACE 21.1 (p&p man.)	33	23	21	25	41	22	67	70
NACE 21.2 (converting)	46	32	38	35	47	29	56	50
All 10 sectors (EU-10)	**32**	**24**	**50**	**45**	**32**	**20**	**75**	**63**
Micro (1-9 empl.)		22		41		16		69
Small (10-49 empl.)		25		42		25		57
Medium (50-249 empl.)		33		45		38		71
Large (250+ empl.)		48		49		53		81
Base (100%)	firms using computers		firms with product innovation		firms using computers		firms with process innovation	
N (for sector, EU-10)	964		359		964		331	
Questionnaire reference	I1		I2		I3		I4	

Source: *e-Business W@tch* (Survey 2006)

Exhibit 3-36: The role of ICT for product and process innovation



Base (100%): Companies using computers. N (for sector, EU-10) = 964.
Weighting: in % of firms. Questionnaire reference: I1 – I4

Source: *e-Business W@tch* (Survey 2006)

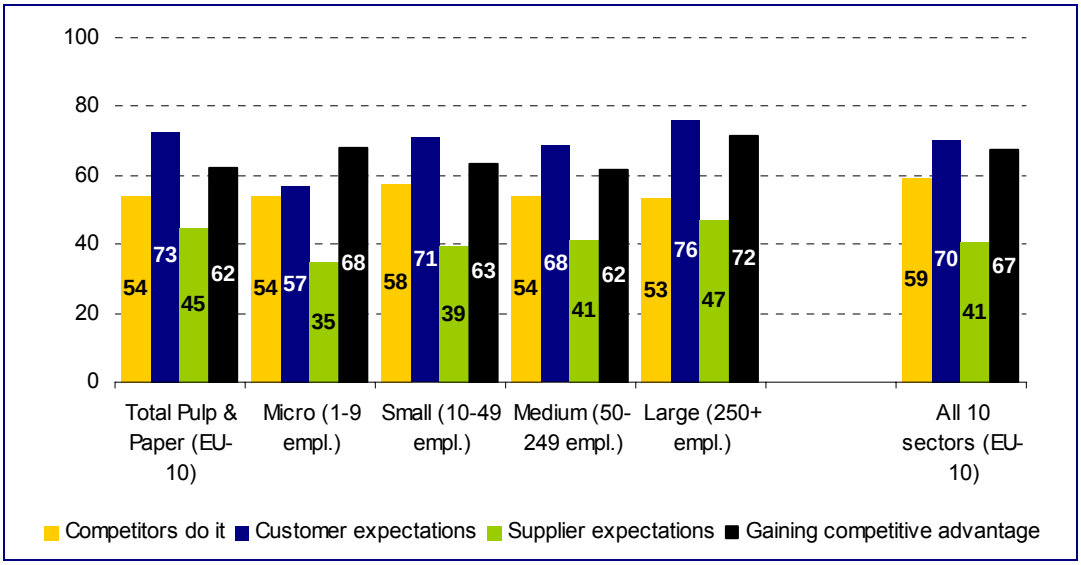
3.8 Drivers and Inhibitors for the Uptake of e-Business

3.8.1 Drivers of e-business adoption

The use of e-business is important for businesses in the P&P industry in 2006. Companies representing about two thirds of employment in this sector report that e-business constitutes "a significant part" or "some part" of the way they operate (see Exhibit 5-1, Section 5.1.1). These companies were asked to indicate important reasons for starting their e-business activity. Four main reasons were suggested, in order to see whether it was more a reaction to pressure from outside (from customers or suppliers), or whether companies saw an opportunity to gain competitive advantage.

Replies show that all reasons are perceived as relevant, with two reasons standing out: **customers' expectations** and the opportunity to **gain competitive advantage** are seen as the most important drivers for adoption (see Exhibit 3-35). Suppliers are not a main driving force, as in most other industries, which indicates that their negotiating power is usually quite limited. Rather, pressure is coming from customers. In fact, this can be confirmed for several emerging ICT applications, e.g. for RFID. This has been confirmed in interviews and case studies (see Section 4.3, as well as other sector studies by *e-Business W@tch*[60]). Imitative behaviour ("… *because competitors do it* …") is also relevant – in the P&P industry, 54% of e-business practitioners said that this was an important reason – but ranks lower than the two main reasons mentioned.

Exhibit 3-37: Drivers of e-business adoption: companies saying that … was an important reason for starting e-business



Base (100%): Companies saying that e-business is a part of their operations. N (for sector, EU-10) = 571. Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: H2

Source: *e-Business W@tch* (Survey 2006)

[60] See *e-Business W@tch* sector study (2006) on the food & beverages industry, which reports that the implementation of RFID is often made in response to respective demand from customers (e.g. from large retail chains).

3.8.2 Barriers to e-business adoption

Companies saying that e-business did *not* play a role in the way they operate were asked to assess the main reasons for not engaging in e-business. Small companies perceive firm size as a main barrier; 75% of micro-firms (out of those that do not engage in e-business) and 55% of small companies think that their "***company size is too small***" for practising e-business. The second most important reason which small firms confirm in interviews is that they feel the "***technology is too expensive***" (about 50% of firms). The opinion that the required "***technologies are too complicated***" is also significantly more widespread among small firms (40%) than large ones (up to 20%).

SME-typical barriers

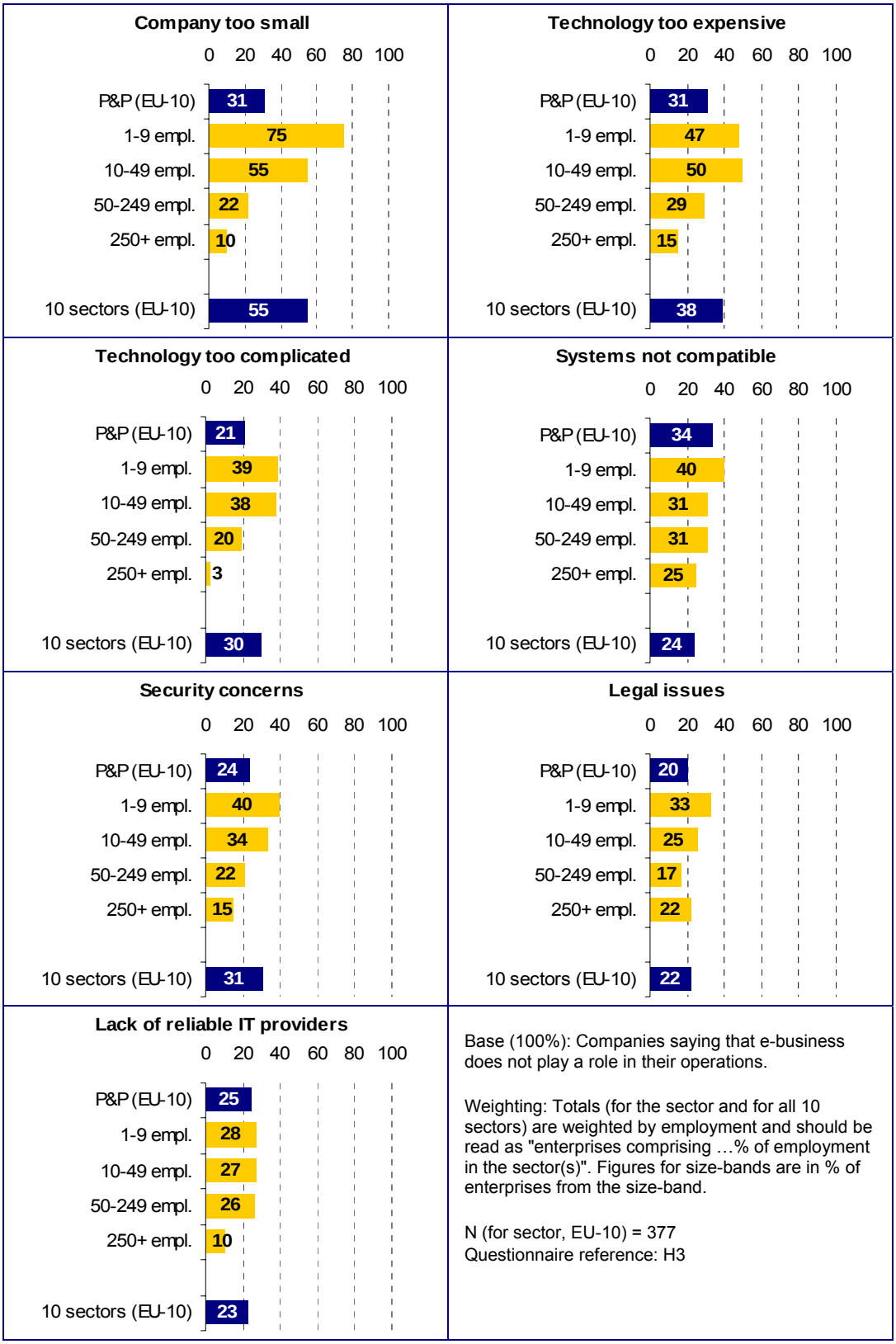
These reasons are SME-typical barriers for ICT adoption. It appears that many small companies still have the impression that e-business is mainly useful for larger firms, and that they themselves have neither the critical size nor the budgetary capabilities to engage in e-business activities. However, while it is probably true that larger manufacturing companies are in a preferred position to benefit from ICT, the reality is more complex. It cannot be brought down to the simple formula that e-business is only for the large companies. The finding rather indicates that there is a lack of awareness, and / or of accessible information about suitable and affordable e-business technologies for smaller enterprises. One of the policy implications suggested in Section 5.2 addresses this issue with regard to ERP systems, as these are particularly important for e-business in the P&P industry.

Among medium-sized and large firms which consider themselves as non-adopters, hardly any of the seven possible barriers suggested met a significant level of reported relevance. Among medium-sized firms, only 20-30% regarded these barriers as relevant; among large firms, 10-20% agreed that these were important reasons for not using e-business. This shows that there is not a typical, single most important barrier for non-adoption in the case of larger firms. It appears that many of these companies take a deliberate decision not to use ICT for certain activities, although the firms do not see a major impediment in case they would decide otherwise. In other words, there are hardly any significant "barriers" – it is more a matter of business strategy.

Interoperability challenges

Answers also point at unsolved interoperability issues. 25-40% of companies from the various size bands (34% in total) argued that "***ICT systems are not compatible*** *with those of suppliers or customers*" (see Exhibit 3-38). This is a higher incidence than in most other sectors. Among medium-sized and large enterprises, the incompatibility of systems is the most frequently reported reason for not practising e-business. On the other hand, the perception among all companies, including e-business users, that interoperability is critical for e-business within or between sectors was not different to the one in most other sectors (see Exhibit 3-11, Section 3.3.2). Thus, the incompatibility of systems constitutes a relevant issue to be addressed (as in all sectors), even if a part of the problem may be a matter of perception rather than a real issue.

Exhibit 3-38: Barriers to e-business adoption as perceived by companies: percentage of firms saying that … is an important reason for not practising e-business



Base (100%): Companies saying that e-business does not play a role in their operations.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band.

N (for sector, EU-10) = 377
Questionnaire reference: H3

Source: *e-Business W@tch* (Survey 2006)

The industry driven initiative in the P&P industry to establish the papiNet® standard for B2B exchanges (see Section 4.1) can be seen as a major effort to improve the compatibility between systems by agreeing on a common "language" for B2B exchanges. However, as shown in Section 3.3.1, the standard is not yet widely diffused among smaller companies. Furthermore, the parallel initiative of the consumer goods industry to deploy GUSI as the dominant standard for trade with their suppliers raises a concern whether it might be a burden for P&P SMEs to adapt their systems for the use of two e-standards in parallel (see Section 5.2.2 – policy implications).

3.9 Summary

Main findings

The P&P industry is a near-perfect **yardstick for the state-of-play** in ICT adoption and e-business activity, at least among the ten sectors studied by *e-Business W@tch* in 2006. For many of the indicators, figures for the P&P industry are very close to the all sector total and represent very well the average situation in manufacturing industries. The P&P industry is neither among the avant-garde in ICT adoption (such as ICT-related sectors themselves), nor is it in any way a slow ICT adopter, such as the footwear and – in parts – the food and beverages industries.

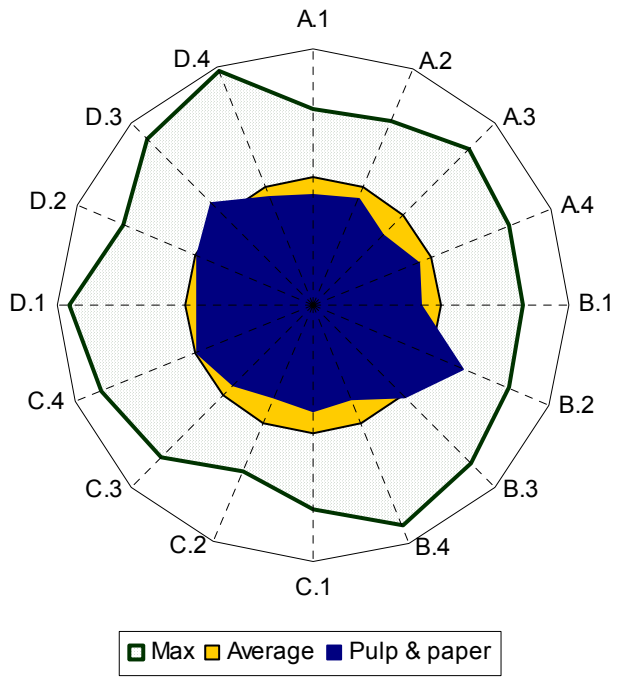
A similar result was obtained in 2005 for the machinery & equipment manufacturing (M&E) industry. In fact, the P&P and the M&E industry have some structural characteristics in common, are traditional manufacturing industries and share a similar e-business history: in both industries, ICT have been intensively used in **production processes** for many years. Now, companies are increasingly recognising ICT and e-business as a valuable tool for **marketing and customer service**.

Survey results show that companies from the P&P industry use ICT quite intensively in all application areas along the value chain: for procurement processes, in production, for inbound and outbound logistics, marketing and customer service. As in most manufacturing industries, improvements in supply chain management by integrating business processes with suppliers and customers is probably the main focus of all activities.

- **Differences by firm size, not by sub-sector**: structural differences between the two sub-sectors (P&P manufacturing, paper converting) do not show up in the survey results. According to these results, it is the firm size that matters, not the sub-sector in which firms operate.
- **ERP as a backbone for B2B integration**: Enterprise Resource Planning (ERP) systems are widespread among P&P companies (45% by employment said they used ERP), compared to most other sectors studied by *e-Business W@tch*. These systems constitute the basis for many advanced forms of e-business in manufacturing.
- **Supply chain management**: According to the 2006 e-Business Survey findings, ICT are intensively used by P&P firms to support logistics and supply chain integration; emerging technologies such as RFID are not yet widely adopted, though.
- **Online marketing is gaining momentum**: almost 30% of firms said they accepted orders online and more than 20% (by employment) that they used a CRM system; this is more than on average in the 10 sectors studied and shows that e-marketing is quickly gaining momentum among several manufacturing industries. It further confirms results from the machinery & equipment industry in 2005.
- **Size and costs as the main barriers for small firms**: SMEs that do not practice e-business see two main barriers that prevent them from doing so: they feel that their company is "*too small*" for doing e-business, and that they "*cannot afford the required technologies*".

e-Business Index and Scoreboard 2006 [61]

e-Business Scoreboard 2006



Component indicators
(based on data in % of firms)

A. ICT Networks
A.1 Internet connectivity (index)
A.2 LAN
A.3 W-LAN
A.4 Remote access to company network

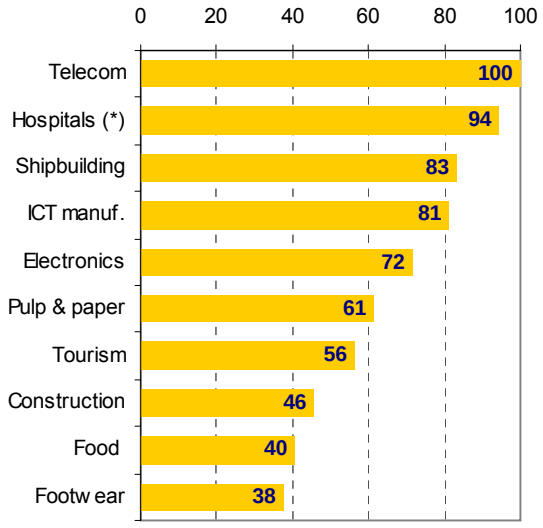
B. e-Integrated Business Processes
B.1 Intranet
B.2 ERP systems
B.3 Online tracking of production time
B.4 e-Invoicing

C. e-Sourcing and Procurement
C.1 Firms placing orders online
C.2 Use of ICT systems for sourcing
C.3 ICT system linked with suppliers
C.4 Online inventory management

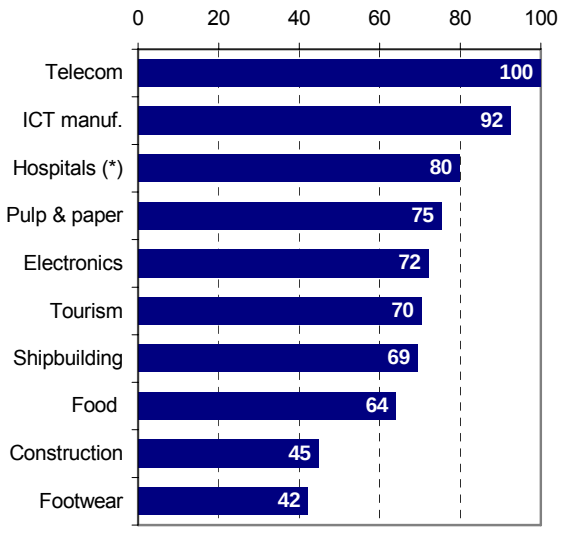
D. e-Marketing and Sales
D.1 CRM use
D.2 Firms accepting orders online
D.3 Use of ICT systems for marketing/sales
D.4 ICT system linked with customers

e-Business Index 2006
(based on 16 component indicators of the Scoreboard)

based on data in % of firms
(emphasises activity in smaller companies)



based on employment-weighted data
(places a higher weight on activity in larger firms)



(*) The index for the hospital sector is not fully comparable to the other industries, as there are only few micro and small organisations in this sector. Thus, the apparently more intensive use of ICT is largely an artefact of the specific structure of this sector. When comparing only the large enterprises and organisations, hospitals would not be within the top rank.

Source: *e-Business W@tch* (Survey 2006)

[61] See Methodology Annex for information about the structure and computation of the scoreboard.

4 Current e-Business Trends and Implications

Topics in focus

This chapter provides insights into current ICT use and e-business activities which are specific to the P&P industry. The chapter does not claim to provide a comprehensive overview, as that would exceed the limits of this report. Therefore, the issues analysed, as well as the case studies presented, should rather be understood as representative examples of current practice and the related opportunities and challenges. The following issues were selected in coordination and agreement with DG Enterprise and Industry and with industry federations as being particularly relevant:

- **papiNet**: papiNet® is a global paper and forest products industry e-Business initiative. It was developed as a cooperative project of customers, suppliers and other trading partners involved in the paper and forest industry. papiNet® supports the implementation of XML based global electronic business transaction standards for parties engaged in the buying, selling and distribution of forest and paper products. The section describes how papiNet® was developed and identifies success factors that contribute to its broad acceptance by players in this industry.
- **ICT as a driver of process efficiency**: Improving the efficiency of production and supply chain processes is a primary objective for all manufacturing businesses. However, the potential depends on the structure and characteristics of supply chain processes. This section explores the impact of ICT on business processes of companies from the P&P industry and where the major potential for innovation and productivity improvements are located. It highlights the critical role of Enterprise Resource Planning (ERP) systems as a key technology platform for e-business in this sector.
- **Deployment and Implications of RFID Technology**: As in other sectors, RFID technology is on the verge of commercial break-through (or even beyond that point, as already used by many companies) in the P&P industry. Several supply chain characteristics of the sector could make it an excellent exemplar of early adoption and usefulness of RFID based solutions. This section explores application areas where RFID is currently used and implications for productivity and competitiveness.
- **ICT impact on demand for paper**: The deployment of ICT in offices and in households since the 1980s has some conflicting effects on the demand for paper. On the one hand, e-mail and the electronic processing of documents (for example in insurance companies and in banking) has the potential to substitute paper-based processes. On the other hand, the concept of the "paperless office" is more a utopia than a reality in most business activities today. ICT has also led to a vast increase of information that has to be processed, and modern printers and copiers allow fast and comparatively low cost printing of documents. This section presents an assessment of the future impact of ICT trends on the overall demand for paper.

Case studies and business examples

The survey data presented and analysed in Chapter 3, along with the case studies and business examples as summarised in Exhibit 4-1, form the basis for conclusions and policy implications presented in Chapter 5 of this report.

Exhibit 4-1: Case studies and business examples presented in this report

Section	Company / project	Country	Topic(s)
3.5	Case study: *VPK Packaging*	Belgium	Improving **supply chain management** by means of an ICT system, resulting in fewer rush orders, increased delivery reliability and reduced stock shortages.
4.1	Case study: *Stora Enso*	Finland	Use of **papiNet® standard** by a global player in the paper manufacturing industry; role of ERP systems in e-business; intelligent packaging.
4.2	Business example: *Karl Knauer KG / COPACO Group*	Germany	Example of a papiNet® based **B2B integration** between a company from the converting industries (packaging solutions) and its raw material supplier
4.2	Business example: *Flexibles GmbH*	Austria / Germany	**Outsourcing** of e-business processes to a third party service provider by a cooperation of German and Austrian SMEs from the converting industries.
4.2	Case study: *Mayr-Melnhof Cardboard Group*	Austria	Example how large companies use **web-based B2B workplaces** (here: "coMMunity" by Mayr-Melnhof, a leading producer of cardboard) as a service for their small and medium-sized customers.
4.2	Case study: *Rexcell*	Sweden	Use of **ICT for quality management** at a medium-sized paper converting company, focusing on the impact on process efficiency and company culture
4.2	Case study: *SCM innovation at a large paper manu-facturer*	(European company)	e-Business activities of a globally operating European producer of office paper in the area of **supply chain management**; introduction of a production tracking software system based on RFID-technology.
4.2	Case study: *Nordic Paper*	Norway	Use of **ICT in production processes** (e.g. for quality assurance and to minimise the use of chemicals) and to link production with logistics processes.
4.3	Case study: *International Paper*	USA	Case on early **RFID** use for increasing the efficiency of inventory management at one of the worldwide largest paper producers.

Source: *e-Business W@tch* (2006)

4.1 papiNet® – a Success Story in e-Standards[62]

The following section contains – inevitably for a discussion of technical issues such as electronic standards – a lot of technical terms and acronyms. A glossary with brief explanations of the most important terms is included in Annex III of this study.

4.1.1 Introduction

papiNet®[63] is a global paper and forest products industry e-business initiative. It is the product of a not-for-profit cooperative international initiative of papiNet® GIE, IDEAlliance, and the American Forest & Paper Association. The objectives of the cooperative are to develop, maintain, and support the implementation of a single set of XML based global electronic business transaction standards for parties engaged in the buying, selling and distribution of forest and paper products. Where possible, papiNet® also aims to align itself with other standards and to give assistance to implementation work.

The papiNet® standard is a single complete standard. It is developed and maintained by customers, suppliers and other trading partners involved in the paper and forest industry in order to improve the efficiency and accuracy of transactions throughout the paper supply chain, while reducing the cost of operations. To facilitate implementation, papiNet® recommends a company to identify its business segments and follow the appropriate segment implementation guidelines.

The standard is relevant for all companies in the forest and paper products supply chain. In addition, many aspects of the strengths of its organisation and its processes have strong potential for similar cooperative developments in other sectors. The lack of a certification structure is not necessarily a weakness, but does allow for divergence.

4.1.2 The organisation of papiNet

Over 60 customers, producers, and technology firms from Europe and North America are involved in the initiative with industry association partners – CEPI, American Forest and Paper Association, and IDEAlliance.

The papiNet® **Executive Committee** is the global advisory and coordinating body of papiNet. It provides direction and sets policy with regard to the strategic priorities of the papiNet® organisation, standard, budget and allocation of resources. This is performed in close coordination with the governing boards of papiNet® Europe GIE and papiNet® NA (North America). Both of these groups are chartered to encourage and facilitate implementation of the standard through supporting tools and guidelines, market segment implementation groups, and related publicity.

The **Central Work Group** manages the content of the papiNet® standard. It is focused on promoting adoption, implementation and use of the standard, maintaining the standard

---

[62] The assistance of David Steinhardt, Art Colman and Michael Merz in the preparation of this section is gratefully acknowledged.

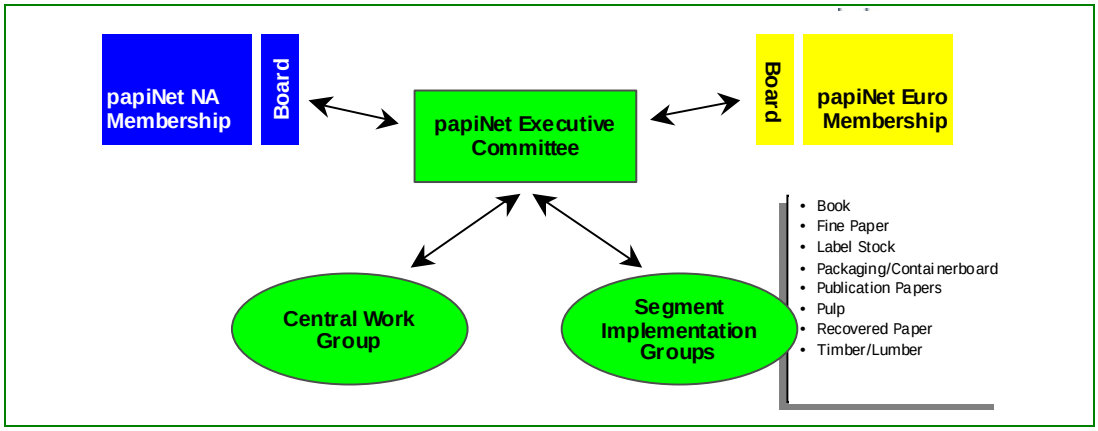
[63] papiNet® is a registered trademark of the European Union and United States.

including handling proposed changes, and working to extend it to additional market segments in the paper and forest products industry and its supply chains.

Segment Implementation Groups (SIGs) highlight those aspects of the papiNet® standard that are of immediate importance to their market segment. SIGs formed within papiNet, because it was recognised that trading partners may specialise in a particular market segment and may not need to implement features contained within the standard that apply to another market segment.

SIGs have created market specific recommendation and reference implementations of the papiNet® standard in the following areas: Book, Carton Board, Fine Paper, Label Stock, Packaging/Containerboard, Publication Papers, Pulp, Recovered Paper, and Wood Products. The goal of these market specific guidelines is to afford the specific market segment participants the opportunity to implement a common message subset of the standard.

Exhibit 4-2: papiNet® Organisation



The members of papiNet® represent companies drawn from across the entire pulp and paper business value system: cataloguers, consumers, corrugators, end customers, merchants and exporters, printers and converters, producers, publishers (magazine, newspaper), pulp, recovered paper, suppliers and solution providers.

4.1.3 papiNet® Standards

The papiNet® standards are open and freely available. Critical mass is achieved by involving key players globally and across the supply chain. The history of this standard is shown in the Fact Box.

The standard Version 2.31 published in April 2006 is a collection of over 30 different standardised XML messages, together with specific data definitions, market sector specific implementation guides and recommended business rules. For ease of understanding and presentation, the set of messages are listed alphabetically by selected range of market segments in Exhibit 3-3. Although listed only once, most message documents (e.g. Load Tender) are applicable in all market segments.

Exhibit 4-3: papiNet® Standard Version 2.31 Messages

Paper, Pulp, Recovered Paper	Availability, Business Acceptance, Business Acknowledgement, Call-Off, Complaint, Complaint Response, Credit Debit Note, Delivery Instruction, Delivery Message, Goods Receipt, Information Request, Inventory Change, Inventory Status, Invoice, Load Available, Load Tender, Load Tender Response, Order Confirmation, Order Status, Planning, Product Attributes, Product Performance, Product Quality, Purchase Order, RFQ, RFQ Response, Scale Ticket, Shipment Status, Usage
Book Manufacturing	Book Specification, Delivery Message, Inventory Disposition Instructions, Order Confirmation, Order Status, Purchase Order, Shipping Instructions
Wood Products	Call-Off, Delivery Message, Invoice, Order Confirmation, Purchase Order
Label Stock	Packing List

Fact Box

History of papiNet

***1999**: European paper companies in the printing industry and their main German customers initiate development of XML business transaction standards. Similar initiative established within GCA in North America.*

***2000**: European papiNet® Consortium is formalised by group of CEPI companies. GCA adopt 5 message standards developed by Time Inc. and Stora Enso NA. The European and North American organisations, recognising that global standards are needed, combine their efforts and issue joint draft papiNet® standard in December 2000.*

***2001**: papiNet® Standard Version 1.0 (June 2001). Scope is messages for ordering of publishing paper, fine paper and packaging paper: Purchase Order, Order Confirmation, Call Off, Delivery Message, and Invoice.*

***2002**: papiNet® Standard Version 1.10 (February 2002) extended to include pulp products and 5 new messages. Version 2.00, a major non-backward compatible version, introduces XML Schemas[64], eBMS, SOAP-ebXML interoperability guidelines and 6 new messages.*

***2003**: papiNet® Standard Version 2.10 (April 2003) and Version 2.11 (September 2003, updated May 2004) includes XBITS (XML Book industry Transaction Standards) and WoodX (Mechanical Wood Processing Industry standards) and 6 new Messages. NPTA Alliance becomes a sponsoring association on behalf of the paper distribution industry.*

***2004**: papiNet® Standard Version 2.20 (June 2004) includes Label Stock (packing list).*

***2005**: papiNet® Standard Version 2.30 (May 2005, Updated December 2005) includes transport and warehouse logistics and 2 new messages.*

***2006**: papiNet® Standard Version 2.31 (April 2006)*

[64] A description of a type of XML document, typically expressed in terms of constraints on the structure and content of documents of that type, above and beyond the basic syntax constraints imposed by XML itself.

4.1.4 Implementation status

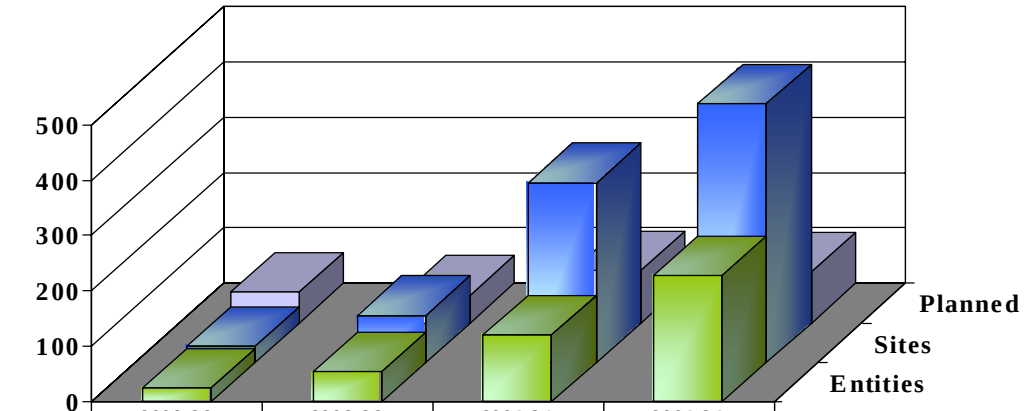
papiNet® is a **mature standard** with significant implementations in four continents and in a wide range of company types and market segments. Companies who use this standard to communicate key supply chain information to their trading partners often also use it to communicate with multiple sites within their organisation. Exhibit 3-4 ("Sites and Entities using papiNet") presents the number of entities (meaning different companies), sites (company facilities, of which there may be several per company) and planned implementations of papiNet® over a three year period. A "planned" implementation is one which is expected to become operational in production within the following 6 months.

Results from the most recent benchmark survey conducted by papiNet® show that the 228 companies who were using it at the end of 2004 had linked together 466 sites. A link is defined as a "from-to trading partner relationship for a given continent". Companies who report using papiNet® for internal communication are not included in this analysis, only their external linkage.

The 2004 data represents a growth of 50% from the 2003 survey. Experience has shown that 90% of those who plan to implement in the following six months actually do so. This survey has been very conservative in reporting the success that the papiNet® standard has received by introducing a stricter set of criteria than the earlier benchmarks. Thus it is estimated that **310 companies at around 600 sites worldwide** had implemented the standard by end of 2005. The benchmark survey has been discontinued, so this figure is difficult to corroborate. If this impressive growth was achieved and is continued, it demonstrates that papiNet® is perceived and accepted by the industry as a very useful and hence successful standard.

These survey results are difficult to link to those from the *e-Business W@tch* survey of 2006, which finds that about 3% of NACE 21.1 (manufacture of pulp, paper and paperboard) companies in the EU-25 said they used papiNet® (see Section 3.3.1). NACE 21.1 comprises about 2,270 firms in the EU-25. 3% of those would be only about 70 companies. However, since the e-Business Survey also included micro and small firms, results are probably not directly comparable to those from the papiNet® user survey. Among large firms, more than 10% said in the *e-Business W@tch* survey that they used this standard. In any case, both figures are of a similar magnitude.

Exhibit 4-4: Sites and Entities using papiNet

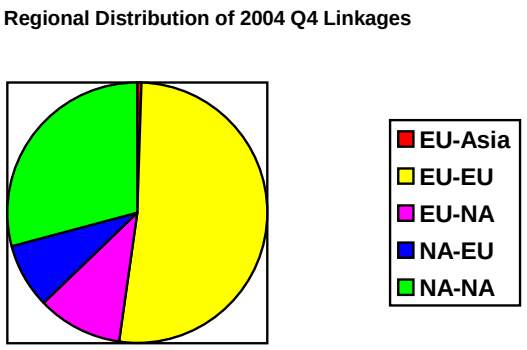


	2002 Q3	2003 Q2	2004 Q1	2004 Q4
Entities	26	55	122	228
Sites	30	86	325	466
Planned	56	51	95	93

Source: papiNet® Benchmark Survey (2005)

The same survey results provide information on the regional distribution and use of the different message types by different market segments. The regional distribution of messages varies significantly between the different market segments. Exhibit 4-5 shows the distribution for Publications Paper markets. Similar data from the book market segment, for instance, indicates only EU-EU messages were recorded in that period.

Exhibit 4-5: Regional Distribution of 2004 Q4 linkages in Publication Papers Market Segment



Source: papiNet® Benchmark Survey (2005)

Not all types of messages are used equally frequently; the usual **80-20 rule**[65] applies here. The most used message types reported at the end of 2004 were Delivery Message, Purchase Order, Order Confirmation, Invoice and Call-Off. Other types of messages, such as Business Acknowledgement, Goods Receipt or Order Status are lesser used.

There are some differences by market segment, though. The variety demonstrates the validity of the generative approach adopted by papiNet® for the introduction of new messages. The most needed messages are introduced first; new messages are added

[65] The Pareto principle (also known as the '80-20 rule') states that, for many phenomena, 80% of the consequences stem from 20% of the causes. The idea implies that only 20% of the resources are needed to solve 80% of all cases - See http://en.wikipedia.org/wiki/Pareto_principle.

according to the business needs and the additional new market segments being addressed.

4.1.5 Success factors

The primary success factors in papiNet's emergence as the global e-business standard for the P&P industry relate to

- **decentralised development** and implementation, focusing on key market segments in the region and their specific semantic issues,
- clear **messaging interoperability** strategy supported by a strong basis in stable message standards (ebXML and AS2[66]),
- effective **cross-sectoral partnerships**, and
- **no certification overheads**.

