



The European
e-Business
Market Watch
Sector Report
No. 3/July 2002

3

*e-business
w@tch*



ICT & e-Business in the Transport Equipment Manufacturing Industry

eEurope
Go Digital



European Commission
Enterprise Directorate General
e-Business, ICT Industries
and Services

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 *DIW Berlin – German Institute for Economic Research* – on behalf of the European Commission, Enterprise Directorate General. It is part of a deliverable in the context of the "European e-Business Market Watch" (short name: *e-Business W@tch*), which is implemented by empirica GmbH in co-operation with DIW Berlin and Databank Consulting on behalf of the European Commission based on a service contract running from January 2002 until June 2003.

Contact



empirica GmbH
Oxfordstr. 2
D-53111 Bonn
info@empirica.com



DIW Berlin
Königin-Luise-Str. 5
D-14195 Berlin
pkoefflinger@diw.de



Databank Consulting spa
Corso Italia 8
I-20122 Milan
dbcons@dbcons.it

Rights Restrictions

Any reproduction or republication of this report as a whole or in parts without prior authorisation is strictly prohibited.

Bonn / Brussels, June 2002

Table of Contents

Introduction	5
Manufacture of Transport Equipment: Sector Profile & e-Business.....	7
1 Economic profile.....	7
1.1 Definition and structure of the sector.....	7
1.2 Regional distribution of the transport equipment production	10
1.3 Employment, productivity and labour costs.....	12
1.4 Size class distribution.....	16
1.5 Trade balance.....	16
1.6 Sector-specific issues and challenges.....	18
2 Usage of ICT & e-business.....	24
2.1 General e-business trends	24
2.2 Government and the military as important customers.....	26
2.3 Impact of e-business	30
2.3.1 Impact on product development.....	31
2.3.2 Impact on procurement and supply.....	34
2.3.3 Impact on customer information, product order and delivery.....	38
2.3.4 Impact on human resource management.....	40
2.4 Differences in e-business adoption	41
2.5 Opportunities and risks.....	44
2.6 Barriers and enablers	45
2.7 Case studies.....	47
2.7.1 Covisint.....	47
2.7.2 E-Procurement at EADS.....	49
2.8 Scoreboard of basic e-commerce indicators	51
2.8.1 Forthcoming: Results of the European e-Business Survey	51
2.8.2 The Eurostat survey on e-commerce.....	53
2.8.3 The e-readiness of industry sectors.....	56
3 Summary and conclusions – possible policy implications.....	61
3.1 Summary of main findings.....	61
3.2 Policy implications.....	62
European-Level Industry Associations	64
References.....	65

Index of tables and figures

Tables

Table 1-1: Structure of the transport equipment sector in the EU by kind of activity (2001)	9
Table 1-2: Production of the automotive industry in EU 13 countries (2000)	10
Table 1-3: Production of other transport equipment (NACE 35) in EU 14 countries (2001)	11
Table 1-4: Employment, productivity and labour costs in the automotive industry (NACE 34) in the EU 13 (2000)	14
Table 1-5: Employment, productivity and labour costs in the other transport equipment sector (NACE 35) in the EU-14 (2001)	15
Table 1-6: Size class distribution in the transport equipment sector	16
Table 1-7: Exports, imports and trade balance for transport equipment (NACE 34+35) (1999)	17
Table 1-8: Foreign trade with transport equipment with non-EU countries in m Euro (1999)	18
Table 2-1: Planned E-Commerce Budgets for German Automotive Suppliers	26
Table 2-2: Major shipyards involved in naval shipbuilding in Europe	28
Table 2-3: Indicators of the European e-Business Survey	52
Table 2-4: Basic e-commerce indicators for industries	54
Table 2-5: Sector benchmarking for Manufacturing transport equipment (best = 100)	55
Table 2-6: e-Commerce Typology: six stages of sophistication	57
Table 2-7: E-Commerce Typology: the e-readiness of industry macro-sectors (% of establishments)	58
Table 2-8: Use of specialised B2B marketplaces on the internet (% of enterprises using them)	60

Figures

Figure 1-1: European transport equipment sector: share of the sub-sectors by production value (2002)	9
Figure 1-2: European transport equipment sector: estimated share of the sub-sectors by number of employees (2002)	12
Figure 1-3: Persons employed in the transport equipment sector (2000)	13
Figure 1-4: Value chain in the transport equipment sector	19
Figure 1-5: Major European Aerospace and Defence Industry Cross-holdings	21
Figure 1-6: Order volume ship Industry in compensated gross tons	22
Figure 2-1: The importance of the internet for automotive suppliers	25
Figure 2-2: Share of civil and military turnover in EU Aerospace Industry	27
Figure 2-3: Advantages of e-Product Development	32
Figure 2-4: Automotive-to-Consumer Strategic Migration Framework	39
Figure 2-5: Hypothetical Cost / Benefit Structure of an E-Business Solution	43
Figure 2-6: E-Commerce Typology: the e-readiness of industry macro-sectors (% of establishments)	59

Introduction

European policy is in a number of areas, including economic, innovation and SME policies, increasingly focused on promoting business techniques and new ways of working which will provide the economic and social foundation of the information society in Europe. To help policy-makers define their programmes, and to monitor the effectiveness of these policies, reports on progress and areas requiring active support are essential. At the same time, many areas of European business are lacking information about the speed of technological progress in European markets, which they expect to make a strong impact on their global competitiveness.

Despite the increasing number of studies and market research on electronic business, especially on electronic commerce, released by a number of authors and research organisations across Europe and the world, there is still a lack of reliable empirical information about the extent, scope, nature of and factors affecting the speed of e-business development in Europe at the industry level in an internationally comparative framework. This report intends to provide such information for the Manufacture of Transport Equipment sector.

This report has been published in the framework of the "European e-Business Market Watch" (or, in short, the "*e-Business W@tch*"). This is a market observatory established by the European Commission, DG Enterprise. Laying the groundwork for a continuous facility, the *e-Business W@tch* monitors and assesses the maturity of electronic business in 15 industry sectors across all EU Member States, including seven manufacturing and eight service sectors. At least two reports will be published on each sector during the 18-month life-time of the *e-Business W@tch*. The sectors and the publication schedule for these reports are as follows:

	Sector	1st Issue Report	2nd Issue Report
1	Food, beverages, tobacco	July 2002	January 2003
2	Publishing, printing and reproduction of recorded media	October 2002	April 2003
3	Manufacture of chemicals and chemical products	July 2002	January 2003
4	Manufacture of metal products	October 2002	April 2003
5	Manufacture of machinery and equipment	October 2002	April 2003
6	Manufacture of electrical machinery and electronics	October 2002	April 2003
7	Manufacture of transport equipment	July 2002	January 2003
8	Retail	October 2002	April 2003
9	Tourism	October 2002	April 2003
10	Credit institutions, investment firms, leasing enterprises	July 2002	January 2003
11	Insurance and pension funding services	July 2002	January 2003
12	Real estate activities	October 2002	April 2003
13	Business Services	October 2002	April 2003
14	Telecommunications, computer related and audio-visual services	July 2002	January 2003
15	Health and social work	July 2002	January 2003

The research presented in these Sector Reports is intended to help to judge progress and to assess how electronic business development can be further enhanced at the European level or at Member State level, strengthening the competitiveness of European businesses. Special attention is paid to the SME dimension of e-business. More information on *e-Business W@tch* can be found at www.ebusiness-watch.org.

Manufacture of Transport Equipment: Sector Profile & e-Business

1 Economic profile

1.1 Definition and structure of the sector

Transport equipment accounted for 15% of total production in the EU manufacturing sector (enterprises employing in general 20 or more people) and for 12.5% of value added in 2001 (Eurostat, New Cronos). The NACE Rev.1 classification of economic activities distinguishes the manufacture of motor vehicles including their parts and components (NACE Rev.1 34) and manufacture of other transport equipment (NACE Rev.1 35), which is a rather heterogeneous sector comprising the manufacture of ships, railway equipment, aircraft and spacecraft as well as motorcycles and bicycles (European Commission, 2000). According to the NACE Rev.1 Code the activities of this sector include:

Code	Activity
34	Manufacture of motor vehicles, trailers and semi-trailers
34.1	Manufacture of motor vehicles
34.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
34.3	Manufacture of parts, accessories for motor vehicles
35	Manufacture of other transport equipment
35.1	Building and repairing of ships and boats
35.2	Manufacture of railway, tramway locomotives, rolling stock
35.3	Manufacture of aircraft and spacecraft
35.4	Manufacture of motorcycles and bicycles
35.5	Manufacture of other transport equipment

Whereas the activities in the sub-sectors of NACE sector 34 – which we will call the “automotive industry” in the following – form a cluster of closely interrelated firms, the shipyards, the railway equipment industry, and the aircraft and spacecraft industries operate in markets with rather different profiles.