Decentralised development and implementation infrastructure

Since its earliest incarnation, papiNet® has been an effective collaborative initiative between European and North American companies. According to Art Coleman, Drybridge Consulting (www.drybridge.com) and papiNet® Technical Director, one of the main reasons for success is the decentralisation of the standards development and implementation process in a global environment: *"We have geographically oriented market segment implementation groups (SIGs). This collaborative structure to communicate developments works quite well. For example in Europe we have strong Fine Paper and Packaging SIGs and in North America the Book Manufacturing and Publication Papers are the dominant SIGs".*

Messaging interoperability

papiNet® standard Version 1.0 allowed for different messaging standards. This included the original EPC Messenger[67] developed as part of the first European implementations. Standard version 2 has kept pace with international standards developments and has firmly established ebMS (the ebXML Messaging Service) as the interoperability messaging core.[68]

Exhibit 4-6 illustrates the approach to ensuring interoperability while allowing continued flexibility in choice of different messaging standards. Messaging interoperability is achieved when the discrete papiNet® payload can be unwrapped from its various envelopes. Trading partners can use the particular message service of their choice. Guidelines for the formation of the message enveloping and hence the business and

---

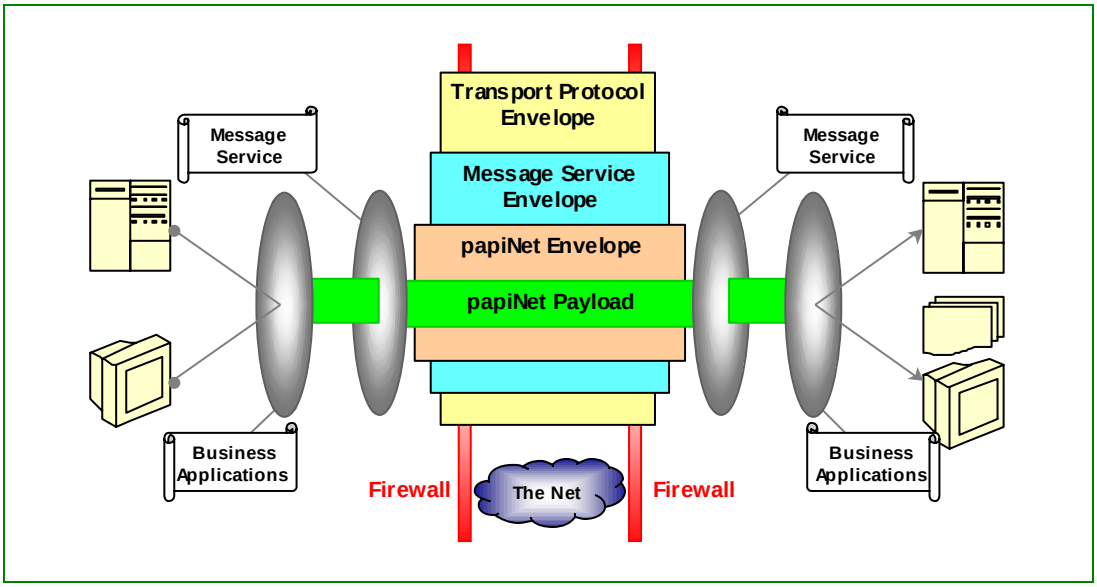
66 MIME-Based Secure Peer-to-Peer Business Data Interchange Using HTTP, Applicability Statement 2 (AS2), see http://www.ietf.org/rfc/rfc4130.txt

67 A tool developed by Ponton Consulting for Enterprise-Application-Integration (EAI) between business partners. Ponton X/P is an ebXML 2.0 compliant Messaging Service that allows secure exchange of signed (and encrypted) XML documents between business partners.

68 Interoperability Guidelines, May 2004. www.papinet.org/V2R20/200401/documents/InterOpGuidelinesV2R30.pdf

semantic interoperability requirements are contained in the papiNet® standard for the specific message being considered.

Exhibit 4-6: Messaging Interoperability Scope



Source: Art Coleman, papiNet® Technical Director (May, 2006)
adapted from papiNet® Interoperability Guidelines (2004)

Cross-sectoral partnership

papiNet® works with other organisations to help ensure that common standards issues are resolved in a mutually compatible way. Several examples show the effectiveness of this strategy. WoodX and XBITS, two groups were at first developing their own standards have since affiliated with papiNet. A further example is the collaboration with CIDX®[69] which has resulted in significant changes being introduced in CIDX to enable the paper industry and the chemical industry to use the Shipping Instructions message.[70]

No certification overheads

papiNet® has not introduced any certification requirements or other overhead processes. Notwithstanding the implementation templates developed by the SIGs, the possibility that trading companies will choose to deviate from the given recommendations is recognised. In such instance, the two companies are required to document the reason for the deviations and maintain that as part of their project.

To prevent the proliferation of multiple standards that would cause the industry more work the **papiNet® copyright notice** explicitly states that *"Documents may be used as templates for a papiNet® implementation. The Presenters grant the right to modify and edit them to fit an actual implementation project provided all copies retain and display the copyright and any other proprietary notices contained in this document. Such modified*

[69] CIDX® is a trade association and standards body focused on realizing transactional efficiency throughout the global chemical industry supply chain. See www.cidx.org

[70] *e-Business W@tch* Sector Study on e-Business in the Chemical Industries (August 2004), available at www.ebusiness-watch.org ('resources')

documents must not be distributed beyond the trading partners implementing or maintaining a papiNet® connection."

Another element of good quality control on implementations is the valuable papiNet® **Implementation Guide**. The purpose of the guide is to help companies avoid the pitfalls and drive down costs and time required for a papiNet® implementation. It guides prospective implementers through the different phases (preliminary study, planning, realisation, testing and go-live) of a typical implementation and includes appendices on message service components, project checklists, risk management and recommended best practices, Trading Partner Agreement templates and ROI (Return on Investment) calculations. Some solution providers have been very active in papiNet® implementations over a long period. Judicious use of such solution suppliers can accelerate the implementation process. The Fact Box indicates possible cost reductions and timelines that can be achieved.

Fact box

A Solution Provider View from Ponton Consulting reports

"Using the Total Cost of Collaboration, it is estimated that the implementation of a common papiNet® approach will cost one third or less than an uncoordinated , bilateral agreements among many different partners

Why standardisation pays off: cost/benefit analysis of the papiNet® project. Ponton Consulting, October 22, 2001

"As of the year 2006, the papiNet® network expands in a "zig-zag" manner between paper customers and suppliers. The core challenge is still back-end integration with local applications. However, nowadays mapping technology has advanced so far that this task can be achieved within a few-person days. So, overall integration cost is down to ca. 5-15k Euro with the opportunity to thereby reach 3-6 relevant parties at the same time

papiNet® and EFETnet: the secret of the success of two industry-wide interoperability projects. Ponton Consulting, March 2006

Source: Michael Merz, Ponton Consulting (www.ponton-consulting.com)

4.1.6 Outlook on expected developments

papiNet® is continuing to drive implementations across the entire paper and forest products industry. Ongoing development work is mainly directed at new market segments, additional message development, and to correct problems or realise interoperability gains attendant on cross-sectoral adoption of widely accepted fundamental technology infrastructure standards. An example of the latter is the commitment, already well flagged in the papiNet® Interoperability Guidelines version 2.30, that the World Wide Web Consortium (www.W3C.org) standard for Digital Signature encryption (also known as "XML Encryption") when formally promulgated will replace the current recommendation for use of S/MIME Digital Signature Encryption.

In common with most other sector-based standards initiatives, papiNet® faces the question of what to do about harmonising with other technology standards groups

operating in the same sector. One of the standard's success stories is they way in which XMLsaw i.e. WoodX became part of the specifications. This is likely to occur again. One immediate opportunity is the possibility of papiNet® adopting the Scottish Forestry Board eFIDS (Electronic Forestry Industry Data Standards), a proposal which is equally attractive to the e-Business Forum of the Scottish Forestry Industries Cluster[71] and the papiNet® Central Working Group. The challenges are significant, but it is well understood that establishing a common standard is the ideal solution. papiNet® wants to have the best standard, and recognising that both WoodX and eFIDS have strengths, favours working gradually towards harmonisation.[72]

Case study

The following case study outlines the use of the papiNet® standard by *Stora Enso*, a global player in the paper manufacturing industry, and focuses in detail on the key role of ERP systems in their e-business activity.

The case study is also relevant to the discussions in Section 4.3 on use of RFID to create an electronic pedigree ("e-pedigree") for tracking the movement of pharmaceuticals through the entire supply chain. Following publication of the recommendations of the Counterfeit Drug Task Force in June 2006[73], the US Food and Drug Administration announced that enforcement of the pedigree regulations will commence after 1st December 2006 and initially focus on products most susceptible to counterfeiting and diversion. RFID technology is central to the proposed mandatory solutions.

[71] www.forestryscotland.com/ebusiness_forum/.
Minutes of the meeting of the e-Business Forum, 3rd March 2006, are available at www.forestryscotland.com/upload/info%20-%20ebf%20minutes/ebf%20minutes%20030306.doc

[72] eFIDS, and the GIS spatial data transfer standard, are now being maintained, improved and promoted as royalty-free standards by a newly launched (August 2006) OASIS Forest Industries Technical Committe, which is also developing other trading standards for forestry products. For more information see http://www.oasis-open.org.

[73] www.fda.gov/oc/initiatives/counterfeit/report6_06.html

CASE STUDY: STORA ENSO, FINLAND

Abstract

Development, adoption and use of papiNet® collaborative messages, combined with FENIX ERP and PartnerWeb, are presented as the major steps and achievements in the Stora Enso overall European world-class supply chain integration strategy. The Packaging Boards Division is also leading the way in intelligent packaging as demonstrated in the summary of PackAgent, currently a pilot software project using RFID to track and trace pharmaceutical products and protect against the growing problem of counterfeit drugs.

Case study fact sheet

Full name of the company:	*Stora Enso Oyj*
Location:	*Helsinki, Finland*
Main business activity:	*Integrated paper, packaging and forest products*
Year of foundation:	*1998 (date of the Stora and Enso merger)*
Number of employees:	*Over 46000 in more than 40 countries on 5 continents*
Turnover in last financial year:	*€13.2 billion*
Primary customers:	*Publishers, printing houses, merchants, as well as the packaging, joinery and construction industries*
Most significant geographic market:	*Western Europe, North America, and Asia*
Main e-business applications studied:	*Use of e-standards, ERP use*
Key words:	*papiNet® standard; ERP; Intelligent packaging*

Background and objectives

Stora Enso is an integrated paper, packaging, and forest products company, with four global divisions: Publication Paper, Fine Paper, Packaging Boards and Forest Products. The group is among the global market leaders in all areas. Stora Enso serves its mainly business-to-business customers through its own global sales and marketing network. A global presence provides local customer service. Customers include publishers, printing houses, and merchants, as well as the packaging, joinery, and construction industries – and are mainly concentrated in Western Europe, North America, and Asia. As Stora Enso moves into the future, the Group is focusing on expanding its operations in new growth markets in China, South America, and Russia.

Packaging Boards produces materials for packaging applications: consumer packaging boards, graphical boards, containerboards and corrugated boxes, industrial papers for laminating industry, coreboards and cores. It comprises three business areas: Consumer Boards, Speciality Papers, and Industrial Packaging. The Packaging Boards Division achieves and maintains its leading position, in selected markets and product segments, through growth based on innovation, development and improved competitiveness.

e-Business activities

The Packaging Boards Divisional IT is responsible for the IT business support and technology development and implementations to enhance business competitiveness and

business integration opportunities. The Corporate IT Group is responsible for all enterprise wide applications, infrastructure services and messaging services.

Stora Enso uses papiNet® extensively in external and internal communications. In this respect Mr Seppo Korhonen, VP of IT, observes that *"it is very important to have technical and business process standards. A good standards framework provides a half-way house to business integration. papiNet® is an excellent e-business standards framework. Adoption and use of papiNet® collaborative messages, combined with ERP, is a major step in our overall supply chain integration strategy"*.

Primacy of ERP

FENIX is the European Stora Enso ERP system. It was tailor-made by Enso prior to the Enso and Stora merge, and prior to the "Y2000" changeover. Stora Enso then further developed FENIX as their common cross-divisional ERP system in Europe and applied it to their products/services and logistics. This later version of FENIX was created specifically for Stora Enso by Tietoenator.

In 2000 Stora Enso acquired US Consolidated Papers, which operates throughout North America with a principal focus on magazine and coated fine paper. They were already in the middle of a JD Edwards (JDE) ERP solution implementation. Thus for ERP today, Stora Enso uses FENIX in Europe and Oracle's JDE in US. Both are XML capable. In addition, Stora Enso uses SAP[74] in Europe for management and administrative tasks, such as credit control, financial reporting, Human Resources, materials management, machine maintenance and reporting. These SAP systems and FENIX are cross-linked to enable internal information access. Stora Enso staff can thereby access detailed up-to-date information in accordance with their specific personal authorization levels.

Mr. Seppo Korhonen summarised the strategic importance and benefits of the FENIX system for Stora Enso business units and partners. *"FENIX is used by all Stora Enso European Paper, Board and Pulp mills. It supports a range of different business practises, using the same fundamentals and basic data, in many production and logistics chains across Europe. This is a big bonus. FENIX also allows us to make further strategic technology investments and harmonisation of business practises between and within different businesses in our worldwide systems that would not otherwise be feasible"*.

Impact

The central focus on ERP has several important effects. Three specific business development enablers are presented in this study:

- PartnerWeb
- papiNet, and other standards
- Intelligent packaging, and the PackAgent Pilot

[74] SAP is a company founded in 1972 as Systems Applications and Products in Data Processing, which provides collaborative business solutions (www.sap.com).

PartnerWeb

PartnerWeb is the customer self-service web interface to the FENIX ERP. PartnerWeb is a harmonised back-end system, which works directly off the master FENIX databases, not from copies. Therefore the information is always up-to-date. The extensive PartnerWeb functionality is built on several different levels of / functions / structures / authorizations, and designed to ensure that operations on FENIX within Stora Enso are not disrupted or placed at risk. Security features ensure that only information that individual partners need to see, and is entitled to see, is accessible to them. Partnerweb is built on BEA WebLogic Server 8.1, which provides the foundation for web access, user identification and monitoring.

PartnerWeb access from any location is a business privilege sought by customers and partners. The size of the order record is not the critical issue in granting access. The important consideration is the presence of a mutual partnership expectation. Each implementation can be tailored to suit the particular requirements of the partner and how they plan to use the system access and for what. Currently, over 100 customers and SME partners can access PartnerWeb for vital information on an order delivery or status. They can place an order, view inventory and print documents that were previously only accessible via special request. Tailored functions are also provided for VMI (Vendor Managed Inventory) customers. Further functional enhancements are envisaged, such as Automatic Order Confirmation. This is required by some, most especially small volume, customers who need immediate assurances that an order has been confirmed and an acceptable delivery date scheduled.

papiNet

Mr Seppo Korhonen explains the pragmatic attitude towards papiNet® in terms of the Stora Enso over-riding commitment to customer service: *"papiNet® is useful and efficient when automating lots and lots of transactions, when an interface or service provider handles the messages, and when data is captured, e.g. as part of a valid bar code scan. Our partners and customers are from many sectors, and some already use standards other than papiNet® such as EDIFACT, and iDoc*[75]*. There is no pressure applied to these partners to change. StoraEnsoConnectivity, our webMethods system operating from a central hub, translates all of these internally to and from papiNet"*.

Stora Enso uses papiNet® internally between FENIX and the corporate European SAP administration system. FENIX and the JDE system are also linked via exchange of papiNet® messages and kept in sync for certain business transactions, e.g. order and related information in North America for European products, and vice versa.

Stora Enso exchanges papiNet® messages with 60 suppliers and customers i.e. those with high level of applications and communication software that are well positioned to handle the messages. Approximately 300 thousand messages are handled monthly by the StoraEnsoConnectivity hub. Over 80% of these deal with suppliers, mainly port and inland terminal operators, and the bulk of these are papiNet® messages.

[75] A standard for electronic data interchange between application programmes written for the SAP business system or between an SAP application and an external programme.

The level of external utilization of papiNet® messages varies considerably depending on the business needs of individual divisions and their business segments. For example, Packaging Boards customers seem to prefer delivery note and weight list messages and not so much order messages. On the other hand, the Fine Paper division has an extensive range of merchant customers and thus the main messages in use deal with order receipt and sending.

Other standards

In implementation pilots with key customers, the first major factor is the willingness of the customer to implement an integration project. Secondly, customers depending on their in-house legacy systems and business domains may wish to implement other message based business standards e.g. iDoc, RosettaNet. In general, when establishing e-business links with its partners, Stora Enso recommends using papiNet® standards but the final decision depends on a mutual analysis of solutions best suited for the individual partner's own systems and for their stock management requirements and strategies.

Intelligent packaging

Intelligent packaging, and associated e-business impacts, are critical for the future of the Packaging Board division. Packaging has evolved from non-descript brown paper basic container technology to multi-functional graphic print and display functionality. The evolution from printed information on the package to electronic information in the package represents an even bigger opportunity for the packaging industry. One likely scenario is that the industry will expand into value-added markets by developing entirely new packaging services using electronic sensors and/or chemicals to gather and store information, and management instructions. For this to happen, the industry companies must work in collaboration with partners and customers to increase the demand for, and the value of intelligent packaging.

PackAgent

Stora Enso's PackAgent is one such solution. The pilot implementation with Orion Pharma is unique in that it involves all of the parties in the supply chain in their real operational environment. RFID tags are inserted into the packaging at the source.

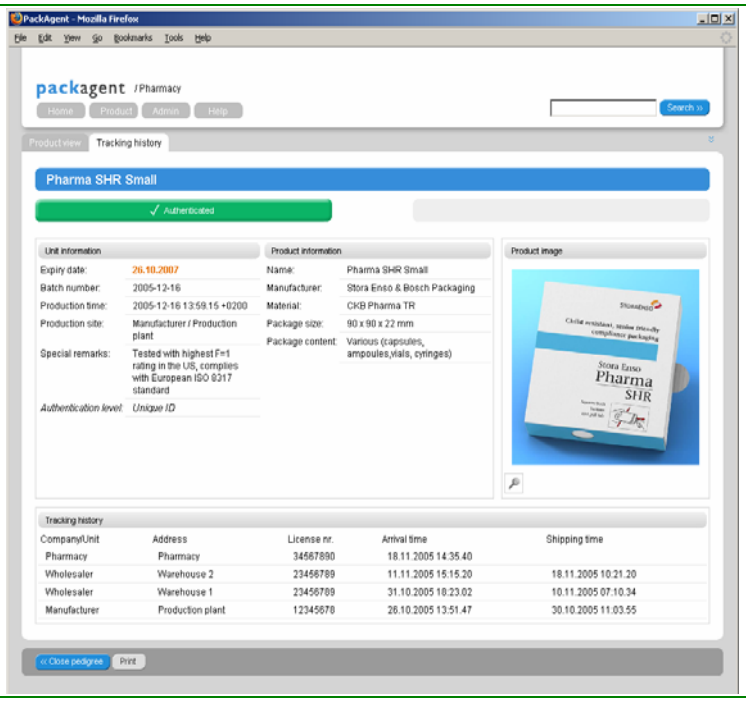
PackAgent is designed to be decentralised, it does not have one centralised database. This enables information to be shared and accessed without traditional integration methods. To see how the packages move, all that is required is to open a browser and key in a batch number or code into a web interface. The system can track any package and is able to simultaneously serve and accommodate many different companies independently of their own internal systems.

PackAgent is moving in the direction of packaging as a solution. This intelligent solution can be applied to any form or level of packaging and is not tied to RFID only. Other security marking technologies are equally possible. These include, for example, 2-D symbologies such as Data Matrix, which can contain more than 100 bytes, i.e. much more data than regular bar codes.

The long term vision is expressed by Kirsi Viskari, one of the main architects of e business applications in Stora Enso and now Manager, Intelligent Solutions, New

Business Innovations in Stora Enso Packaging Boards: *"PackAgent is capable of other things than just authenticating and tracking of products. One of its most important long term strategic capabilities is that it will allow the manufacturer to put specific information into the supply chain, effectively co-packaged as an integral component of the physical product. PackAgent is like a metro system – much like a metro supports business and social life by the movement of people, the PackAgent system enables the emergence of new forms of business and social integration based on the concept of 'data as a platform', one of the key pre-requisites for the vaunted Web 2.0"*.

Exhibit 1: Screen shot from the PackAgent Pilot



Lessons learned

The PartnerWeb capabilities and the papiNet® implementations are designed, in conjunction with the ERP system, to enable fundamental changes in business dynamics. In practice, Stora Enso customers have two immediate complementary options for e-transactions: PartnerWeb and use of papiNet. Customers can avail of each or both depending on the circumstances and perceived benefits relative to the efforts to be invested by either partner. Initial decision in the case of working with SMEs may be to steer towards PartnerWeb, and aim for papiNet® messaging between the company systems in the longer term.

The main lesson summarised by Mr Seppo Korhonen is that *"e-Business adoption should be a natural choice, a natural and normal evolution of doing business well. It does not have to be anything fancy. In collaboration with partners, present the business tools, study the possibilities, focus particularly on business process integration, and only implement in those areas where there is real advantage. Then treat every implementation as a separate project important in its own right"*.

Another lesson is that the initial excitement of smaller partners for papiNet® implementation is often dampened when the magnitude of the task relative to their existing implementation of ERP is understood. Even though papiNet® is universally recognised as being a very good standard, specific implementations in particular market sub-sectors do not require all of the data elements in the standard papiNet® messages. For example having to process a full general papiNet® message would be perceived as an “overkill” by those whose "ERP system" may be an EXCEL spreadsheet. This is well understood and is being addressed via the Segment Implementation Groups in papiNet.

The PackAgent project was designed in anticipation of much tighter rules on recording and tracking the pedigree of pharmaceuticals. These mandatory rules have since been realised. The US Food and Drug Administration announced the end of their hold on the implementation date for e-pedigree legislation, originally enacted as the Prescription Drug Marketing Act in 1998. Prior to the 1st December 2006, it is expected that the FDA will issue a draft Compliance Policy Guide. From that date the FDA enforcement of the pedigree regulations will focus on products considered most susceptible to counterfeiting and diversion. At that time it must be possible for distributors to be able to track and trace specific drugs. Thus the expectations and statutory requirements for packaging traceability based on technology such as RFID are now clear and RFID technology will be used widely throughout the pharmaceutical industry from 2007 onwards to improve security and safety concerns in the tracking of medical drugs.

One lesson for policy consideration from the PackAgent Pilot is that the legal status and any timetable for implementation of mandatory e-pedigree in Europe needs to be clearly established to enable packaging companies and their partners to plan accordingly. The requirement is fairly self-evident. Products ship across borders, and companies sell in every country, therefore EU Member State national rules and requirements must be compatible. Significantly different practices between the Members States will render it very difficult to have a common approach across the European market.

Conclusions

The future of the packaging industry is an exciting one, especially if it can move from a commodity-oriented business to a packaging system industry. The path is full of possibilities for imaginative and creative ICT enabled products and services which meet the needs of the industry, the customers, their products and the regulators in ways we can hardly imagine today.

Kirsi Viskari’s vision, however, is clear: *“PackAgent capabilities and design features indicate the way. The fundamental prerequisite is to move beyond supply chain efficiency to integrating supply and distributed management of information in products in line with demand and increasing expectations. In addition to the interoperability and associated standards challenges, above all else this requires the establishment and nurturing of alliances, research networks and commercial joint venture outside the traditional packaging sector”.*

References

Research for this case study was conducted by Henry J F Ryan, (henryryan@eircom.net) on behalf of e-Business W@tch. Sources and references:

- *Interviews with Stora Enso Packaging Boards Division staff: Mr Seppo Korhonen, Vice-President for IT, and Mrs Kirsi Viskari, Manager, Intelligent Solutions, New Business Innovations, conducted in April 2006.*
- *Desk research, press clippings and www.storaenso.com*

4.1.7 Summary and conclusions

The importance of standards and interoperability for e-business is commonly acknowledged.[76] In the forest and paper products supply chain, the papiNet® standard has been **successfully established** as the main industry standard for e-business.

Even if papiNet® is by all measures a well managed and successful initiative, there is still **a lot of scope for new implementations** of this standard, especially for those involving SMEs. Due to legacy factors and wide diversity of partners from different industries, implementation issues are not always straightforward. Currently, as the e-Business Survey 2006 shows, only about **2-3% of firms** in the P&P industry say that they use this standard, and these are mainly large enterprises (see Exhibit 3-8). However, their number as well as the amount of messages exchanged increase fast (see Section 4.1.4).

The strengths of the papiNet® organisation and its processes may have strong potential for similar cooperative developments in other sectors. In this sense, papiNet® could serve as **role model**. This study has identified some factors which have substantially contributed to the success of papiNet, and which could also be **success factors** for the deployment of industry standards in other sectors:

papiNet® Success Factors

- **decentralised development and deployment**: the implementation focus can differ between market segments and market areas, depending on the specific semantic issues that are most important in the segment/area;
- a clear messaging **interoperability** strategy, supported by a strong basis in stable message standards (ebXML);
- effective **cross-sectoral partnerships**, and
- **no certification overheads**.

To further enhance this deployment, there is an ongoing **requirement for good case studies** on the practical benefits accruing to SMEs that implement papiNet®. The case study on *Stora Enso* illustrated this point: the initial excitement of smaller partners for papiNet® implementation is often dampened when the **magnitude of the task** relative to their existing software architecture is understood.

In this sense, although papiNet® is universally recognised as being a very good standard, specific implementations (e.g. in particular market sub-sectors) do not always require all the data elements in the standard messages. In particular, having to process a full general papiNet® message would be perceived as an “overkill” by those whose business management software consists of simple spreadsheet calculation. Thus, the further deployment and broad adoption of such standards for e-business partly depend on the installed base of **business software systems**, such as ERP systems. This aspect is discussed in more detail in the following section.

[76] See *e-Business W@tch* Special Report on Interoperability and Standards, September 2005. Available at www.ebusiness-watch.org ('resources')

4.2 ICT as a Driver of Process Efficiency

4.2.1 Introduction

Improving the efficiency of **production and supply chain processes** is an important objective for all manufacturing businesses. However, the potential depends on the structure and characteristics of supply chain processes. This section explores the impact of ICT on business processes of companies from the P&P industry and assesses where the major potential sources for innovation and productivity improvements are located.

The assessment and conclusions are based on desk research, case studies (all case studies featured in this report, not only those contained in this section), interviews with business representatives and data from the e-Business Survey 2006. A significant challenge for this industry is how to draw valid general conclusions: the **sub-sectors have different characteristics** and therefore potentially different drivers leading to differences in their major e-business activities (e.g. technology for paper manufacturing vs. technology for paper converting). Furthermore, main conclusions are presumably different for **small and large firms**. To the extent possible within the scope of this report, these functional and structural differences are taken into account. However, some generalisations (for "the industry"), are proposed where applicable.

Companies from the P&P industry, depending on the segment and size of operations, have chosen different approaches to building their supply chain, linking to suppliers from forestry and the chemical industries (upstream) and to customers, e.g. in the food and beverages industry (downstream). ICT service providers talk about the "total forest supply chain" in this context.[77] Supply chain integration via connecting ERP systems (or similar standard software packages) is the most common approach which medium-sized and larger companies in the sector use to manage their operations.

4.2.2 Substitution of paper-based processes

An important focus of e-business activities in the P&P industry is intended to increase the supply chain efficiency by eliminating paper-based processes as much as possible in all stages of B2B trade, thus optimising the flow of information and documents in and between companies. ERP systems are currently the main platform to enable this goal.[78]

The critical role of ERP systems

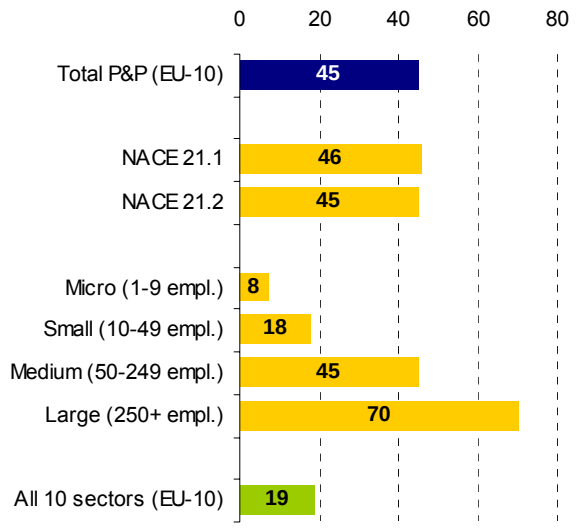
The use of ERP systems is widespread among companies from the P&P industry, compared to most other sectors studied by *e-Business W@tch* in 2006 (see also Section 3.4.1). In total, companies representing 45% of employment said they operated an ERP system; the ICT manufacturing industry is the only one among the 10 sectors studied with an even higher adoption rate. In general, ERP systems are mostly used by manufacturing

[77] See, for example, TietoEnator, a service provider catering to the pulp, paper, board and tissue industries (www.tietoenator.com > industry expertise areas, April 2006).

[78] Note that ERP (Enterprise Resource Planning) software has a broader functionality for companies than just to eliminate paper-based processes. This section focuses on specific aspects only.

industries. However, in most surveyed industries, there is still a considerable gap in ERP adoption between small firms on the one hand and the medium-sized and large firms on the other. In the P&P industry, for example, about 70% of large companies and 45% of medium-sized ones said they had an ERP system, but less than 20% of small firms did (see Exhibit 4-7).

Exhibit 4-7: Companies with an ERP system



Sector	Have ERP (%)	
	Total	large (250+)
Food & Beverages	32	66
Footwear	23	40
Pulp & Paper	45	70
ICT Manufacturing	61	74
Consumer electr.	39	75
Shipbuilding	30	76
Telecom services	32	53
Hospital activities	33	36
All 10 sectors	**19**	**45**

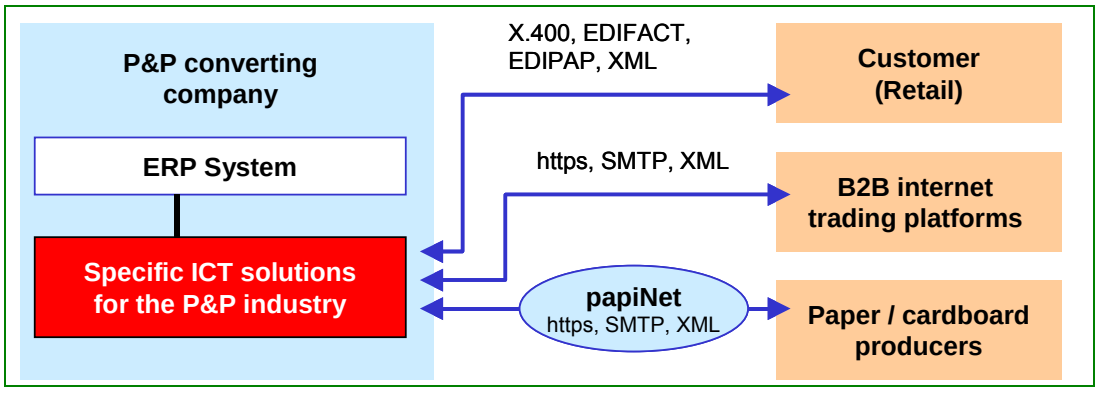
Base (100%): All companies using computers. N (for sector, EU-10) = 964.

Weighting: Totals (for the sector, sub-sectors and all sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: D1d

Source: *e-Business W@tch* (Survey 2006)

Exhibit 4-8 shows typical ways of linking systems with customers and suppliers from the perspective of a paper converting company, e.g. a packaging producer.

Exhibit 4-8: Data exchange mechanisms in the P&P supply chain



Source: Developed from information by Seeburger AG about the role of papiNet® in their solutions for the P&P industry (www.seeburger.de)

Assuming that the company has an ERP system, it will typically have implemented sector specific solutions and modules on its ERP to facilitate the document exchange with suppliers and customers. Depending on the legacy systems in place, this can include

modules to exchange data via EDI, e.g. with customers in the retail sector, where EDI is still widely used. The system will also enable the exchange of data in XML-based standards. When trading with paper and cardboard manufacturers, companies may have agreed to exchange data using the papiNet® standard (see Section 4.1), which will normally also be enabled by the system.If companies decide to conduct e-business with each other via their ERP systems and using papiNet, an initial mapping process has to take place to ensure that the systems "talk the same language". This will normally take a few days; some test orders and invoices will be exchanged to see that the receiving system can read the information in the way intended by the sender (for example, to check if the "address" is also understood to be an "address" by the receiver).

The exchange of order-related data in standardised electronic format is the most common form of e-business between large firms or between large and medium-sized firms in the P&P industry. The business example of Karl Knauer KG / COPACO Group (see following box) is a typical example. The case study on *Stora Enso* (Section 4.1) also confirms the "primacy of ERP" for e-business exchanges.

Business example:

papiNet®-based B2B Integration at Karl Knauer KG / COPACO Group

Karl Knauer KG in Biberach, Germany, is a producer of innovative packaging solutions. The company employs about 400 people and is part of the international COPACO Group, a European cooperation of mostly medium-sized producers of cardboard packaging solutions. In 2005, the group employed about 1900 people and had a turnover of about 258 million euros. Customers are mainly companies from the food & beverages and the pharmaceutical & healthcare industries (about 70% of revenue).

*A few years ago, COPACO adopted the strategy of standardising based on the papiNet® standard as much as possible, its data exchanges with producers, customers and suppliers. In this framework, Karl Knauer AG digitally integrated business processes with cardboard producer Mayr-Melnhof (Vienna), one of their major material suppliers, by implementing a system for standardised data exchange (using **papiNet®**). The company selected Seeburger AG to realise the system integration. The case served as a pilot for the whole COPACO group.*

The main hub for the data exchange is a Seeburger Business Integration Server (BIS). Data are transmitted via the internet in XML format. BIS connects specific modules of the ERP systems of the participating companies, as well as certain legacy systems and programmes. In this way, most of the former paper-based documention exchange has been converted to electronic data exchange.

According to Richard Kammerer, Managing Director of Karl Knauer KG, the process integration based on BIS has improved supply-chain management by accelerating processes and reducing error rates. This, he concluded, is "a win-win situation for all parties involved – supplier, producer and customers".

Sources: Seeburger (Customer references, see www.seeburger.de); COPACO Group (www.copaco.de); Karl Knauer AG (www.karlknauer.de)

Many companies, including the larger ones, adopted ERP systems in the mid or late 1990s. Interviewees for this report confirmed that the change from the non-ERP to the ERP era constituted the single most important and most difficult step for the company with regard to e-business, with considerable requirements for change management. All other steps were regarded as follow-up steps which were comparatively easy to accomplish and did not constitute another paradigm change.

Outsourcing of ICT functions as a substitute solution

While small firms may not need a fully-fledged ERP software system in way large firms do, they could still benefit from functionally equivalent ICT solutions that support their planning and controlling processes and enable them to improve the overview of all business processes with customers or suppliers.

However, It is not easy to achieve the same benefit of B2B e-business by using other, more affordable, software packages, mainly because it can be difficult and potentially costly in the long term as well to link those systems to the systems of larger companies. Therefore, the relatively high implementation costs for ERP systems remain a critical challenge for SMEs (see also policy implications, Section 5.2, of this report).

Outsourcing of ICT services could be a viable alternative to buying ones own system. The e-Business Survey 2006 found that more than 10% of SMEs in the P&P industry had outsourced ICT services in 2005 (see Section 3.2.2).

The following business example of a cooperative outsourcing initiative (see box) shows that outsourcing can be combined with cooperation. Here, four packaging companies from two countries have joined forces; one of the areas where they cooperate is the outsourcing of technical B2B e-business operations to a third party service provider. This non-typical model innovatively combines cooperation with outsourcing. Its success appears to confirm the standard argument about the importance of e-business cooperation for SMEs in today's market environment. Although this specific business example is based on a customer reference by the system provider and cannot necessarily be expected to constitute objective assessment, the approach is certainly plausible and resonates with articles about ICT outsourcing in e-business and ICT magazines.

Business example:

Cooperative Outsourcing at United Flexibles GmbH

Four packaging specialists PAWAG (Austria), Sopal PKL, Reuther Verpackungen and HUECK Folien (Germany) joined forces under the name of United Flexibles GmbH in order to strengthen their market position vis-à-vis large international companies. They also used this cooperation for a joint outsourcing of ICT services.

United Flexibles GmbH has outsourced a large part of their infrastructure for data exchange with customers. The main server architecture for business integration is operated by a third party service provider (Seeburger AG), and only a client module (the communication system "BIS:SpokeUnit") is directly located at each of the four constituent companies. The communication system is connected to the Seeburger computer centre, where the main integration server is located. Outsourcing has reduced fixed costs for the four companies, each of whom now pay a monthly service fee.

The cooperation in a group and joint outsourcing services has enabled the individual companies to save costs, when comparing their monthly fee to costs which would occur if each of them had to build and maintain the same functionality for their B2B exchanges on their own.

Sources: Seeburger (Customer references, see www.seeburger.de); company websites of United Flexibles GmbH constituent companies.

4.2.3 Peer-to-peer instead of marketplaces

Many of the smaller P&P firms, however, will probably not have the required ICT systems to conduct sophisticated e-business, even by exploiting opportunities of cooperation – at least not in the short term. Against this background, large companies from the P&P industry have created special services for their smaller trading partners to provide them with at least some of the functionality of more advanced systems.

PDF document exchange – the typical "e-business" of the small firm

If measured only by the number of transactions regardless of transaction value, the majority of B2B exchanges today are most probably still conducted in a traditional manner. The exchange of delivery notes, a sub-process of B2B trading, may serve as an example. A (large) company interviewed for this study reports that currently only about 5-10% of all delivery notes are directly confirmed by messaging to the ERP system of the trading partner, while about 90-95% are sent in other, more conventional ways.

A typical method currently used by many firms is to send the delivery note by e-mail as an attached PDF document. This can be regarded as an **intermediate stage** between paper-based and more advanced automated processing. Exchanging PDF documents by e-mail, as two interviewees said, is *"currently the typical 'e-business' of the small company"*. On the other hand, interviewees also noted that use of ERP-to-ERP data exchange is increasing fast and is already the dominant form of B2B in business transactions between large companies.