The motor vehicles sector is highly dependent on business cycles. During the 1990s the industry went through a massive restructuring of its production schemes in order to create the flexibility required to serve an extremely competitive market. The organisation of production reflects continuous striving for more efficient structures and procedures. The need to change the organisation of firms and production processes on the shop floor has led to industrial conflict, but also to modern solutions for problems in industrial relations, such as flexitime schemes. Personal income, consumer preferences, consumer credit schemes and technical innovations are the factors likely to have the most impact on demand in the automotive market and also on the market for motorcycles and bicycles (NACE 35.4). The overall level of economic activity in a country thus affects these markets, in particular unemployment rates and wage levels.

The other transport equipment sub-sectors, however, follow different rules. Some industries still have a strong public presence. Despite recent privatisation, deregulation attempts and the reduction of government subsidies, large parts of the sector are dependent on government demand. This holds, for example, for several parts of the aircraft and spacecraft industry. Markets, such as railway transport, that were subject to deregulation in many countries, follow their own patterns of innovation and investment, which have a strong impact on equipment production.

The automotive production sector will have to face a series of technical and organisational challenges in the next few years. The most prominent of these challenges include: further streamlining of the organisation of production over the entire value chain (from research to marketing and customer services), including the improvement of logistics and procurement; the introduction of mobile communication features in cars and lorries to realise transport tracking and flexible routing schemes; the development of environmentally suitable engines (for example, by technically maturing and promoting the use of fuel cells); and lightweight materials in car bodies. Hence, safety and environmental issues, cost control, customer response and innovation are the main competitive variables.

The other transport equipment sectors follow the same patterns of having to optimise technology, keeping costs low and responding to customer requests. However, sub-sectors face different conditions. Dependence on a few large customers, the scarcity of financial resources in the budgets of some major customers, and an international re-organisation of markets makes survival difficult, especially for the less powerful companies. Production processes in most sub-sectors of the transport equipment sector are characterised by small batches: customised products often require intensive research efforts. Hence problems related to procurement, organisation and marketing are essentially different from those faced in the mass production scenario in the production of automobiles.

Data for the composition of the sector and the shares of individual sub-sectors have been estimated on the basis of the Eurostat New Cronos database SBS ENTER, which provides data for the period 1995 to 1999 (enterprise statistics for all enterprises employing one or more people, 1995-1999). For selected variables and for more recent figures, however, only enterprises with 20 or more persons employed are covered. Since May 2001, for the first time, figures are available for all enterprises in Germany as well. The data in the following tables represent about 99% of EU production, even if in most cases Greece, Ireland and Luxembourg are not included. However, these countries are engaged to a lesser extent in this sector, so not considering them has a small impact on the overall picture. Gaps in the Eurostat data set have been filled by estimation or extrapolation using information from various associations (VDA 2001a and SBAC 1998/1999 and 2000/2001).

The two sectors together contributed a value of 677 billion Euro to production in Europe (EU except Greece, Ireland and Luxembourg) in 2001. Almost 80% can be attributed to the automotive industry (NACE 34) and one fifth to other transport equipment (NACE 35). Within the automotive industry, the manufacture of motor vehicles, i.e. the very large producers of final products, which are often called Original Equipment Manufacturers (OEM, cf. Chapter 1.6. in this report) is by far the biggest industry. Nearly two-thirds of the production value in the other transport equipment sector was produced in the aircraft and spacecraft industry.

Value added is proportionally higher in the sub-sector 'other transport equipment'. Its share in the overall transport equipment sector rises to almost 28%. Within the sub-sector, the aircraft and spacecraft industry again holds a dominant position. Within the automotive industry the value added share of the producers of parts and accessories for motor vehicles and their engines is bigger than their share in production value.

Table 1-1: Structure of the transport equipment sector in the EU by kind of activity (2001)

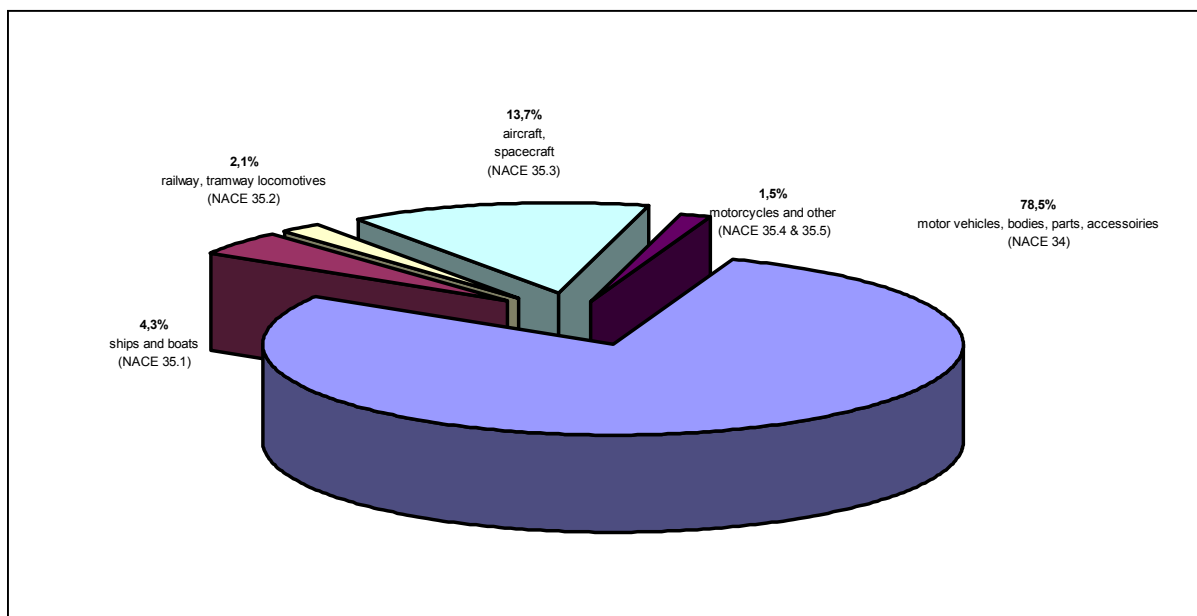
NACE Rev.1	Production value		Value added at factor cost	
	Euro (m)	%	Euro (m)	%
Automotive total (34)	531,321.1	78.5	120,126.0	72.4
Motor vehicles (34.1)	404,716.0	59.8	75,611.9	45.6
Bodies (34.2)	22,772.4	3.4	7,296.4	4.4
Accessories (34.3)	103,832.9	15.3	37,217.7	22.4
Other equipment total (35)	145,917.2	21.5	45,693.6	27.6
Ships, boats (35.1)	28,807.2	4.3	8,883.8	5.4
Railway, tramway (35.2)	14,001.1	2.1	4,268.6	2.6
Aircraft, spacecraft (35.3)	93,082.8	13.7	29,568.9	17.8
Motorcycles, bicycles (35.4)	9,016.0	1.3	2,597.3	1.6
other (35.5)	1,010.1	0.1	374.7	0.2
Transport equipment total (34+35)	677,238.3	100.0	168,819.6	100.0

EU-12: EU 15, excluding Greece, Ireland and Luxembourg = 100
Enterprises with in general 20 and more persons employed.

Source: Eurostat New Cronos SBS ENTER 2002, estimates and calculations by DIW Berlin 2002

The cyclical movement in the development of real value added and employment was more distinct in the transport equipment industry than in total manufacturing: between 1990 and 1995 real value added in this sector fell by an annual rate of 2.7% compared with a fall of 0.4% in total manufacturing. Employment fell by an annual rate of 3.7% compared with a fall of 3.0% in total manufacturing. From 1995 to 2000, value added grew by 5.9% annually (total manufacturing: 4.1%) and employment developed at 0.8% (total manufacturing: 0.3%).

Figure 1-1: European transport equipment sector: share of the sub-sectors by production value (2002)



Source: Eurostat New Cronos SBS ENTER 2002, estimates and calculations by DIW Berlin 2002

1.2 Regional distribution of the transport equipment production

In most countries the automotive industry is by far the larger sector of the two sub-sectors. Only in a few small countries (Denmark, Greece, Ireland and Finland), which have almost no car producing facilities is this not the case; these are also the countries with the lowest share of both sectors in total manufacturing. The two largest producers of automobiles (Germany and France) account for 67% of the production value in the 13 EU countries considered in Table 1-2; the first three (adding the UK) account for almost 76%. If the next largest countries, Spain and Italy, are added, almost 90% of European production is covered. Thus the industry is highly concentrated with respect to regional distribution. In the sub-sector 'other transport equipment', France, the UK and Germany lead the list in production value, followed – at some distance – by Italy and Spain. The first three countries add up to 77% of production and the first five to almost 90%. Regional concentration is, thus, at a similar level as in the NACE 34 sector.