Peer-to-peer trading portals on company websites

While waiting until such more advanced forms of e-business are more common, most large P&P manufacturers have established **extranet-like portals** on their website for suppliers and customers. The "coMMunity" portal by *Mayr-Melnhof Cardboard Group* (see following case study) is an example of such an approach. Their portal supports trade with smaller customers who do not have an ERP system, and enables these companies to manage and maintain a well-structured overview of the **status of all orders and supply fulfilment** in all their business with *Mayr-Melnhof*.

Servicing trading partners is certainly an important aspect of this activity; however, this portal approach is not entirely a selfless act – both parties are expected to profit from ensuring higher transparency of all ongoing and completed business processes between the partners.

A simple example showing how portal providers benefit as well is the use of these portals for communicating the latest version of the terms of business. Previously any change would have to be communicated to all business partners by sending out printed copies of the new terms. Companies can now simply refer to the respective document on the web. Only few countries still insist, in case of a change, that terms have to be sent by mail. This not only is a better and faster way to substitute the formerly paper-based processes, but – interestingly – is also found to result in fewer complaints compared to the earlier way of communicating changes. It seems that firms are less annoyed *about* a change of the terms (with reference to a website) than when receiving the changed text in full detail.

CASE STUDY: ENHANCING RELATIONS WITH BUSINESS PARTNERS - MAYR-MELNHOF, AUSTRIA

Abstract

The Mayr-Melnhof Cartonboard Group (MMK), headquartered in Vienna, is a leading producer of recycled cartonboard within Europe and world-wide. As a vital part of its strategy, the company lays emphasis on developing and maintaining lasting business relations with clients as well as suppliers. This case study shows how MMK uses ICT and e-business deliberately as instruments to support this strategic goal. The case focuses on a web-based workplace ("coMMunity"), which was mainly implemented as a service for smaller companies with whom MM is in business. It illustrates how online services of this type can support B2B trade processes in a win-win situation, with a high chance of creating value for both parties involved.

Case study fact sheet

Full name of the company:	*Mayr-Melnhof Karton Gesellschaft m.b.H.*
Location (HQ / main branches):	*Headquartered in Vienna, Mayr-Melnhof operates nine cartonboard mills in Austria, Germany, the Netherlands, Switzerland, Slovenia and Bulgaria. It has sales offices and agencies in more than 40 countries worldwide.*
Sector (main business activity):	*Cartonboard production*
Year of foundation:	*1950*
Number of employees:	*about 3,000*
Turnover in last financial year:	*767 million euros (2005)*
Primary customers:	*Producers of collapsible cardboard boxes, mainly for the food industry, pharmaceuticals, healthcare products and cosmetics*
Most significant market area:	*Western Europe (about 60% of sales). Overseas exports account for 23%.*
Focus of case study:	*Use of ICT for supporting B2B trade processes*
Key words:	*Webbased workplace, online products catalogue, business process transparency, trade with SMEs*

Background and objectives

The Mayr-Melnhof Cartonboard Group (MMK) is a leading producer[79] of recycled cartonboard within Europe and world-wide. It is part of the Mayr-Melnhof Group, which is listed on the Vienna Stock Exchange and consists of two divisions: the Cartonboard Group and the Packaging Group. In total, the MM Group employs about 7,300 people, 3,000 of whom work in the Cartonboard Group.

The cartonboard industry is part of the paper industry. It produces mainly millboard (but no corrugated board) from a grammage[80] starting from 180 g/m² for packaging. MMK is specialised on the production of recycled cartonboard, i.e. cartonboard containing a

[79] The company states that it is "*the* leading producer" worldwide with the largest market share of all companies in the recycled fibre-based cartonboard production for collapsible boxes.

[80] "Grammage" is a measure of paper weight based on the same square meter sheet of paper, regardless of paper grade.

certain percentage of recycled fibre (the percentage can vary between products), mainly used for the production of collapsible cardboard boxes.

MMK sells its cartonboard mainly to companies from the 'converting' industries that produce these boxes; 15% of sales are within the Mayr-Melnhof Group (to the MM Packaging Division), 85% to other converting companies. Downstream in the value network, the main "users industries" of the packaging solutions produced from MM cartonboard are the food industry and producers of pharmaceuticals, healthcare products and cosmetics. In a few exceptional cases, MMK sells cartonboard directly to companies from these industries.

Business goals and strategy

MMK has the declared operational goal to maintain and even expand its position as a market leader in an increasingly competitive environment. To this end, the company is committed to proactively seek and exploit opportunities for further growth in its core business, by acquisitions as well as a natural expansion of market shares in Europe and export markets outside Europe. To achieve these goals, the company pursues the ambitious strategy of combining cost leadership with service leadership.[81] Both are regarded as key to stay competitive in the marketplace, and for the pursuit of the ultimate goal of a market leader to be “best in business”.

Maintaining excellent and longstanding relations with business partners is a vital part of the business strategy, as pinpointed and summarised in the mission statement: "*For Mayr-Melnhof Karton good co-operation is a must. We strive to build lasting relationships with our clients, as well as our suppliers. We act as a team and partner in mutual respect, trust and reliability*."

The use of ICT and e-business by MMK is fully embedded within this strategy. Any investment into ICT systems is critically checked on its contribution to cost leadership or customer service.

e-Business activity

Overview of e-business strategy

As a large, internationally operating company, MMK makes intensive use of ICT for conducting business. Important application areas and activities include the following:

- **Paper-less exchanges via ERP systems** (mainly with other large companies): 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 which each other. This enables the automated processing of data during all transaction phases (request for quotations / proposals, placing the order, order confirmation, invoicing process, dispatch confirmation). Data exchange between ERP systems represents the most sophisticated form of e-business.

[81] Cf. Mayr-Melnhof Karton AG, Annual Report 2004, p. 9

- **B2B workplace "coMMunity"**: A service targeted in particular to smaller enterprises which do not have an ERP system, as a substitute; it is the focus of this case study.
- **Online products catalogue "Cartonette"**: An online products catalogue with detailed information about quality grades of cartonboard for specific user sectors and types of products to be packaged. The website front-end of the database is directly fed from the ERP system. Thus, the products catalogue is always up to date without requiring manually entering the data.
- **MM Sourcing**: As part of the MM Group, MMK participates in the e-sourcing platform that was developed by MM Group for its two main divisions. Current and prospective suppliers are invited to use the "eRFX" sourcing platform (at www.mm-sourcing.com) for requests for information or for participating in one of the following tender procedures:
  - **Requests for Quotation**, enabling single quotation requests for specific products and services. Since 2005, MM Sourcing includes a special module for logistics companies ("Interstar"), where they can log in and submit offers in response to the published RfQs. Logistics service providers are currently one of the key target groups of MM Sourcing.
  - **Requests for Tender** (multiple quotation request for specific products and services) and **Requests for Auction** (an online reverse auction module) are also possible via MM Sourcing, but used to a lesser extent.

One of the main challenges for further expanding its B2B e-business activity is that many of the **small customers and suppliers** do not have sophisticated e-business systems in place; in particular, if a business partner does not have an ERP system, the exchange of data in standardised, electronic format is hardly possible.

Although this dichotomy between large and small firms is typical of most of the manufacturing industries, many of the smaller companies in the pulp & paper industry, notably in the converting industries, can be characterised as being particularly conservative in their attitude towards ICT. According to Mr Pachta, Manager Electronic Solutions & Services, many of the small firms MMK is trading with were rather late in taking even the first steps in connecting to the internet, and – once connected – often had only one central e-mail address for the whole company to send messages to. Without going into technical details, it is easy to imagine that this is not a favourable business environment for sophisticated B2B integration schemes for the whole value network.

The B2B Workplace "coMMunity"

Confronted with this situation, MMK considered how it could be possible to bring at least some benefits of e-business to its smaller trading partners, even if they do not have the systems for enabling fully integrated B2B exchanges. The key objective was to create a service for trading partners which they could not afford or manage on their own, i.e. which has a clear value for them. At the same time, the system should enhance the transparency of business processes between MMK and its customers and thus support ordering and delivery processes in terms of quality assurance, reporting and follow-up activities.

These considerations resulted in the decision to set up a web-based workspace mainly for customers of MMK, which offers several functionalities that compare to the reporting function of an ERP system. The workspace was named "coMMunity". It was implemented in 2001, with development of the initial version taking about 6 months. The workspace was developed in cooperation with Freecom Internet Services GmbH, a company founded in 2000 as the IT arm of MMK.[82]

"coMMunity" can be regarded as an extension of the existing customer information system, with the objective to foster online B2B exchanges. The service is exclusively being offered to existing MMK customers, who do not have to pay any fee for using it. In order to enable not-yet-registered or prospective customers a preview of how the system works, anyone can log in as a guest member without a password. Guest users can then access and download test reports (with data being random numbers) which provides them with a good understanding of how the system operates.

The overall objective to promote B2B exchanges online was broken down into **two main goals** and development phases: the establishment of an online information system as the first phase, and the expansion of the functionality.

Phase I: The coMMunity online information system

The first level goal / phase was to offer registered users access to an innovative **online information system**, providing them with individualised data for analysis and decision making processes. This phase has mainly been completed; the workspace offers a wide range of information and reporting tools. Trading partners that register for the portal can access practically all information regarding the status of their current orders, as well as the record of previous orders. A broad range of reports can be downloaded with information about the following areas:

- **Production preview**. The production preview shows an overview of the current production programme and its completion date. This is the most frequently used service.
- **Stock tracking and monitoring ("my inventory")**. Reports in this category provide a precise overview of your actual stock level. They help both customers and MMK to optimise the stock turnover of specific grades, by showing orders where the confirmed delivery date has already passed including today.
- **Order monitoring**. Information about the status of orders, including current orders and monthly statistics of orders completed (by customer, enabling customers to analyse data).
- **Dispatch tracking**. Detailed logistics information enabling customers to track the delivery status of their orders (in form of a detailed table with lines for each product ordered, showing when and from where the product was dispatched, with order numbers and the planned dispatch dates of their orders).

[82] MMK owns 65% of Freecom Internet Services GmbH. For information about services, see www.freecom.at.

Some examples of specific reports in these areas available are: The "**Pending Orders**" Report, the second most popular report next to the production preview report, shows the status of a customer's orders (packed, called off, dispatched, invoiced). The "**Monthly Development**" Report provides customers with a quick overview of cumulative figures for their orders on a monthly basis. The "**Sales Statistics**" Report supports customers in their analysis and controlling, by enabling a flexible and customised analysis of all invoiced orders. Similar reports are available for inventory and logistics.

Most of these customer-specific reports can be downloaded in **different formats**, for example as Microsoft Excel spreadsheets or (for further data analysis), or in Microsoft Access format. In addition, the portal informs about products, company news and production plans. Technically, the reports are directly **generated from the TietoEnator[83] ERP system** of MMK via an Oracle interface.

As of August 2006, the coMMunity portal had **1284 registered users**. About a quarter of these **(330) are frequent users**. The number of registered users has doubled since 2003 and increased by about 10% since 2005. The main users of the portal are printing companies and export companies, i.e. the main customers of MMK. Logistics companies and other suppliers have also access to specific services.

Since 2003, users can not only download reports ("pull"), but also issue subscriptions for specific reports ("push"). Subscribers receive the requested reports in a specified interval automatically by e-mail. As of August 2006, about **870 subscriptions** had been placed via the portal.

Phase II: Online ordering

The second goal and phase for the coMMunity portal will consist in the conversion of the paper-based documentation between MMK and its key customers (e.g. for order confirmation and invoicing) to a **paperless e-system** connecting computer networks via the internet. This phase has not yet been realised. It is planned to complete it until end of 2007. By then, customers will be able to place orders with MMK online via the workplace. Thus, it is planned to enhance the platform from an information space (with reporting functions related to current and past exchanges) into an e-commerce trading platform for placing new orders.

MMK expects that these services – both the online information system and the e-ordering – will raise the awareness for the benefits of e-business among its customers. By creating a concrete value for companies that use the system, it will help them understand the strategic role of e-business trends in advancing their own business objectives. MMK is committed to actively promote and accelerate e-business uptake in its industry by continuing to develop new tools, services and applications, because the company believes that it can realise a **win-win situation**. "*We are convinced that coMMunity helps both partners – our customers and MM Cartonboard Group, as it enhances the quality of data exchange and communication,*" says Erasmus Pachta.

---

[83] TietoEnator (www.tietoenator.com) is one of the largest IT services providers in Europe. IT services for the forest and energy industries, including the P&P industry, is one of ifs main business fields. MMK implemented an ERP system from TietoEnator in 1999.

Therefore, MMK has a strong interest in **assisting its customers** with the implementation of this new instrument into their day to day business. The company employs professionals that are well experienced in the areas of web design and programming, process redesign and project management. This know-how is – to the extent possible – made available to SME customers as a service.

Impact

It is hardly possible to quantify the impact of "coMMunity" in any way. Since the work-space is a tool that it is used by many trading partners, benefits are not only realised by MM Cartonboard Group itself, but to a large extent by the target group for whom the service was implemented.

According to Mr Pachta, an important effect is that the portal paves the way for **testing new business models**, such as Vendor Managed Inventory (VMI) or Supplier Managed Inventory (SMI). In VMI, the manufacturer is responsible for maintaining the distributors inventory levels. The manufacturer has access to the distributors inventory data and is responsible for generating purchase orders. By contrast, in the traditional business model, distributors place an order against a manufacturer when they need it; thus, the distributor is in total control of the timing and size of the order.[84] Users of the coMMunity portal can gain experience how these models work. They can test them without facing any risks or costs for technology implementation. "*This is an important step leading towards* real *e-business in our industry*", says Mr Pachta.

Besides paving the way for new (e-)business models, MMK reports that the workspace has had effects on B2B exchanges in the following areas:

- It facilitates and **speeds up communication** by actively encouraging the use of online communication.
- It **reduces total transaction costs** in comparison to a comparable transaction (with a similar type of customer) that would be accomplished without the use of community. However, MMK says that they do not have any figures on absolute savings nor do they want to publish estimates of the percentage of cost reductions.
- It strengthens **customer service**, as it provides small companies access to a flexible tool for analysis, based on e-business instruments they do not have available on their own.
- It enhances **paperless office management**, enabling HTML, XML, MS Excel and Adobe Acrobat Reader download of all reports generated.

[84] For more information about VMI, see for example www.vendormanagedinventory.com.

Lessons learned

The single most important critical success factor for operating an e-business portal such as coMMunity, according to MMK, is that the underlying ICT system(s) from which the portal is fed – typically the ERP system – is perfectly organised. "*A company has to make sure it has a well organised system in place where all the relevant business data are seamlessly linked, before it can build applications and services upon this basis. If you don't have such a system in place, it will inevitably be a nightmare*", says Mr Pachta. He says that it is possible to create interfaces between different business areas, e.g. between ICT systems for resources planning and financial systems; however, it will not work to have two or three different ICT systems within one functional area. This can be a big issue and challenge in the case of mergers, when different legacy systems for resources planning have to be integrated.

MMK accomplished the main step towards an ICT-based integration of business data in 1999, when the company introduced a comprehensive ERP solution from TietoEnator. The decision to take this step was taken in 1996; it took three years to complete it. With regard to e-business, 1999 constitutes "the beginning of time": there is only a time before ERP and after. All other subsequent steps since have been comparatively uncomplicated to manage, once the ERP implementation had been successfully completed.

Although the coMMunity workspace is intended to pave the way for new business models between MMK and its customers in the long run, MMK states that it is very important not to impose any limitations on current or future customer relationships that are developed and maintained outside of this e-environment. Thus, the workspace is not perceived as a substitute for traditional ways of conducting business, but a beneficial addition to them. The goal is clearly to facilitate and enhance relationships without disrupting them.

References

Research for this case study was conducted by Hannes Selhofer, empirica GmbH, on behalf of e-Business W@tch. Sources and references used:

- *Interviews with Erasmus Pachta, Manager Electronic Solutions & Services at MM, in March and September 2006*
- *Mayr-Melnhof Group Annual Report 2004*
- *Newsletters by Mayr-Melnhof Cartonboard Group (2005, 2006)*
- *Websites: www.mm-karton.com, www.mm-packaging.com*

Limited success of third-party marketplaces

The implementation of sophisticated B2B extranet portals by large players, as illustrated by the case study above, is one of the reasons why third-party online trading platforms did not really get off the ground in the P&P industry.

In theory, the P&P industry seems to be well suited to trade its products on e-marketplaces, as many of the products can be standardised and described with clear technical specifications. However, as argued in this section, the significant market power of the large (and often internationally operating) companies in this industry has enabled them to establish their own marketplaces and to successfully prevent intermediation on a larger scale. Moreover, e development and deployment of the papiNet® standard, which was predominantly driven by large players from the industry, has also been a strategic move to prevent the market entry of third party operators. The use of a shared standard facilitates direct B2B trade between companies; the provision of a smooth infrastructure for online trading could otherwise have been potential competitive advantage of third-party e-marketplaces.

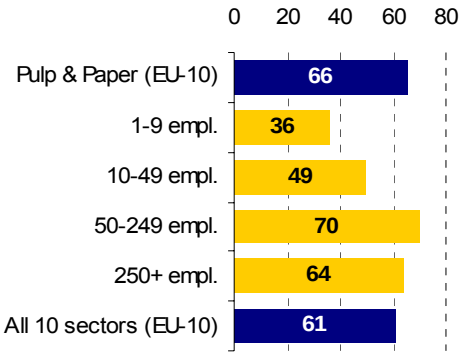
Consequently, since all evidence points to a very limited use and impact of e-marketplaces in the P&P industry, the topic is not followed up in more detail in this study. As of November 2006, eMarket Services[85] lists only seven internet trading platforms for pulp and paper products, four of them focusing on North American or Asian markets. While companies from the P&P industry are mainly the sellers on these platforms, buyers include printing mills, publishing companies and dealers of paper.

4.2.4 Impact on work organisation

It is widely recognised that ICT can have significant impact on work organisation in a company, because the introduction of new technologies tends to go hand in hand with changes in work processes. In the pulp and paper industry, the effects are probably less visible on the overall organisational structure of a company, than in how work processes are organised.

In fact, companies from the P&P industry observe that the most significant impact by far of ICT is on business process efficiency and work processes. About two thirds of all firms interviewed observe a positive impact in these areas. Hardly any company has experienced a negative impact; the other third have not experienced any impact due to ICT (see Section 5.1).

Exhibit 4-9: Companies observing a positive influence of ICT on internal work processes



Base (100%): Companies using computers.
N (for sector, EU-10) = 964.
Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment. Figures for size-bands are in % of enterprises from the size-band.
Questionnaire reference: H4

Source: *e-Business W@tch* (2006)

[85] www.emarketservices.com, a not for profit project, funded by the trade promotion organizations of Australia, Ireland, Norway, Portugal, Spain, Sweden and The Netherlands, with co-funding from the European Commission, DG Enterprise & Industry during 2004-2005.

ICT and the transparency of business processes

An important aspect of the ICT impact on work organisation is that the increasing use of ICT in all business areas (not only in B2B trade, but also internally) has effects on the transparency of business processes. The first of the following two case studies, about *Rexcell* a manufacturer of tissue and airlaid paper in Sweden, describes how a company uses ICT for quality management by meticulously documenting all business processes in a system.

A very important side effect of this innovation is that factory workers are now in a much better position to understand how business processes are linked to each other, for example how marketing activities by sales people in the organisation are linked to the delivery of the products they are manufacturing. This transparency and knowledge has strengthened the 'team-spirit' and company culture, as every employee has a concrete understanding of what is their individual role and contribution to the company's work.

Improving supply chain management

In the e-Business Survey 2006, enterprises representing about 20% of employment in the P&P industry said that they used a Supply Chain Management (SCM) system (see Exhibit 3-27, Section 3.5.2). Among large companies, about 40% said so. Thus, the P&P industry is among the leading SCM user sectors.

The second case study featured in this section ("*ICT for New Production Tracking*") describes the innovative e-business activities of a large European producer of office paper in the area of SCM. The case study clearly illustrates the impact of ICT on work organisation, but from a different focus. It demonstrates effects of introducing systematic SCM on work processes, skills requirements and organisational performance. The case study shows that the requirements for complementary skills were initially met with some resistance, but that the use of ICT – with a focus on an RFID-supported SCM system– eventually translated into significant efficiency gains. The state-of-play of RFID use in the P&P industry is then discussed in more detail in Section 4.3.

CASE STUDY: ICT FOR QUALITY MANAGEMENT AT REXCELL TISSUE AND AIRLAID AB, SWEDEN

Abstract

Rexcell, a large manufacturer of tissue and airlaid paper in Sweden, looked for new ways to organise and structure their quality management system (QMS) in order to meet demands from customers. Today, ICT help the company to ensure quality management throughout all processes within the company as well as provide a better overview of these processes. The company implemented an ICT based quality management system which allows employees to follow any process within the company from start to finish and see what steps to maintain quality are taken.

Case study fact sheet

Full name of the company:	*Rexcell Tissue and Airlaid Paper AB*
Location (HQ / main branches):	*Bengtsfors, Sweden*
Sector (main business activity):	*Production of tissue and airlaid paper*
Year of foundation:	*1874*
Number of employees:	*about 300*
Turnover in last financial year:	*1,2 billon SEK (~130 million EUR)*
Primary customers:	*Tabletop retailers, feminine hygiene product retailers*
Most significant market area:	*Tabletop products and feminine hygiene products*
Focus of case study:	*ICT for quality management*
Key words:	*ISO 9001, transparency of business processes*

Background and objectives

Rexcell Tissue and Airlaid Paper AB is a Swedish company manufacturing tissue and airlaid paper. 98% of the company's products are exported to other countries within the EU. The distance to the USA is deemed to be too great for business there to be profitable, as shipment costs would be too expensive.

On the European market, Rexcell has a market share of approximately 20% for both tissue paper and airlaid paper. Competition is intense. The company's strategy is focused on quality, thus it has to be in the frontline when it comes to methods for ensuring the quality of their products.

Rexcell manufactures tabletop and hygiene products. The company uses two different production techniques: tissue and airlaid. Tissue is used to produce high quality tabletop products such as tissue napkins. Airlaid is a technology used for developing products within feminine hygiene, wipes, tablecloths or napkins. With airlaid technology, firms usually manufacture products with a cloth-like texture.

Rexcell had specific instructions for quality management for each process and department within the company. These respective measures were described separately and kept in various binders in the different departments of the company according to the demands of ISO 9001:1994.

In December 2000, a revised standard ISO 9001:2000 for quality management systems was issued by ISO, the International Standards Organisation, called. Quality manage-

ment systems to ISO 9001 standard provide an organisation with the means to fulfil customers' quality requirements, improve a company's capability to consistently provide products that meet these requirements, and ensure compliance with regulatory requirements. The system enables a company to show how quality is maintained in every process. Thus, the ultimate objective of such a system is to enhance customer satisfaction, while at the same time continuously improve the firm's performance.

Soon after ISO 9001 was developed, customers started to require that their suppliers had an ISO 9001 approved quality management system. Rexcell decided to keep up the certification according to the revised ISO 9001:2000 as well as for the revised ISO 14001:2004. Such demands called for changes in Rexcell's organisation of quality management, which led to Rexcell investing in an IT-based solution, "control-ES". Rexcell hoped that this new system would also provide an overview of the company's different processes and how they are all linked together.

e-Business activities

To meet the ISO 9001:2000 standards, organisations are required to show their quality management system process by process. Rexcell's old system made it difficult for customers and employees to have an overview of the company's processes.

Rexcell explored various solutions available on the market. Through another company, Rexcell discovered that there are attractive IT solutions, which provide a complete overview and explanation of all business processes, and how they are linked with each other. Rexcell decided this was the way to go forward and to invest in an IT-based quality management system of its own. The company purchased the quality management software called "control-ES" from Nimbus Partners.

Implementation

Control-ES was implemented in 2002. The whole implementation process took about three months. Consultants normally recommend that the implementation of an extensive quality management system should take about ten months, but Rexcell decided to take the risk and speed up processes. Five people within the company worked full time on the project during the implementation period. The company also contracted a consultant who trained staff how to use control-ES.

The cost of the software (i.e. the licence) and for the consultant amounted to approximately 200,000 SEK (about 21,700 EUR). Rexcell did not need to make any investments in additional hardware. The existing hardware architecture was sufficient to run the system.

Features

The quality management system control-ES, is available to every employee via Rexcell's Intranet. This enables each to get a better understanding of how the marketing, sales, management decisions and product manufacturing are all linked together. Furthermore, instructions on how to solve problems in various situations are available for all and are easily accessed if needed.

A key feature of control-ES is that information concerning *all* quality management routines is easily accessible by every employee. If there are questions concerning any procedure, this information is easily accessed from the system. This includes practically

everything: from how to clean a machine in the factory, to how to deal with customer complaints.

During negotiations, potential customers often come and visit the factory to see how the company works and how the paper is manufactured. Rexcell cannow present to its customers how quality is maintained, at and throughout each step of the manufacturing process. Rexcell also prepared and issued a pamphlet of eight pages, explaining in a simplified and transparent way how their quality is managed by every employee throughout different work processes.

The new quality management system is also used for following up on the company's results. In the system, success criteria can be specified, with key figures for measuring how well departments are doing. Departments have access to the system and can check whether they are "on track"; the system indicates the status by showing a green, yellow, or red field.

As noted earlier, when control-ES was implemented, five employees at Rexcell worked on the project full time. Now, a few years later, only one person works full time updating the information, informing and training staff in how to use it, and presenting it to customers.

Impact

The impact on sales which control-ES had for Rexcell is hard to quantify. The company states that it is a clear competitive advantage to have such a system, for it is often, if not always, a requirement from Rexcell's customers to have a quality assurance system in place, certified by ISO 9001 standard.

Peter Lundin, Rexcell Quality Manager notes that "… *while it is difficult to translate the value of this strategic move into either savings (e.g. in terms of effort in customer relations) or additional income, we believe without any doubt, that the investment was useful, if not absolutely essential to secure the company's position in the market. Customer relations have improved, simply because the company is now able to paint a clear picture of how it assures quality throughout every process, and show how quality management is a core company strategy. Our employees welcome the transparency of the system and they are interested in using it.*".

Another important merit of the system is its contribution to strengthen shared corporate values regarding quality issues. Employees have a better understanding of the processes within the company and, thus, how their own work contributes to the company's success. For example, factory workers are able to see how marketing of the company's product is linked to the delivery of the items they are manufacturing. This knowledge strengthens every employee's perception of their role in the company.

Overall, Rexcell says that its working processes have improved through using control-ES. All routines and work instructions are available on the Intranet and it is easier to follow up on performance relative to the company's goals and commitments to customers.

Lessons learned

Rexcell representatives say they have learned two important lessons from the implementation of this extensive quality management system:

- It adds great value to a company if all **employees fully understand the effect** their daily work has on the business of the entire company. From management to factory worker, all employees gain from knowing how the quality of their specific work impacts other processes within the company.
- It is important to **allow enough time** for the implementation of such an extensive system, as the project needs to be well anchored among the employees. Also, a company needs to allow for time to collect accurate information beforehand.

References

Research for this case study was conducted by Lisa Ståhl, Rambøll Management, on behalf of e-Business W@tch. Sources and references used:

- *Interview with Peter Lundin, Quality Manager, 21 April 2006*
- *Websites: www.rexcell.se, www.sis.se, www.iso.org*

CASE STUDY: ICT FOR NEW PRODUCTION TRACKING (NPT) – INTEGRATED E-BUSINESS INNOVATION IN OFFICE PAPER PRODUCTION

Abstract

This case study describes the e-business activities of a globally operating European producer of office paper[86] and its implementation of production tracking software system for supply chain management based on RFID-technology.

Being part of a wider innovation policy and investment scheme, the integration of the new system within the existing production processes resulted in higher machine utilization, greater process efficiency, and improved order throughput times. However, new demands on workers' skills, high investment costs in complementary physical structures, and huge RFID data output that needed to be "translated" into managerially useful information, arose as main challenges to value creation.

Case study fact sheet

Main business activity:	*Business and packaging paper, converted packaging*
Primary customers:	*Other businesses from various industries*
Most significant geographic market:	*global*
Main e-business applications studied:	*RFID use, supply chain management*
Key words:	*production management, warehouse management, process efficiency*

Background and objectives

The firm under study is a globally operating paper manufacturer and part of a bigger group which serves markets all over the world. It has a total production capacity of more than 2 million tonnes of uncoated woodfree (UCWF) paper per year.

This case study looks at issues of RFID technology for integrated SCM (supply chain management) in the P&P industry. Objectives of the case study are:

- to describe the technical architecture of the newly employed IT software (technology dimension);
- to analyse how e-business RFID technology was adopted, and is being used;
- to assess the impact on individuals, business processes and organisational performance in general terms (impact dimension).

The information is based on interviews with decision-makers who are responsible for managing both the implementation in the branches and the development of the new software.

[86] The company does not want to be named.

e-Business activity

The business vision and its implementations

The business vision, funded in 2005 by a budget of 137 million euros, is to set the industry benchmark for operational efficiency and successful supply chain management in paper production, as well as to establish theme leadership with regard to innovation and environmental protection. The current project, and subject of this case study, focused mainly on the development of information technology and new processes, comprised eight sub-projects ranging from the optimisation of product portfolios and cycles, to the launch of an integrated planning system. The funding for the supply chain elements of the wider programme amounted to 8.5 million euro.

A core element of this strategy was the early decision to develop an integrated new production tracking software system based on RFID technology. This RFID-supported SCM system is described and assessed in terms of its functionality and impact on the realisation of the business vision.

SCM in business paper production – How the systems are integrated

In 2004, an IT consulting company was engaged to develop a comprehensive mill management system for order handling, planning, production management, warehouse management, and bill of material handling management (see Exhibit 1 below). The tailor-made solution was designed to optimise integration between the existing ERP system and various specialised systems in the mills (e.g. automatic mother reel storage, palletizer).

The decision to develop a tailored solution was taken only after extensive detailed talks with standard software suppliers determined that this was the only way to meet the business expectations. After nine months of software development, a small-sized paper production process (A3 and A4) started operating on the basis of the new software in July 2004. In spring 2005, all other paper formats bigger than A3 were produced by means of the new integrated IT software. However, the introduction of this new software system required substantial hardware investments into the production system, particularly for fully automatic reels in the master warehouse and a state-of-the-art automatic palleting centre.

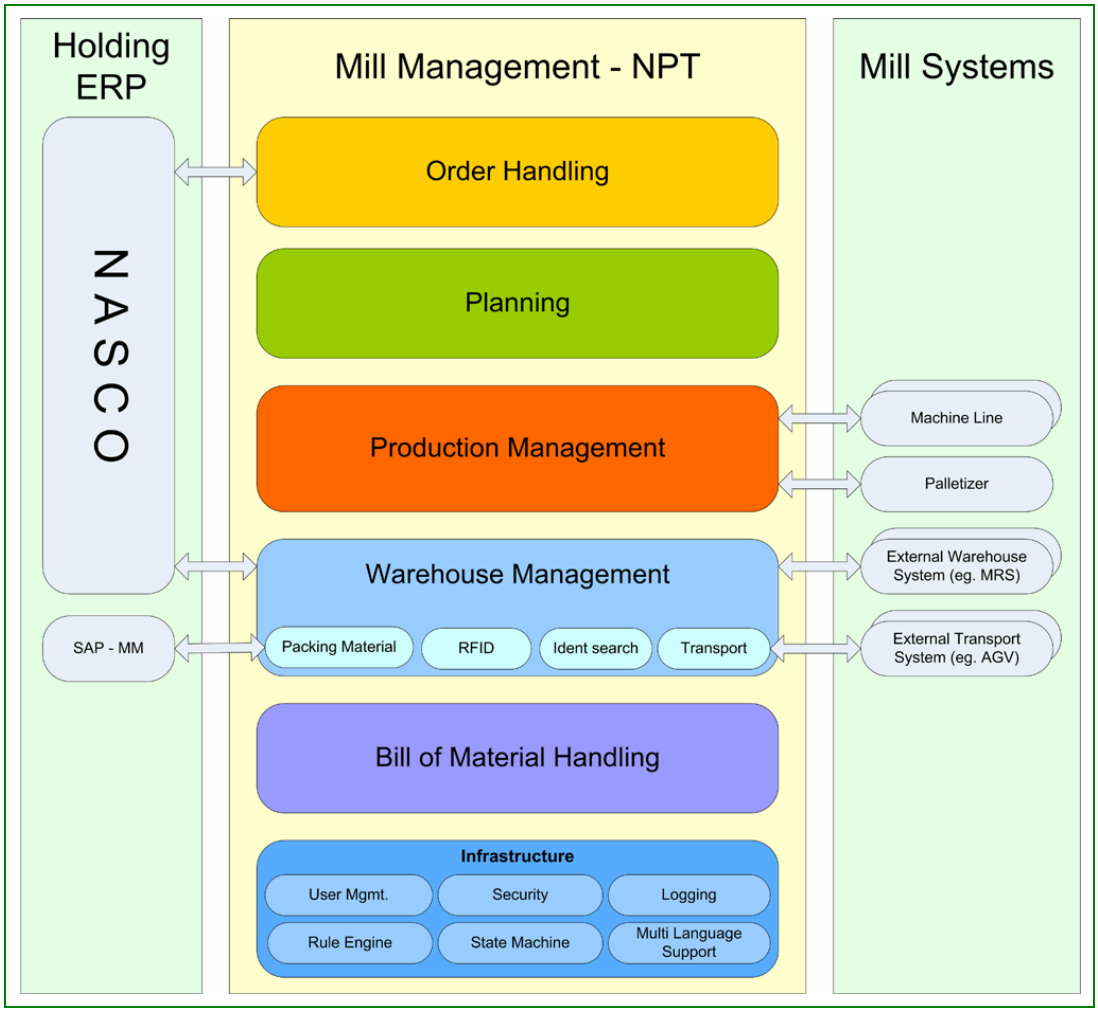
System integration is organised as follows (see Exhibit 1): The legacy system holds the original customer orders and all logistic information. The new production tracking (NPT) system then receives all necessary article information and transforms these data into a flexible hierarchical bill of material (BOM) structure. This is a major requirement for loading customer orders into NPT.

During the planning and production management, the customer order passes through various states tracking the production process. All status changes are reported to the legacy system, thus supporting customer support and logistics. Additionally, the planned and concrete consumption of packaging materials are sent to the SAP system for further disposition of material requirements. Packing material orders and their delivery dates are sent back to warehouse management, goods receipts are booked in NPT and transferred back to the SAP system.

The production and transport systems are tightly coupled with NPT. When production of a specific order starts, NPT generates all necessary transport orders to supply the production lines just in time (back stand materials, packaging materials needed for the production steps). Each machine unit in a machine line reports the actual production data for each customer order. When an order is finished on a machine, NPT is informed of the completion.

The last machine in the production process produces customer pallets (palletizer). The pallet information is reported to NPT, checked against tolerances and transferred to the full-automatic warehouse for finished goods. After final transport the pallet-data is transferred back to the ERP legacy system (NASCO) and further product-management is done by the holding ERP-system (dispatch-management). This solution provides online (real time) information and transparency for the whole production process.

Exhibit 1: New Production Tracking – The modules



The main modules of the firm's new automatic production tracking system (shown in Exhibit 1) have the following functionality and scope:

Order handling: The mill management system process chain starts with the transfer of customer orders from the holding ERP system (NASCO). Internal orders for the production of semi-finished material (e.g. mother reels), which are required for the

different production steps, are created automatically. Order management modules display an in-depth view of all related order information such as the current status, the history of what has happened with the order, which form pallets have been produced when, by whom and based on which mother reels. This information is available later on for backtracking over the various production steps on batch-level.

Planning: The NPT planning mechanisms are based on the requested delivery date of customer orders and a production calendar (shifts, planned downtimes etc.). Production plans are optimised by merging similar orders (e.g. colour, grade, grammage[87], packaging material) for a certain machine line for outmost machine-efficiency (prevent change-over-costs and waste). Another step of the production planning is to plan the just-in-time-delivery of all needed input-material (Bill of Material) for production. Furthermore, the planning modules allow lead-time calculation and detailed capacity planning.

Production management supports the execution of production plans by usage of online work-order management. All machine-events (production, changeover, waste, standstills) are tracked in the production management.

Warehouse management: The warehouse module provides lifecycle management for inventoried materials (mother reels, semi-finished and finished form pallets, packing material). This functionality can be extended by the use of specialised sub modules for (a) packaging materials, (b) item search, (c) RFID, and (d) transport.

Bill of material (BoM) handling: Hierarchical BoMs provide information about the inventoried and non-inventoried components used to fulfil a production order. These data are vital for identifying, rating and combining the necessary semi-finished and packaging materials for detailed planning and production management.

The warehouse management module is based on radio frequency identification (RFID) system technology placed on both stationary and mobile readers fixed on staplers. By this, the firm built a general-purpose technology in order to support item search and the transport system. In practice, forklift drivers in the mills now receive transport orders to deliver the crates from the storage area to the packaging machines on an item-per-item basis. The drivers not only drive the goods but also hand-scan barcodes on the crates to trigger the new RFID-based tracking system (parcel data are transmitted via Wireless LAN (Local Area Network) to the storage management system). The main advantage of this online-supported parcel delivery system lies in improved process and parcel control.

When interviewed, firm representatives identified the following benefits of the usage of the installed RFID-based NPT system: more accurate production planning, just-in-time delivery to production lines, exact booking of orders, lower search costs of items, improved incoming orders control, better inventory management, as well as better control of supply chain data and data tracking of produced paper rolls from the mill to the warehouse and on to the carrier.

The firm's IT developer added the following system benefits: "*At the time of the project start, there was no consistent data tracking application for managing data coordination at the production lines. The new NPT system, however, offers a user-friendly web-browser-*

[87] "Grammage" is a measure of paper weight based on the same square meter sheet of paper, regardless of paper grade.

based interface for the online production management system that provides information on status of the stock and limits of the enterprise's working assets. This includes information about the current stock of raw and auxiliary materials and finished products in the company's warehouses and the related costs."

Since August 2005, the RFID-based NPT system is also in place in a second mill. When asked why the management chose this plant for the systems change to the RFID-based NPT-system, firm managers interviewed affirmed that this mill "suffered" from the same legacy system as the other paper mill. Both works had 10-15 year-old predecessor systems installed which needed to be upgraded. Therefore, the company decided to use these two works as test-beds for an applied RFID solution.

Impacts and lessons learned

The firm's business managers admitted that the impacts of its new SCM on the overall performance would not be easy to isolate and assess. This is because only by the end of 2006 would the new strategy be fully operational and strengthen process integration for suppliers and customers alike. Although the firm is only halfway through the process, its integrated new supply chain strategy has already proven to be very successful, yielding a 12% improvement in delivery reliability and 40% reduction in lead times. When interviewed for the impacts of the firm's ICT-induced SCM innovations, management considered them as being massive. These high-level impacts are visible on the following levels.

Impact on individuals

The firm reports a noticeable impact on increased specific skills requirements for workers. Workforce used to handle paper-based orders prior to the implementation of the new system; now, people had to get accustomed to use computers and online technology. This created some pressure for workers to comply with the faster throughput times in the mills. According to the management, these requirements for complementary skills met some resistance among workers, particularly in the second mill. Workers felt that they had "to follow the rules imposed by the system" and were no longer in command of the work processes, according to their own needs. This created resistance, and it took some time until the new working style was accepted.

Impacts on business processes

Another important impact of the newly installed NPT-software is the increased degree of automation. Management observed and report improvements of process efficiency and order throughput times. In comparison to older paper-based order management which took 3-5 days in lead time from intake to fulfilment of order, online management has substantially shortened the time necessary for dealing with incoming orders. This further increases the flexibility, efficiency, and subsequent value created by these time-saving processes.

Organisational performance

Concrete figures on the impact on business performance are not available. Some anecdotal evidence on the effects include the following general observations: Management reported performance benefits such as general efficiency gains and the optimisation of batch size for production. These efficiency gains are mainly attributable to

the RFID-powered SCM information systems which allow the firm to adjust their production planning and effectively improved production accuracy. Further efficiency benefits are gained by tracking manufacturing equipment usage, which has led to the elimination of manufacturing bottlenecks and to the enabling of smoother workflows. In effect, machine performance, run times, and, consequently, machine utilization (e.g., of reels) were optimised.

Critical issues

The company's management identified two critical impact issues: initial investment costs and problems of managing the large amounts of data. Furthermore, achieving the full potential of the RFID technology requires costly integration with existing enterprise systems. Moreover, it requires a redesign of business processes in all areas of the value chain where the technology is used.

In addition, management warned against the risk that RFID can easily become just another tool for "data collection", while missing targets in terms of its return on investment. To avoid this, software applications must be used which can be embedded into business processes. Only in this way can data be translated into managerially useful information. The firm claims that it has succeeded in meeting this challenge: the IT department successfully delivers useful information to management.

References and acknowledgements

This case study was conducted by Paul Murschetz on behalf of the *e-Business W@tch*. Sources and references used:

- In March 2006, the author conducted two interviews with management representatives from the firm's headquarter and with the IT consultant / software developer.

4.2.5 Impact on production processes

ICT are intensively used to run and monitor production processes in the P&P industry. Although production is not among those business areas where companies anticipate the most pronounced impact of ICT in the future (see Section 5.1.1, Exhibit 5-6), it is without any doubt that the use of ICT is pervasive in this context. It is likely that many companies do no longer perceive this as an area of "ICT impact", since technology is so deeply embedded in production routines that it has become a commonplace.

However, the most important anticipated impact of ICT for the future is probably that it enables companies to better **link production processes with ordering and logistics** and, thus, improve their supply chain. Furthermore, intelligent systems support quality control already during the production process. The following case study on *Nordic Paper* demonstrates how ICT-based systems can help a company to reduce the amount of products with flaws that are delivered to customers, and at the same time to optimise the quantities of chemicals in production. Thus, the skilful use of ICT could also have a positive environmental effect.

CASE STUDY: NORDIC PAPER, NORWAY

Abstract

Nordic Paper in Greåker, Norway is the world's largest producer of greaseproof paper. Since the late 1990s, the company has been using the computer-based tracking system "Semtracker" to have a complete overview of logistic information about their products and orders. In 2004, Nordic Paper linked the lab analysis-tool Mikon LIMS with Semtracker in order to further increase the information transparency across production and logistics processes: the new system provides the company with real-time electronic information about the quality of the paper and the levels of chemicals in it.

Case study fact sheet

Full name of the company:	*Nordic Paper, Norway*
Location (HQ / main branches):	*Greåker, Norway*
Sector (main business activity):	*Manufacturing of greasepaper*
Year of foundation:	*1905*
Number of employees:	*130*
Turnover in last financial year:	*Approx. € 80 million*
Primary customers:	*Retail and wholesalers*
Most significant market area:	*Americas, Europe*
Main e-business applications studied:	*Semtracker, Mikon LIMS, ChemSource*

Background and objectives

Nordic Paper (NP) is a Scandinavian paper group operating in Norway and Sweden. It is the world's largest manufacturer of greaseproof paper, which is used, for example, for baking paper, baking cups and barrier paper (that is used as isolation in containers and packages). NP manufactures the paper and customers convert it into a variation of products. The company's market share of grease paper is estimated to more than 20% worldwide. The intra-market competition is quite stable with a slight decrease in competitors over the past few years. Nevertheless, NP products are facing tough competition from other materials that can be used for the same purposes, such as aluminium and plastic.

The NP paper mill in Greåker has 130 employees that operate two paper machines with a yearly capacity of 30,000 tons. It is an on demand production, with paper rolls going directly to shipment. No larger storing facilities are used.

Until eight years ago, NP processed incoming orders manually, using a system of Microsoft Excel spreadsheets to keep track of these orders. In the late 1990s, when more sophisticated ICT systems started to become widespread in the industry, Nordic Paper decided to implement a new system in order to automate the processing of orders and to increase the internal transparency of business processes. NP decided to deploy the Semtracker production management system, provided by ABB. The system was intended to give each roll an electronic identity so that operators and administration would be able to track it through all stages of the distribution chain. Later on, the lab-analysis tool Mikon was integrated with Semtracker.

e-Business activities

Semtracker

Semtracker is a Windows NT-based production management system (PMS) from ABB, an earlier version of the software that is now called “Industrial IT Production Tracking”. Orders are fed into the computer and Semtracker schedules the production in time and in quantity. The Semtracker system also keeps track of the paper rolls. A barcode is automatically attached to the core and to the side of the recently produced roll. The same code then follows the individual parts of the “mother-roll” until the end of the distribution chain. Before leaving the mill, the barcode is manually registered with a scanner gun, sending a confirmation to Semtracker that the paper is on its way to the customer.

Semtracker thus allows the operators to see where in the distribution chain a roll of paper is. The barcode is linked to information about who the customer is and to a specification of the order. Using this information, Semtracker also guides the invoicing procedure.

Another advantage of the computerised system is that the relevant information can be sent to the customs’ administration and to shippers. This reduces considerably administrative efforts for NP and its partners. Shippers, for example, are informed about dimensions and weights of the paper in order to plan the loading into containers.

Mikon LIMS, Laboratory Information Management System

Although generally satisfied with Semtracker, NP felt that it would be of great advantage if the system could not only handle administrative procedures electronically, but also provide information about the quality of the paper. To achieve this goal, NP linked in 2004 the Mikon LIMS system with Semtracker. Mikon LIMS, provided by Norwegian Mikon AS, automatically measures the chemical composition of the paper immediately after its production. It is a software and analytical tool which can be interfaced with other software and production management systems such as Semtracker.

Mikon LIMS links the quality analysis with the code in Semtracker enabling the operators to see if the paper on a specific roll is of the required quality. If the quality does not comply with requirements, the paper can be either redirected to be used for another type of end-product (requiring a lower quality) or be pulped and recycled into the beginning of the production. As a consequence, bad paper almost never reaches the customer, but is detected before it leaves the mill. In addition, Mikon has helped NP to optimise the quantities of chemicals in production. It gives operators real-time information about the relation between input levels of chemicals and the output paper quality. If a paper roll of bad quality slips through the system and reaches the customer, it can be traced back, and the reason for the flaw can be detected and analysed. “*Before deploying Mikon we used varied quantities of chemicals. We can now run much closer to the input threshold values. Over the last years we have seen a significant decrease in the use of chemicals so the investment has paid off rather quickly*”, says Finn Solgård, Quality Manager of the Greåker paper mill.

Outlook to future development

NP is in continuous contact with the Mikon software provider and there are plans on implementing their CEMS system (Continous Emission Management Solution). This tool

keeps track of emissions in order to help the industry meet quotas and minimise pollution. Another potential development is to link Mikon LIMS to the feeding mechanism of the paper machines in order to automatically update the input levels of chemicals.

ChemSource

Another e-business tool that supports production processes is ChemSource, provided by Swedish STFI. NP uses it to have a constant overview of the chemicals that are stored in the mill. The suppliers of chemicals pre-report their NP-deliveries to STFI, in order to have it checked against chemical legislation and health requirements. Nordic Paper then has immediate online access to information about the chemicals used in the plant, which is important in case of an accident or a fire. *"For example, ChemSource proved useful when one of our co-workers had accidentally ingested chemicals of unknown nature. Thanks to the online system we could acquire instant information about these chemicals and he could be given swift and accurate treatment*", says Finn Solgård.

Impact and 'lessons learned'

The implementation of Semtracker and Mikon has helped NP to substantially improve ordering, production and distribution processes, which are running smoother compared to the time when manual systems were used. Furthermore, these ICT systems have helped NP to fulfil the ISO 9000 quality standards. The main positive effects experienced from using these systems are the following:

- **Reduced administrative costs** by using Semtracker for logistics, invoicing and customer service;
- The chemical control built into Mikon has contributed to an approximate **decrease in the use of silicone** by 10 %
- **Increased customer satisfaction**, as the ratio of bad quality paper reaching the customer has diminished. Most of the times the Mikon system helps NP to detect flaws in production already in the mill, and paper can be recycled into the production chain before being delivered to the customer;
- The use of the two systems for quality control has led to a **better use of resources**.

Finn Solgård, Quality Manager at NP, describes the process of installing the ICT systems at the NP mill in Greåker as relatively painless. He stresses the benefit of keeping in close contact with the supplier (Mikon) not only during the implementation, but also afterwards. This enables NP to improve and update the use of the quality system and to discuss the implementation of additional components and systems.

References

Research for this case study was conducted by Ola Medelberg, Rambøll Management AB, on behalf of e-Business W@tch. Sources and references used:

- Interview with Finn Solgård, Quality Manager, Nordic Paper
- Homepage: www.nordic-paper.com

4.2.6 Summary and conclusions

The use of ICT is a key enabler of **increased process efficiency** in the P&P industry, just as in other manufacturing industries. Relevant applications in this context are ERP and SCM systems, other applications for managing capacity and inventory, collaborative tools, e.g. for production planning (see Section 3.4). In particular, the integration of digital information flows during all phases of **B2B transactions** (including ordering, invoicing and payments) with production management and logistics has significantly facilitated business processes between P&P producers and their suppliers and customers (see, as examples, case studies "*ICT for Production Tracking*" and *Nordic Paper*).

Effects are most pronounced if companies operate **ERP systems** and use them as the platform on which e-business processes are conducted. ERP systems are widely diffused in the P&P industry among larger companies, but not yet among smaller firms (see Sections 3.4.1 and 4.2.2). This translates into a significant gap between large and small companies when it comes to more advanced forms of e-business.

On the whole, the impact of ICT adoption with regard to process efficiency certainly includes the acceleration of processes (as illustrated by the *VPK* case study), an increased company-internal transparency of processes (as illustrated by the *Rexcell* case study), and improved use of production capacity. Ultimately, these effects certainly translate into **cost reductions** for companies. However, this does not automatically imply an opportunity for competitive advantage of individual firms. Particularly among the large P&P firms, most companies are quite advanced in making use of sophisticated ICT systems for their B2B processes. The use of these systems will therefore show in an increase in productivity on the (aggregate) industry level. For *smaller* companies in this industry, process innovation by means of ICT can be a strategy to gain competitive advantage.

- **Acceleration of processes.** In most of the larger P&P firms, the former manual handling of orders and the related paper work has largely been automated by means of ICT (e.g. by ERP systems). This has enabled companies to accelerate processes and, thus, shorten lead times for their customers (i.e. reduce the amount of time between the placing of an order and the receipt of the goods ordered).
- **Increased internal transparency of processes.** ICT are a powerful tool to increase the transparency of business processes within a company. This is an important effect with implications for **work organisation** in this industry and should not be underestimated.
- **Improved use of production capacity.** ICT support P&P companies improving their planning processes in sourcing, production and logistics, and enable wider collaborative processes such as vendor managed inventory. This leads to an acceleration of ordering and delivery processes and, thus, to improved internal use of production capacity.

4.3 Deployment and Implications of RFID Technology

> *"Yet, despite the benefits, RFID is a complex, costly undertaking, with considerable potential to disrupt operations."*
>
> *Source: "Beyond Compliance", White Paper by BearingPoint (2005)*

4.3.1 Introduction

The technical concept

RFID (Radio Frequency Identification) is a prime example of the rapid technological development in the field of ICT. Within only about 2-3 years, RFID has matured from a rather unknown topic for specialists into an important issue for many companies. It is expected to become a key technology for innovation in several areas, particularly in inventory management and logistics. A core functionality of RFID systems is their ability to track moving objects. Quite a lot of companies already use RFID, others are closely monitoring developments in order to be ready to adopt once it is inevitably required.

Technically, an RFID system usually consists of several components, including tags (also called responders), tag readers, servers and application software.

RFID tags consist of a microchip attached to an antenna and work as data carriers. They can be either passive, semi-passive (also known as semi-active), or active. Passive RFID tags have no internal power supply. They receive the power they need for responding from the incoming radio frequency signal. This means that the device can be quite small – in early 2006, the smallest of such chips measured 0.15 mm × 0.15 mm. They are also cheaper to manufacture. Semi-passive RFID tags have a small battery which allows the tag to be constantly powered. They are faster in response. Active RFID tags have their own internal power source which is used to generate the outgoing signal. As they more expensive and larger, they are typically used to track high value goods like vehicles and large containers of goods. At present, the smallest active tags are about the size of a Euro coin.[88]

The code in passive RFID tags is based on the Electronic Product Code (**EPC**). In contrast to EAN (European Article Number) barcodes, which only contain information about the country of origin, the manufacturer and the product category, EPC also includes a serial number capability. This enables a distinction to be made between different items of the same product category.

When an RFID tag passes through the electromagnetic zone, it detects the **reader's** activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer. The combination of data stored on the tag (e.g. type of product, manufacturer, series) with data about its movements (when and where this product specific data is read) is potentially powerful information. Theoretically, it enables companies to track their products throughout the whole supply chain and product life cycle.

[88] See: "Types of RFID tags", http://en.wikipedia.org/wiki/RFID (March 2006)

As regards the **frequency bands** used to transmit data from tags, EPCglobal, the GS1 subsidiary and driver of standards for the use of RFID in the supply chain, is currently testing which bands are best suited for using RFID to identify and track individual items. High-frequency (HF) 13.56 MHz tags and ultrahigh-frequency (UHF) 915 MHz tags can be used. The former have a shorter read range, but tend to perform better on items that can cause interference.[89]

Advantages over barcode technology

From a functional perspective, RFID has several advantages over the older barcode technology. The main advantages which are relevant for the P&P industry are:

- RFID tags can store **more information** than a barcode. This increases considerably opportunities and options for their use (while at the same time carrying the risk of creating an overflow of less relevant data).
- Transmitting information from an RFID tag does not require **line-of-sight** with the reader. Thus, manual processes (e.g. hand scanning of barcode labels) can be partly of fully automated, as RFID readers can read information even from tags that are hidden or embedded in items.
- RFID systems allow for **simultaneous identification**. Systems are capable of processing about 400 signals per second, including the identification of several tags **at the same time**.[90] Thus, information from several pallets or other units can be transmitted simultaneously, while scanning barcodes can only be done in a sequential mode.

However, while these functional advantages are certainly an attractive proposition for the future, RFID technology is still **rather expensive** when compared to barcode equivalents, mainly due to the implementation cost of the overall system (see Section 4.3.4).

4.3.2 Adoption of RFID: commercial break-through among large firms

e-Business W@tch asked companies questions about RFID in the e-Business Surveys of 2005 and 2006. Results demonstrate the gap between expectations that a technology *will be* important and the *actual usage* of it. In 2005, companies representing about 40% of employment in the food and beverages and the automotive industries, and about 30% in the textile industry said they expected that RFID would be important for them in the future. In the pharmaceutical industry and in machinery and equipment, about 25% of firms regarded RFID as relevant.[91]

Based on this finding, a new question was introduced in 2006, asking companies whether they actually use RFID, with a follow-up question for users about the purposes for which they use this technology. The result may come as a surprise, considering the great expectations of firms and the enormous attention which RFID enjoys as an issue in the

[89] "EPCglobal Developing HF Tag Standard", by Mary Catherine O'Connor, published at www.rfidjournal.com, 8 May 2006.

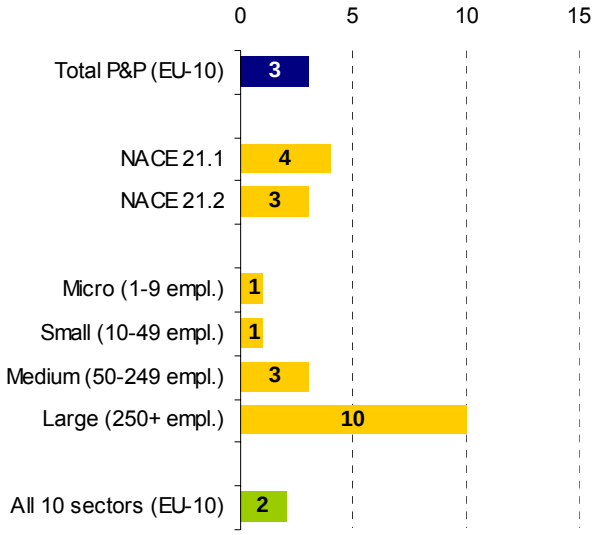
[90] See e-commerce magazine, 02/2005, p. 48.

[91] See respective *e-Business W@tch* sector studies of 2005, available at www.ebusiness-watch.org ('resources'). The P&P industry was not covered in the survey of 2005.

press: only about 3% of the firms interviewed in the P&P industry reported the use of RFID technology (see Exhibit 4-10).

However, among large firms RFID has actually gained some momentum (10% in the P&P industry). The situation is quite consistent across the 10 sectors covered by *e-Business W@tch* in 2006. Industries with high RFID adoption rates, particularly among the larger companies, are the ICT manufacturing, consumer electronics and the shipbuilding industries (about 15-20% of large firms). The P&P industry is in between these pioneering industries and other sectors where RFID is not yet widely used (see Exhibit 4-10).

Exhibit 4-10: Companies using RFID



Sector	RFID users (%)	
	Total	large (250+)
Food & Beverages	3	5
Footwear	2	9
Pulp & Paper	3	10
ICT Manufacturing	7	19
Consumer electr.	2	19
Shipbuilding	7	14
Telecom services	6	8
Hospital activities	4	4
All 10 sectors	**2**	**6**

Base (100%): All companies using computers. N (for sector, EU-10) = 964.

Weighting: Totals (for the sector, sub-sectors and all sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: D3

Source: *e-Business W@tch* (Survey 2006)

These findings show that, with adoption rates of more than 10% among large firms, RFID-based systems have reached commercial break-through in several industries. At present, however, their implementation is mostly limited to large companies. Nevertheless, if the typical innovation life-cycle applies to RFID technology, a possible scenario for the P&P industry as well as other manufacturing sectors is that the technology will be adopted by medium-sized and smaller companies once it has proven successful in larger firms, and when the technology has matured and become more affordable to SMEs.

4.3.3 Factors determining the use of RFID in the P&P industry

RFID implementation mandates set by customers, for various different reasons, will play a critical role in the uptake of RFID by P&P producers, particularly within the packaging industry. Some customers already demand that RFID should be used to improve supply chain processes; in the case of converting companies, customers may for instance require that the packaging products they order are equipped with an RFID tag for further

tracking along the supply chain towards their own customers (e.g. in the food industry, which delivers to retailers).

Packaging industry: customer demand as a key driver

In the packaging industry (NACE 21.2), RFID adoption is mainly driven by customer requirements, in particular from companies in the **consumer goods industry** and **large retail chains**. They are increasingly considering the use of RFID to improve their supply chain processes, which includes packaging producers. Thus, packaging producers typically implement RFID to comply with customer demand rather than proactively as a means to further improve their own business processes.

Customer pressure is usually exerted by retailers upon consumer goods producers, e.g. in the food and beverages industry,[92] which pass on this pressure to their packaging suppliers. The large retail chains have the bargaining power to force members of their extended supply chain to adopt their standardised RFID related processes.

General ICT capability matters

Among manufacturers of P&P (NACE 21.1), several players have taken the initiative on their own and opted to become an early RFID adopter. Examples can be found in case studies presented in this report (*International Paper, Stora Enso*). Others, while also being advanced users of ICT in their operations and B2B exchanges, feel quite comfortable with a "stand-by" strategy. An example is *Mayr-Melnhof Karton AG*, an international producer of cardboard and packaging solutions, who argue that they are well prepared to adopt RFID "*if the market should demand it*".[93] For the time being, they think that costs are still too high (in particular for RFID tags) and would negate yielding a positive result over the current use of barcode technology, if all costs and benefits are considered. This raises some important questions:

- It is debatable whether the strategy of early adoption is to be recommended, and whether companies that decide to delay RFID implementation until customers demand it gain advantages. Companies have different opinions about the 'right time', i.e. when the technology has reached the right status of maturity for investment.
- A critical factor in that respect is whether adoption at any point of time is possible, or whether this move needs to be prepared and suitably timed well in advance.

There is no clear answer to these questions. Analysts and industry experts take different positions, having good arguments for either option. In their White Paper, BearingPoint, a consultancy, addresses the broad issues manufacturers are facing with regard to RFID and concludes that "*a good-sized hill stands before those manufacturers who have been told by their customers to implement radio frequency identification (RFID). Companies large and small that sell goods (…) to the nation's largest retailers will be learning firsthand that lighting up crates and cases with RFID is more than an incremental*

[92] Cf. *e-Business W@tch* Sector Study on Food and Beverages (2006), available at www.ebusiness-watch.org ('resources').

[93] Interview with Erasmus Pachta, Manager Electronic Solutions & Services, on 27 March 2006

technology change" (2005, p. 2). This is quite in contrast to the opinion expressed by paper manufacturer *Mayr-Melnhof Karton AG* (see above).

This particular example may help to explain the apparently different assessments of how 'easy' or 'difficult' it is for a company to introduce RFID in its operations. To a large extent, the innovation capacity depends on the overall IT capability of a company. A large player, whose information management is well embedded in the overall company strategy and where highly sophisticated systems are already in place, is probably well prepared to implement RFID at any time. For a small company, however, which cannot draw on comparable e-skills and resources, this is certainly more of a challenge and may need more in-advance planning. Thus, their risk is also higher.

Strategic positioning and RFID adoption

It appears that the decision whether to adopt now or later is closely linked to overall firm strategy. Companies with a **cost leader strategy** (cf. Porter 1980) may be disinclined to adopt RFID at this point, if they are not forced to do so by customers. Firms with a **differentiation strategy**, on the other hand, in particular if they focus on 'cutting-edge' supply chain management, are much more likely to see RFID as a useful vehicle to underline their strategic positioning.

The case study on *Stora Enso* (Section 4.1), which positions itself as an innovative company with "*a world-class supply chain integration strategy*", is a good example for the latter. Aligned with its claim and strategy, the company currently pilots RFID enabled possibilities as part of its "PackAgent" solution, together with Orion Pharma (see case study). In contrast, *Mayr-Melnhof Karton AG* is an example of a company that positions itself as a cost leader in producing cardboard and related packaging solutions. The company does not see RFID as a tool to save costs at this point of time. Thus, as outlined above and in line with its strategy, the decision is to wait until the technology is even more mature and less costly.[94]

In the USA, a majority of firms is convinced that RFID matters for their business. In a survey among US companies conducted in 2005 by BearingPoint, three out of five respondents regarded RFID as “important” or “very important” to their organisation’s strategy.[95] The case study on *International Paper* illustrates that RFID certainly holds an attractive promise for P&P companies to increase efficiency, but it also shows the challenges that are involved, even for such large players, for example with regard to the impact on business processes and routines.

Paper production: focus on warehouse / inventory management

A key application area for RFID systems in pulp and paper production, as in other manufacturing industries, is warehouse management. The efficiency and accuracy of order fulfilment is closely related to the efficiency of warehousing activities. As RFID systems promise to support the company in its warehouse management, this is directly linked to the quality of customer service in terms of ordering and delivery processes.

---

[94] Interview with Erasmus Pachta, Manager Electronic Solutions & Services, on 27 March 2006

[95] See: "Beyond Compliance: The Future Promise of RFID", White Paper by BearingPoint, published in May 2005, p. 3. Available at www.rfidjournal.com

Therefore, as argued above, customers have a critical influence on RFID decisions of P&P companies.

RFID solutions can improve the **efficiency** of receipt, storage and retrieval activities in warehouses, thereby eliminating possible bottlenecks in the flow of products and materials. They can also help companies to optimise space utilisation.

Typically, as in the following case study on *International Paper*, inventory in paper mills has been bar-coded and manually linked into a legacy production system that handles order fulfilment. RFID systems enable the company to digitally link ordering and production processes with the warehouse management system. When a customer order is received, the respective data (customer data, prospective delivery date, and product specifications), are not only entered into the existing information system (normally an ERP system), but can also be linked to a particular RFID tag by means of a unique ID number on the tag. This tag is then placed on the core of a paper roll and linked to a unit shipment for that customer. This way, the handling of the final product is greatly facilitated. In practice, forklift drivers in the mills can, for example, receive transport orders to deliver the crates from the storage area to the packaging machines on an item-per-item basis. This constitutes a process innovation which clearly has potential for increasing efficiency in various ways. *International Paper*, for example, reports a 5% increase in inventory turns due to the implementation of RFID in late 2002.

In an RFID-focused future scenario, each roll of paper will have a unique identifying tag that provides on demand information about processing, location, and shipping status. This could not only facilitate internal processes, but could also improve customer services. On the other hand, however, there are issues that still need to be examined into more depth, such as the disposal of tags in the case of recyclable packaging material.

CASE STUDY: INTERNATIONAL PAPER, USA

Abstract

Business growth has compelled International Paper, a worldwide leader in the manufacture of paper and packaging solutions, to look for new ways to increase operational efficiency and to improve customer service. To achieve these goals, the company decided to implement an RFID based tag and reader system as the basis of a new warehouse tracking system. The integration of the new system with existing production processes at a mill in Texarkana, Texas, resulted in noticeable improvements in the efficiency of inventory handling.

Case study fact sheet

Full name of the company:	*International paper*
Location (HQ / main branches):	*Headquartered in New York, USA, International Paper has operations in 40 countries*
Main business activity:	*Production of paper products, mainly packaging*
Year of foundation:	*1898*
Number of employees:	*about 83,000*
Turnover in last financial year:	*US$ 25 billion (€ 20.2 billion)*
Primary customers:	*other businesses from various industries*
Most significant geographic market:	*USA / global*
Main e-business applications studied:	*RFID*
Key words:	*RFID, warehouse and inventory management*

Background and objectives

International Paper is the world's largest paper and forest products company. Their factories produce a wide selection of paper products for printed communication, as well as corrugated shipping products for food and beverage packaging. The company operates 36 pulp, paper and packaging mills, 132 converting and packaging plants, 35 wood products facilities, 13 specialty chemicals plants, and 2 specialty panels and laminated products plants.[96]

The Texarkana, Texas mill and warehouse supports approximately one hundred different customers with a range of paper products of different weights and sizes. Although the mill was already performing well, International Paper executives felt that the number of products and daily transactions in the warehouse offered opportunity for improvement, and they were not satisfied with the results of other solutions, such as bar coding inventory stock.

[96] Figures as of 31 December 2003, information from the company website at www.internationalpaper.com (downloaded in Feb. 2006).

At the same time, the International Paper Smart Packaging group, based in Memphis, Tennessee, had been developing RFID product solutions since 1999. The mill and the smart packaging group jointly agreed to develop a warehouse inventory tracking system using RFID, with the goal of providing each roll of paper with a unique identifying tag that would provide visibility into processing, location, and shipping. It was hoped that the activity could demonstrate a business benefit, a return on investment, and an ability to adapt to new technology.

e-Business activities

The Texarkana mill processes raw timber into giant rolls of finished paper products. The rolls can weigh up to seven tons, and be up to 1.9 meters in diameter. They are handled by forklift trucks with padded “hands” that manoeuvre the rolls between various locations in the warehouse and mill. Up to eight rolls are stacked vertically on top of each other. On a typical day, 5000 product moves are made, often simply to access other rolls in storage. Between the physical handling, and the size of the rolls, and the extent of the warehouse, inventory tracking is a difficult problem.

From bar-coded to RFID-based inventory handling

Prior to the decision, in late 2001, to implement an RFID system, there was no automated warehouse management system. Inventory was bar-coded and manually linked into a legacy, off-the-shelf, production system that handled order fulfilment. Over the course of a one-year period, International Paper was able to develop an RFID system that integrated into the existing manufacturing process, while solving a number of challenges. The system was in use in production by the end of 2002.

The solution that was ultimately deployed makes use of Matrics passive UHF disposable RFID tags and associated readers, which are mounted on the forklift. They partnered with Apriso (www.apriso.com), of Long Beach, California, to provide middleware, which is used to map out locations and provide directions to drivers via forklift mounted computer screens. Two key challenges that were solved were frequency selection in a noisy environment, and durability of the chosen components, in a relatively harsh environment.

The RFID system is fully integrated into the warehouse management system. When a new customer order is received, the order detail , including customer, delivery date, and product specifications, are entered into the existing information system, and at the same time also linked to a particular RFID tag through the unique ID number on the tag. The tag is placed on the core of a paper roll; data are linked to a unit shipment for that customer. The roll is then sent into the production process.

When the paper roll exits production, it is collected by an RFID reader equipped forklift which scans the tag and provides the driver with detailed information about the next process step, on the forklift’s computer screen. This can include options such as shipping, or storage location. If the forklift driver delivers the roll to the wrong storage bay or shipping dock, he immediately gets an alert. The system asks if he wants to override the instructions. The driver presses yes or no. If he presses yes, he gets a list of reasons and he must choose one. A real-time locating system also tracks the trucks movement and position, which not only gives International Paper the ability to track where a roll was dropped, but also makes it possible to optimise the warehouse.

Unexpected benefits

The system has also been expanded to monitor the efficiency of workers who operate forklifts. The mill keeps track of each worker's success rate for inventory delivery to the proper location. It provides alerts to drivers who are mishandling rolls, which allows them to quickly correct mistakes. The system is also used to report driver performance to factory management.

Impact

This warehouse tracking system has resulted in substantial benefits for the mill. International Paper reports that the system is more than 99% accurate, and has resulted in a five percent increase in inventory turns.

One consequence of this has been record monthly shipments. Additionally, inventory is managed more closely to their first-in, first-out (FIFO) goal, and forklift equipment is managed more efficiently, which results in reduced maintenance costs.

Lessons learned

As a result of the deployment of this RFID based warehouse tracking system, International Paper has learned a number of important lessons:

- The introduction of a technology, when there is no precedent, is quite a **significant challenge**. But, through smart and patient application of a new technology, they were able to overcome the conventional wisdom, even within the mill, that technical considerations would make automated warehousing impossible.
- It is important to **partner with experts**, such as the linkage between the smart packaging group and mill, to overcome technical challenges.
- Professional **change management** is critical. Business processes have changed, and employees had to be trained in the new processes. In this context, it was important to convey the message to the staff that the new technology was intended to support workers and not as a labour replacement.
- Successful deployment should look for **auxiliary benefits**, such as the opportunity to monitor and improve worker efficiency.

References

Research for this case study was conducted by Gordon Bitko, RAND Corporation (bitko@rand.org), on behalf of e-Business W@tch. Sources and references:

- Interviews with Ramona Jackson, Marketing Manager, Smart Packaging, conducted in February 2005.
- Company brochures
- International Paper Smart Packaging website: www.ipsmartpackaging.com
- International Paper website: www.internationalpaper.com
- "IP Unveils RFID-Enabled Warehouse", In: RFID Journal, Aug. 14, 2003. www.rfidjournal.com (Jan. 2006)

4.3.4 Challenges and outlook

Most of the challenges which P&P companies have to face when implementing RFID systems are not specific for this industry, but are rather generic for warehousing and inventory management in manufacturing.

The challenge of creating a torrent of data

One of the possible challenges is that RFID systems can create an **abundance of data** which may not only become irrelevant for business, but also create storage problems. Companies planning to introduce RFID should, therefore, carefully **consider in advance** exactly which data they want to collect and why. This implies, obviously, a decision on which data (that would theoretically be available) *not* to collect. Managers from European P&P companies interviewed for this report confirmed that transferring the potentially huge RFID data output into managerially useful information is a critical and often difficult challenge when implementing RFID (see, for example, case study "*ICT for New Production Tracking*", Section 4.2.4; and BearingPoint 2005).

Apart from planning, it also requires **adequate software** applications which can be smoothly **embedded into business processes** to ensure the 'business utility' of the data generated. Thus, exploiting the potential of RFID technology and hence not only requires the RFID hardware systems themselves, but must also be backed by quite sophisticated business software suites, such as ERP. This constitutes a challenge for smaller companies which do not possess such systems. For them, it would be very difficult to effectively manage the data which the system would generate.

Cost is still a key issue

As with any emerging technology, prices for RFID tags have fallen fast in the past few years. Back in 2003, the average unit price of tag was about 0.55-0.90 euro for a passive tag, depending on the type of tag and the number of tags purchased.[97] By 2005, the cost range of typical prices had decreased to 0.20-0.35 euro; as of spring 2006, the average price is at about 0.20 – 0.30 euro[98] (or more), depending on features and packages. It is expected that prices may fall below 0.10 euro during 2007, or even in 2006 for very large orders.[99] Analysts forecast that the decrease in prices will considerably slow once it has reached a level of about 0.05-0.10 euro per tag, pinpointing toward the "five-cent mark".

In parallel with the decrease of cost per tag, sales have increased. According to IDTechEx (2006), in 2005 a total of about 600 million tags were sold. For 2006, the analysts expect "*1.3 billion tags to be sold, with 500 million RFID smart labels for pallet*

[97] Study by ARC Advisory Group, quoted in: "5-Cent Tag Unlikely in 4 Years", by Diane Marie Ward, 26 April 2004, published at www.rfidjournal.com/article/articleview/1098/1/1/ (April 2006).

[98] The price range most frequently quoted in the specialist press is about 0.20 – 0.40 euro cent. See, for example, "RFID-Technologien und -Anwendungen – zentrales Thema des Wireless Congress 2006", Press Release, 18 July 2006, in the context of the "Wireless Congress 2006 – Systems and Applications", held at the electronica 2006 trade fair in Munich (14-17 Nov. 2006).

[99] US manufacturer RSI announced that the price per tag would drop to 9.9 cents by December 2006 for customers that committed themselves to ordering about four million units per year or a two-year volume contract. See: "RSI Pushes Performance Amid RFID Price Wars", by Rhonda Ascierto, 3 November 2005, published at www.computerwire.com (April 2006)

and case level tagging, but the majority into a range of diverse markets from baggage and passports to contactless payment cards and drugs.[100]"

However, it is important to note that the cost for companies is not determined only by reference to such relatively inexpensive tags; the cost of the supporting equipment (readers, receivers), the costs of the data management software and organisational implications must also be taken into account. Business consultancies point out that benefits and costs have to be assessed from this broader perspective: *"Yet, despite the benefits, RFID is a complex, costly undertaking, with considerable potential to disrupt operations."* (BearingPoint 2005)

Outlook

Notwithstanding the challenges that still exist, most analysts forecast that there will be no future without RFID in industries where supply chain management is critical. This applies definitely to the P&P industry, but also to other manufacturing sectors and retailing.