Table 1-2: Production of the automotive industry in EU 13 countries (2000)

Country	Production value		Value added		Share in total manufacturing in %		Value added Rates
	Euro (m)	%	Euro (m)	%	prod. value	value added	%
Austria	7,461	1.3	2,173	1.8	7.5	5.8	29.1
Belgium	15,785	2.8	3,218	2.7	9.7	7.1	20.4
Denmark	1,049	0.2	397	0.3	1.5	1.5	37.9
Finland	933	0.2	364	0.3	1.0	1.2	39.1
France	171,084	30.1	19,652	16.6	18.4	8.7	11.5
Germany	211,355	37.1	54,985	46.5	15.5	12.1	26.0
Ireland	592	0.1	167	0.1	0.6	0.5	28.3
Italy	36,572	6.4	7,736	6.5	4.8	3.7	21.2
Netherlands	7,011	1.2	1,641	1.4	3.5	2.8	23.4
Portugal	3,847	0.7	824	0.7	5.7	4.3	21.4
Spain	43,571	7.7	8,959	7.6	13.1	9.3	20.6
Sweden	21,209	3.7	6,434	5.4	13.3	12.7	30.3
UK	48,827	8.6	11,616	9.8	7.5	5.1	23.8
EU13 ¹⁾	569,295	100.0	118,166	100.0	11.4	7.8	20.8

1) EU-13: EU excluding Greece and Luxembourg = 100 (accounts for more than 99.5% of EU-15 production)
All enterprises. 2000 estimated using VDA data. VDA 2001a.

Source: Eurostat New Cronos SBS ENTER 2002, estimates and calculation by DIW Berlin

The weight of the NACE 34 industries in manufacturing as a whole is relatively high in Europe, but varies considerably between countries. Germany, Sweden, Spain and France exceed the European average. In Belgium, the UK, Austria, Portugal and Italy these industries still make a major contribution to overall manufacturing output. Not surprisingly, 'other transport equipment' does not show the same high impact. The European average for this category lies slightly over 3%, and even in countries with high shares (France and UK), the sector is relatively small.

Production value measures the output of an industry including the inputs needed to produce this output. When only the contribution of the industry itself is to be considered, the relevant

indicator is the *value added*. The relationship between the two indicators varies between industries and within the same industry in different countries according to the degree of vertical integration. If an industry is highly integrated, it is likely to produce high value added on the basis of the low value of inputs of raw material and semi-final products. In some countries, the same industry may operate only as a final assembly line, thus leaving the bulk of value added to previous stages of production. The value added rate, i.e., the share of value added in production value is therefore an indicator for the integration of industries. However, it can also differ owing to differences in the remuneration of factors of production, i.e., in wages and profits. If an industry is able to generate higher value added, this may be due to a higher degree of sophistication or higher productivity, which allow higher factor compensation to be paid.

In the transport equipment sector, the difference in the weight of the two main sub-categories in total manufacturing in the countries considered is less pronounced for value added than for production value. Hence, value added rates will differ between countries.

Table 1-3: Production of other transport equipment (NACE 35) in EU 14 countries (2001)

Country	Production value		Value added		Share in total manufacturing in %		Value added Rates
	Euro (m)	%	Euro (m)	%	prod. value	Value added	
Austria	1,167	0.8	320	0.7	1.3	1.0	27.4
Belgium	1,897	1.3	685	1.5	1.2	1.5	36.1
Denmark	1,167	0.8	366	0.8	1.8	1.6	31.3
Finland	1,897	1.3	457	1.0	2.1	1.6	24.9
France	46,694	32.0	8,682	19.0	5.9	4.5	18.6
Germany	29,183	20.0	9,824	21.5	2.4	2.5	33.7
Greece	583	0.4	366	0.8	2.1	4.0	62.7
Ireland	584	0.4	274	0.6	0.7	0.9	47.0
Italy	11,673	8.0	3,793	8.3	2.0	2.6	32.5
Netherlands	3,940	2.7	1,005	2.2	2.4	2.2	25.5
Portugal	730	0.5	228	0.5	1.1	1.2	31.3
Spain	6,566	4.5	2,330	5.1	1.8	2.3	35.5
Sweden	3,356	2.3	1,142	2.5	2.4	2.6	34.0
UK	36,479	25.0	16,221	35.5	5.8	7.6	44.5
EU14 ¹⁾	145,917	100.0	45,694	100.0	3.3	3.4	31.3

1) EU-14: EU excluding Luxembourg = 100
Enterprises with in general 20 and more persons employed.

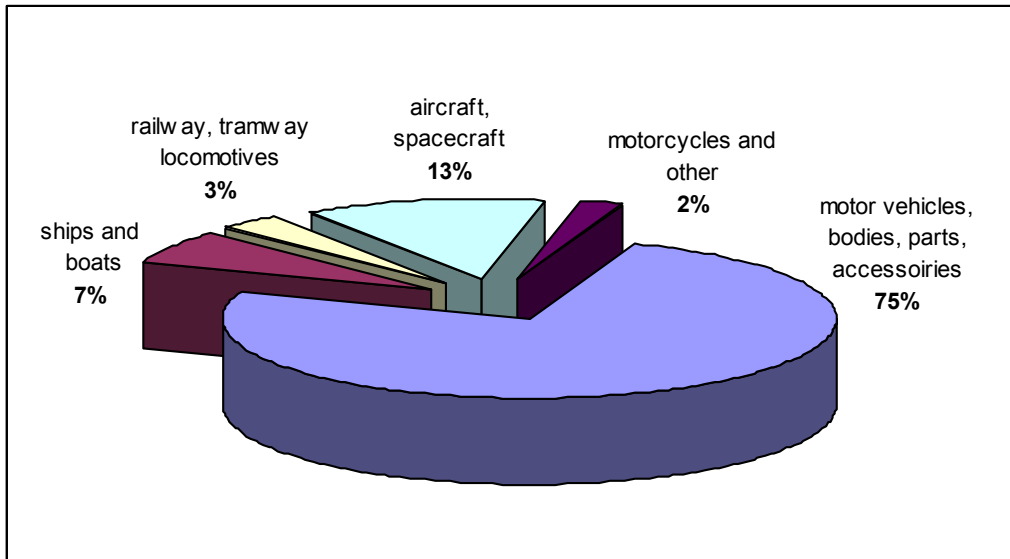
Source: Eurostat New Cronos SBS ENTER 2002, estimation and calculation by DIW Berlin

Value added rates in the automotive industry in EU-13 average 21%. This varies considerably however between countries, with France at the lower end (11.5%) and Finland at the higher end (39%) of the scale. Belgium and Spain are, like France, also below the EU average. This data constellation is to be tested again as its figures show surprising developments. For example, the production value (+80%) and turnover (+70%) in France rose significantly in 1999, whereas value added (+6.6%) and employment grew only slightly (+1.7%). Value added rates are generally higher in other transport equipment industries.

1.3 Employment, productivity and labour costs

The manufacture of motor vehicles and related parts accounts for three-quarters of the total sector employment and represents the most important sub sector of the transport equipment industry. The aerospace and shipbuilding industries form relatively smaller branches, but still contribute considerably to employment in the European transport equipment sector. Figure 1-2 illustrates the shares of the sector in total employment.

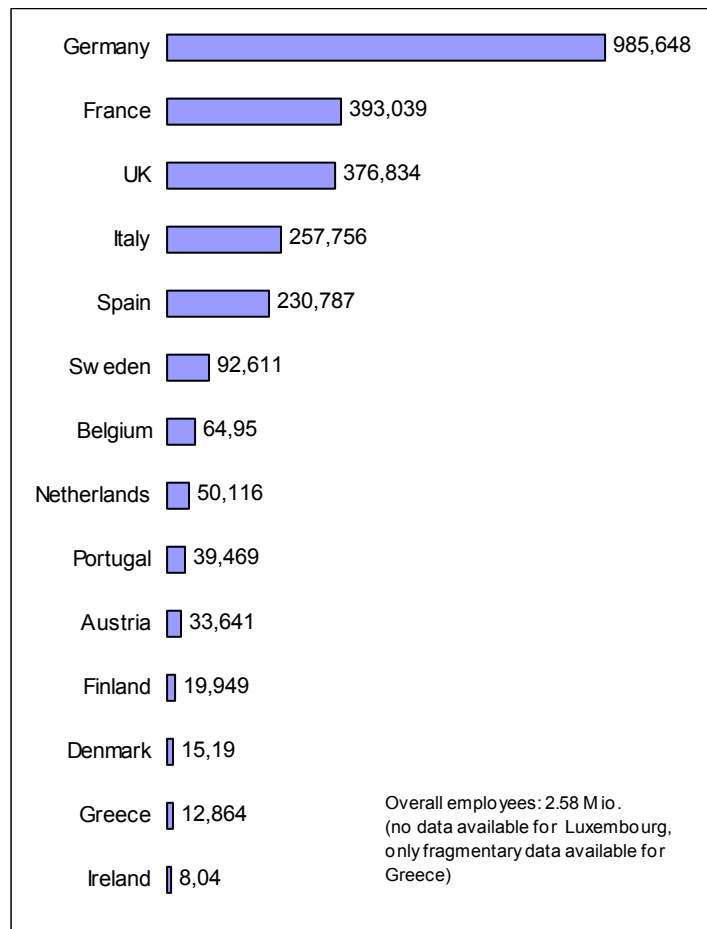
Figure 1-2: European transport equipment sector: estimated share of the sub-sectors by number of employees (2002)



Source: Eurostat New Cronos 2002, estimates and calculations by DIW Berlin 2002

The regional structure of employment shows the heavy weighting Germany has in the European transport equipment industry. Employing more than 44% of the industry's workers, Germany is ahead of the UK, France, Italy and Spain, which together contribute slightly less than 49% to the industry's overall employment. Figure 1-3 shows the regional structure of sector employment.