In a **short and medium term scenario** (i.e. for the next few years), the typical way forward for many companies may be to combine the functions of RFID with the economic advantages of older barcode technology. If so, it is likely that many products in the P&P industry will be tracked by the pallet using RFID tags, while at the package / unit level Universal Product Code (UPC) or EAN barcodes will continued to be used. This short and medium term scenario for RFID adoption is also being found in the food & beverages industry.[101]

In a **longer term scenario**, companies will increasingly use RFID not only to improve their internal supply chain management, but also for **intra-firm processes**. The second generation of RFID provides new opportunities to create full transparency of the whole production, order and delivery cycle. This should ultimately translate into significant cost saving potentials, which cannot easily be achieved today. If this dynamic scenario unfolds, RFID might soon become a key technology with significant impact on B2B trade relationships: "*We will see a massive RFID boom, which takes cooperative trading among enterprises to a completely new level.*"[102]

The results of the e-Business Survey 2006 do not yet confirm that this boom has already occurred in the P&P industry. In total, only about 3% said they used RFID in 2006 (see Section 4.3.3). However, if large firms are the forerunners, there are signals that RFID actually *is* gaining momentum – 10% of large P&P companies are already using it.

---

[100] Das, Raghu / Harrop, Peter (2006): RFID Forecasts, Players & Opportunities 2006 – 2016. Your complete guide to the RFID markets and opportunities. Study by IDTechEx, featured at www.idtechex.com/products/en/view.asp?productcategoryid=93 (April 2006)

[101] See *e-Business W@tch* Sector Study on Food & Beverages (2006), www.ebusiness-watch.org ('resources')

[102] Volker Roelofson, Vice President Supply Chain Management and RFID at Seeburger, quoted from eCommerce Magazin, 04/2006 (May/June), p. 48 (see: "Lückenlos nachvollziehbar", p. 46-48).

4.3.5 Summary and conclusions

In the P&P industry, about 3% of all firms said they used RFID in 2006. Large companies are the forerunners: 10% reported RFID adoption (see Section 4.3.2).

The main application areas for RFID in P&P manufacturing are **warehouse and inventory management** (the case studies *International Paper, ICT for New Production Tracking* and *Stora Enso* are representative examples). RFID can help companies to link ordering, production and logistics processes, and thus to streamline their supply chain and reduce lead times.

However, the benefits of RFID over the use of barcode technology for the same purposes are still not so obvious. In particular, although tags are constantly decreasing in price, the **total costs** for RFID projects are still **considerable**, when implementation and operation costs are taken into account. Implementation can also have a substantial impact on work processes and skills requirements in the company.

- **Different strategies**: While some P&P manufacturing companies have chosen to be early adopters, others deliberately opt for a wait-and-see strategy with regard to RFID. There is no single right strategy for all firms; it depends on the context, such as the company's overall strategy, its vision, market position and customers.

  Companies with a cost leadership strategy may be hesitant to adopt at this point of time, as RFID is still quite costly. Companies with an innovation leader strategy are more likely to adopt.
- **Impact of customer demand**: Compliance with customer demand is a key driver for RFID adoption in the packaging industry. Large retail chains and consumer goods producers (notably the food & beverages and the pharmaceutical industries) are influential sectors in this respect.
- **General IT capability critical for smooth adoption**: A company with a clear information management strategy, and with sophisticated IT systems already in place, is likely to manage the transition to RFID relatively fast and in a smooth way.
- **Risk of information overload**: RFID creates an abundance of data which, in turn, necessitate sophisticated business administration software to manage and make good use of them.
- **High impact potential in the long run**: Notwithstanding the limited diffusion in 2006, RFID could become a key technology with substantial impact on B2B trade in the future.

4.4 ICT impact on the demand for paper

4.4.1 Introduction

For the P&P industry, ICT are not only relevant as a means of increasing the efficiency of business processes, but also in terms of their impact on demand for paper and paper products. In theory, the substitution of paper-based information, communication and documentation processes by electronic services and processes could, in the long run, negatively affect demand. This section explores these issues and draws conclusions on the likely overall effect of ICT on paper consumption.

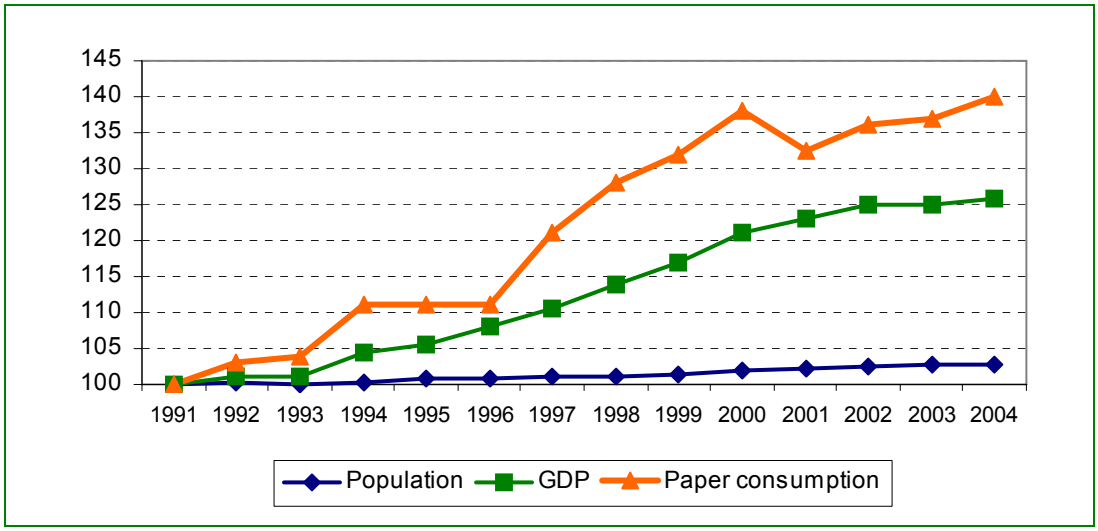
A quantitative assessment of the future demand, e.g. by scenario modelling, would be far beyond the scope of this study (if possible at all). Important assumptions that would have to be taken for the various scenarios would inevitably be quite speculative. However, some conclusions can be drawn from evidence about the developments of paper demand in the past and under different economic conditions, and from several studies that explored the impact of ICT on paper demand in offices and households.

In addition, some general arguments are proposed as regards the future demand for paper, since it is difficult to fully separate the influence of ICT and information society developments from other factors that are likely to have an impact on aggregate demand.

Development of paper consumption in Europe

CEPI monitors the total consumption of pulp and paper in its member countries. Results show that growth in paper consumption outperformed GDP growth since 1991. While GDP increased by about 25% between 1991 and 2004, paper consumption grew by about 40% in the same period (see Exhibit 4-11). Considering that there was only a slight growth in population, it is evident that per-capita consumption has substantially increased. This finding is also important as the increase since 1995/96 occurred in parallel with the rise of ICT and the internet in offices and households.

Exhibit 4-11: Increase in paper consumption since 1991 compared to GDP and population (indexed, in CEPI countries)



Source: CEPI (2004)

The dip in paper consumption in the year 2001 is probably connected with the burst of the new economy and the subsequent economic downturn. One of the links with paper production is that a lot of magazines which had specialised on new economy and ICT topics (many of which were founded in the late 1990s) went out of business that year, thus reducing the demand for paper in the media industry.

A US study on the use of energy in the P&P industry (Nilsson et al. 1996) shows that paper is one of the few basic materials for which per-capita demand has not saturated in the United States: The average increase in per capita consumption was 1.8% annually from 1960 to 1980 and 1.6% from 1980 to 1993. According to the study, projections are that consumption will further increase at 0.6% annually until 2040.

Thus, a starting point for the following observations is that projections from the past would indicate a further increase in paper consumption rather than saturation. The key question is to what extent new ICT related factors have to be taken into account when making extrapolations of these observed trends.

4.4.2 Trends affecting demand for paper in the information society

Ambivalent trends in the information society

The deployment of ICT in offices and in households since the 1980s has conflicting effects on the demand for paper. On the one hand, e-mail and the electronic processing of documents (for example in insurance companies and in banking) has a potential to substitute for paper-based processes. On the other hand, the concept of the "paperless office" is more of a utopia than a reality in most business activities today. ICT has also led to a vast increase of information that has to be processed, and modern printers and copiers allow fast and comparatively cheap printing of documents.

Exhibit 4-12 suggests an overview of the main information society related factors that are having an influence on paper consumption. It is difficult to clearly separate these factors from each other. In particular, trends that contribute to a substitution of paper-based processes (right side of the box) are clearly interrelated. For example, changing patterns in consumer behaviour are a cause for the decline of the traditional newspaper industry.

It is nearly impossible to quantify these effects on an aggregate level. The two most significant factors are probably the overall global economic development and the further rise of the internet as a backbone of global business activity and communication. To illustrate this point, some data from various studies that have explored related developments are presented in the following paragraphs.

Exhibit 4-12: Factors driving and reducing the demand for paper

Factors driving demand for paper	Factors reducing demand for paper
• **Economic growth** / industrialisation in major emerging markets (most notably in China, India, Russia, Brazil) • **Publication of new magazines** in the wake of new technological developments (e.g. magazines about digital photography). • **Easy printing**. ICT has greatly facilitated rather than eliminated the printing of documents. This applies to both office and domestic use of ICT.	• **Changing patterns in consumer behaviour**. Young people of today have grown accustomed to "digital"; their information and communication behaviour is different to those of previous generations. • **Decline of the traditional newspaper industry**. Circulation of newspapers is decreasing in Western economies. • **Substitution of classified advertising** in newspapers by equivalent online services. This reduces the volume of newspapers, particularly in the USA. • **Substitution of paper-based delivery** for specific media products, such as STM[103] journals, encyclopaedias, directories and manuals. • Digital **document management** replaces paper-based archiving in business. • **"Digital paper"**: new digital technology, imitating the look & feel of paper.

Impact of industrialisation and growth

As with the utilization of practically all manufactured resources, paper consumption differs enormously between developed and emerging economies. According to the World Resources Institute, the worldwide average annual per-capita consumption of paper and paperboard was about 52 kg in 2004. In Europe it was about 130 kg, in the USA even more than 300 kg, but in Asia it was less than 30 kg. In Africa and the Middle East it was less than 20 kg.[104] In consideration of this huge gap, it is likely that industrialisation and growth in economies such as China and India will have a significant worldwide impact on future paper demand.

The growth of paper consumption in Germany since the 1950s may serve as an example of the effects of overall economic growth on demand for paper. In 2004, paper consumption in Germany was about 19.5 million tonnes. This is more than 12 times the volume of 1950 (1.6 million tonnes). Germany consumes more paper than the combined consumption of the continents of Africa and South-America.[105]

[103] scientific, technical and medical journals

[104] See "Earth Trends", the online database provided by the World Resources Institute (WRI) (http://earthtrends.wri.org). See data on "Forests, Grasslands and Drylands". The WRI is a US based environmental think tank, launched in 1982 and operating as a not-for-profit organisation.

[105] Source: Initiative Pro-Recyclingpapier (www.initiative-papier.de); See: "Papierverbrauch steigt", http://www.initiative-papier.de/cms/gutegruende_papierverbrauch.php?navid=2 (Sep. 2006)

Although this development cannot simply be projected to the emerging economies of today, such as the "BRIC" countries (Brazil, Russia, India and China), it appears reasonably safe to assume that demand for paper will rise significantly in these countries in parallel with the overall economic growth and industrialisation. Thus, on a global scale, paper demand will probably increase substantially over the next 10-20 years, particularly in Asia.

The environmental implications of this anticipated development are globally relevant and should be a serious concern for international policy, considering the critical role of the P&P industry in this respect (see Section 2.2). They are not discussed in this report, however, as ICT and e-business cannot make a significant contribution to ease environmental effects of paper production.

The key point for this study is that growth in the emerging economies is probably the single most important factor governing the global demand for pulp and paper, towering over all other factors such as substitution of paper products through ICT based services.

Substitution effects of the internet

Substitution effects are most significant in the daily and weekly newspaper markets. A large proportion of their **classified advertising** is migrating to the internet. As a result, the number of commercial pages (average volume) of newspapers is decreasing as well as the total circulation. This concerns tabloids and quality newspapers, as well as the special market segment that has entirely focused on classifieds. For example in the used car and real estate markets, prior to the internet, a broad variety of special magazines and free papers provided platforms for these markets; to a large extent, the same functionality is now offered by marketplaces on the internet. Circulation of free papers of this type has diminished.

Effects are most pronounced in the USA, but can also be observed in the European newspaper market. A study by the European Publishing Market Watch on the European Newspaper Market (2004)[106] concludes that "*circulation is either static or falling in most EU member states, and has been for some years. Declines are steady rather than dramatic.*"

The fundamental change in classified advertising also creates pressure for standard newspapers. First, they are losing a part of their former income, as fewer classifieds are placed in newspapers. Second, it has also implications for the attractiveness of the product. Classified advertising used to be an important content and buying motive for many readers. The loss of this functionality contributes to the decrease in total circulation, as some people stop buying newspapers if they are no longer the primary source for "market intelligence" in the form of classifieds.

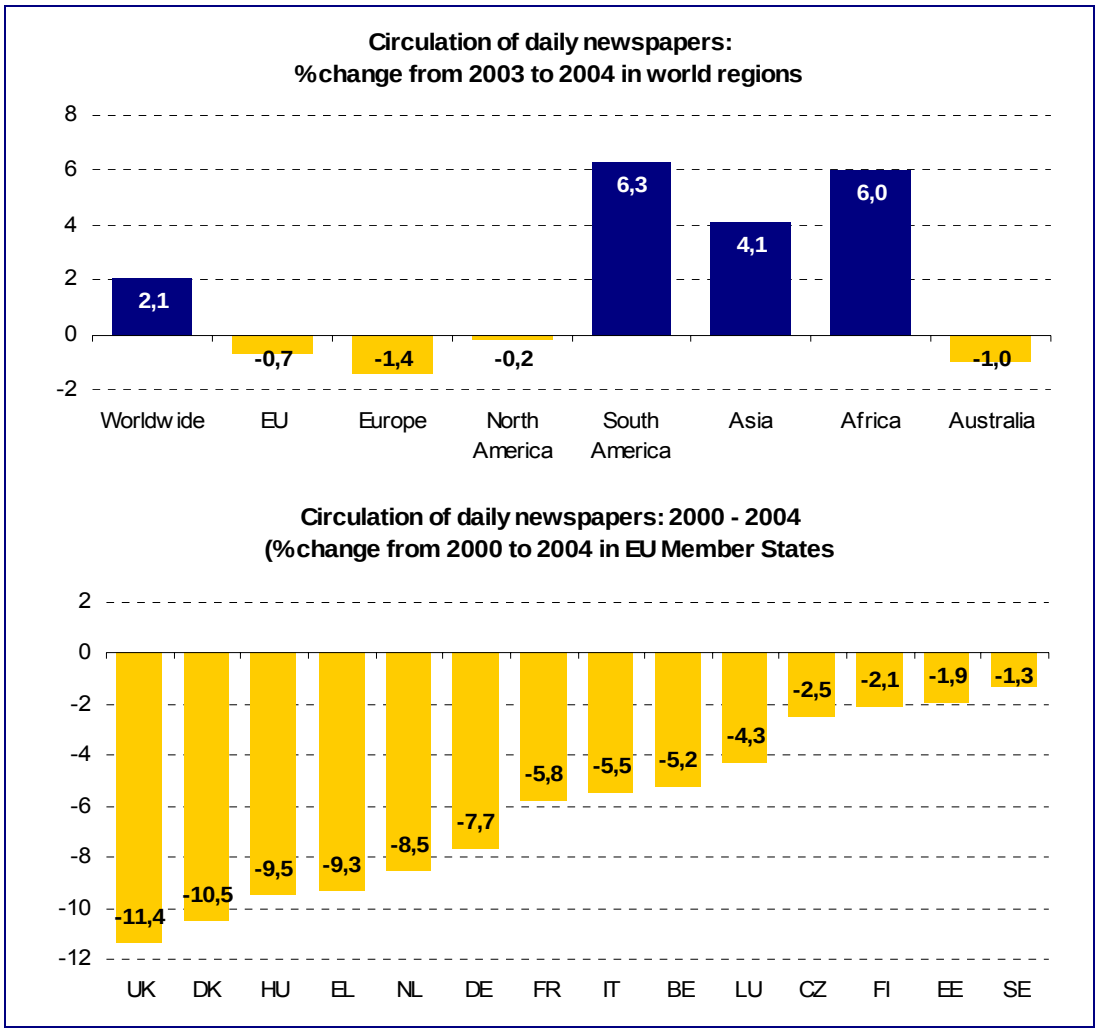
However, as it is certain that classified advertising is migrating to the internet, publishers are adapting to this situation. In fact, **statistics** published **by the World Association of**

[106] Cf. European Publishing Market Watch, Sector Report 1: The European Newspaper Market (2004), p. 7; p. 90f. See www.publishing-watch.org.

Newspapers (WAN)[107] point at a recovery of the newspaper market in 2004/05 after the decline in the immediate years before. In a press release on its latest annual report ("World Press Trends 2005"),[108] WAN presented the following figures:

- **Global development**: The total circulation of daily newspapers in the world climbed 2.1% in 2004 (see Exhibit 4-13a). Over five years, it is up 4.8%.
- **Europe / USA**: Newspapers in EU Member States saw a slight 0.7% drop in circulation in 2004, but sales were only 0.4% less (or 360,000 copies) than five years ago. However, over the five years 2000-2004, circulation has declined in most Member States (see Exhibit 4-13b). By comparison, the circulation of US dailies fell 1.0% in 2004 and 2.1% over five years.

Exhibit 4-13: Development of the daily newspaper circulation



Source: World Association of Newspapers (WAN): World Press Trends 2005

(graph by *e-Business W@tch*)

[107] The Paris-based WAN, the global organisation for the newspaper industry, represents 18,000 newspapers; members include 72 national newspaper associations, individual newspaper executives in 102 countries, 11 news agencies and nine regional and world-wide press groups.

[108] "World Press Trends: Newspaper Circulation and Advertising Up Worldwide", WAN, Seoul, 30 May 2005. www.wan-press.org/article7321.html

In summary, these figures show that circulation has declined over a five-year period in most European countries and in the USA, but not in a dramatic way. While the European and US newspaper markets are saturated, circulation increases in emerging economies. Thus, overall global newspaper circulation has increased by nearly 5% over the past 5 years.

Additional demand effects of the internet

In addition to enabling substitution, the internet also creates new demand for printing paper. A recent survey among 617 Swiss companies about their demand for paper found that consumption had increased by about 20% from 2000 to 2005.[109] Growth was particularly high among large enterprises, although the digital saving and archiving of data has increased by a factor of four in the same time. While 70% of firms said that the vision of the "paperless office" has some relevance for them, and also about 70% of the firms interviewed said that they used software systems for document management; however, this has not translated into a reduced demand for paper.

This Swiss finding is quite interesting, as it indicates that there is no inverse correlation between increasing digitisation and the demand for paper in business. In essence, the amount of information which is required, used and processed by companies for management and other purposes has substantially increased; in practical terms this means that the increased saving and archiving of digital data and an increased level of printing hardcopy reports and documents have occurred in parallel.

An earlier survey among German internet users by Ipsos on behalf of Minolta in 2000 found that 18% of the total population consumed considerably more paper due to using the internet than before, mainly because of printing out web pages. Not even e-mails help to reduce paper, according to the survey, because users like to print out e-mails. Only about 7% of users said that they would read e-mails entirely on the screen.[110] Since internet access has considerably increased since then, the impact on increased paper consumption in households and offices can easily be imagined.

Similar evidence was reported for the USA, where a study by Hewlett-Packard (HP) found that about a third of managers interviewed said that demand for printing documents had considerably increased due to the internet.[111]

Outlook

Europe currently consumes 205kg of paper per capita, four times the world average. In total, European countries consume 80 million tonnes of paper each year, 25% of world consumption. Some projections by industry show per capita paper consumption growing significantly in the next 10 years.[112]

---

[109] "Steigender Papierverbrauch trotz Digitalisierung", 5 April 2006, news.ch. See: www.news.ch (download in April 2006)

[110] "Das Internet erhöht den Papierverbrauch", heise online, 27 July 2000, www.heise.de/newsticker/meldung/10889 (download in April 2006)

[111] ibid

[112] Source: Jaakko Poyry. Quoted from "A Common Vision for Transforming the European Paper Industry", Vision paper signed by 50 NGOs on 27 Jan. 2006, Frankfurt. See: www.taigarescue.org (accessed in April 2006).

A more conservative scenario is that total demand in Europe will continue to increase at a moderate growth rate, but that the type of paper demand may change. On the one hand, there will be an increased demand for better quality paper; on the other hand, environmental concerns and awareness may also drive recycling and the use of recovered paper. If this is the case, paper makers will have to position themselves even more than today as producers either of high quality or recycled material. To what extent these two requirements can possibly be combined by means of modern production technology remains to be seen.

On a global scale, world markets for paper and paper products will certainly continue to grow fast, and particularly in Asia and South America. While local supply will be available for bulk products, the growth in these countries should nevertheless continue to be an interesting market opportunity for producers in the EU. However, their competitive advantage derived from capabilities of high quality production is gradually eroding, as the producers in emerging economies are learning fast and modernising their facilities.

4.4.3 Summary and conclusions

In 2004, the paper industry in European countries represented by CEPI[113] produced an output of about 100 million tonnes of paper and about 43 million tonnes of pulp. Production of paper and board **increased by 4.5%**, and demand grew by 2.4%. Thus, growth in production was higher than in the countries of major competitors (see Section 2.2.1).

However, it is frequently assumed that the fast adoption of ICT by households and businesses could lead to **substitution of paper or paper-based products** in some areas in the future. Important factors that could decrease the demand for paper include the substitution of classified advertising in newspapers by online services, the general decline of the traditional newspaper industry in advanced economies, and the replacement of formerly paper-based media products (e.g. encyclopaedia, scientific journals) by electronic equivalents.

On the other hand, the net impact of all factors that have an influence on demand for paper rather points at a **continued growth** in paper demand and consumption. On a global scale, the rise of the emerging economies in Asia and South America could even lead to a significant growth of consumption in the near future. The gap between current consumption per head between emerging and developed economies is still huge. Moreover, a projection of figures on paper consumption in Europe since the mid 1990s indicates a **moderate growth even in advanced economies**.

If this holds true, the environmental impact of a possible sharp increase in global paper production could be a more legitimate concern for policy than a decrease in consumption in some parts of the world.

[113] See section 2.2.1

- **Growth in consumption in past 10 years**. According to CEPI, paper consumption in Europe has increased by about 25% from 1994 to 2004, which was the decade of the ICT and internet boom in offices and households.
- **Ambivalent effects of the information society**. Some information society developments drive the demand for paper and paper products, others have substitution effects.
- **Economic growth in emerging markets is the key factor**. At least for the next 3-5 years, the effects of growth and industrialisation in China and India are likely to outweigh all other factors affecting worldwide paper demand.
- **Majority of forecasts point at growing paper consumption**. In line with these considerations, the majority of forecasts, including those from NGOs and environmental groups, indicate a growing paper consumption over the next 10 years. This certainly will be true for the emerging markets in Asia; but even in Europe, consumption is likely to increase at moderate growth rates.

5 Conclusions

Among the ten sectors studied by *e-Business W@tch* in 2006, and probably for other sectors as well, the P&P industry is a near-perfect **yardstick for the state-of-play in ICT adoption** and e-business activity. For many of the indicators, figures for the P&P industry are very close to the all sector averages and represent very well the typical situation in manufacturing industries. The sector is neither among the avant-garde in ICT adoption (such as ICT-related sectors themselves), nor is it in any way a slow ICT adopter, as for instance the footwear and – to some extent – the food and beverages industries.

Survey results and case studies presented in this report show that companies from the P&P industry use ICT quite intensively in all application areas along the value chain: for procurement processes, in production, inbound and outbound logistics, in marketing and customer service. As in most manufacturing industries, improvements in supply chain management by integrating business processes with suppliers and customers is probably the main focus of these activities.

5.1 Business impact

5.1.1 Implications for enterprises

From cutting costs to serving the customer

In the P&P industry, ICT have their main impact as a driver and **enabler of process innovation** in supply chain management and B2B trading processes. About 50% of all firms active in the sector said they placed at least some orders to suppliers online (see Section 3.5.1). Specific software systems for integrating related business processes are widely deployed, at least among the larger firms: ERP and SCM systems are used by more than 40% of the large P&P companies (see Sections 3.4.1 and 3.5.2). However, survey results also show that these sophisticated systems are much wider deployed among large companies (for example the large paper manufacturers) than among smaller firms in the sector (for instance printing companies from the paper converting industry).

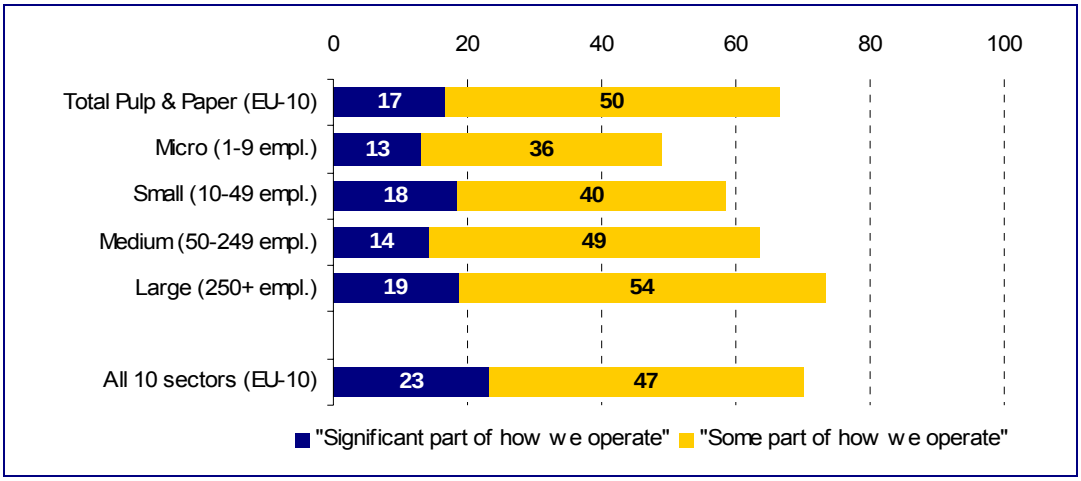
Irrespective of the company size, however, **quality management**, **improving process efficiency** and **enhancing customer relationships** are key underlying objectives for ICT adoption in the various business areas. Furthermore, in manufacturing, improving supply chain management and providing excellent customer service are closely intertwined objectives.

Until recently, the focus of e-business activity in manufacturing has often been on cutting operational costs. Competitive pressure has driven firms everywhere in a constant search for opportunities to **cut costs**, and reducing costs has been one of the most important promises of e-business. More recently, however, innovative firms have discovered and begun to exploit the potential of ICT for delivering against key business objectives; they have integrated ICT into their delivery of quality goods and services, into their quality management, in **marketing** and for **improving customer service**.

Perceived overall significance of e-business

As in the previous surveys, *e-Business W@tch* asked companies for a concluding assessment whether e-business constituted a "*significant part or some part of the way they operate, or none at all*". In the P&P industry, companies representing about two thirds of the sector's employment feel that e-business constitutes at least some part of their operations. Only 17% said that it was a significant part (see Exhibit 5-1).

Exhibit 5-1: Perceived overall importance of e-business for company operations



Base (100%): Companies using computers (excl. "don't know"). N (for sector, EU-10) = 948.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: H1

Source: *e-Business W@tch* (Survey 2006)

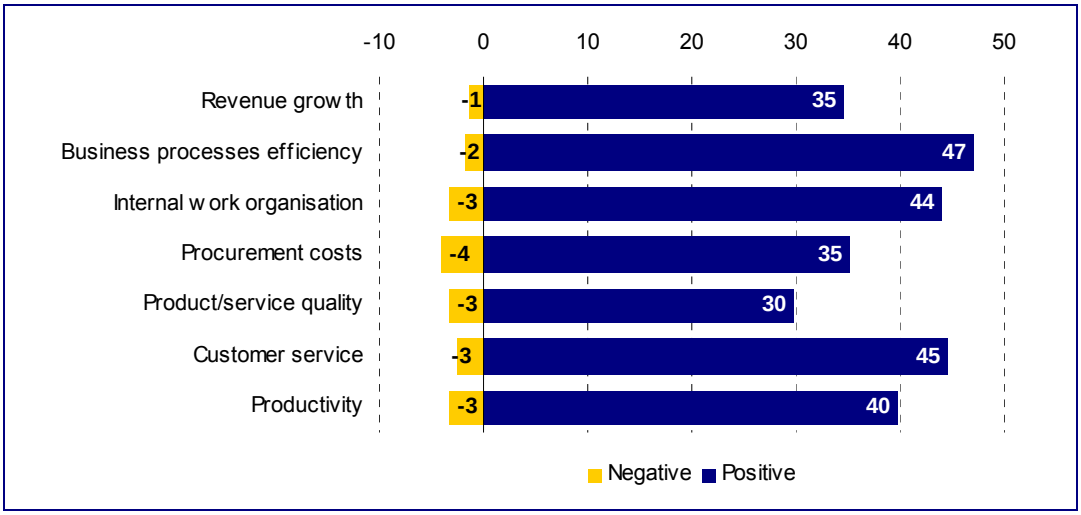
This overall assessment also emerges from case studies and interviews with industry representatives and sector experts conducted for this study (see "References"). As can be expected, the perceived relevance of e-business increases slightly with firm size, from about 60% among small companies to nearly 75% of large firms. These figures are in line with the all sectors average.

Perceived ICT impact on the firm

The business areas where most companies from the P&P industry observe *"a positive influence of ICT*", out of a list of seven areas proposed, are "**business process efficiency**" (47%), "**customer service**" (45%) and "**internal work organisation**" (44% of firms, see Exhibit 5-2). These findings are similar to those from the other manufacturing sectors surveyed, with the possible exception of shipbuilding (where the impact on customer service is less pronounced).

Interestingly, positive ICT effects on procurement costs, which is one of the most commonly quoted objectives of e-business, appears to be comparatively less relevant in this industry, as only 35% observe positive effects.

Exhibit 5-2: Perceived ICT influence on the company's business

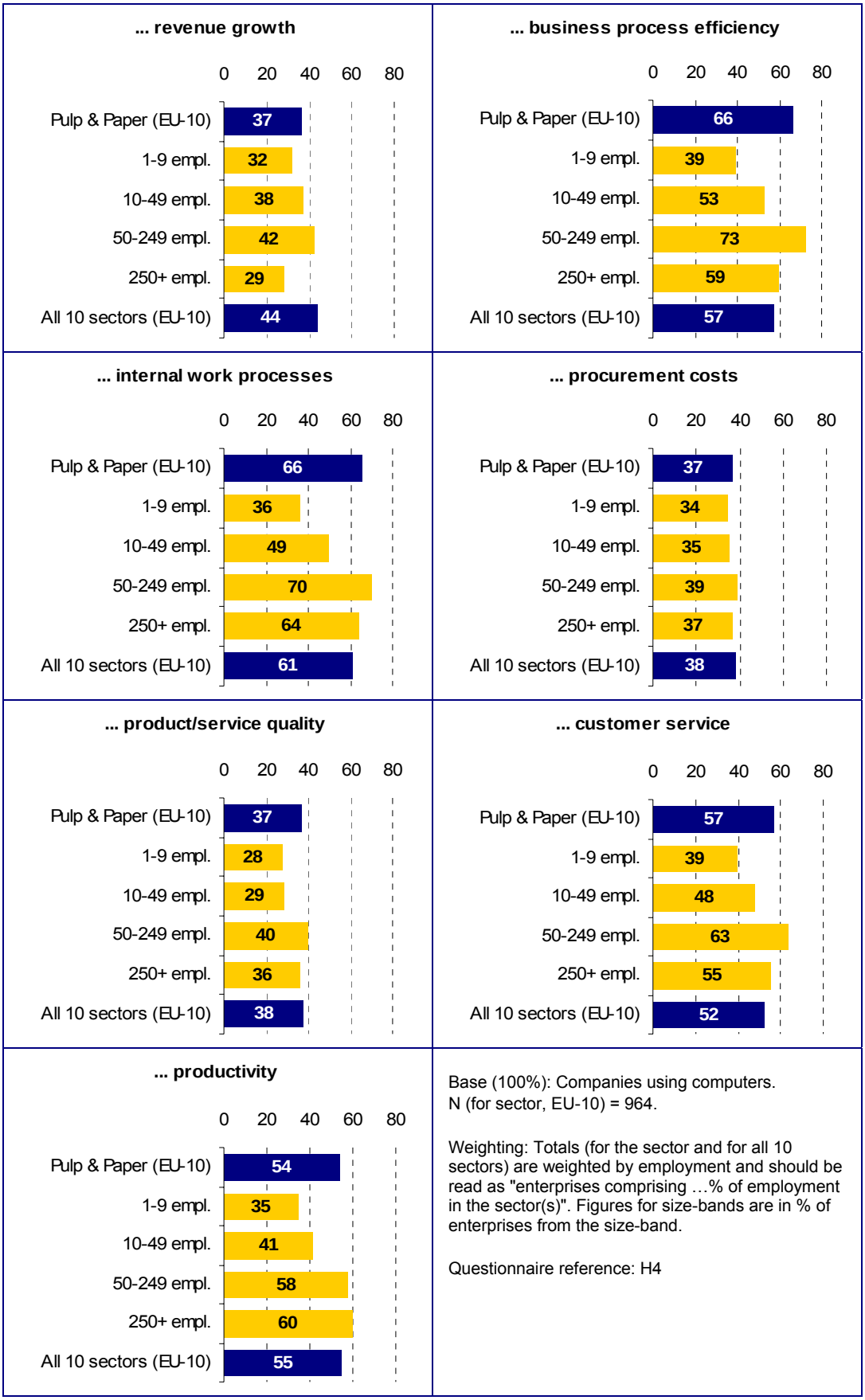


Base (100%): Companies using computers. N (for sector, EU-10) = 964.
Weighting: in % of firms. Questionnaire reference: H4

Source: *e-Business W@tch* (Survey 2006)

Within the sector, there are some differences between size-bands with regard to the perceived ICT impact, but only for specific business areas (see Exhibit 5-3). In particular, the percentage of companies saying that they experienced positive effects on -the closely related areas of- business **process efficiency** and **internal work processes**, as well as on **customer service** is larger for medium-sized and large P&P companies than for small ones. On the other hand, the share of companies that reported positive effects on revenue growth, procurement costs and product quality is very similar for all size-bands.

Exhibit 5-3: Companies observing a positive influence of ICT on …



Base (100%): Companies using computers.
N (for sector, EU-10) = 964.

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band.

Questionnaire reference: H4

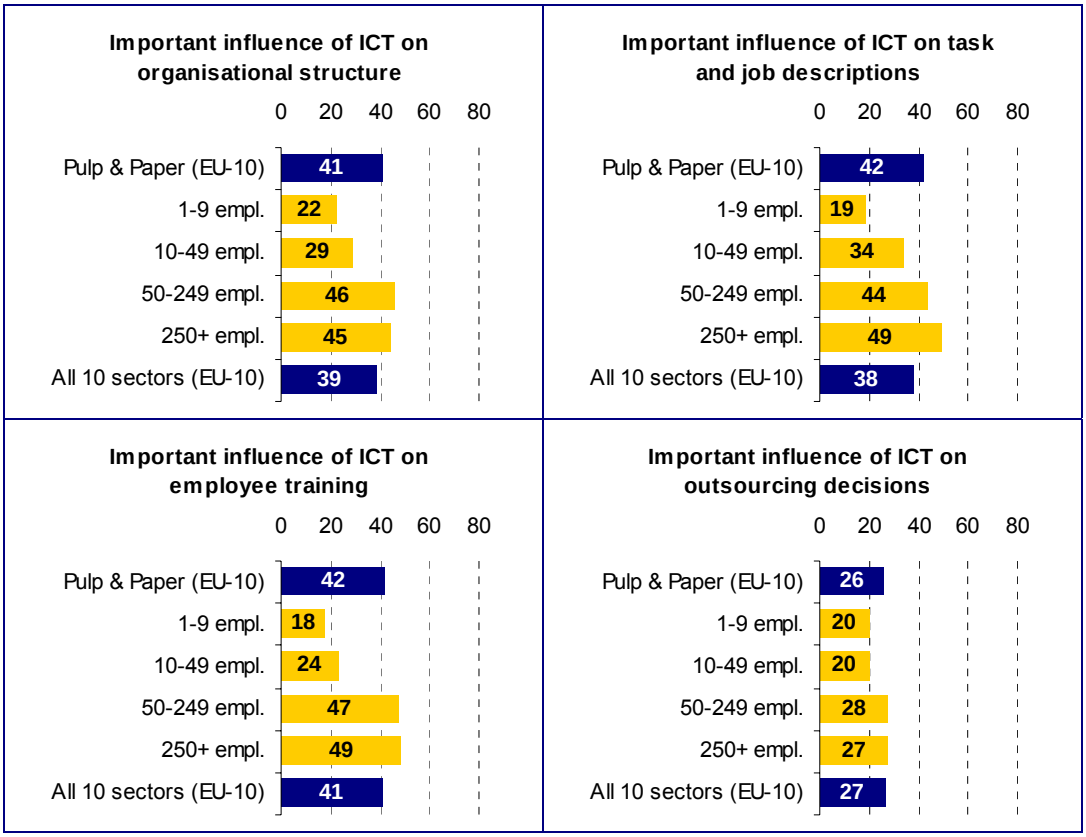
Source: *e-Business W@tch* (Survey 2006)

ICT impact on organisation

Introducing e-business can go hand in hand with organisational changes in the company. This applies to many of the applications discussed in Chapter 3; in particular for those ICT systems that are intended to support the internal and external integration of processes along the supply chain, e.g. advanced software systems such as ERP and SCM.