Figure 1-3: Persons employed in the transport equipment sector (2000)



Source: Eurostat New Cronos 2002, VDA 2001, estimation and calculation by DIW Berlin 2002

Employment, productivity and labour cost statistics reveal significant regional differences between the EU Member States. Table 1-4 shows data for the automotive industry. The production of automobiles is a most important business activity for national economies in Germany, Sweden and Belgium (employment share in total manufacturing). By contrast, automobile production does not play a significant role in Ireland, Denmark, and Finland.

Productivity, measured as value added per employee, also varies considerably between EU Member States. Portugal and Ireland show the lowest productivity figures. Sweden exhibits the highest productivity per employee, followed by Austria and France. But even the figure for Sweden (88,100 Euro value added per employee) remains far behind that of automobile workers in the USA. US statistics report more than 130,000 Euro of value added per employee (1999), which is more than twice as much as the EU average.

Table 1-4: Employment, productivity and labour costs in the automotive industry (NACE 34) in the EU 13 (2000)

Country	Employment		Productivity		Labour Costs	
	Persons employed	share in manufacturing total	Value added per person employed (1000)	in % of manufacturing total	per employee (1000 Euro)	in % of manufacturing total
Austria	28,984	4.6	€75.0	126.4	41.2	108.9
Belgium	53,809	8.0	€59.8	89.1	44.3	107.8
Denmark	7,485	1.6	€53.1	97.9	34.3	102.1
Finland	8,309	1.9	€43.9	65.1	30.7	82.0
France	276,673	6.9	€71.0	126.0	39.8	108.6
Germany	855,883	11.4	€64.2	106.2	52.3	120.1
Ireland	3,339	1.3	€50.2	36.9	21.8	76.4
Italy	177,893	3.8	€43.5	99.3	29.9	108.2
Netherlands	28,292	3.2	€58.0	86.8	35.9	95.7
Portugal	25,288	2.6	€32.6	165.6	16.0	139.3
Spain	177,309	6.9	€50.5	135.5	30.5	118.2
Sweden	73,029	9.2	€88.1	137.2	41.1	105.6
UK	217,100	5.3	€53.5	95.1	39.3	118.3
USA*	1,027,000	5.5	\$130.67	157.6	n.a.	n.a.
EU13 ¹⁾	1,914,020	6.8	€61.1	113.0	43.3	123.1

* USA: 1999 figures from VDA2001a (latest available figures), no labour costs statistics available. However, wages and salaries are given with €45,900 per employee. This figures does not take into account the social benefits, which are included in the labour costs statistics.

1) EU-13: EU excluding Greece and Luxembourg = 100 (accounts for more than 99.5% of 'EU-15' production). All enterprises.

Source: Eurostat New Cronos 2002, VDA 2001, estimation and calculation by DIW Berlin 2002

Labour costs also differ across Europe. Portugal and Ireland report the lowest costs per employee, both paying less than 50% of the EU average. Germany reports the highest labour costs in the EU automobile industry, paying 20% more than the EU average. Labour cost statistics take into account social benefits received by employees. For the United States only wage and salary statistics without social benefits were available. The reported figure of 45,900 Euro per employee for 1999 (VDA 2001a) would therefore have to be adjusted by adding social benefits to be comparable to the EU statistics. However, the figure indicates that US-workers are even more expensive than German workers – possibly reflecting the higher productivity per employee.

Table 1-5 exhibits the same indicators as table 1-4 but for the other transport equipment sub-sectors (NACE 35). Again, regional differences in the importance of the sectors in their national economies are visible, but they are not as pronounced as in the automobile industry. NACE 35 sub-sectors have the largest share in total manufacturing in the UK where aircraft and spacecraft as well as the shipbuilding industries are well developed.

Table 1-5: Employment, productivity and labour costs in the other transport equipment sector (NACE 35) in the EU-14 (2001)

Country	Employment		Productivity		Labour Costs	
	Persons employed	share in manufacturing total	value added per person employed (1000 Euro)	in % of manufacturing total	1000 Euro per employee	in % of manufacturing total
Austria	4,657	0.9	68.7	110.5	50.4	133.6
Belgium	11,141	1.6	61.5	92.3	47.0	120.3
Denmark	7,705	1.9	47.4	87.6	41.5	118.8
Finland	11,640	2.7	43.2	65.3	33.7	101.0
France	116,366	3.6	74.6	125.2	50.0	128.7
Germany	129,765	2.0	73.9	124.2	52.9	121.7
Greece	12,864	3.9	32.0	116.4	25.3	170.7
Ireland	4,701	1.8	58.3	46.6	35.0	107.2
Italy	79,863	2.8	49.2	96.7	33.8	114.2
Netherlands	21,824	3.3	50.2	72.4	34.2	86.4
Portugal	14,181	1.4	19.3	100.5	17.5	164.5
Spain	53,478	2.1	44.4	109.0	30.4	134.2
Sweden	19,582	2.9	60.7	91.9	42.0	105.3
UK	159,734	4.5	100.1	165.8	42.4	129.1
EU14 ¹⁾	647,500	2.7	70.6	126.5	42.6	123.0

EU-13: EU excluding Luxembourg = 100 (accounts for more than 99,5% of 'EU-15' production)
Enterprises with in general 20 and more persons employed.

Source: Eurostat New Cronos; estimation and calculation by DIW Berlin

The variance of productivity measures for NACE 35 across Europe is bigger than in the automotive industries, ranging from 19,300 Euro value added per worker in Portugal to 100,100 Euro in the UK. The European average is 70,600 Euro. Surprisingly, 2001 productivity measures for NACE 35 are much higher than 1997 values. UK figures have increased by 77%, whereas those for Portugal decreased by 22%. An explanation for these differences can be found in variations in the utilisation of some plants that account for a large share of a country's NACE 35 output. While in 1997 the EU average productivity in NACE 35 was lower than that of the automotive industries, it is now higher.

Labour cost statistics for NACE 34 and 35 are similar to each other. Similar to the automotive industries, the other transport equipment sub-sectors report the highest cost of labour in Germany (52,900 Euro per employee) and the lowest in Portugal (17,500 Euro per employee).

1.4 Size class distribution

The transport equipment sector is characterised by an extremely high degree of concentration. In the automotive industry, 91.1% of the entire sector turnover is generated by firms with more than 250 employees, although large firms only account for 3.8% of the total number of enterprises in the sector. Out of 15 sectors covered by the *e-Business W@tch*, the automotive industry exhibits the highest degree of concentration in large firms. The situation in the other transport equipment sectors is quite similar. Here, 81.5% of total turnover is generated by large firms which account for 1.6% of the total number of enterprises. The consolidation and concentration of the entire transport equipment sector is being driven by high sunk costs for production facilities, high fixed costs for engineering, and highly competitive markets.

Table 1-6: Size class distribution in the transport equipment sector

	Automotive Industry (34)					Other Transport Equipment (35)				
	0	1-9	10-49	50-249	>250	0	1-9	10-49	50-249	>250
Turnover (%)	0.1	0.8	2.9	5.1	91.1	0.8	2.0	5.7	10.0	81.5
Persons Employed (%)		2.1	4.8	8.2	84.9		5.6	8.2	11.0	75.2
Number of Enterprises (%)	33.8	35.9	19.2	7.4	3.8	38.1	42.8	13.6	4.0	1.6

1996 (latest available figures).

Source: Eurostat New Cronos, 2002. DIW Berlin

1.5 Trade balance

The transport equipment sector shows a high degree of integration in international trade. Some industries in the sector are dominated by large international firms operating across national borders and stimulating export and import activities, but the larger part of trade is still taking place within the EU. The total sector trade balance is positive for the EU as a whole, but there are significant differences between countries and sub-sectors. The countries with the highest export surplus were those with the highest production values (with the exception of the UK, where quite a substantial output is accompanied by a slight import surplus).

A substantial part of transport equipment exports is directed towards other EU countries, with the exceptions of Greece, where the share of extra EU-exports is more than 90% and Finland (more than 50%). Countries with a positive trade balance tend to show a surplus, with trade partners inside as well as outside the EU. The exceptions are Austria, Finland and Italy.

Imports also mainly come from other EU countries. The highest shares of extra-EU imports (about 40%) are reported by Germany and Greece, the lowest by Belgium.