These systems are quite widely used in the P&P industry, compared to the other sectors surveyed, but their use increases clearly by firm size (see Section 3.4). As can be expected from this evidence, survey results show that the perceived impact of ICT on firm organisation also increases by firm size. Companies representing about 40% of employment in the P&P industry reported an important influence of ICT on their organisational structure, on task and job descriptions, and on employee training (see Exhibit 5-4). Among medium and large firms, close to 50% perceived an important impact in these areas; among small ones, only about 20-25% did so.

Exhibit 5-4: Perceived influence of ICT on organisation: companies observing an …



Base (100%): Companies using computers. N (for sector, EU-10) = 964

Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band. Questionnaire reference: H7

Source: *e-Business W@tch* (Survey 2006)

The impact of ICT on outsourcing decisions is less pronounced, even among larger firms (see Exhibit 5-4). This finding correlates with evidence that about 15% of the sector's firms said they had outsourced ICT services in 2005, and that their share increased only slightly with company size (see Section 3.2.2 on outsourcing).

These findings, which are quite in line with the picture in other sectors, also demonstrate that a majority of firms in the P&P industry (about 60%) do not feel that ICT have an important influence on firm organisation. ICT impact is rather experienced on the level of internal work processes, but not so much in terms of the overall organisational structure or job descriptions. While companies representing about 65% of employment reported an important impact on work processes (see Exhibit 5-3), 'only' about 40% did so with regard to organisational structure and job descriptions (see Exhibit 5-4).

In specific areas, the introduction of new technologies can lead to changed skills requirements for employees (e.g. when RFID is introduced in warehousing and logistics); however, since RFID (and other emerging technologies) are not yet widely diffused (see Section 4.3), the experienced impact of their implementation in the company does probably not really show up in the figures of Exhibit 5-4.

ICT impact on competitiveness and productivity

ICT-induced productivity effects vary significantly between sectors and countries. The largest productivity growth effect occurs in the ICT-producing sectors themselves. The highest impact of ICT on firm-level productivity and performance is found when ICT investments are combined with complementary investments in work practices, human capital and firm restructuring.[114]

In the P&P industry, about 40% of small firms and 60% of medium-sized and large firms said in the e-Business Survey 2006 that they observed a positive influence of ICT on productivity (see Exhibit 5-3). Only about 2% reported a negative impact, the rest observing no impact at all. This self-assessment differs considerably between sectors, even among manufacturing sectors. ICT related industries observe a much stronger influence than other sectors; the P&P industry, once again, represents the average of sectors (see Exhibit 5-6).

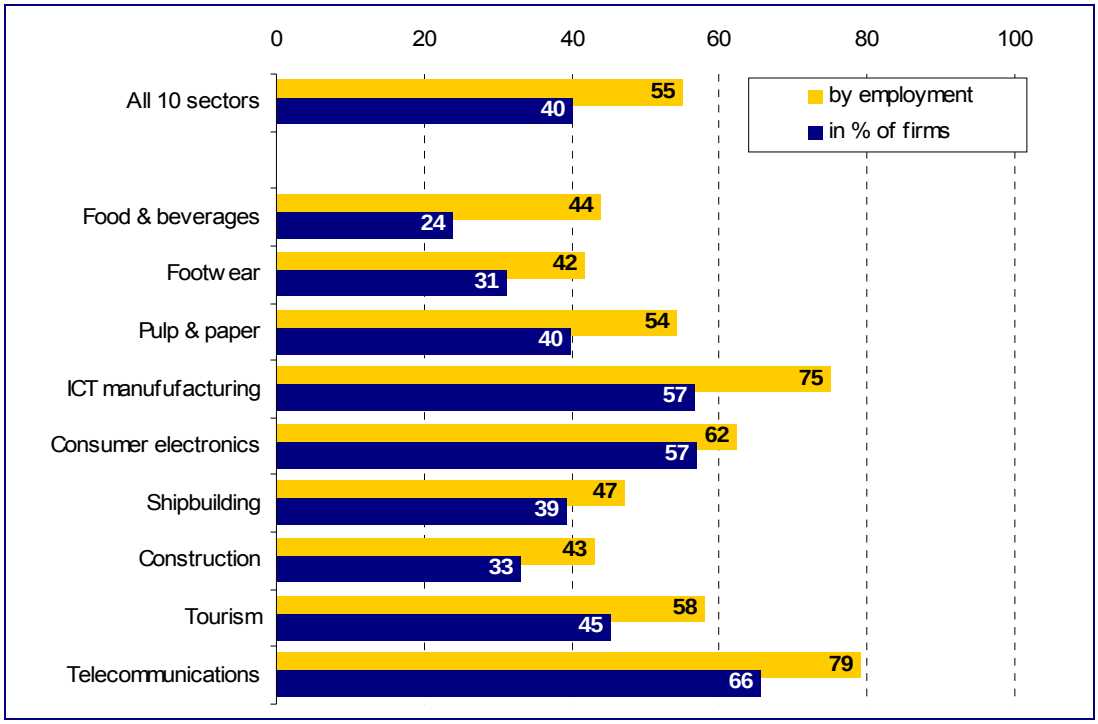
The ICT impact on productivity depends on several factors, which do not only include the technologies used themselves, but also the organisational culture and conditions in a company in which these technologies are embedded.

Evidence in this report indicates that for (large) firms in the P&P industry, a sophisticated ERP system is often the main platform for e-business processes between a company and its suppliers and customers (see Section 3.4.1, and case studies on *Stora Enso, VPK Packaging* and *Mayr Melnhof*), and probably enables the most significant productivity increases. The rising acceptance of e-business standards for trade within the value system (papiNet®, GUSI – see Sections 3.3 and 4.1) could further enhance B2B integration.

However, as long as many SMEs do not have ERP systems, the full potential for industry-wide productivity gains cannot be exploited (see policy implications, Section 5.2). During this transition period, larger firms are pushing their small business partners to 'upgrade' their systems in order to enable digital integration. The case study on *VPK Packaging* (see Section 3.5) illustrates that there non-ERP-based supply chain integration with customers can also lead to productivity gains.

[114] See *e-Business W@tch* Special Study on the "Impact of ICT on corporate performance, productivity and employment dynamics" (2006), available at www.ebusiness-watch.org ('resources').

Exhibit 5-5: Companies observing a positive influence of ICT on productivity



Base (100%): Companies using computers. N (for sector, EU-10) = 964
Weighting: "by employment" means "enterprises comprising …% of employment in the sectors(s)".
Questionnaire reference: H4g

Source: *e-Business W@tch* (Survey 2006)

Anticipated future impact of ICT

According to the e-Business Survey 2006 results, many P&P firms expect ICT to have an important impact on certain areas of their business in the future (see Exhibit 5-6). In particular, firms expect that ICT will have an impact on accounting, marketing and customer support. The importance and intense use of ICT for accounting, controlling and management purposes is evident and need not be discussed here. Replies from companies demonstrate that they are aware of this situation and expect that ICT will be even more important for **planning and decision making** processes in the future.

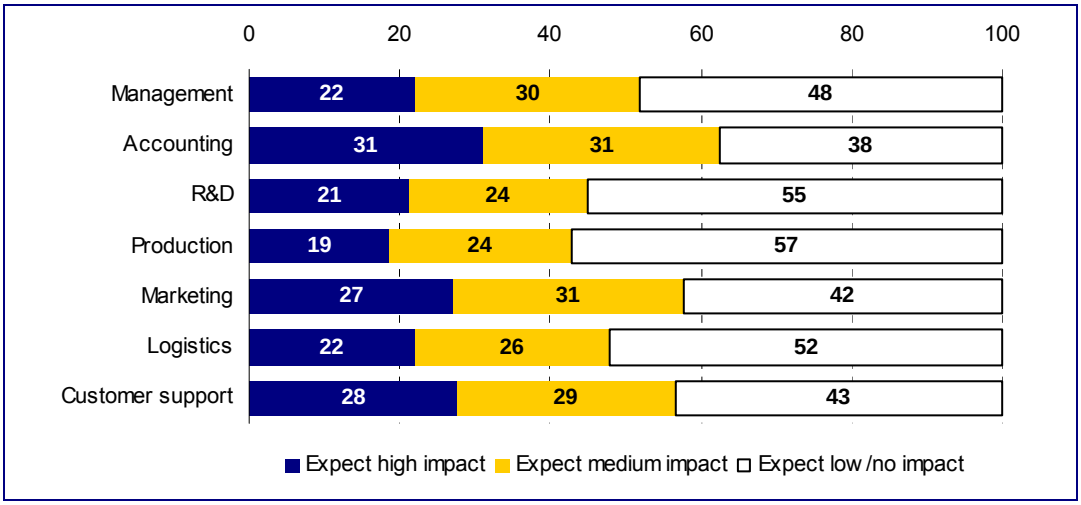
P&P companies' statements on the expected future ICT impact also confirm the impression that e-business is increasingly moving from a tool for planning and cutting costs to an instrument that helps companies to **better serve their customers**. This finding is quite interesting for a manufacturing industry: contrary to what would be expected, more companies said that they expect ICT to have an important or medium impact on marketing and customer support than on production and logistics, which used to be core ICT application areas in manufacturing in the past. This is not to say that ICT will no longer be important in these areas; but it shows that ICT for customer service will be an equally important application area in a not-so-distant future.

In 2005, *e-Business W@tch* already concluded and forecast that companies would increasingly focus on using ICT for customer relationships: "*The 'cost cutting paradigm' is still prevalent among many firms, mainly as a result of increased competitive pressure on prices in a global economy. However, there will be an end to that story at some point, at*

least for procurement and supply chain management. Many of the large players have already optimised their supply side processes in highly sophisticated ways or are in the process of doing so. In comparison, the use of ICT for marketing and sales purposes is still remarkably underdeveloped in many industries."[115]

Much of the evidence presented in this report, including the results of the e-Business Survey and examples from the conducted case studies, confirm that this assessment holds true for the P&P industry.[116] It may be too early to call this development a new paradigm, but first signs of changing perspectives and priorities in e-business are becoming visible.

Exhibit 5-6: Anticipated future impact of ICT



In % of firms. Base (100%): Companies using computers. N (for sector, EU-10) = 964
Questionnaire reference: H8

Source: *e-Business W@tch* (Survey 2006)

Until recently, e-business activity has focused on marketing and sales particularly in B2C oriented service sectors (tourism, telecommunications, financial services). It appears that a similar development is currently taking place in B2B focused manufacturing industries, adapted to the specific requirements of B2B trade, of course.

The rather high percentage of P&P companies enabling customer to order online (close to 30%, see Section 3.6.1) and those using CRM systems (22%, see Section 3.6.2) support this assessment. Case studies presented in this report (*VPK Packaging, Mayr Melnhof, Rexcell),* as well as in other sector reports (e.g. the case study on *Tesla* in the study on the ICT manufacturing industry) also point at this development.

[115] See *e-Business W@tch* Brochure "E-Business in Europe – 2005. Industry perspectives on electronic business development", p. 4. The brochure can be downloaded from the website at www.ebusiness-watch.org ('resources').

[116] See, for example, Section 3.6.1: Close to 30% of all firms active in the P&P industry said that they enabled customers to order products online. See also case studies *VPK Packaging* (Section 3.5.2) and *Mayr-Melnhof Cartonboard Group* (Section 4.2.3), which illustrate the importance of e-business for customer service.

Concluding assessment

Exhibit 5-5 summarises the assessment of ICT impact on firms from the P&P industry, based on survey results, interviews, case studies and desk research conducted for this study. The scores are by no means to be understood as 'exact' results of a quantitative computation, based on any model. They are tentative, reflecting the picture emerging from the study, and should be regarded as a vehicle to stimulate debate. It is also clear that no such general conclusion can apply to each individual company. There will be specific cases of SMEs and large firms with a totally different ICT experience for whom the pattern below does not apply.

Exhibit 5-7: Impact of ICT and e-business on competition in the P&P industry

	Business areas where ICT and e-business can have an impact	Observed impact in large firms *low < > high*	Observed impact in SMEs *low < > high*
1	Organisational structure	■	■
2	Work-flows / operational organisation	■■	■
3	Sourcing and procurement	■■	■
4	Processing of incoming orders	■■■	■
5	Production processes	■■	■■
6	Logistics (outbound & inbound)	■■■	■■
7	Online sales	■	■
8	Customer service and support	■■■	■
9	Research & development	■■	■■
10	Product innovation	■	■
11	Process innovation	■■	■
12	Skills requirements	■	■■
13	Outsourcing	■■	■
14	Employment	■	■■
The scale has a maximum of 3 in either direction – "low" (■■■) or "high" (■■■)			

Source: *e-Business W@tch* (2006)

In general, however, all available evidence suggests that the powerful ICT systems and e-business solutions of the large companies currently allow more advanced practices, which enable and result in greater achievements in terms of cost savings and efficiency. Therefore, while the areas of e-business activity are similar in large and small firms, the impact is probably more pronounced for large firms.

However, the industry has good pre-prerequisites for e-business, for example due to the agreement on industry standards for B2B messaging. Thus, a quite **dynamic development** in e-business can be expected over the next 3-5 years. The number of companies whose systems fulfil minimum requirements to link with other companies is on the rise. It can be argued that Metcalfe's law[117] should also apply to B2B exchanges: when more companies are capable of exchanging data electronically, aggregate effects (e.g. on productivity) should increase substantially.

[117] The value of a network is proportional to the square of the number of users of the system. First formulated with regard to the internet by Robert Metcalfe, founder of 3Com and co-inventor of the Ethernet protocol.

5.1.2 Implications for industry structure

This section assesses the implications of ICT and e-business adoption on the structure of the respective industry. As in 2005, we use the 'five-forces-model' developed by Michael E. Porter (1980), to discuss and assess e-business implications on the industry's structure.

Background information:

Michael E. Porter's Five-Forces Model

The 'Five Competitive Forces' model was developed by Michael E. Porter in his book "Competitive Strategy: Techniques for Analysing Industries and Competitors" in 1980. Since that time it has become an important tool for analysing industrial structure, competition and strategic options of players. Porters model is based on the insight that a corporate strategy should meet the opportunities and threats in the organisations external environment.

Porter has identified five competitive forces that shape every industry and every market. These forces determine the intensity of competition and, hence, the profitability and attractiveness of an industry. The objective of corporate strategy should be to modify these competitive forces in a way that improves the position of the organisation. Porters model helps to identify the main driving forces in an industry. Based on the information derived from the Five Forces Analysis, companies can decide how to influence or to exploit particular characteristics of their industry.

The instrument has been applied by e-Business W@tch since 2004/05 to assess the influence of ICT and e-business on competition in a sector.

Michael E. Porter is the Bishop William Lawrence University Professor at Harvard Business School.

While ICT and e-business have a considerable impact on business processes and internal work processes in individual companies (see Exhibit 5-3), survey results and interviews conducted for this study do not indicate a major impact on the overall industry structure.

Although the structural determinants of industry competition point at a currently very **intense competitive scenario** for the P&P industry, the key drivers of competition are not really to be found in ICT and developments in e-business. For example, the expected increase in rivalry in the European market due to the entry of Asian competitors has little or nothing to do with ICT: even if ICT facilitates global expansion, it is certainly not the cause or key driver of this trend. Similarly, the critical impact of rising energy costs for paper manufacturers is not in any way linked directly to ICT or e-business developments.

For some determinants, **differences between the two sub-sectors** (pulp and paper manufacturing versus the converting industry) have to be taken into account. For example, the substitution of cardboard packaging solutions by plastic ones has a more significant impact on converting companies than for paper manufacturers (see "substitution of products and services" below).

Exhibit 5-8: Impact of ICT and e-business on competition in the P&P industry

	Competitive forces	General importance in the sector (currently) *low < > high*	Impact of ICT and e-business *low < > high*
1	Threat of new entrants[1]		
2	Substitution of products / services		
3	Bargaining power of suppliers		
4	Bargaining power of customers		
5	Rivalry in the market		
The scale has a maximum of 3 in either direction – "low" ( ) or "high" ( )			

[1] "New entrants" in the sense of new companies being founded. New entrants in the sense of companies from a different geographic area entering the European market is considered under "rivalry in the market"

Source: *e-Business W@tch* (2006), developed from Michael E. Porter

Threat of new entrants

As the P&P industry is very capital intensive, high initial investments and fixed costs constitute a critical barrier for market entry. As a result, the configuration of major players in the industry is quite stable. There are not many newly founded companies around. In this industry, "new entrants" are mainly companies that expand their market size geographically.

ICT played a critical role in this context, but only for a short period of time – when the first e-marketplaces for the paper industry were launched, establishing themselves as new **business intermediaries**. Confirming economic theory, players reacted to this threat and developed a counter-strategy: they realised that the broad agreement on industry standards to facilitate direct B2B trade between companies could, to a large extent, eliminate the advantage of marketplaces (see Section 4.2.3 – "Peer-to-peer instead of e-marketplaces"). Defending the industry against new e-intermediaries was one of the main objectives that drove the development of papiNet® (see Section 4.1).

Currently, there is no obvious link between ICT and e-business developments and the risk of new entrants. Neither do ICT facilitate market entry in this industry in a substantial way, nor do they create a barrier for market entry. A possible exception may be innovation in production technology and processes in the converting industries; however, survey results and interviews conducted for this report did not find strong evidence for substantial effects towards lowering market entry barriers.

Substitution of products and services

Substitution of products is a relevant factor for the P&P industry from two completely different perspectives:

- **Use of plastic instead of cardboard for packaging**. For paper and cardboard manufacturers, and to some extent for producers of cardboard based packaging solutions, substitution of cardboard by plastic is a major threat and has a clear impact on competition and strategy. A recent dispute on the ecological impact of manufacturing plastic and paper products between the paper and converting industries confederations (CEPI, CITPA) on the one hand, and PlasticsEurope on

the other hand[118], is indicative of the substitution competition between these industries.

However, while different packaging materials are competitors, they are often used together; for example, innovative combinations of paper and plastics for packaging solutions. Thus, plastics are not only a competitor in terms of substituting paper packaging; the joint use of materials also creates opportunities for product innovation.

- **Digital services replacing paper-based ones**. In the information society, paper-based consumption of media products such as newspapers, magazines and books can be substituted by equivalent digital services. This could have implications on demand for paper.

While ICT and e-business do not play a major role with regard to the competition between cardboard and plastics, they are obviously the main cause for the digital substitution of formerly paper-based products. However, this does not necessarily mean that the consumption of paper will decrease, since ICT not only substitutes paper, but also trigger demand (the relative effects are discussed in more detail in Section 4.4). Thus, ICT have a mixed impact; the net effect is difficult to forecast, but should not be overrated either way.

Bargaining power of suppliers

Energy is the outstanding, critical input to the manufacture of pulp and paper where the suppliers have high bargaining power. Rising energy prices can have a significant impact on pulp and paper mill profitability (see "industry background", Section 2.2.2) and on transport costs. Case study interviewees confirmed the importance of this input for their industry.[119] However, the topic is not linked to ICT and e-business. ICT may contribute to improving the efficiency of paper production processes, and thus to reducing the consumption of energy, but not in such a substantial way that it will have a significant impact on firm or industry strategy. Otherwise, the bargaining power of suppliers is rather limited, as in most industries, compared to the power of customers (see Section 3.8.1).

A notable exception, in the long run, could be logistics services. Currently, paper manufacturers still tend to manage a large part of their logistics and warehouse processes themselves, for example by directly commissioning transport and delivery to a range of haulage companies they work with. A recent trend in manufacturing is that companies increasingly outsource logistics processes completely to 3PL (third party logistics) or 4PL

[118] Cf. "European paper and board industries refute results of recent PlasticsEurope study on Resource Efficiency when applied to paper", Press release by CEPI and CITPA, The press release was issued in response to the report “The Contribution of Plastic Products to Resource Efficiency” by GUA, Gesellschaft für umfassende Analysen GmbH, commissioned by PlasticsEurope. The study had estimated how energy use and emissions of greenhouse gases would be affected if the total market of plastic products in Western Europe would be substituted by products of other materials, with the same function.

[119] Energy prices are not a central topic in the case studies; however, the issue was mentioned as a sideline in several interviews conducted for this report and is also emphasised by CEPI.

(fourth party logistics)[120] providers in order to focus on their core business (e.g. production, marketing). In this case, the bargaining power of logistics companies will certainly increase, as switching costs are high. Particularly if logistics are completely outsourced (e.g. to a 4PL), the decision is practically irreversible. This is a general risk involved with outsourcing.

Bargaining power of customers

The bargaining power of customers can differ considerably by industry and type of products. On the one hand, certain customer segments depend critically on supplies from the **paper industry**, for example the publishing and printing industry. On the other hand, the increasingly global dimension of competition opens up new options for buyers to switch suppliers.

A good example to illustrate the distribution of power between P&P companies and their customers is a visit of representatives from leading German publishing companies (including Axel Springer, Holtzbrinck and WAZ) to Moscow to explore opportunities and conditions for paper imports from Russia.[121] The strategic objective of this visit was that publishers were trying to become less dependent from their current suppliers in the EU. Paper producers had announced plans to consolidate the production capacity,[122] which could lead to an increase in prices. Paper prices are a very important cost factor for publishers. Russia has vast resources in forestry, but the quality of most of the paper production does not yet comply with Western European standards.

Thus, while bargaining power of customers from the publishing industry may not be high in the short term, due to their dependency on paper as a raw material, their position may become stronger in the medium and long term, as the quality of paper from Russia and Asia increases. While there is certainly a dynamic trend towards internationalisation (see Section 2.2.3), this development is **not substantially linked to ICT** and e-business. Obviously, ICT facilitate the data exchange within different branches of internationally operating companies. In this sense, ICT is to some extent an enabler of international trade, which then increases the bargaining power of customers; but it would be extremely far-fetched to establish a causal relation between e-business and customer power in the P&P industry.

For companies in the **converting industries**, the bargaining power of customers tends to be much stronger. For example, a major factor determining the implementation of RFID in the packaging industry is customer demand (see Section 4.3.3). Particularly if customers are very large companies, for instance from retailing, the food, pharmaceutical or cosmetics industries, they can exert considerable pressure on packaging solution providers. The case study on *VPK Packaging* is a good example illustrating how new customer requirements forced the company to rethink its business processes.

---

[120] Unlike a 3PL, a 4PL is not asset based, but typically uses 3PLs to supply services to customers. Thus, a 4PL can be regarded as a process integrator on behalf of its customer, while not owning the warehouses or trucks.

[121] "Verlage hoffen auf Altkanzler", in: Der Spiegel, No. 51/2005, Dec. 2005, p. 93.

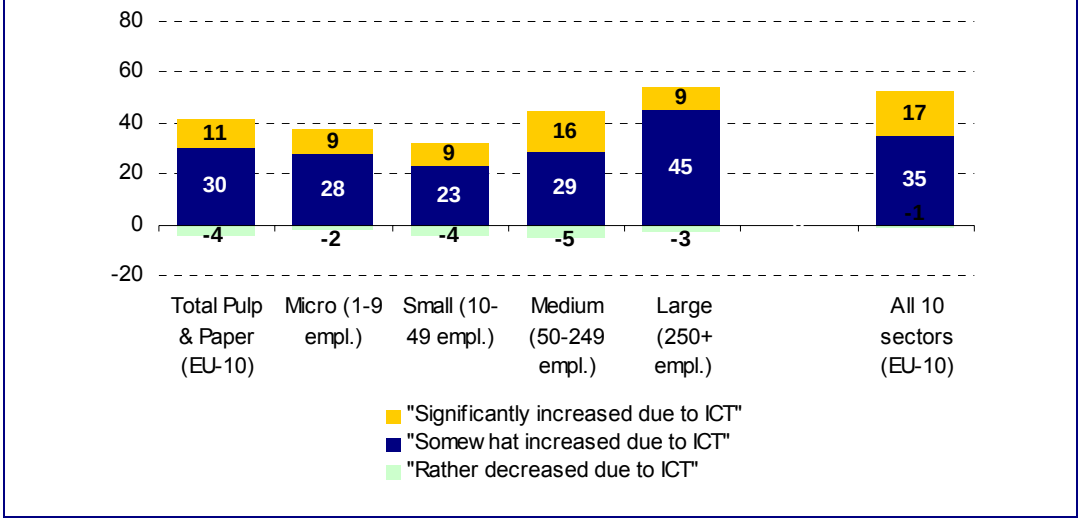
[122] CEPI points out that a reduction in capacity was not foreseen, but rather a consolidation in the development of new capacities, i.e. a slow-down in the capacity progress (comment received from Mr Bernard Lombard, 5 October 2006).

In these cases, however, the bargaining power of customers determines - at least to some extent – the adoption of ICT rather than the other way round, i.e. the bargaining power is not derived from by ICT.

Rivalry in the market

In-depth interviews with industry experts conducted for this study suggest that ICT and e-business only have a **moderate influence** on the intensity of rivalry in the market. On the other hand, the e-Business Survey 2006 indicates that P&P companies *do* perceive some influence of ICT on competition. While only about 10% of firms felt that competition had "*significantly increased due to ICT*", another 30% said that it had "*somewhat increased*". A very small share of companies said that competition had rather decreased due to ICT. Thus, about 40-45% said that they perceive "*at least some*" impact of ICT on competition. This is less than in most other sectors surveyed and below the average of the 10 sectors studied, where 17% see a significant impact (see Exhibit 5-9).

Exhibit 5-9: Perceived impact of ICT on competition in the industry



Base (100%): Companies using computers. N (for sector, EU-10) = 964. Weighting: Totals (for the sector and for all 10 sectors) are weighted by employment and should be read as "enterprises comprising …% of employment in the sector(s)". Figures for size-bands are in % of enterprises from the size-band.
Questionnaire reference: H6

Source: *e-Business W@tch* (Survey 2006)

These findings need to be put into perspective. Although the landscape of the European P&P industry has been rather stable for years (at least with regard to the major players), the **intensity of rivalry** in the market is quite **high**. Aggressive practices to 'steal' customers from competitors are not uncommon. Companies are aware that this rivalry **could increase even further** as Asian (and – to a lesser extent – Latin American) companies are expanding their operations to the European market (cf. Section 2.2.3 on international competition). Thus, many companies interviewed observed there was a *general increase* in competition; ICT might easily be named as a driver in a spontaneous interview situation.

However, closer reflection on drivers of the competition increase indicates that ICT is not among the main ones. Certainly, ICT will be intensively used by all parties involved; but as e-business activity among larger companies within the industry is quite mature, there is little opportunity for gaining competitive advantage for a single company. It will predominantly be other factors (such as developments in labour costs, strategic partnerships, capabilities for managing global logistics) which will shape competitive developments.

Moreover, a distinction has to be made in this context between the situation in the paper market and in the pulp market. In the **paper market**, production units in the EU are losing out on export markets in Asia and South America. This is why European companies are consolidating the development of new production capacities, and – in some cases – closing mills. There are contrasting views, however, on whether Asian or South America paper producers will make any large inroads into the EU. One line of argument is that they have enough expansion room in their own fast growing markets and will, therefore, not focus their expansion strategies into Europe or the USA. On the other hand, it cannot be excluded that Asian and South American companies temporarily increase their paper export to the EU at times when they expand their production capacity too fast in relation to their own regional demand increase.

For **pulp production**, on the contrary, imports are increasing, in particular from South America. A growing part of this trade flow is, and will continue to be, within EU-based companies which have built and are building capacity in South America. The main reason for this shift is the very low wood costs (about one quarter of the EU level). Imports from Russia have also reached significant size. The expansion of the Russian production capacity and their foreign investments have been relatively slow, but could pick up in the near future.

In **summary**, for European P&P manufacturers, the expansion strategies of competitors from emerging markets will probably be a very influential factor determining market developments and their own strategy in the next 10-15 years; but this development is not strongly induced or reinforced by ICT and e-business.

5.2 Policy implications

Introduction

e-Business developments can have implications for several policy areas. Relevant considerations made in this context can be grouped around two main overall objectives (see European Commission 2005b, p. 15):

- **Promote ICT adoption**: Policies aiming at accelerating the adoption of ICT and e-business activity among companies, particularly among SMEs. This is based on the assumption that ICT is a key driver of productivity and competitiveness.
- **Counteract ICT induced 'flaws' or market failure**: Policy interventions to counteract the areas where deployment of ICT in business leads to undesirable effects on the aggregate level.

With a view to the P&P industry, four areas are identified in this section where policy initiatives could be considered. Two of these areas concern the objective of **promoting ICT adoption** among the smaller and medium-sized P&P companies:

- **Large firms as multipliers**: The limited degree of B2B integration between large firms and their smaller business partners (see Sections 3.4 and 4.2) is a principal bottleneck for the exploitation of e-business opportunities. Innovative policy approaches use large firms (and possibly the public sector) as a vehicle to accelerate e-business adoption among their smaller supply firms. Policy makers could consider such an approach for the P&P industry in particular.
- **Solutions for SMEs**: Enterprise Resource Planning (ERP) systems are important for doing e-business in this industry (see Section 4.2). However, fully-fledged ERP packages are still not readily affordable for small companies. Nevertheless, there are signs of a strategy change among the respective software providers, now turning towards SMEs. Policy makers could, in fact, use some of their instruments to give this trend additional momentum.

The following two suggestions concern the objective to create a **favourable framework for e-business** rather than directly promoting the uptake of ICT:

- **Standards for e-business**: papiNet® and GUSI are parallel industry initiatives to establish e-standards (see Sections 3.3.1 and 4.1). This has implications for companies from the converting industry in particular and deserves a closer look. In this sense, it could be assessed whether there is a business case for integration and consolidation of technical components and semantic aspects of these standards.
- **Legal framework for e-invoicing**: The fast development of e-invoicing has led to some legal uncertainties with regard to taxation in certain EU Member States. Furthermore, the different approaches taken in Member States make it difficult to use e-invoicing in cross-border transactions. A consultation among stakeholders how to amend this situation seems opportune.

The arguments for raising these topics are elaborated in Sections 5.2.1 and 5.2.2. Exhibit 5-10 indicates that policy may not have the same **leverage** (right column) in each of these areas, i.e. the extent to which policy initiatives can have a direct impact differs.

However, this does not mean that an issue with a lower leverage becomes irrelevant; it may require a different approach to address it (e.g. multi-stakeholder initiatives).

Exhibit 5-10: Policy implications arising from e-business activity in the P&P industry

	Policy issues	Possible initiators	Policy leverage *low < > high*
1	Consider regional initiatives to use large companies as e-business multipliers by creating incentives for their smaller suppliers	Regional Governments National Governments Business support networks	
2	Promote development of affordable ERP modules for SMEs	European R&D programmes Industry associations	
3	Parallel development of two industry standards (papiNet®, GUSI): assess implications for enterprises and the business case for integration / consolidation	European Commission Industry associations	
4	Address legal uncertainties with regard to taxation issues in e-invoicing	National Governments (European Commission)	
The scale has a maximum of 3 in either direction – "low" ( ) or "high" ( )			

Source: *e-Business W@tch* (2006)

5.2.1 Accelerating ICT adoption among smaller P&P firms

Besides the large paper manufacturers, the P&P industries also comprise a large number of small and medium-sized businesses, particularly in the converting industries. Many of the smaller firms from this sector are characterised by a rather **conservative attitude towards ICT** and e-business. An earlier industrial analysis by the Enterprise and Industry DG of the European Commission (dating back to 2002) had already concluded that a 'wait and see' attitude was predominant among many of the smaller firms in the forest based industries as regards e-commerce.[123] Although ICT uptake has certainly increased since, and notwithstanding that there are many innovative small companies, this observation still holds true in the broad sense.

The **limited degree of B2B integration** between large firms and their smaller business partners is a principal bottleneck to a better exploitation of the potential of e-business in terms of process efficiency and cost savings. Indicative evidence is the low percentage of small firms – less than 10% – that has linked their ICT systems with suppliers or customers (see Sections 3.5.2 on "e-Integrated supply chains" and 3.6.2 on "e-Integration of marketing processes"). The use of SCM software is also very limited among smaller companies.

Against this background, policy could consider initiatives to **accelerate the adoption** of ICT systems among smaller companies. The following suggestions are possible leverage points for policy to achieve this objective.

[123] See website of the European Commission, DG Enterprise & Industry, Industry Sectors – Forest Based Industries: www.europa.eu.int/comm/enterprise/forest_based/e_commerce_en.html

Cooperative initiatives – create 'positive pressure' on small companies by using large firms as e-business multipliers

Small and medium-sized P&P firms are increasingly facing pressure to upgrade their ICT systems from customer industries (in particular from the large retail chains, the pharmaceutical and the food and beverages industries - see Section 4.3.3), as well as from large suppliers within their own sector (pulp and paper manufacturers).

An innovative policy initiative in the region of South Karelia has 'exploited' this bargaining power of large companies and of the public sector towards their SME suppliers to speed up ICT adoption (with a focus on e-invoicing) among SMEs. The strategic objective is to create a win-win situation for all parties involved while at the same time enhancing the competitiveness of the regional economy (see Policy example in box).

Policy example

The eInvoicing Initiative in South Karelia

The eInvoicing Initiative was launched in the beginning of 2004 by a number of regional stakeholders under the coordination of Kareltek Technology Centre in Lappeenranta, Finland (www.kareltek.fi). The policy focuses on assisting South Karelian SMEs in adopting ***e-Invoicing****. This application is seen as a relatively* ***easy-to-realise opportunity*** *for SMEs to save costs.*

A specific feature of this policy is that ***large companies*** *as well as the* ***public sector*** *of the region are involved* ***as "ePioneers"*** *who help speed up the diffusion of technology to smaller companies. This strategic approach stems from the fact that large firms and the public sector constitute the main recipients of invoices in the region. The participating ePioneers have agreed to contact their regional suppliers, mostly SMEs, and ask them to send their invoices electronically.*

Source: EC, DG Enterprise and Industry (2006). Impact Assessment of e-Business Policies. Study by Databank, empirica and IDATE. Available via the e-BSN website at www.e-bsn.org.

The **replication** of this approach in other regions could be considered. Policy has a role in such initiatives as a **coordinator and moderator** of the respective processes, bringing together the stakeholders and ensuring – as much as possible – conditions of 'fair play' among them.

The P&P industry could be a highly **suitable sector** for this approach, since a widely accepted e-standard for messaging (papiNet®) is already available. This standard can be used for different messages along the supply chain, e.g. Delivery Message, Purchase Order, Order Confirmation, Invoice, Call-Off (see Section 4.1.4). Therefore, once companies have learned to send invoices electronically using this standard, it might be only a small step to using it in other processes as well. Moreover, companies in the P&P industry have typically long-standing business relations with their customers and suppliers. This is a favourable environment for B2B process integration (as compared to sectors with a higher customer / supplier fluctuation).

Cooperative initiatives should involve not only the companies that trade with each other, but also third party service providers such as ICT companies (e.g. local representatives of software providers), banks and other payment solution providers. All of them are e-business stakeholders; the policy focus would basically be in **aligning the interests** of these stakeholders **towards a common goal**. Such initiatives could also be used to clarify certain open legal issues regarding e-invoicing (see Section 5.2.2).

Promote the development of affordable ERP modules for SMEs

The e-Business Survey 2006 confirmed that ERP systems are still mostly used by large and medium-sized enterprises. In the P&P industry, about 70% of large firms have an ERP system, about 45% of medium-sized ones, but less than 20% of small firms (see Section 3.4.1). Figures are similar for other manufacturing sectors, e.g. the food & beverages industry. As also illustrated by case studies presented in this report, ERP systems play an important role for B2B e-business processes in this industry (see *Stora Enso*, *ICT for Production Tracking, VPK Packaging*). The implementation of an ERP system constitutes a major turning point in every company, as this move has significant impact on work processes, and can require substantial investments.

ERP software providers have frequently been confronted with criticism that they have mainly catered for large firms, while not developing suitable packages for the requirements of smaller companies. The situation has changed over the past few years, since the large company market shows signs of saturation. This has forced software firms to make changes in their business strategy and increased competition in the segment of **SME oriented solutions**, with positive effects on prices.[124] Anecdotal evidence confirms this development, which might even trigger serious internal change processes in large software firms in the short and medium term.[125]

Depending on the particular type of solution proposed (e.g. packaged versus customised) and the extent of consultancy services necessary for successful implementation, the total actual investment for ERP solutions – even for packaged ones – can vary considerably. In principle, this should remain a market-driven development. However, a **faster deployment of ERP** systems among medium-sized and small enterprises would create a much broader base for e-business (not only in the P&P industry), and this could drive process efficiency and productivity gains in European enterprises. If more companies engage in advanced forms of e-business, a snowball effect may set in and aggregate effects on the industry level surge – cf. Mecalfe's law.[126] Against this background, mechanisms to enhance and accelerate this development could be considered.

---

[124] Current developments in the ERP systems market are also discussed in the *e-Business W@tch* Sector Study on the Food & Beverages Industry (2006), Section 4.1 ("Internal process automation"). This report is available at www.ebusiness-watch.org ('resources').

[125] See for instance: "SAP buhlt um den Mittelstand", in: Computerwoche, 10.3.2006, p. 1; "Kampf der Kulturen", in: WirtschaftsWoche, 20.3.2006, p. 58-64

[126] Metcalfe's law states that the value of a telecommunications network is proportional to the square of the number of users of the system (n^2). This can be applied to B2B e-business: if more companies engage in advanced forms of e-business, the increase in value and effects will be disproportionally high.

Policy could act as a facilitator and moderator in this process. A possible instrument could be specific actions in **ICT related R&D programmes** (such as the IST Programme within the European Union's Framework Programme), which co-finance R&D measures that are directed towards the development of SME-oriented business administration systems, or projects fostering the market deployment of such systems (e.g. by financing pilots). A multi-stakeholder approach would be necessary in such projects, ideally involving software providers and user industries' associations, thus representing both sellers and buyers of these systems.

5.2.2 Ensure a favourable framework for e-business

Research conducted for this study has not found evidence for ICT-induced market failure in the P&P industry which would call for policy intervention (see Section 5.1.2 – "Implications for industry structure"). However, there are a few e-business related issues which **deserve a closer look**, as they might create problems for firms in this sector.

The following two issues emerged, respectively, from the study of industry-specific e-standards (see Section 4.1) and from the analysis of ICT as a driver of process efficiency (see Section 4.2). They raise quite complicated questions which cannot be solved as part of this study. Nevertheless, policy could **follow up** on these issues in order to counteract undesirable effects for companies in this industry as potentially in other sectors studied by *e-Business W@tch* in 2006.

Assess the business case for integration and consolidation of industry standards for the P&P industry

As shown in Sections 3.3.1 ("Types of e-standards used") and 4.1 ("papiNet®"), there are parallel industry initiatives to establish standards for B2B trade within the P&P industry and in exchanges with the consumer goods industry.

- **papiNet®** is an industry initiative to develop a standard specifically for the forest and paper industries for automating business flows in this sector. It is currently used by 2-3% of firms, but more than 10% of large firms, and in particular by pulp and paper manufacturers (see Section 3.3.1).
- In parallel, the consumer goods industry promotes **GUSI** (Global Upstream Supply Initiative) as a standard for exchanges with their suppliers, which includes packaging suppliers (NACE 21.2).

papiNet® and GUSI therefore currently co-exist and respectively constitute the main standards for e-business (i.e. automated B2B processes) in the two sub-sectors of the P&P industry.

An interesting question for the future – which cannot be answered by this study – is whether there is a **business case for integration and consolidation** of common technical components and semantic aspects of the papiNet® and GUSI standards. Policy could consider exploring this question in more detail. There is a potential risk that the ICT systems of small companies from the converting industries have to comply with two independent industry specific standards, in response to pressure from paper suppliers on the one side and the consumer goods industry (customers) on the other.

Address legal uncertainty with regard to the use of e-signature

The issue discussed in the following paragraphs does not specifically concern the P&P industry and may not be valid in the same way for all European countries. However, it emerged in interviews conducted for this report and was raised by participants at e-business events; therefore the authors believe that it is relevant and deserves a closer look.

Since 2005, the use of **e-invoicing** has increased rapidly, as this application promises enterprises a fast return on investment, also for SMEs. Currently, firms accounting for about 25% of employment in the P&P industry say they receive e-invoices, and about 20% send e-invoices. Among SMEs, about 15% send or receive e-invoices (see Section 3.4.3).

However, there are still some unsolved issues with regard to the legal framework which could put companies at risk. There are many different ways of processing, sending, receiving and storing invoices electronically. For example, many companies send invoices as PDF documents by e-mail. However, this does not necessarily involve the use of digital signature; as a result, firms that accept such simple "e-invoices" take a high risk that they will be declared invalid for **pre-tax deduction** in future audits.

Technically, sending e-invoices in an XML-based standard is not much of an issue anymore. And, at first sight, this business transaction appears to be clearly regulated. The European Union adopted in 2001 Directive 2001/115/EC, often referred to as the "**E-Invoicing Directive**".[127] It stipulates that the authenticity of the origin and the integrity of contents must be safeguarded by means of either an advanced electronic signature as defined in the "**E-Signature Directive**" (1999/93/EC)[128] or by EDI.

The advanced electronic signature (see following Fact box) may be appended with a qualified certificate and created with a secure signature creation device, but this is not an obligation. Member States may opt for this when implementing the E-Invoicing Directive. The intention is to facilitate the use of e-invoicing in business, by introducing some uniform rules regarding VAT throughout the European Union. e-Invoices that comply with these stipulations shall be accepted by Member States.

[127] Council Directive 2001/115/EC of 20 December 2001 amending Directive 77/388/EEC with a view to simplifying, modernising and harmonising the conditions laid down for invoicing in respect of value added tax. Available at http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_015/l_01520020117en00240028.pdf (October 2006).

[128] Directive 1999/93/EC of the European Parliament and of the Council of 13 December 1999 on a Community framework for electronic signatures. Available at http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_013/l_01320000119en00120020.pdf (October 2006).

Fact box

Advanced vs. Qualified Electronic Signatures

The term "Advanced Electronic Signatures" stems from the EU E-Signature Directive (see Article 2, point 2). It is commonly understood to be a signature created within a rules-based Public Key Infrastructure (PKI).

Member States may, however, go beyond this by requiring that the advanced e-signature be based on a set of specific Europe-wide standards that prescribe specific hardware, policy, legal and operational components. This case is also known as a Qualified Electronic Signature.

However, notwithstanding the importance of this attempt to create a common framework, there are still legal as well as technical challenges. The situation is much more **complicated in practical terms**, mainly due to the following reasons:

- first, there is broad array of actual business practices and technologies used for e-invoicing (e.g. different software systems for sending and archiving invoices electronically or the widely used practice of simply e-mailing scanned invoices);
- second, Member States have taken different routes in their regulatory approach, with some of them making full use of the flexibility allowed by the e-Invoicing Directive, while others prefer a "light regulatory approach" (see following Fact box and draft report of the EC study "Benchmarking of existing national legal e-business practices."[129]).

The Nordic countries have a most critical attitude towards e-signature altogether. They regard it as a barrier rather than a facilitator of e-commerce. A business article on the e-Finland website (http://e.finland.fi – A Window to Finnish Information Society) summarises the challenge: *"Although standards on EDI and electronic signatures are available to a certain extent, too many issues on interoperability surround especially cross border electronic invoicing and VAT, and excessively diverse legislation on electronic signatures and VAT in Member States prevents business and administration from making adequate use of European harmonisation in electronic commerce."*

Thus, due to the lack of harmonisation, companies which trade internationally have to comply with different regulatory schemes across countries when using e-invoices. In order to be on the safe side, they have to adopt one of the following strategies: either they work intensively with one of the large auditors and consultancies in order to ensure compliance in all their trade relations, which is quite costly; or they try to comply with the strictest standard (qualified signature), which is for certain accepted in all countries, but is very demanding.

[129] "Benchmarking of existing national legal e-business practices from the point of view of enterprises (e-signature, e-invoicing and e-contracts)." Draft Final Report. November 2006. 150 pp. Study by Rambøll Management on behalf of the European Commission. http://ec.europa.eu/enterprise/ict/policy/legal/2006-bm-cr/ramboll-benchmarking-final-report-draft.pdf (Nov. 2006)

Fact box

Different legal frameworks for e-Invoicing in EU Member States

National governments regulate digital accounting on the basis of assumptions on the trustworthiness of electronic signatures and of data format(s). The regulatory frameworks differ between EU countries, as the following examples demonstrate.

Light regulation: Nordic countries

The Accounting Act in Nordic countries permits the use of electronic archives for both vouchers and accounts ledgers. The national VAT legislation in Finland does not include the requirement of electronic signatures for electronic invoices. No taxation problems stemming from electronic invoicing have been reported. The e-invoice operator or bank identifies business parties by their Business Identity Code (BID), a code given to businesses and corporations by the authorities.

The Finnish Information Society Development Centre (TIEKE), coordinator of the Finnish eInvoice Forum, supports this approach. They take the position that legislation should not include mandatory requirements that are too strict and argue with an analogy between paper and digital invoices: paper invoices do not have to be signed in Finland – and therefore the requirements for e-invoices should be similar.

For more information, see: TIEKE (www.tieke.fi/in_english/_ebusiness/einvoice)

Medium regulation: Austria

In Austria, e-invoices – to be valid – have to be signed by Advanced Electronic Signature. This excludes, in contrast to the situation in the Nordic countries, simple "e-invoices" which are sent as PDF or MS Word documents by e-mail without electronic signature, as well as those sent by fax (since 2006). Companies which accept such simple "e-invoices" risk that auditors will not accept them for pre-tax deduction.

Strict regulation: Germany

German law stipulates the use of Qualified Electronic Signature for e-invoices. This involves the use of hardware systems such as chipcard or smartcard. Invoices for individual orders can be 'bundled' and sent as a collective e-invoice (which only requires one signature), i.e. an invoice that refers to more than one purchase order.

In light of the still existing uncertainties, ETSI, the European Telecommunications Standards Institute, has established a Task Force on "Procedures for handling Advanced Electronic Signatures On Digital Accounting". The terms of reference for the Task Force lay down the reasons for implementing it: "*Actually the only way to keep accounting data without additional risks is to use paper, because for invoices and accounting data on paper there is a stabilized legal regulative framework. So the most likely adopters of electronic signatures are forced to passivity (paper) by compliance to national regulation or fear that digital data will be deemed as less reliable by national tax authorities, despite*

Article 5.2 of the Directive 1999/93/EC on Electronic Signatures" (ETSI 2006). ETSI concludes that "*a wider adoption of e-Invoicing is currently delayed by two factors: (a) lack of signature verification interoperability within the EU 25 Member States; (b) the need (in some of the EU 25 Member States) to keep accounting on paper."*

It would go too far for this report to dwell on the details. The bottom line is that companies, if they are not very careful, risk that invoices they have accepted may not qualify in a future tax audit for pre-tax deduction.

When it comes to technical details (e.g. how to store and archive invoices electronically), it is not always easy to apply the existing guidelines, i.e. whether national tax authorities will accept a certain method or technology in a future audit. A work-around currently practised by companies is to send a **paper-based collective invoice** to each customer at the end of the month, including all items previously invoiced electronically.[130] However, this is not an ideal solution, as it is a step backwards to the paper-based world. This uncertainty about the legal validity of certain types of e-invoices is a barrier to a possible increase in process efficiency and thus to productivity gains.

The way forward, and this is where European and / or national policy comes in, could be to **describe a number of concrete procedures** guaranteed to be valid, i.e. which have to be accepted by tax authorities in the Member States. For instance, a determination could be made that sending invoices as PDF attachments in a certain way complies with the e-Signature Directive (or not). This could create certainty for companies.

[130] This method is currently practised, for example, by *Mayr-Melnhof Cartonboard Group* (see case study in Section 4.2.3) in order to ensure that the company and its customers are on the safe side with regard to pre-tax deduction.

References

Publications, policy documents and research reports

"A Common Vision for Transforming the European Paper Industry". Vision paper signed by 50 NGOs at the "International Paper" trade fair, 27 Jan. 2006, Frankfurt. Available at www.taigarescue.org (accessed in April 2006)

BearingPoint (2005): "Beyond Compliance: The Future Promise of RFID", White Paper, published in May 2005. Available at www.rfidjournal.com and www.financialtech-mag.com/_docum/38_Documento.pdf

Carr, Nicholas (2003). "IT Doesn't Matter". In: Harvard Business Review, May 2003

CEN (2006): Approved resolution 218: comments of CEN/TC 225 on Chapter 4.3 Challenges in the Adoption of RFID Standards in the EU publication "Strengthening Competitiveness Through Production Networks".

CEPI (2006). "The European paper industry supports the European Commission in its efforts to create a better environment for companies to invest and create jobs in Europe" CEPI Position Paper No. T&C/01/006, Feb. 2006

CEPI (2005). European Pulp and Paper Industry. Annual Statistics 2005. Confederation of European Paper Industries. Available at www.cepi.org.

CEPI (2004). European Pulp and Paper Industry. Annual Statistics 2004 – Detailed Report. Confederation of European Paper Industries.

CEPI. Competitiveness and Europe's Pulp & Paper Industry: The State of Play.

Das, Raghu; Harrop, Peter (2006): RFID Forecasts, Players & Opportunities 2006 – 2016. Your complete guide to the RFID markets and opportunities. Study by IDTechEx. See www.idtechex.com/products/en/view.asp?productcategoryid=93 (April 2006)

"EPCglobal Developing HF Tag Standard", by Mary Catherine O'Connor, published at www.rfidjournal.com, 8 May 2006.

ETSI (2006): Terms of Reference for Specialist Task Force STF 305 (TB ESI) on "Procedures for handling Advanced Electronic Signatures On Digital Accounting (SODA)", ToR STF 305 (TC ESI). Version: 0.0.9., 24 March 2006.

European Commission, DG Enterprise and Industry (2006c). Benchmarking of existing national legal e-business practices from the point of view of enterprises (e-signature, e-invoicing and e-contracts). Study by Rambøll Management on behalf of the European Commission, Draft Final Report, November 2006. http://ec.europa.eu/enterprise/ict/policy/legal/2006-bm-cr/ramboll-benchmarking-final-report-draft.pdf (Nov. 2006)

European Commission, DG Enterprise and Industry (2006b). The European E-Business Report. 2005 edition. 4th Synthesis Report of the e-Business W@tch.

European Commission, DG Enterprise and Industry (2005a). Impact Assessment of e-Business Policies. Study by Databank, empirica and IDATE.

European Commission (2005b). "More Research and Innovation - Investing for Growth and Employment: A Common Approach". Communication from the Commission, COM(2005) 488 final.

European Environment Agency (2006): Paper and cardboard — recovery or disposal? Review of life cycle assessment and cost-benefit analysis on the recovery and disposal of paper and cardboard. EEA Technical report No 5/2006.

Eurostat (2006). European Business - Facts and figures - Data 1995-2004.

Gartner (2001). Collaborative Commerce – An Overview of the New C-Commerce Equation. Stanford: Gartner, Inc.

Huen, Christopher (2005). Juggling paper and postal costs. The magazine for magazine management, November 2005, Volume 34 Issue 11 p. 53-56 www.foliomag.com/viewMedia.asp?prmMID=5206

Jacobs, Edwin (2004): Electronic Invoicing: More than Just VAT Aspects. Web paper, published at www.arraydev.com/commerce/jibc/2004-12/Jacobs131204.HTM (April 2006)

Johnson, Jesse and Professor Chris Trimble (2001). Stora Enso North America (case study). Tuck School of Business at Dartmouth, 2001 http://mba.tuck.dartmouth.edu/pdf/2001-2-0001.pdf

"Kampf der Kulturen", in: WirtschaftsWoche, 20 March 2006, S. 58-64

Krcmar, Helmut (2005). Informationsmanagement. 4. Auflage. Berlin, Heidelberg, New York: Springer

"Lückenlos nachvollziehbar", In: eCommerce Magazin, 04/2006 (May/June), p. 46-48.

Merz, Michael (2001). Why standardisation pays off: cost/benefit analysis of the papiNet® project. Ponton Consulting, October 22, 2001

Merz, Michael. papiNet® and EFETnet: the secret of the success of two industry-wide interoperability projects. Ponton Consulting, March 2006. www.ponton-consulting.de/downloads/papiNet-EFETnet-Reference_2006-03-16_en.pdf

Nilsson, Lars J.; Larson, Eric D.; Gilbreath, Kenneth; Gupta, Ashok (1996). Energy Efficiency and the Pulp and Paper Industry. Based on a report presented at the ACEEE Summer Study on Energy Efficiency in Industry, "Partnership, Productivity, and Environment," held in Grand Island, New York, on August 1-4, 1995.

OECD (2001). Measuring ICT usage and electronic commerce in enterprises: proposals for a model questionnaire, DSTI/ICCP/IIS(2001)1/REV1, Paris.

OECD (2004). OECD work on measuring the Information Society, Paper submitted to the 19th meeting of the Voorburg Group on Services Statistics, held in Ottawa, Canada, September 27 to October 1, 2004.

Porter, Michael E. (1985). Competitive Advantage. New York: Free Press. Page references in quotations refer to the Free Press Export Edition 2004.

Porter, Michael E. (1980). Competitive Strategy. New York: Free Press. Page references in quotations refer to the Free Press Export Edition 2004.

"SAP buhlt um den Mittelstand", in: Computerwoche, 10 March 2006, p. 1

Steinhardt, David (2005). papiNet® e-standard offers chance to improve, integrate the value chain. Pulp & Paper. June 2005

Steinhardt, David (2005). Use papiNet® e-standard to improve processes. Pulp & Paper. March 2005

Stora Enso North America. From Theory to reality: using the papiNet® XML Standards: a case study by Stora Enso North America. Published by papiNet, May 1, 2002

"Verlage hoffen auf Altkanzler", in: Der Spiegel, No. 51/2005, Dec. 2005, p. 93.

Worrell, E., Cuelenaere, R.F.A., Blok, K. and Turkenburg, W.C. (1994). "Energy Consumption of Industrial Processes in the European Union", In: Energy 11 19 pp.1113-1129.

Interviews conducted for this report

Mr Art Coleman, Drybridge Consulting, papiNet® Technical Director, interviewed in April 2006.

Ms Ramona Jackson, Marketing Manager, Smart Packaging International Paper, interviews conducted in February 2005.

Mr Seppo Korhonen, Vice-President for IT, and Mrs Kirsi Viskari, Manager, Intelligent Solutions, New Business Innovations, Stora Enso Packaging Boards Division, interviewed in April 2006.

Mr Bernard Lombard, CEPI (exchanges by e-mail, comments on draft reports)

Mr Peter Lundin, Quality Manager, Rexcell Tissue and Airlaid AB , interviewed in April 2006.

Mr Erasmus Pachta, Manager Electronic Solutions & Services, Mayr-Melnhof Cardboard Group, interviewed in March 2006.

Mr Finn Solgård, Quality Manager, Nordic Paper, interviewed in October 2006.

Mr Jan Willaert, Manager Logistics, and Mr David Wellens, supply chain integrator, VPK Packaging Group, interviewed in September 2006.

Management representatives and IT consultants of a large manufacturer of paper head-quartered in Europe (names not to be disclosed).

Annex I: The e-Business Survey 2006 – Methodology Report

Background and scope

e-Business W@tch collects data relating to the use of ICT and e-business in European enterprises by means of representative surveys. The e-Business Survey 2006, which was the fourth survey after those of 2002, 2003 and 2005, had a scope of 14,081 telephone interviews with decision-makers in enterprises from 29 countries, including the 25 EU Member States, EEA and Acceding / Candidate Countries.[131] Interviews were carried out in March and April 2006, using computer-aided telephone interview (CATI) technology.

Questionnaire

The questionnaire is similar to those used in the previous surveys from 2002 to 2005 in order to ensure a basic continuity of the research approach. The module on ICT impact was substantially extended compared to 2005, in response to current policy interest, in exchange for some questions from other modules.

Some questions which were also used in previous surveys were slightly modified. The most important change in this context concerns questions on e-commerce: up to 2005, companies were asked whether they "purchase / sell online"; in 2006, companies were asked whether they "place / accept orders online". This is a more precise question, since the terms "purchasing" and "selling" leave it open whether ordered goods also have to be paid online in order to qualify for "online purchasing / selling".

Some specific topics were added or expanded in the questionnaire in order to reflect the latest e-business developments; examples are the new questions on the use of RFID and Voice-over-IP.

The questionnaires of all four surveys (2002, 2003, 2005, 2006) can be downloaded from the *e-Business W@tch* website (www.ebusiness-watch.org/about/methodology.htm).

Population

As in 2005, the survey considered only **companies that used computers**. Thus, the highest level of the population was the set of all computer-using enterprises which were active within the national territory of one of the 29 countries covered, and which had their primary business activity in one of the 10 sectors specified on the basis of NACE Rev. 1.1.

Evidence from previous surveys shows that computer use can be expected to be 99% or more in all sectors among medium-sized and large firms. Differences are more relevant, however, for micro and small enterprises, in particular in the food and beverages industry, the textile and footwear industries, construction and tourism. In these four sectors, 10-30% of micro enterprises and 4-15% of small firms (depending on the country and sector) do not use a computer.[132] This should be considered when comparing figures over the years, as figures either represent a percentage of "all companies" (as in 2002 and 2003)

[131] The EEA (European Economic Area) includes, in addition to EU Member States, Iceland, Liechtenstein and Norway. Acceding Countries with whom an Accession Treaty has been signed are Bulgaria and Romania; Candidate Countries, which are candidates for accession into the EU, are (as of September 2006) Croatia, the former Yugoslav Republic of Macedonia, and Turkey. In most of these countries, interviews and/or case studies were conducted.

[132] Non-computer users include typically small craft firms (textile, construction), bars, restaurants or pensions (in tourism), and small food producing companies.

or a percentage of "companies using computers" (as in 2005 and 2006). Differences are minimal, though, when figures have been weighted by employment.

The 10 sectors which were selected for the 2006 survey are extremely heterogeneous in terms of their size. Construction and tourism are by far the largest with about 1.5 million enterprises in each of the EU-25.[133] At the other end of the range is the consumer electronics industry with about 5,400 enterprises; this is a factor of about 280 between the largest and smallest sector. This imbalance has inevitably a substantial impact on weighting and thus on aggregate results, which are dominated by figures from construction and tourism.

Table 1: Population coverage of the e-Business Survey 2006

No.	NACE Rev. 1.1	Sectors covered	No. of enterprises in EU-25 *	No. of interviews conducted
1	DA 15 (most groups)	Food and beverages	282,000	1,709
2	DC 19.3	Footwear	13,700	980
3	DE 21	Pulp, paper and paper products	18,400	1,158
4	DL 30, 32.1+2	ICT manufacturing	31,800	1,687
5	DL 32.3	Consumer electronics	5,400	665
6	DM 35.11	Shipbuilding and repair	7,200	150
7	F 45.2+3 (selected classes)	Construction	1,546,000	2,655
8	H 55.1/3, I 63.3, O 92.33/52	Tourism	1,500,000	2,663
9	I 64.2	Telecommunication services	12,900	1,580
10	N 85.11	Hospital activities	(e) 13,000	834

* mostly based on Eurostat SBS, latest available figures

(e) = estimated on the basis of figures for the former EU-15 (no figures available for EU-25)

Sampling frame and method

No cut-off was made in terms of minimum size of firms. The sample drawn was a random sample of companies from the respective sector population in each of the countries, with the objective of fulfilling minimum strata with respect to company size class per country-sector cell. Strata were to include a 10% share of large companies (250+ employees), 30% of medium sized enterprises (50-249 employees), 25% of small enterprises (10-49 employees) and up to 35% of micro enterprises with less than 10 employees.

Samples were drawn locally by fieldwork organisations based on official statistical records and widely recognised business directories such as Dun & Bradstreet or Heins und Partner Business Pool (both used in several countries).

The survey was carried out as an enterprise survey: data collection and reporting focus on the enterprise, defined as a business organisation (legal unit) with one or more establishments.

Due to the rather small population of enterprises in some of the sectors, target quota, particularly in the larger enterprise size-bands, could not be accomplished in each of the countries. In these cases, interviews were shifted to the next largest size-band (from large to medium-sized, from medium-sized to small), or to other sectors.

[133] Construction (NACE Rev. 1.1 F 45) in total has about 2.3 million enterprises. The sub-sectors covered in 2006 (see Table 1) account for about 1.5 million out of these.

Fieldwork

Fieldwork was coordinated by the German branch of Ipsos GmbH (www.ipsos.de) and conducted in cooperation with its local partner organisations (see Table 2) on behalf of *e-Business W@tch*.[134]

The survey had a scope of 14,081 interviews, spread across the 29 countries and 10 industries covered. In 10 countries ("EU-10"), all 10 sectors were covered; in the other countries, selected industries were surveyed. In most countries, between 400 and 750 interviews were conducted. Pilot interviews prior to the regular fieldwork were conducted with 23 companies in Germany in February 2006, in order to test the questionnaire (structure, comprehensibility of questions).

Table 2: Institutes that conducted the fieldwork of the e-Business Survey 2006 and no. of interviews per country (#)

	Institute	# Int.		Institute	# Int.
BE	Ipsos Belgium, 1050 Brussels	400	MT	Misco International Ltd., Valetta VLT 04	101
CZ	Ipsos Czech Republic, Skolska 32/694, 110 00 Praha 1	750	NL	Ipsos Belgium, 1050 Brussels	400
DK	Vilstrup Research AS, 1360 Copenhagen	403	AT	Spectra Marktforschungs-gesellschaft m.b.H., 4020 Linz	400
DE	Ipsos GmbH, 23879 Mölln	800	PL	Ipsos Poland, 02-508 Warszawa	752
EE	Marketing and Public Opinion Research Centre SKDS, Riga LV-1010	314	PT	Ipsos Portugal, 1070-15 Lisbon	400
EL	Synovate Hellas, 15451 Athens	407	SI	GfK Gral-Iteo trazne raziskave d.o.o., 1000 Ljubljana	400
ES	Ipsos Eco Consulting, 28036 Madrid	754	SK	GfK Slovakia Ltd., 813 41 Bratislava 1	400
FR	Ipsos France, 75739 Paris	751	FI	Taloustutkimus Oy, 00510 Helsinki	752
IE	Landsdowne Market Research, Dublin 1	400	SE	GfK Sverige AB, 22100 Lund	400
IT	Demoskopea S.p.A., 00199 Roma	756	UK	Continental Research, London EC1V 7DY	750
CY	Synovate Cyprus, 2107 Nicosia	209		EEA and Acceding/Candidate countries	
LV	Marketing and Public Opinion Research Centre SKDS, Riga LV-1010	432	NO	Norstat Norway, 0159 Oslo	401
LT		404	BG	TNS BBSS Gallup Interbational, 1164 Sofia	400
LU	Ipsos GmbH, 23879 Mölln/20097 Hamburg	117	RO	Field Insights, Bucharest 2	440
HU	Szonda Ipsos, 1096 Budapest	772	TR	Bilesim International Research & Consultancy Inc. Turkey, 34676 Istanbul	400

[134] The survey was carried out under two different contracts. The survey in the six largest EU countries (DE, ES, FR, IT, PL, UK) was carried out as part of the e-Business W@tch contract between the European Commission and empirica GmbH; the survey in the other countries was carried out in parallel, but under a different contract (following an open call for tender for the "extended e-Business W@tch survey", issued in 2005).

Non response: In a voluntary telephone survey, in order to achieve the targeted interview totals, it is always necessary to contact more companies than just the number equal to the target. In addition to refusals, or eligible respondents being unavailable, any sample contains a proportion of "wrong" businesses (e.g., from another sector), and wrong and/or unobtainable telephone numbers. Table 3 shows the completion rate by country (completed interviews as percentage of contacts made) and reasons for non-completion of interviews. Higher refusal rates in some countries, sectors or size bands (especially among large businesses) inevitably raises questions about a possible refusal bias. That is, the possibility that respondents differ in their characteristics from those that refuse to participate. However, this effect cannot be avoided in any voluntary survey (be it telephone- or paper-based).

Table 3: Interview contact protocols: completion rates and non-response reasons (2006, examples)

		CZ	DE	ES	FR	HU	IT	NL	PL	FI	UK
1	**Sample (gross)**	5595	7763	7730	8686	21540	8533	4576	11054	3016	11821
1.1	Telephone number does not exist	283	1055	0	186	5545	717	349	2282	139	2663
1.2	Not a company (e.g. private household)	79	80	356	66	2076	89	219	681	34	324
1.3	Fax machine / modem	56	48	0	79	1120	61	28	53	4	130
1.4	Quota completed -> address not used	43	124	660	1939	1665	2154	1002	877	66	158
1.5	No target person in company	17	359	730	142	9	178	232	959	319	736
1.6	Language problems	9	18	0	25	0	1	36	0	41	20
1.7	No answer on no. of employees	2	1	10	13	6	8	1	19	1	0
1.8	Company does not use computers	48	47	158	250	279	314	235	460	28	51
1.9	Company does not qualify	134	330	103	156	0	113	47	813	49	215
	Sum 1.1 – 1.9	671	2062	2017	2856	10700	3635	2149	6144	681	4297
2	**Sample (net)**	4924	5701	5713	5830	10840	4898	2427	4910	2335	7524
2.1	Nobody picks up phone	1071	582	1645	6	1023	647	82	513	22	1898
2.2	Line busy, engaged	83	122	57	46	89	0	3	73	1	1
2.3	Answering machine	143	145	121	1315	1200	0	9	127	1	145
2.4	Contact person refuses	2080	1125	2553	131	2011	729	1653	2009	578	2523
2.5	Target person refuses	450	1865	202	1475	2776	642	113	280	405	1618
2.6	No appointment during fieldwork period	3	11	70	182	2571	384	112	150	50	376
2.7	Open appointment	295	953	35	1896	258	1041	21	763	459	51
2.8	Target person is ill / unavailable	2	31	0	0	0	13	0	29	2	32
2.9	Interview abandoned	43	67	271	29	108	686	34	176	15	130
2.10	Interview error, cannot be used	4	0	5	5	32	0	0	38	50	0
	Sum 2.1 – 2.10	4174	4901	4959	5085	10068	4142	2027	4158	1583	6774
3	**Successful interviews**	750	800	754	751	772	756	400	752	752	750
	Completion rate (= [3] / [2])	15%	14%	13%	13%	7,12%	15%	16,48%	15%	32%	10%
	Average interview time (min:sec)	19:19	18:46	17:29	19:39	17:14	16:43	19:00	23:44	20:19	20:16

Feedback from interviewers

No major problems were reported from the fieldwork with respect to interviewing (comprehensibility of the questionnaire, logical structure). The overall feedback from the survey organisations was that fieldwork ran smoothly and that the questionnaire was well understood by most respondents. The main challenge was the fulfilment of the quotas, which was difficult or impossible in some of the sectors, in particular among the larger size-bands. Some of the more specific remarks from fieldwork organisations, which point at difficulties encountered in the local situation, are summarised in Table 4.

Table 4: Comments by national fieldwork companies on their experience (2006, examples)

Country	Comments
Belgium	• The questionnaire was very clear. • Business-to-business (B2B) research (i.e. surveys on behalf of companies or authorities amongst companies) is often difficult when the questionnaire length is longer than 15 minutes; target persons often complained that they have no time for an interview during their normal work. • Positive reaction from respondents that the results can be found on the website.
Bulgaria	• Many companies (especially within the tourism sector) have outsourced their ICT operations. Therefore, it was sometimes difficult for respondents to understand the questions.
Czech Republic	• It was difficult to fulfil quotas in several sectors which are mainly represented by very small companies, often by one-person-companies (self-employed), many of which are not willing to do a relatively long interview. There was a high percentage of refusals among micro-companies.
Denmark	• Some technical terms (such as internet protocol, LAN, W-LAN, VPN, RFID, and EDI) were hard for interviewers and respondents to understand.
Finland	• The questionnaire was quite long and that is why there were more refusals than normal. • Smaller companies often refused to answer or interrupted the interview because they thought that they did not know enough about e-business. Respondents in the pulp and paper sector were especially not interested in this topic due to comparably low ICT usage.
Germany	• As with previous e-Business surveys carried out, fieldwork ran relative smoothly overall and the questionnaire was easy to understand and interesting for most of respondents. • Respondents from small companies often had difficulty when answering questions related to specific technical terms and applications. • Respondents reacted positively to the fact that the survey was carried out on behalf of the European Commission.
Greece	• There were several cases where companies have outsourced the IT support and thus there was no person to interview. • Respondents who were not IT specialists found some of the IT terminology difficult to understand.
Spain	• Fieldwork did not run as smoothly as expected due to several bank holidays occurring during the period, therefore it was difficult to reach the target persons. • IT professionals in large companies were the most available.
France	• In general, the fieldwork went without any problems and the questionnaire was understood by the respondents. • For some sectors, the lack of contact addresses was a serious problem. • For future surveys, the case concerning new companies which cannot answer the financial questions should be considered.
Hungary	• The cooperation level in this survey was similar to other telephone surveys among companies; but a problem was that many small companies use only one computer, and only for basic functions.
Ireland	• The B2B sector (not general population or household surveys) is very over researched in Ireland; hence there was a high level of refusals. • In Ireland more than 90% of businesses employ less than 9 employees so many companies do not have the need nor use for ICT.

Italy	• Many refusals among the smallest and/or family owned business, where only one PC is available and used more for personal reasons than for business. • Respondents often lost their patience because considering the low use of the PC in their business, they had to spend time on the phone always giving the same answers ("no, do not use …").
Latvia	• The main problem was the length of the questionnaire. Although the average interview length was 16 minutes and thus the shortest of all participating countries, surveys among companies with interviews lasting more than 15 minutes are generally not recommended in Latvia. • It was rather hard for IT managers to answer about budget, market shares and so on.
The Netherlands	• The questionnaire was very clear, so positive. • Business-to-business surveys are often difficult when the questionnaire length is longer than 15 minutes. • Secretaries/receptionists in the Netherlands are very well trained in refusing the transferring of a call.
Norway	• Interviewers experienced that many respondents / businesses did not wish to participate due to the topic of the survey. Main reason was that they did not feel competent, although they qualified from the results of the screening.
Poland	• There were some difficulties in getting an interview with computer/IT specialists. In many big companies they refuse to take time for an interview. • Many small companies did not understand some of the more technical terms.
Sweden	• The questionnaire was understood by most of the respondents.
UK	• Although some of the questions do appear to be quite technical, this did not prove a particular problem for respondents. • There was a very low universe of companies in certain quota cells. Given the limited sample available in some sectors, and the need to target a high proportion of large companies, a longer field period would probably have helped to maximize the number of complete interviews. • It is becoming increasingly difficult to secure interviews with IT/DP professionals, and we suspect that this situation will only worsen in the future.

Weighting schemes

Due to stratified sampling, the sample size in each size-band is not proportional to the population numbers. If proportional allocation had been used, the sample sizes in the 250+ size-band would have been extremely small, not allowing any reasonable presentation of results. Thus, weighting is required so that results adequately reflect the structure and distribution of enterprises in the population of the respective sector or geographic area. *e-Business W@tch* applies two different weighting schemes: weighting by employment and by the number of enterprises.[135]

- Weighting by employment: Values that are reported as employment-weighted figures should be read as "enterprises comprising x% of employees" (in the respective sector or country). The reason for using employment weighting is that there are many more micro-enterprises than any other firms. If the weights did not take into account the economic importance of businesses of different sizes in some way, the results would be dominated by the percentages observed in the micro size-band.
- Weighting by the number of enterprises: Values that are reported as "x% of enterprises" show the share of firms irrespective of their size, i.e. a micro-company with a few employees and a large company with thousands of employees both count equally.

[135] In the tables of this report, data are normally presented in both ways, except for data by size-bands. These are shown in % of firms within a size-band, where employment-weighting is implicit.

The use of filter questions in interviews

In the interviews, not all questions were asked to all companies. The use of filter questions is a common method in standardised questionnaire surveys to make the interview more efficient. For example, questions on the type of internet access used were only asked to those companies that had replied to have internet access. Thus, the question whether a company has Internet access or not serves as a filter for follow-up questions.

The results for filtered questions can be computed on the base of only those enterprises that were actually asked the question (e.g. "in % of enterprises with internet access"), but can also be computed on the base of "all companies". In this report, both methods are used, depending on the indicator. The base (as specified in footnotes of tables and charts) is therefore not necessarily identical to the set of companies that were actually asked the underlying question.

Statistical accuracy of the survey: confidence intervals

Statistics vary in their accuracy, depending on the kind of data and sources. A 'confidence interval' is a measure that helps to assess the accuracy that can be expected from data. The confidence interval is the estimated range of values on a certain level of significance. Confidence intervals for estimates of a population fraction (percentages) depend on the sample size, the probability of error, and the survey result (value of the percentage) itself. Further to this, variance of the weighting factors has negative effects on confidence intervals.

Table 7 gives some indication about the level of accuracy that can be expected for industry totals for the EU-10[136] (based on all respondents) depending on the weighting scheme applied. For totals of all-sectors (in the EU-10), an accuracy of about +/- 3 percentage points can be expected for most values that are expressed as "% of firms", and of about +/- 2 percentage points for values that are weighted by employment.