Table 1-7: Exports, imports and trade balance for transport equipment (NACE 34+35) (1999)

Country	Total Exports	Exports to extra - EU in % of total exports	Total Imports	Imports from extra-EU in % of total imports	Trade balance	Trade balance to Extra-EU
Austria	10,167.8	30.4	10,819.7	28.2	-651.9	45.35
Belgium	24,759.9	15.5	22,007.4	14.2	2,752.5	718.65
Denmark	2,395.0	34.0	4,393.3	32.4	-1,998.4	-606.34
Finland	2,515.8	60.1	3,613.3	31.2	-1,097.5	386.51
France	78,425.3	40.6	63,539.0	32.9	14,886.3	10,955.55
Germany	110,215.3	40.8	60,947.0	41.8	49,268.3	19,454.19
Greece	241.3	90.7	3,579.1	43.3	-3,337.8	-1,331.11
Ireland	764.9	26.7	4,241.5	39.3	-3,476.6	-1,464.34
Italy	24,822.8	35.3	30,692.9	25.2	-5,870.1	1,027.37
Netherlands	11,815.6	26.6	16,560.6	25.6	-4,745.1	-1,100.28
Portugal	3,642.6	5.6	6,739.8	18.5	-3,097.2	-1,039.05
Spain	27,966.4	16.4	28,836.5	17.2	-870.1	-378.72
Sweden	11,546.0	38.7	8,479.7	28.9	3,066.3	2,017.96
UK	42,613.7	41.7	53,005.2	33.9	-10,391.5	-199.76
EU15¹⁾	125,390.1	100.0	97,673.6	100.0	27,716.5	2,7716.5

1) Production: EU13 = EU excluding Greece and Luxembourg

Source: Eurostat New Cronos; estimation and calculation by DIW Berlin

Given the heterogeneity of the sector, which includes final and semi-final products, trade figures tend to reveal that in fact there is a high degree of international division of labour in the industry. High import and export figures, for example, can relate to sophisticated export and re-import schemes, where components are exported to a third country to be further processed there and are then re-imported to be assembled as a final product. Some internationally operating firms have concentrated the production of specific parts in one country, which then exports these parts to other branches of the same firm in another country. In these cases, high export and import values should be interpreted as an indicator for a high degree of specialisation and integration in international production schemes.

If the automotive and other transport equipment industries are considered separately, the trade balance remains positive for both sub-sectors with respect to the EU-15. However, the ratio of imports and exports for the automotive industry barely reaches 62%, while standing at almost 99% for other transport equipment.

Car manufacturing therefore has a higher trade surplus not only in absolute terms, but also relative to the overall trade volume. This balance is positive for eight out of 14 countries, whereas in other transport equipment only four countries have a trade surplus with countries outside the EU. Sweden, France and Germany report the highest relative trade surplus in this industry.

Table 1-8: Foreign trade with transport equipment with non-EU countries in m Euro (1999)

Country	Automotive industry			Other transport equipment		
	Exports	Imports	Trade balance	Exports	Imports	Trade balance
Austria	1,978.5	2,029.1	-50.6	1,114.9	1,018.9	96.0
Belgium	3,348.9	2,360.0	988.9	488.0	758.2	-270.3
Denmark	347.6	543.7	-196.1	467.3	877.6	-410.3
Finland	605.1	422.6	182.5	907.9	703.8	204.1
France	7,159.2	2,992.3	4,166.9	24,673.0	17,884.3	6,788.7
Germany	36,752.7	16,065.6	20,687.1	8,161.4	9,394.3	-1,232.9
Greece	91.1	913.1	-822.0	127.7	636.8	-509.2
Ireland	15.2	419.6	-404.3	189.2	1,249.3	-1,060.0
Italy	4,719.8	4,511.8	208.1	4,041.5	3,222.2	819.3
Netherlands	1,798.4	2,032.8	-234.4	1,343.1	2,209.0	-865.9
Portugal	142.7	983.3	-840.6	62.4	260.8	-198.5
Spain	3,169.4	2,835.1	334.3	1,407.8	2,120.8	-713.0
Sweden	3,581.5	1,291.7	2,289.8	888.0	1,159.8	-271.8
UK	7,273.4	6,497.8	775.6	10,511.3	11,486.7	-975.3
EU15	70,988.6	43,915.5	27,073.1	54,401.5	53,758.1	643.4

Source: Eurostat New Cronos; estimation and calculation by DIW Berlin

1.6 Sector-specific issues and challenges

The globalisation of markets and excess capacity in the industry have led to a rapid horizontal concentration. In the automotive sector, for example, 99% of all passenger cars and light-duty trucks worldwide are produced by approximately 50 automotive companies, controlled by 33 corporations (AMM 2001).

Consolidation is also visible in the manufacturing of aircraft and spacecraft. A few big European players dominate the industry, most notably EADS with its majority shares in Airbus Industry, Eurocopter, Arianespace and others.

Industry supply chains are broad and deep. Their technological challenges span a wide gamut across aerodynamics, fluid dynamics, mechanical, electrical, material and civil engineering, strict safety guidelines and ecological issues and regulation, among others. The transport equipment sector (and the automotive sector in particular) is the largest end-use market for production materials such as steel, aluminium, powder metals, lead, magnesium, or platinum metals. Design costs are large and sunk, driving chronic industry over-capacity and price competition into all segments except those most in demand.

The supply chain

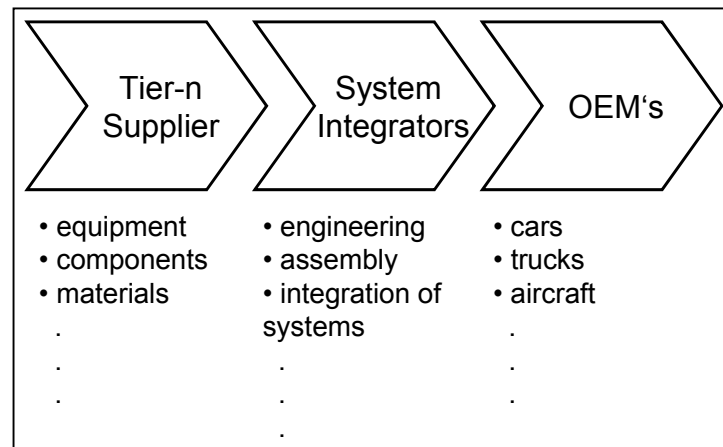
Figure 1-3 shows a simplified model of the sector value chain. At the end of the supply chain, a few usually extremely large firms assemble the final products. These firms are often referred to as *Original Equipment Manufacturers* (OEMs), and include Fiat, Volkswagen, DaimlerChrysler and Airbus, among others.

One level below, *System Integrators* (SIs) or Tier-One-suppliers, assemble and integrate entire components or systems for the later final product. These Tier-One-suppliers, such as

Robert Bosch GmbH or Delphi Automotive Systems Corp., usually also have a strong engineering competence. Their products stretch over multiple modules, and their sub-supplier connections are frequently diverse and numerous. From here, the supply chain can be further followed down to n-Tier suppliers, who either deliver to the System Integrators, the OEMs or other n-Tier suppliers. This is the complex supplier network which lies behind the e-enabled industry restructuring and the accompanying shift of power.

The supplier market at the n-Tier level is much more heterogeneous than at OEM level and also comprises a large number of smaller firms. However, consolidation is also visible at the SI level, with a few large Tier-One-suppliers generating a large share of overall supplier revenues.

Figure 1-4: Value chain in the transport equipment sector



Source: DIW (2002)

The transport equipment sector was once a prime example of Old Economy vertical integration, but now faces the same pressures to reconfigure the value chain that has transformed the faster-paced high technology industries. OEMs are increasingly dependant upon and co-operant with large and sophisticated Tier-One-suppliers that take on design and logistics responsibilities and make investments in capital equipment and advanced technology development. Alliances among car manufacturers as well as with firms outside the industry are becoming increasingly common, not least because of the high costs of developing new technologies and serving global markets, which put strain on the resources of even the largest firms (IMVP Research 2002).

The role of suppliers to the automotive industry is currently undergoing a process of change, marked by their increasing share of responsibility for the end-product. This can be seen in the widening scope of their activities in terms of production and, most importantly, in product development. According to various analyses the proportion of development expenditure by supply companies relative to overall expenditure (which is estimated to be currently at about 25-30%) will increase to 50% or more within the next ten years (VDA 2001). Automotive OEMs were therefore able to shift some of the development costs for essential parts onto the supplier industries. In order to keep technological development under control, these R&D projects are entirely delegated to a specific (or several) supplier(s) or OEMs instead of just closely co-operating with the developing supplier.

Transport manufacturing is also characterised by extreme differences in the financial performance of its firms. Even enterprises that operate from comparable geographic regions exhibit very different financial success. North Italian car manufacturer Fiat, for instance, has

only made a profit in one out of the last eight years (Handelsblatt, 15/05/2002). On the other hand, German BMW has just announced the best sales and profits in its history for the year 2001 and this trend is expected to continue in the future (Handelsblatt, 17/05/2002). Financial resources and the strategic position of companies in such diverse situations will clearly have an influence on their investment decisions for e-business technology.