The confidence intervals for industry totals (EU-10) differ considerably depending on the industry and the respective value; on average, it is about +/- 5 percentage points (in both weighting schemes). Confidence intervals are highest for the shipbuilding and repair industry, due to the small number of observations, and because this sector is more sensitive to weights due to its structure (i.e. the dominance of large firms in a comparatively small population). Data for this industry are therefore indicative and cannot claim to have statistical accuracy.

The calculation of confidence intervals is based on the assumption of (quasi-) infinite population universes. In practice, however, in some industries and in some countries the complete population of businesses consists of only several hundred or even a few dozen enterprises. In some cases, literally each and every enterprise within a country-industry and size-band cell was contacted and asked to participate in the survey. This means that it is practically impossible to achieve a higher confidence interval through representative enterprise surveys in which participation is not obligatory. This should be borne in mind when comparing the confidence intervals of *e-Business W@tch* surveys to those commonly found in general population surveys.

[136] The EU-10 are composed of those countries in which all 10 sectors were covered by the survey. To ensure data comparability, only interviews from these countries are included in the aggregated "total" values. The EU-10 are: CZ, DE, ES, FR, IT, HU, NL, PL, FI, UK. These 10 countries represent more than 80% of the population and GDP of the EU.

Table5: Confidence intervals for all-sector and sector totals (EU-10)

		Confidence interval								
	Survey result	Weighted as "% of firms"			Weighted by employment			Unweighted		
All sectors (aggregate), EU-10	**10%**	**8.1%**	**-**	**12.3%**	**8.7%**	**-**	**11.5%**	**9.4%**	**-**	**10.6%**
Food and beverages	10%	**6.6%**	-	**14.8%**	**7.3%**	-	**13.6%**	**8.4%**	-	**11.9%**
Footwear	10%	**7.5%**	-	**13.2%**	**7.6%**	-	**13.1%**	**8.4%**	-	**11.9%**
Pulp and paper	10%	**7.8%**	-	**12.7%**	**7.5%**	-	**13.3%**	**8.5%**	-	**11.7%**
ICT manufacturing	10%	**7.9%**	-	**12.6%**	**7.6%**	-	**13.0%**	**8.7%**	-	**11.5%**
Consumer electronics	10%	**7.4%**	-	**13.4%**	**6.0%**	-	**16.2%**	**8.0%**	-	**12.4%**
Shipbuilding and repair	10%	**4.8%**	-	**19.7%**	**4.6%**	-	**20.4%**	**6.0%**	-	**16.1%**
Construction	10%	**6.9%**	-	**14.3%**	**7.6%**	-	**13.1%**	**8.3%**	-	**11.9%**
Tourism	10%	**6.6%**	-	**14.8%**	**6.8%**	-	**14.4%**	**8.3%**	-	**12.0%**
Telecommunication services	10%	**7.6%**	-	**13.1%**	**6.6%**	-	**14.8%**	**8.4%**	-	**11.9%**
Hospital activities	10%	**7.2%**	-	**13.7%**	**7.2%**	-	**13.8%**	**8.1%**	-	**12.3%**
All sectors (aggregate), EU-10	**30%**	**26.8%**	**-**	**33.4%**	**27.9%**	**-**	**32.2%**	**29.1%**	**-**	**30.9%**
Food and beverages	30%	**24.2%**	-	**36.6%**	**25.4%**	-	**35.0%**	**27.4%**	-	**32.8%**
Footwear	30%	**25.9%**	-	**34.5%**	**26.0%**	-	**34.3%**	**27.3%**	-	**32.8%**
Pulp and paper	30%	**26.4%**	-	**33.9%**	**25.8%**	-	**34.6%**	**27.6%**	-	**32.5%**
ICT manufacturing	30%	**26.5%**	-	**33.8%**	**26.1%**	-	**34.2%**	**27.9%**	-	**32.2%**
Consumer electronics	30%	**25.6%**	-	**34.8%**	**22.9%**	-	**38.1%**	**26.8%**	-	**33.5%**
Shipbuilding and repair	30%	**20.2%**	-	**42.0%**	**19.7%**	-	**42.8%**	**23.0%**	-	**38.1%**
Construction	30%	**24.7%**	-	**35.9%**	**25.9%**	-	**34.4%**	**27.3%**	-	**32.8%**
Tourism	30%	**24.2%**	-	**36.5%**	**24.6%**	-	**36.1%**	**27.3%**	-	**32.9%**
Telecommunication services	30%	**25.9%**	-	**34.4%**	**24.2%**	-	**36.5%**	**27.4%**	-	**32.7%**
Hospital activities	30%	**25.3%**	-	**35.2%**	**25.3%**	-	**35.2%**	**26.9%**	-	**33.4%**
All sectors (aggregate), EU-10	**50%**	**46.4%**	**-**	**53.6%**	**47.6%**	**-**	**52.4%**	**49.0%**	**-**	**51.0%**
Food and beverages	50%	**43.2%**	-	**56.8%**	**44.7%**	-	**55.3%**	**47.0%**	-	**53.0%**
Footwear	50%	**45.3%**	-	**54.7%**	**45.5%**	-	**54.5%**	**47.0%**	-	**53.0%**
Pulp and paper	50%	**45.9%**	-	**54.1%**	**45.2%**	-	**54.8%**	**47.3%**	-	**52.7%**
ICT manufacturing	50%	**46.0%**	-	**54.0%**	**45.5%**	-	**54.5%**	**47.7%**	-	**52.3%**
Consumer electronics	50%	**45.0%**	-	**55.0%**	**41.7%**	-	**58.3%**	**46.3%**	-	**53.7%**
Shipbuilding and repair	50%	**38.2%**	-	**61.8%**	**37.5%**	-	**62.5%**	**41.8%**	-	**58.2%**
Construction	50%	**43.9%**	-	**56.1%**	**45.4%**	-	**54.6%**	**47.0%**	-	**53.0%**
Tourism	50%	**43.3%**	-	**56.7%**	**43.7%**	-	**56.3%**	**46.9%**	-	**53.1%**
Telecommunication services	50%	**45.4%**	-	**54.6%**	**43.3%**	-	**56.7%**	**47.1%**	-	**52.9%**
Hospital activities	50%	**44.6%**	-	**55.4%**	**44.6%**	-	**55.4%**	**46.5%**	-	**53.5%**
All sectors (aggregate), EU-7	**70%**	**66.6%**	**-**	**73.2%**	**67.8%**	**-**	**72.1%**	**69.1%**	**-**	**70.9%**
Food and beverages	70%	**63.4%**	-	**75.8%**	**65.0%**	-	**74.6%**	**67.2%**	-	**72.6%**
Footwear	70%	**65.5%**	-	**74.1%**	**65.7%**	-	**74.0%**	**67.2%**	-	**72.7%**
Pulp and paper	70%	**66.1%**	-	**73.6%**	**65.4%**	-	**74.2%**	**67.5%**	-	**72.4%**
ICT manufacturing	70%	**66.2%**	-	**73.5%**	**65.8%**	-	**73.9%**	**67.8%**	-	**72.1%**
Consumer electronics	70%	**65.2%**	-	**74.4%**	**61.9%**	-	**77.1%**	**66.5%**	-	**73.2%**
Shipbuilding and repair	70%	**58.0%**	-	**79.8%**	**57.2%**	-	**80.3%**	**61.9%**	-	**77.0%**
Construction	70%	**64.1%**	-	**75.3%**	**65.6%**	-	**74.1%**	**67.2%**	-	**72.7%**
Tourism	70%	**63.5%**	-	**75.8%**	**63.9%**	-	**75.4%**	**67.1%**	-	**72.7%**
Telecommunication services	70%	**65.6%**	-	**74.1%**	**63.5%**	-	**75.8%**	**67.3%**	-	**72.6%**
Hospital activities	70%	**64.8%**	-	**74.7%**	**64.8%**	-	**74.7%**	**66.6%**	-	**73.1%**
All sectors (aggregate), EU-7	**90%**	**87.7%**	**-**	**91.9%**	**88.5%**	**-**	**91.3%**	**89.4%**	**-**	**90.6%**
Food and beverages	90%	**85.2%**	-	**93.4%**	**86.4%**	-	**92.7%**	**88.1%**	-	**91.6%**
Footwear	90%	**86.8%**	-	**92.5%**	**86.9%**	-	**92.4%**	**88.1%**	-	**91.6%**
Pulp and paper	90%	**87.3%**	-	**92.2%**	**86.7%**	-	**92.5%**	**88.3%**	-	**91.5%**
ICT manufacturing	90%	**87.4%**	-	**92.1%**	**87.0%**	-	**92.4%**	**88.5%**	-	**91.3%**
Consumer electronics	90%	**86.6%**	-	**92.6%**	**83.8%**	-	**94.0%**	**87.6%**	-	**92.0%**
Shipbuilding and repair	90%	**80.3%**	-	**95.2%**	**79.6%**	-	**95.4%**	**83.9%**	-	**94.0%**
Construction	90%	**85.7%**	-	**93.1%**	**86.9%**	-	**92.4%**	**88.1%**	-	**91.7%**
Tourism	90%	**85.2%**	-	**93.4%**	**85.6%**	-	**93.2%**	**88.0%**	-	**91.7%**
Telecommunication services	90%	**86.9%**	-	**92.4%**	**85.2%**	-	**93.4%**	**88.1%**	-	**91.6%**
Hospital activities	90%	**86.3%**	-	**92.8%**	**86.2%**	-	**92.8%**	**87.7%**	-	**91.9%**

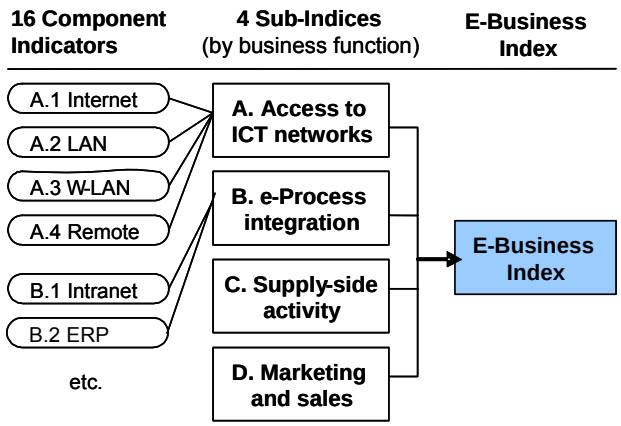
confidence intervals at α=.90

The e-Business Scoreboard 2006

The e-Business Scoreboard approach was developed by *e-Business W@tch* in 2004. It is a compound index that condenses data on ICT adoption and e-business activity, enabling comparisons across different sectors, countries or size-bands.

Conceptually, the e-Business Scoreboard owes a debt to the Balanced Scorecard (BSC) approach, which suggests that an organisation should be viewed from four perspectives, and that metrics (and targets) are to be defined for each perspective. Similarly, the e-Business Scoreboard looks at ICT use by enterprises from four (inter-related) perspectives. The Scoreboard consists of **16 component indicators** (see next page), which represent the metrics for these perspectives. Component indicators (CI) can be aggregated on several levels.

- First, CI can be aggregated into the 4 main **sub-indices** (with 4 CI each) that represent major application areas of e-business.
- Second, the four sub-indices can be further aggregated into 2 dimensions and, finally, into the overall "**e-Business Index**".



The e-Business Scoreboard takes into account the percentages (diffusion rates) from all sectors (size-bands, …) and show how a specific sector (size-band, …) differs from the all-sector-average. An index value is based on mean values and standard deviations. Thus, index values express the multiple of the standard deviation (1 or (-1)) for a specific sector and the selected indicator. 0 equals the mean value for all sectors (size-bands, …).

Indexes simplify multi-dimensional concepts. To correctly assess the validity and shortcomings of the Scoreboard and its overall index, the following notes should be taken into account:

- **Weighting**: Results are influenced by the selection of the underlying weighting scheme for component indicators. If employment-weighted figures are used, e-business activity in large firms is emphasized. If indicators are weighted by the number of enterprises (irrespective of their size), the situation in smaller firms is emphasized.
- **Component indicators**: The selection of component indicators may have a bias towards manufacturing activities, as some indicators can be more relevant for manufacturing than for service sectors (e.g. ERP use).
- **Relative comparison**: The Scoreboard results do not represent absolute measures of e-business activity, but depend on the respective set of sectors (or countries, ...) that are compared to each other, because figures express standard deviations from the *average* of the respective set.

Component indicators of the e-Business Scoreboard 2006

(Definitions for indicators weighted by employment)

A. ICT infrastructure and basic connectivity		
A.1	**Internet** connectivity	= the percentage of employees working in enterprises that are connected to the internet, with a supplementary indicator for the type of internet connection in terms of bandwidth. Enterprises that are connected with broadband (via DSL, cable, direct fibre or wireless broadband) are computed with a factor of 1.0, enterprises connected via analogue dial-up modem or ISDN with a factor of 0.5. The maximum value of 100 would be returned if all employees work in enterprises with broadband connections.
A.2	Use of **LAN**	= the percentage of employees from a sector working in enterprises that have connected computers with a Local Area Network (LAN).
A.3	Use of a **Wireless LAN**	= the percentage of employees working in enterprises which use a Wireless LAN.
A.4	**Remote access** to the company's computer network	= the percentage of employees from a sector working in enterprises where it is possible to access data from the company's computer system from a remote location.
B. Internal business process automation		
B.1	Use of an **intranet**	= the percentage of employees working in enterprises that use an intranet.
B.2	Use of an **ERP** system	= the percentage of employees working in enterprises that have implemented an ERP (enterprise resource planning) system.
B.3	Use of online technology to **track** working hours and/or production time	= the percentage of employees working in enterprises that use online technologies (other than e-mail) to track working hours and/or production times.
B.4	Companies sending or receiving **e-invoices**	= the percentage of employees working in enterprises that send and/or receive e-invoices.
C. Procurement and supply chain integration		
C.1	Companies placing >5% of their **orders to suppliers online**	= the percentage of employees working in enterprises saying that they place orders to suppliers online on the web or via other computer-mediated networks, for example via EDI based connections to their suppliers, and that these online orders account for at least 5% of their total orders.
C.2	Use of **specific ICT** solutions for e-procurement	= the percentage of employees working in enterprises that use specific IT solutions to support the selection of their suppliers and/or procurement processes.
C.3	Companies **linking their ICT system with suppliers**	= the percentage of employees that work in enterprises whose ICT system is linked with those of suppliers.
C.4	Companies managing **capacity and inventory online**	= the percentage of employees working in enterprises that that use technologies to manage capacity and inventory online.
D. Marketing and sales processes		
D.1	Use of **CRM** software systems	= the percentage of employees working in enterprises that use a CRM (customer relationship management) software to organise data about their customers electronically.
D.2	Companies receiving >5% of **orders from customers online**	= the percentage of employees working in enterprises saying that they accept orders from customers online on the web or via other computer-mediated networks, and that these online orders account for at least 5% of their total orders received.
D.3	Use of **specific ICT** solutions to support marketing and sales processes	= the percentage of employees working in enterprises that uses specific IT solutions to support marketing and sales processes.
D.4	Companies **linking their ICT system with customers**	= the percentage of employees that work in enterprises whose ICT system is linked with those of customers.

Annex II: Expanded Tables - Data by Country

General remarks on country data break-downs

The studies of *e-Business W@tch* have a sectoral perspective and focus, within sectors, on small and medium-sized enterprises; the analysis of geographic differences is not in the foreground. This decision on the study focus recognises that the e-business activities of a company are mainly determined by its business activity, the configuration of its value system and its size, rather than by the location of a firm.

For several reasons, country data on e-business adoption must be taken with a pinch of salt. They can reflect, at least to some extent, the structure of the economy rather than the overall e-maturity of firms. In Italy, for example, sectors dominated by small firms are much more prevalent than in other countries. Since large firms are more advanced in electronic business, aggregated data may point at a lower level of e-business activity in Italy. In contrast to Italy, the relative performance of French and Dutch companies is significantly better if the emphasis is on larger firms. These benchmarking results suggest that the digital divide between small and large firms could be quite pronounced in these countries.

It should also be considered that the average size of the companies interviewed in a sector can differ by country, depending on industry structure and the available business directories used for sampling. It cannot be excluded that some directories may have a bias towards smaller / larger firms. Although this effect is counteracted by weighting the answers (according to the representation of various company sizes in the population), it cannot be excluded that structural differences in the sample have an impact on results. Ideally, comparisons between different countries should only be made within the same size-band of firms, rather than on the aggregate level. However, at least within a given sector, the number of observations available does not allow a break-down by country *and* size-band.

Exhibit A2-1: Internet access and remote access to company network

	Companies with internet access		Companies with broadband internet access		Share of employees with internet access		Remote access to company network	
	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**99**	**94**	**80**	**68**	**n.a.**	**40**	**56**	**21**
Micro (1-9 empl.)		91		60	n.a.	49		9
Small (10-49 empl.)		99		77	n.a.	29		27
Medium (50-249 empl.)		100		80	n.a.	29		55
Large (250+ empl.)		100		86	n.a.	36		85
NACE 21.1 (p&p man.)	99	92	79	67	n.a.	33	61	25
NACE 21.2 (converting)	99	95	81	68	n.a.	42	54	20
Czech Republic	99	92	55	54	n.a.	63	61	30
Denmark *	100	100	98	86	n.a.	68	89	49
Germany	100	98	82	72	n.a.	37	49	36
Spain	98	95	86	78	n.a.	27	53	17
France	99	94	88	85	n.a.	38	54	27
Italy	98	92	80	64	n.a.	22	34	7
Lithuania *	100	100	96	77	n.a.	53	22	16
Hungary	99	92	78	65	n.a.	58	58	32
Netherlands *	100	100	59	80	n.a.	55	88	54
Poland	99	93	79	46	n.a.	61	50	14
Finland	100	98	100	88	n.a.	53	92	44
Sweden	100	100	92	84	n.a.	73	75	47
United Kingdom	100	98	72	71	n.a.	55	60	29
All 10 sectors (EU-10)	**95**	**93**	**76**	**69**	**n.a.**	**43**	**35**	**16**
Micro (1-9 empl.)		89		62		51		12
Small (10-49 empl.)		98		75		29		22
Medium (50-249 empl.)		99		83		33		43
Large (250+ empl.)		99		84		44		60
Base (100%)	firms using computers		firms using computers		firms with internet access		firms using computers	
N (for sector, EU-10)	964		964		924		964	
Questionnaire reference	A1		A3		A2		A5	
* Data only indicative due to low number of observations (N ~ 25-50).								

Source: *e-Business W@tch* (Survey 2006)

Exhibit A2-2: Demand for ICT skills and skills development

	Companies employing ICT practitioners		Regular ICT training of employees		Companies with hard-to-fill vacancies for ICT jobs in 2005		Companies using e-learning	
Weighting scheme:	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**35**	**16**	**29**	**12**	**3**	**1**	**21**	**13**
Micro (1-9 empl.)		10		6		0		11
Small (10-49 empl.)		17		16		1		13
Medium (50-249 empl.)		38		28		3		21
Large (250+ empl.)		50		49		8		27
NACE 21.1 (p&p man.)	37	23	33	19	2	1	28	9
NACE 21.2 (converting)	35	14	28	10	4	1	18	14
Czech Republic	35	12	56	19	0	0	43	22
Denmark *	65	25	51	30	11	1	58	27
Germany	27	17	30	16	6	3	14	10
Spain	24	15	31	12	1	1	16	6
France	36	13	14	10	0	1	13	5
Italy	45	23	16	12	0	0	14	7
Lithuania *	45	43	30	12	3	10	32	19
Hungary	23	4	15	5	1	5	1	9
Netherlands *	65	32	56	35	5	3	61	22
Poland	35	8	26	7	2	0	16	28
Finland	72	28	52	17	6	1	26	16
Sweden	89	53	37	21	0	0	29	15
United Kingdom	27	14	28	12	3	1	30	21
All 10 sectors (EU-10)	**27**	**14**	**22**	**13**	**2**	**1**	**21**	**11**
Micro (1-9 empl.)		12		9		2		12
Small (10-49 empl.)		15		16		0		11
Medium (50-249 empl.)		29		28		2		19
Large (250+ empl.)		59		41		6		35
Base (100%)	firms using computers		firms using computers		firms using computers		firms using computers	
N (for sector, EU-10)	964		964		964		964	
Questionnaire reference	B1		B4		B2		B5	
* Data only indicative due to low number of observations (N ~ 25-50).								

Source: *e-Business W@tch* (Survey 2006)

Exhibit A2-3: Companies ordering supply goods online

	Place orders online		Place 1-25% of orders online		Place more than 25% of orders online		Use specific ICT solutions for e-sourcing	
	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**59**	**49**	**81**	**75**	**19**	**25**	**14**	**8**
Micro (1-9 empl.)		42		70		30		5
Small (10-49 empl.)		55		82		18		8
Medium (50-249 empl.)		62		75		25		13
Large (250+ empl.)		68		91		9		30
NACE 21.1 (p&p man.)	52	42	87	86	13	14	10	5
NACE 21.2 (converting)	62	50	80	73	20	27	17	8
Czech Republic	61	45	56	63	44	37	18	9
Denmark *	93	78	91	73	9	27	29	4
Germany	75	64	88	85	12	15	13	8
Spain	45	38	74	75	26	25	26	17
France	48	58	82	87	18	13	11	12
Italy	37	29	91	87	9	13	3	1
Lithuania *	63	58	89	68	11	32	20	32
Hungary	46	40	80	79	20	21	29	7
Netherlands *	92	77	73	70	27	30	12	8
Poland	78	63	59	52	41	48	14	9
Finland	48	69	99	73	1	27	39	19
Sweden	84	64	80	67	20	33	15	7
United Kingdom	69	60	81	74	19	26	13	7
All 10 sectors (EU-10)	**57**	**48**	**74**	**75**	**26**	**25**	**16**	**9**
Micro (1-9 empl.)		44		73		27		7
Small (10-49 empl.)		54		80		20		10
Medium (50-249 empl.)		60		76		24		16
Large (250+ empl.)		68		75		25		29
Base (100%)	firms using computers		firms placing orders online		firms placing orders online		firms using computers	
N (for sector, EU-10)	964		511		511		964	
Questionnaire reference	E1		E3		E3		E7	
* Data only indicative due to low number of observations (N ~ 25-50).								

Source: *e-Business W@tch* (Survey 2006)

Exhibit A2-4: Companies receiving orders from customers online

	Accept orders from customers online		Receive more 1-25% of orders online		Receive more than 25% of orders online		Use specific ICT solutions for e-selling	
	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
Pulp & Paper (EU-10)	**26**	**28**	**78**	**77**	**22**	**23**	**19**	**11**
Micro (1-9 empl.)		30		75		25		9
Small (10-49 empl.)		26		80		20		12
Medium (50-249 empl.)		24		77		23		15
Large (250+ empl.)		26		84		16		24
NACE 21.1 (p&p man.)	18	19	77	81	23	19	20	14
NACE 21.2 (converting)	29	31	78	73	22	27	18	11
Czech Republic	41	35	*	*	*	*	13	10
Denmark **	60	41	*	*	*	*	61	14
Germany	25	29	*	*	*	*	11	10
Spain	12	13	*	*	*	*	20	10
France	20	21	*	*	*	*	18	13
Italy	22	21	*	*	*	*	5	7
Lithuania **	27	25	*	*	*	*	31	25
Hungary	25	45	*	*	*	*	16	14
Netherlands **	13	17	*	*	*	*	40	18
Poland	50	54	*	*	*	*	18	12
Finland	46	42	*	*	*	*	52	20
Sweden	23	25	*	*	*	*	8	13
United Kingdom	21	28	*	*	*	*	16	16
All 10 sectors (EU-10)	**35**	**25**	**73**	**75**	**27**	**25**	**18**	**9**
Micro (1-9 empl.)		23		79		21		6
Small (10-49 empl.)		26		76		24		12
Medium (50-249 empl.)		29		75		25		16
Large (250+ empl.)		26		74		26		27
Base (100%)	firms using computers		firms accepting orders online		firms accepting orders online		firms using computers	
N (for sector, EU-10)	964		271		271		964	
Questionnaire reference	F4		F6		F6		F10	

* Data are not displayed because the number of observations in individual countries is too low for this indicator.
** Data only indicative due to low number of observations (N ~ 25-50).

Source: *e-Business W@tch* (Survey 2006)

Annex III: Glossary of Technical Terms

Term	Definition[137]
Access	The ability to retrieve information and to communicate online through the use of digital information and communication technologies.
AS2	Applicability Statement 2
B2B	Business to Business. Electronic transactions between companies.
B2B e-marketplace	Electronic trading platforms on the internet where companies can sell and/or buy goods or services to/from other companies. They can be operated by a single buyer or seller or by a third party. Many marketplaces are industry-specific. Some marketplaces require registration and membership fees from companies that want to conduct trade on them.
B2C	Business to Consumer. Electronic transactions, between companies and consumers.
Bandwidth	The physical characteristic of a telecommunications system that indicates the speed at which information can be transferred. In analogue systems, it is measured in cycles per second (Hertz), and in digital systems in binary bits per second. (Bit/s).
Broadband	High bandwidth internet access. In *e-Business W@tch* reports, broadband is defined as the capacity to transfer data at rates of 2 Mbit/s (megabits per second) or greater.
CEPI	Confederation of European Paper Industries (www.cepi.org)
Channel	In communications, a physical or logical path allowing the transmission of information; the path connecting a data source and a receiver.
CIDX	Chemical Industry Data Exchange (CIDX) (www.cidx.org)
CRM	Customer Relationship Management. Software systems that promise the ability to synthesize data on customers' behaviour and needs and thus to provide a universal view of the customer.
Dial-up	The process of establishing a temporary connection (to the internet) via the switched telephone network.
Digital signature	An electronic signature that can be used to authenticate the identity of the sender of a message or the signer of a document, and to ensure that the original content of the message or document that has been sent is unchanged. Digital signature usually refers specifically to a cryptographic signature, either on a document, or on a lower-level data structure.
DRM	Digital rights management. DRM is a system of IT components and services, along with corresponding law, policies and business models, which strive to distribute and control intellectual property and its rights. Product authenticity, user charges, terms-of-use and expiration of rights are typical concerns of DRM.
DSL	Digital Subscriber Line. A family of technologies generically referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as "twisted copper pairs") into high-speed digital lines, capable of supporting advanced services. ADSL (Asymmetric Digital Subscriber Line), HDSL (High data rate Digital Subscriber Line) and VDSL (Very high data rate Digital Subscriber Line) are all variants of xDSL
EAI	Enterprise-Application-Integration
eBMS	ebXML Message Service Specification
e-Business	Electronic business. The *e-Business W@tch* uses the term "e-business" in the broad sense, relating both to external and to company internal processes. This includes external communication and transaction functions, but also ICT supported flows of information within the company, for example, between departments and subsidiaries.

[137] Some of the definitions in this glossary are derived from or based on definitions suggested by Whatis?com, a leading online ICT encyclopaedia and learning centre. See http://whatis.techtarget.com.

ebXML	Electronic business using XML. A proven framework and unified set of internationally agreed upon technical specifications and common XML semantics designed to facilitate global trade.
e-Commerce	Electronic commerce. As distinct from the broader concept of e-business, e-commerce refers to external transactions in goods and services between companies (B2B), between companies and consumers (B2C), or between companies and governments (B2G) and may therefore be seen as a subgroup or component of e-business activities.
EDI	Electronic Data Interchange. A way for unaffiliated companies to use networks to link their businesses by using a common technical standard for exchanging business data. While electronic mail between companies is common, electronic data interchange passes bigger bundles that replace large paper documents such as bills and contracts.
EDIFACT	Electronic Data Interchange For Administration Commerce and Transport. See UN/EDIFACT
EDM	Electronic Document Management. The management of different kinds of documents in an enterprise using computer programmes and storage devices. An EDM system allows an enterprise and its users to create a document or capture a hard copy in electronic form, store, edit, print, process, and otherwise manage documents.
EFET	European Federation of Energy Traders (http://www.efet.org)
eFIDS	e-Forestry Industry Data Standards
e-Invoicing	Electronic invoicing. A business-to-business transaction in which invoices are generated, delivered (and normally paid) electronically, replacing the equivalent traditional paper-based invoicing processes.
e-Learning	e-Learning means supporting training with learning material in electronic format, for example material that is available on the intranet or the internet. e-Learning applications can be used for ICT-related training, but also for sector-specific or even company-specific training content.
ERP	Enterprise Resource Planning. A software system that helps to integrate and cover all major business activities within a company, including product planning, parts purchasing, inventory management, order tracking, human resources and finance.
EU	European Union
Extranet	A network using internet protocols that allows external organisations (for example customers or suppliers) access to selected internal data. Essentially it is an Intranet which gives external users restricted access (often password protected) to information through the firewall.
FDA	Food and Drug Administration
FENIX	Stora Enso's European ERP system
Firewall	A firewall is a set of related programmes that protects the resources of a private network from users from other networks. The term also refers to the security policy that is used with the programmes.
GCA	Graphic Communications Association
GIE	Groupement d'Intérêt Economique
ICT	Information and communication technology. ICT includes networks, computers, other data processing and transmitting equipment, and software. The application of ICT in business processes leads to e-business.
iDOC	Intermediate document
Information security	Measures taken to protect information systems against unauthorised use and attacks
Internet	The world's largest computer communication system, with an estimated 700 million users worldwide.[138] The internet is a loose confederation of principally academic and research computer networks. It is not a network but rather the interconnection of thousands of separate networks using a common language.

[138] Cf. Global Internet Statistics by Global Reach, www.glreach.com

Interoperability	The technical features of a group of interconnected systems (includes equipment owned and operated by the customer which is attached to the public telecommunication network) which ensure end-to-end provision of a given service in a consistent and predictable way.
Intranet	An internal internet, that is an internal network running using TCP/IP, which makes information available within the company. Most Intranets are connected to the internet, and use firewalls to prevent unauthorised access.
ISDN	Integrated Services Digital Network. An international telecommunications standard for transmission of voice and data over dial-up lines running at 64 Kbit/s (kilobits per second). It allows sharing of multiple devices on a single line (for example, phone, computer, fax).
IT	Information technology. IT includes hardware (computers, other data processing and transmitting equipment) and software.
KM	Knowledge Management. ICT solutions that support enterprises in systematically gathering, organising, sharing, and analysing their knowledge in terms of resources, documents, and people skills. Knowledge management software typically involves data mining and some method of operation to push information to users.
LAN	Local Area Network. The most common way of connecting computers in a small area (typically inside a building or organisation) for sharing databases and communication facilities. The two most common versions are Ethernet and Token Ring. Implementation is based on coaxial cables or plain wires. Speed achieved ranges from 10 Mbps to 100 Mbps.
Leased line	A private communication channel leased from the common carrier. It is usually a dedicated fixed-route link (e.g. point-to-point frame relay).
m-Commerce	Mobile commerce. E-commerce that takes place using mobile connection devices and through data transmission via technical standards for mobile communication.
Micro enterprise	A company with fewer than 10 employees.
Modem	Modulator/Demodulator. A device that modulates outgoing digital signals from a computer or other digital device to analogue signals suitable to be transmitted through a conventional telephone line (copper twisted pair telephone). The reverse procedure takes place for incoming signals.
MRO goods	Maintenance, repair and operating goods. Supplies which companies need to maintain their operations, for example office supplies, in contrast to "direct production goods" which are components of the goods and services the company produces.
NA	North America
NACE	Nomenclature Générale des Activités Economiques dans les Communautés Européennes; Classification of Economic Activities in the European Community
NPTA	National Paper Trade Association
OOS	Open source software refers to computer software under an open source license. An open-source license is a copyright license for software that makes the source code available and allows for modification and redistribution without having to pay the original author.
Processes	Business processes are operations that transform the state of an object or a person. This can, for example, be an order placed via the internet. Ordering an object or a service creates a liability for the supplier to deliver, and initiates the transfer of property rights from one entity to another. The electronic handling of processes is likely to speed them up and to introduce new processes in the realisation of the same transaction.
PLM	Product lifecycle management. The process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. PLM software helps companies effectively and efficiently innovate, for example by managing descriptions and properties of a product starting from conception and development.
Remote access	The ability of a company computer network's transmission points to gain access to a computer at a different location.

RFID	Radio Frequency Identification. A wireless technology which is used to uniquely identify an object, animal, or person. RFID is coming into increasing use in industry as an alternative to the bar code. The advantage of RFID is that it does not require direct contact or line-of-sight scanning.
S/MIME	Secure/MIME, a version of the Multipurpose Internet Mail Extensions, a specification for formatting graphics, video and audio files so that they can be sent over the Internet.
SCM	Supply Chain Management. Software that helps businesses to match supply and demand through integrated and collaborative planning tools.
Sector	Sectors of the economy with comparable business activities. These constitute the main research unit of the *e-Business W@tch*. Aggregated information at the industry level is used to document the diffusion of activities within the industries as well as the overall importance of the observed phenomena for changes in the economy as a whole. The definition of sectors follows NACE Rev.1.1 classifications.
Secure server technology	Secure server technology means that data exchange between computers is based on certain technical standards or protocols, for example "Secure Sockets Layer" (SSL).
SIGs	Segment Implementation Groups
SME	Small and medium-sized enterprises with 0-249 employees. To be classified as an SME, an enterprise has to satisfy the criteria for the number of employees and one of the two financial criteria, i.e. either the turnover total or the balance sheet total. In addition, it must be independent, which means less than 25% owned by one enterprise (or jointly by several enterprises) falling outside the definition of an SME or a micro-enterprise, whichever may apply. The thresholds for the turnover and the balance sheet total will be adjusted regularly, to take account of changing economic circumstances in Europe.
SOAP	XML based lightweight protocol for exchange of information in a decentralized, distributed environment (http://www.w3.org/TR/2000/NOTE-SOAP-20000508/)
SSL	Secure Sockets Layer. A commonly-used protocol for managing the security of a message transmission on the internet. SSL has recently been succeeded by Transport Layer Security (TLS), which is based on SSL.
Standard	A standard is a technical specification approved by a recognised standardisation body for repeated or continuous application, with which compliance is not compulsory.
Transaction	Electronic transactions can be subdivided into several steps, each of which initiates a process. There are pre-sale (or pre-purchase) phases, sale and after-sale phases. Typically a transaction starts with information gathering, price and quality comparisons and possibly pre-sale negotiations. During the sale phase contracting and delivery are the core processes, and payment is the final stage of this phase. After-purchase transaction stages comprise customer service, the administration of credit payments and the handling of returns as well as marketing activities preparing for the next purchase.
UMTS	Universal Mobile Telecommunications Service. A third-generation (3G) digital standard for mobile communication, enabling packet-based transmission of voice, text and video at data rates up to 2 megabits per second (Mbps).
UN/EDIFACT	United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport http://www.unece.org/cefact/
Value added	Gross output minus intermediate inputs. It is valued at producers' prices and includes all indirect taxes, but excludes VAT and subsidies.
VMI	Vendor Managed Inventory
VoIP	Voice over Internet Protocol (IP). The use of telephony services over internet networks, by means of digitised voice transfer technology.
VPN	Virtual Private Network. A way to use a public telecommunication infrastructure, such as the internet, to provide remote offices or individual users with secure access to their organisation's network.
WAN	Wide Area Network. A network allowing the interconnection and intercommunication of a group of computers over a long distance.
WAP	Wireless Application Protocol. A communication protocol for delivering data over mobile telephone systems, allowing cellular phone sets and other mobile hand-set systems to access WWW pages and other wireless services.

Website	A related collection of World Wide Web files that includes a beginning file called a home page.
Wi-Fi	Wireless fidelity. A popular term for a high-frequency wireless local area network (W-LAN). Wi-Fi technology is rapidly gaining acceptance as an alternative or complementary infrastructure to a wired LAN.
W-LAN	Wireless Local Area Network. An implementation of a LAN with no physical wires, using wireless transmitters and receivers. It allows a mobile user to connect to a LAN or WAN through a wireless (radio) connection. A standard, IEEE 802.11, specifies the technologies for wireless LANs.
WoodX	Mechanical Wood Processing Industry standards
WWW	World Wide Web. The collection of pages in HTML format which reside on web-servers. Although WWW and the internet are different, the terms are increasingly becoming interchangeably used.
XBITS	XML Book Industry Transaction standards
XML	Extensible Mark-up Language. A standard to describe the contents of a page or file. XML is a way to create common information formats and share both the format and the data on the World Wide Web, intranets, and elsewhere.

Contact information:

European
Commission

Enterprise and Industry Directorate-General
Unit D4 "Technology for Innovation /
ICT industries and e-Business"
1040 Brussels, Belgium

Fax: (32-2) 2967019
e-Mail: entr-innov-ict-ebiz@ec.europa.eu
Web: http://ec.europa.eu/enterprise/index_en.htm

e-Business W@tch
c/o empirica GmbH
Oxfordstr. 2
53111 Bonn, Germany
e-Mail: info@ebusiness-watch.org
Web: www.ebusiness-watch.org