Globalisation and industry consolidation: the case of the automotive and aerospace industries

The transport equipment sector can be considered a truly global business. The trend towards globalisation is particularly visible in the automotive, aerospace and defence industries. Highly competitive domestic markets have led to increased activities in foreign markets and capital investments outside of home countries.

PwC reports that there are still about 250 companies engaged in the assembly of light vehicles worldwide. Only few of them, however, have global significance, although industry consolidation is well underway. Of the top 20 automobile manufacturers in 1965, 14 had merged or been taken over by 2000. By 2006, the top 14 vehicle manufacturers will account for almost 90% of total light vehicle output worldwide. If the current trend continues, fewer than seven automobile manufacturers of a close to global scale will dominate the market within 5-10 years (PwC 2000).

The six largest automobile manufacturers can be said to dominate the world-market. These are GM, Ford, DaimlerChrysler, VW, Renault Nissan and Toyota. Two of these, namely DaimlerChrysler and Renault Nissan, have only recently entered the "champions league" through merger activities. In addition to these giants, nine competitors which have remained independent until now are also playing an important role on the global market: The French PSA group, Italian FIAT, Hyundai Group and Daewoo from South Korea, BMW and Porsche from Germany, Honda, Suzuki, Subaru and Mitsubishi Motors from Japan. However, most of them have also recently engaged in co-operation schemes and cross share-holdings with other automobile manufacturers. For example, General Motors holds 20% of Fiat Auto SpA and has another option to buy, valid from 2004 to 2009 (Handelsblatt, 15/05/2002a). And DaimlerChrysler co-operates with both Hyundai and Mitsubishi in different joint-ventures to build new trucks and gasoline engines (Handelsblatt 22/05/2002).

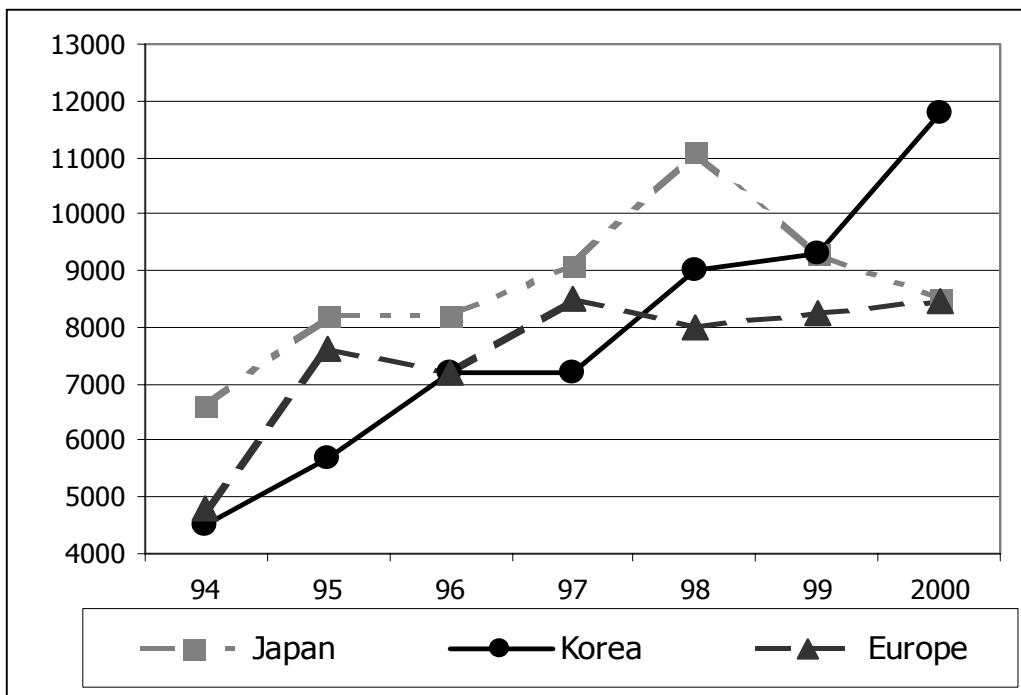
All this contributes to globalisation and concentration being considered by many experts to be the single most important factor in driving change in the automotive industries. Blurring markets in North America, Europe, and Asia, and numerous joint ventures, synergies, production agreements, international partnerships, strategic alliances, and the global sourcing of parts and components further strengthen this view. The global use of modular car platforms (platforms that are used to build different cars for different markets, realising economies of scale and saving development costs) is also a result of the trend towards concentration and globalisation. For example, Volkswagen's PQ33/34 platform (the European light vehicle platform with the highest production volume of all platforms in 2001) is used as a basis for products as different as the VW Golf, VW Bora, VW Beetle, Audi A3, or Seat Leon, each serving a different consumer and geographical market segment (OESA 2001).

Consolidation In the aerospace and defence industry is also becoming increasingly evident. The structure of the European aerospace industry has undergone profound changes in the last decade. A process of mergers and rationalisation has taken place to enable the aerospace industry primes to cope with US competition and reduced customer budgets. This has led to the formation of global players such as BAE Systems in 1999 and EADS in 2000,

heavily in debt and started making enormous price concessions. At that time the Korean government heavily subsidised its shipbuilding industry, creating a situation for development with which European competitors simply could not compete. The subsidies included tax relief, financial aid and specific export incentives, and state-owned banks were also quick to help out with moratoriums when the first shipyards were threatened with bankruptcy.

But Korean yards continued to increase their competitiveness. Productivity gaps were closed, existing facilities were expanded and the latest technology was introduced (especially information technology and CAD/CAM). Company structures were reformed and more efficient work processes and flexible industrial relations introduced (Hessel 2000).

Figure 1-6: Order volume ship Industry in compensated gross tons



Source: Heselers 2000

Another advantage was that Korean shipbuilders are affiliated in conglomerates making co-operative projects much easier. They also offer a wide range of diversified products (super-tankers, bulk-carriers, container vessels, hi-tech special ships, offshore facilities), and the production of series instead of single customised ships allows economies of scale and cost reductions to be fully exploited. The passenger vessel market is still dominated by European shipyards, but Korean Samsung and Daewoo have already received orders for ferries from European shipping lines.

However, the prospects of further development in Korea are limited by high debt and worldwide over-capacity. The formation of Korean conglomerates has also led to cross-subsidies and convoluted processes. In recent years, European shipyards have reacted to the Korean challenge by entering into co-operation agreements and mergers.

This brief case study of the European ship-building industry provides us with an example of a European industrial sector being unable to profit from globalisation. Due to the specific nature of the products and production procedures involved, other countries were able to gain comparative advantages over European producers, making it hard to imagine the European ship-building industry regaining its 1970s lead.

In general, firms in the transport equipment sector respond to the challenges of globalisation with worldwide strategies, cost reduction and a strengthening of their competitive positions. E-business solutions frequently play an important part in these strategies, and Internet-enabled communication technologies are often the “glue” that is needed to build truly global firms. However, the potential of these e-solutions seems to be much greater in sectors with customised mass production (such as cars), rather than in sectors with made-to-order investment goods (such as aircraft and ships).

Profiting from globalisation and achieving a strong competitive position does not come cheap. High capital investments are often needed to pursue global strategies – another argument that points to further consolidation in the industry. Without doubt, globalisation and consolidation activities are the most visible and dominant at the OEM level. However, as globalisation in the industry continues, consolidation might increasingly take place among n-Tier suppliers.

2 Usage of ICT & e-business

2.1 General e-business trends

The supply chain in the transport equipment manufacturing sector is traditionally highly integrated with intensive flows of information between the different stages of the value chain and between firms operating in the same stage of the value chain. During the 1990s, co-operation in engineering between OEMs, SIs and n-Tier suppliers became more common, leading to an increasing specialisation of suppliers and closer interdependencies between firms. The use of communication technology for exchanging structured and unstructured data has long been an issue in the sector and is not only due to the increased use of the Internet as a worldwide standard for communication.

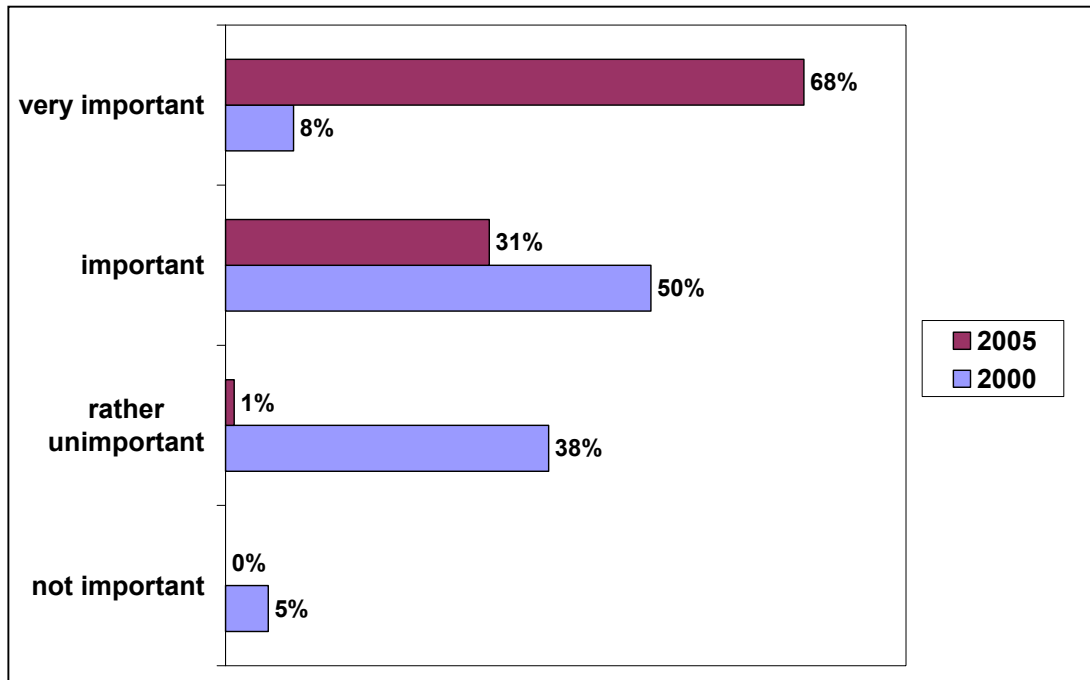
During the 1980s, Electronic Data Interchange (EDI) was implemented in almost all transport equipment industry firms. However, there was no standard solution or even a uniform data standard. This led to an extremely fragmented field of "island solutions" that were unable to communicate with each other. Furthermore, implementing proprietary EDI systems was rather costly, because it was not based on existing communication networks such as the Internet. Implementing EDI usually meant investing in computer hardware, proprietary network equipment, lines, non-standardised software, and in employee training. Nevertheless, EDI communication became widely accepted in the industry and many firms today still have high levels of EDI use and a variety of proprietary legacy communication and information processing systems that are unable to exchange data across system boundaries.

In a way, the rapid adoption of EDI became somewhat of an obstacle to achieving more advanced e-business solutions. Given the importance of supply-chain-wide communication solutions for the sector, it may be surprising to find that until 2000 the sector was slow to adopt electronic business processes (KPMG 2001a). The reasons for this range from the strong general acceptance of EDI systems to a relatively conservative way of thinking about business in the industry, but the evidence is that the adoption of e-business in the transport equipment sector lagged behind that of other sectors. A KPMG survey of automotive executives conducted in 2000 found that e-procurement has actually had little effect on the industry so far, according to the majority of respondents. These companies indicated that what electronic business they do conduct consists of purchasing and supply-chain management through closed communications networks, like EDI, or sending drawings and quotes to business partners using PC-based design software. Some said that their e-commerce activity was limited to maintaining websites for information purposes or online catalogues.

Another KPMG survey revealed similar results. Only 20% of the automotive/ manufacturing respondents said the internet was helping to increase profits. This figure was the lowest for all the seven industries surveyed. The study also indicated that senior management in these companies is the least involved in e-business strategy compared with the other segments surveyed. Only 35% of automobile companies said that senior management was involved in e-business planning "to a high degree" or "to a great degree" (KPMG, 2001a). The study concluded that the transport equipment sector was trailing six other sectors (financial services, chemical, pharmaceutical, electronics, consumer markets, and communications) in terms of e-business progress.

A similar picture is revealed by a VDA¹ industry survey, but with indications that e-business is likely to have a significant impact in the near future. In 2000, only 50% of respondents said that the Internet was already important for suppliers in the automotive industry, whereas 43% said that it was “rather unimportant” or “unimportant”. When asked how important the Internet would be in 2005, however, 99% said that it would be “important” or even “very important” (VDA 2000, p. 28).

Figure 2-1: The importance of the internet for automotive suppliers



Source: VDA (2000)

It seems that the transport equipment manufacturing sector needed some time to embrace the concept of electronic business and its potential opportunities for business. Since 2000/2001, however, the situation has changed and the sector has made rapid progress compared to other industries. Some major initiatives have been successfully launched (like Covisint) and all major automotive OEMs are now engaged in some sort of e-business activities.

This is encouraged by the e-business leadership role that large firms and OEMs in the sector have taken on, according to all major surveys and a sample of anecdotal references. Large firms have the financial resources to buy and implement powerful e-business solutions. They can also spread these investments over a larger number of employees, products, business units and locations to gain a quicker positive return to their investment than smaller firms would. Usually, large firms allocate higher budgets for e-business solutions. A VDA survey revealed that 80% of smaller automotive suppliers had e-commerce budgets of less than DM 500m (255m Euro), whereas 80% of larger suppliers had planned higher budgets.

¹ Survey conducted by the Center of Automotive Research and the German Fachhochschule Gelsenkirchen for the German Automotive Association VDA among 106 industry suppliers in summer 2000.

Table 2-1: Planned E-Commerce Budgets for German Automotive Suppliers

E-Commerce Budgets* (€)	Suppliers with <€255m Annual Turnover	Suppliers with >€255m Annual	Total
0 – 128,000	36%	5%	41%
128,000 – 255,000	17%	2%	19%
255,000 – 511,000	7%	12%	19%
511,000 – 2.56m	5%	11%	16%
2.56m - 5.11m	1%	1%	2%
5.11m - 25.56m	0%	2%	2%
over 51.12m	0%	1%	1%
Total	66%	34%	100%

* Original nominal values were in DM

Source: VDA 2000, presentation by DIW

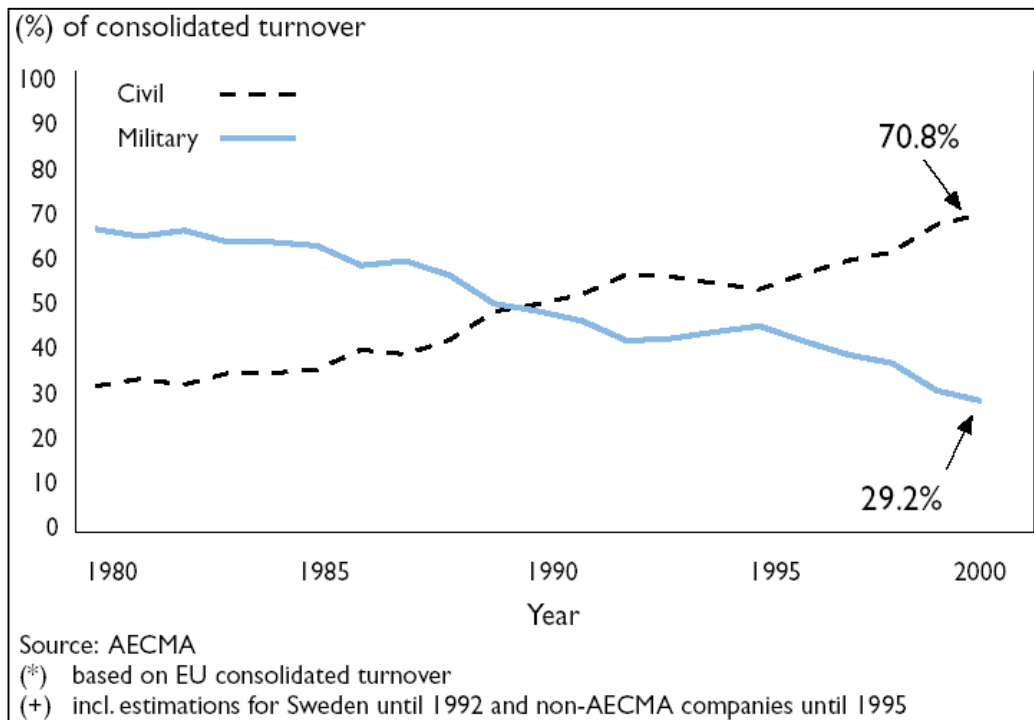
However, it can also be expected that the e-business initiatives of the sector's "giants" will have a knock-on effect on the smaller firms and lower level suppliers in the years to come. In fact, in many cases the decision to follow the e-business strategies of large firms might be a "take it or leave it" decision for SMEs who supply to larger customers and are therefore forced to adapt to their standards.

2.2 Government and the military as important customers

The military and government are very important customers of transport equipment manufacturers, especially for the aerospace industry. In 2000, 23.8% of the EU aerospace industry's total turnover resulted from business with European governments, and 29.2% from sales to military organisations (including those from EU governments). Some years ago, the sector used to be even more dependant on government and military customers, when between 65 to 75% of business came from governments. Parity between sales volumes to civil and government customers was reached in the 1980s, and since 1997, EU governments account for just more than a quarter of overall turnover, while commercial domestic customers and export customers now constitute three quarters of business for the EU aerospace industry. By comparison, government purchases in the US account for 38% of sales (including NASA and other agencies). Thus the European aerospace industry depends to a much lesser extent on government contracts, but nevertheless enjoys a smaller home market base (AECMA 2000, p.9).

The trend of a falling proportion of sales going to military and government customers will finally be turned around in the near future. EU governments have launched long-term investment programmes into their military organisations, such as the purchase of new military transport aircraft (Airbus A400M), the Tiger helicopter, and the Eurofighter. EADS, the European market leader in the aerospace industry, expects military sales to grow by 50% to 9 bn Euro by 2004 (Die Welt, 18/05/2002). EADS hopes to extend its sales to military customers to about 30% of total sales, so as to become less dependant on Airbus sales. Civil aircraft business is also currently experiencing a difficult time, because airlines around the world are struggling with the aftermath of the September 11th terrorist attacks in USA. The industry is therefore hoping for increasing purchase volumes from governments and the military which are currently seen as attractive growth markets with good profit margins (Die Welt, 07/05/2002).

Figure 2-2: Share of civil and military turnover in EU Aerospace Industry



Source: AECMA 2000

The military and government sector plays a less significant role for the automotive industry, despite considerable revenues from the sale and maintenance of military trucks, jeeps and cars to police and other government organisations across Europe.

The shipbuilding industry presents a different picture. Shipbuilding has always received considerable subsidies from EU governments. During the cold war period, naval capacities were primarily concentrated in the US and the Soviet Union, and after the cold war, numerous naval shipyards closed down or were transformed into civilian shipyards. The situation for shipyards in the EU during the last decade was characterised by decreasing defence budgets and increasing costs for producing high-tech military equipment. Governments initiated a number of joint European projects. The desire for standardisation within NATO and for cost-effectiveness through larger series production and the preservation of skills and technologies has created incentives for collaboration in naval shipbuilding.

Table 2-2: Major shipyards involved in naval shipbuilding in Europe

	Carriers	Frigates	Corvettes	Sub-marines	Mine counter-measure vessels	Fast attack craft	Landing docks and vessels
B					Antwerp SKB		
DK			Danyard – Aalborg		Danyard - Aalborg	Danyard - Aalborg	
FIN					Hollming	Hollming	
F	DCN/Brest	DCN/Brest DCN/Lorient Chantiers-de-l'Atlantique	Chantiers-de-l'Atlantique	DCN/Cherbourg	DCN/Lorient	CMN+SFCN	DCN/Lorient
D		Blohm & Voss Lürssen Group HDW Thyssen NSW	Blohm & Voss Lürssen Group HDW Thyssen NSW Abeking & Rasmussen	HDW Thyssen NSW	Lürssen Group Abeking & Rasmussen	Lürssen Group Abeking & Rasmussen	
EL		Hellenic Shipyard				Hellenic Shipyard	
UK	BAE Systems	BAE Systems (Yarrows) Vosper Thorny.	Vosper Thorny.	BAE Systems (VSEL)	Vosper Thorny.	Vosper Thorny.	BAE Systems (VSEL)
I	CNI/ Fincantieri (Trieste)	CNI/ Fincantieri (Riva Trigoso)	CNI/ Fincantieri (Riva Trigoso)	CNI/ Fincantieri (Trieste)	Intermarine	CNI/ Fincantieri (Trieste) Intermarine	CNI/ Fincantieri (Trieste)
NL		Damen (De Schelde)		RDM	Van der Giessen-de Noord	Damen	Damen (De Schelde) Van der Giessen-de Noord
NO					Umoe Mandal	Umoe Mandal	
S			Kockums (Karlskrona)	Kockums (Malmö)	Kockums (Karlskrona)	Kockums (Karlskrona)	
E	Bazan	Bazan		Bazan	Bazan	Bazan	

Source: COST 2001

Mirroring current developments in the aerospace industry, the changing international security situation, with its increasing interest in European military interventions, including coastal naval operations, may imply a growing need for sea transport capabilities in the future. Given the importance of government and military organisations as customers for the sector, it is worthwhile considering the effect of their ongoing e-initiatives on the transport equipment sector. EU governments, NATO and EU military organisations are currently in the process of implementing a number of large-scale e-initiatives throughout their organisations. The implementation of SAP throughout the German Bundeswehr, different e-government initiatives throughout Europe, or the Life Cycle Management initiative of NATO (see box) serve as examples.

Life Cycle Management (LCM) initiative by NATO

Definition: "The coordinated and coherent deployment and exploitation of advanced management information techniques and practices in order to enhance the effectiveness and efficiency of NATO's business processes across the life cycle of defence systems, resulting in measurably improved support to NATO's operational capabilities."

Goals: for example,

- total and shared view on the objectives of a project
- create seamless life cycle management process extending from mission analysis to product disposal
- establish a life cycle partnership between all stakeholders in the project

Disciplines: for example,

- Procurement
- Overhauling
- Training
- Transport and traffic
- Infrastructure / facility management
- Human Resource Management
- Configuration Management

It requires: for example,

- Information systems that manage technical and logistical data and processes
- E-Commerce
- Knowledge Management
- Connectivity and security

(from CPM-congress at ILA 2002, May 8th, presentation by Peter Janatschek)

It is very likely that these e-initiatives by government and military customers will require some level of web-based interaction with firms from the transport equipment sector. For example, the LCM-initiative of NATO aims at a seamless management of military equipment (such as aircraft and trucks), from detecting the need for a vehicle, procurement, operation and overhaul right as far as disposal. Such ambitious projects require close co-operation and e-connectivity with industry partners.

Given the importance of institutional customers from the public sector for transport manufacturers and their current efforts to implement e-solutions, it is likely that these institutions could have a "knock-on effect" for e-business implementation in those firms with whom they conduct frequent business. However, it is hard to say at this point how large this effect will actually be and how many firms it will ultimately reach. In some cases it is currently rather the other way round. Large OEMs in particular in the automotive sector appear to be ahead of government institutions and militaries in terms of e-business integration, so that a "knock-on effect" seems unlikely. However, the effect could occur in the shipbuilding or aerospace sectors. At least it is quite safe to forecast that e-initiatives like the LCM-project at NATO will act as a driver and not a barrier to e-business implementation in European transport equipment firms.

2.3 Impact of e-business

Now that the transport equipment sector has started to fully embrace the electronic business revolution and its associated technologies, e-business is beginning to exert an impact on industry structures, processes, relationships and activities within and between firms. In this report, we will consider two levels of e-business impact: the "macro-impact" on the industry structure and the "micro-impact" at the level of the individual firm.

At the sector level, it is very likely that in the long run the Internet will affect the entire industry and value chain structure. Currently its impact is not significant and up until 2000, e-business was considered by many firms to be mainly an IT-issue with little strategic implication. The majority of industry players were not prepared to invest in e-solutions as tools to strengthen their competitive position and adopted a "wait-and-see" approach. As a consequence, no dramatic changes in the supply chain and the industry structure are currently visible. However, the picture gradually appears to be changing, and particularly some of the spectacular large-scale e-business initiatives such as Covisint (see case study below) have drawn the industry's attention to the issues at stake.

At the level of individual firms, the first e-business applications that were introduced were often just tacked onto the existing organisational structures and tools and have had little impact on structures yet. Many companies still regard e-business as an activity of the sales and marketing department.

A KPMG study (KPMG 2001c) revealed some of the problems that occurred when introducing first generation e-business activities. Suppliers in particular had a tendency to launch various web-projects without having first examined their customers' needs and their competitors' Internet activities. More than half of the firms interviewed did not plan their e-business activities strategically, nor did they define any aims or estimate any costs or profits for their initiatives. The results were consequently not very encouraging. Only one fifth of such initiatives have been successful (Handelsblatt 10/09/2001).

But after this somewhat discouraging start, the trend seems already to have turned around. Today companies often create special e-commerce teams, committees and divisions to concentrate on looking strategically at electronic business. Large firms (often in co-operation with consulting firms) are the ones most actively engaged in these activities at this point. For example, DaimlerChrysler has just launched a new firm, DCX, which is supposed to handle all of the firm's Internet activities.

Four key areas of e-business impact can be distinguished at company level:

- impact on product development;
- impact on procurement and supply;
- impact on customer information, product order and delivery; and
- impact on human resource management.

In this chapter, we will look separately at each of these categories. The findings suggest a number of conclusions. The impact of e-business is currently most visible in the car industry and can be expected to grow further in the future. The other sub-sectors are lagging behind the automobile sector, partially due to the different type of business in which they are involved. This would indicate a somewhat reduced positive effect of e-business solutions for those who use them (cf. section 2.4 for a discussion on differences in e-business adoption.).

Nevertheless, e-business cannot be disregarded and is clearly relevant for all sub-sectors in the transport equipment industry.

Out of all the e-business solutions, e-procurement currently seems to be the most widely used application. e-SCM promises the largest efficiency gains and can also be expected to have the biggest impact on industry structures in the future. However, the outcome of these structural changes in the industry and in the way business is conducted will not be determined by technology but by strategic decisions on how to use it. Much of what we will see in the future depends on how the current e-business barriers will be dealt with. The shift of power between suppliers, system integrators and OEMs is an issue of particular importance in that respect.

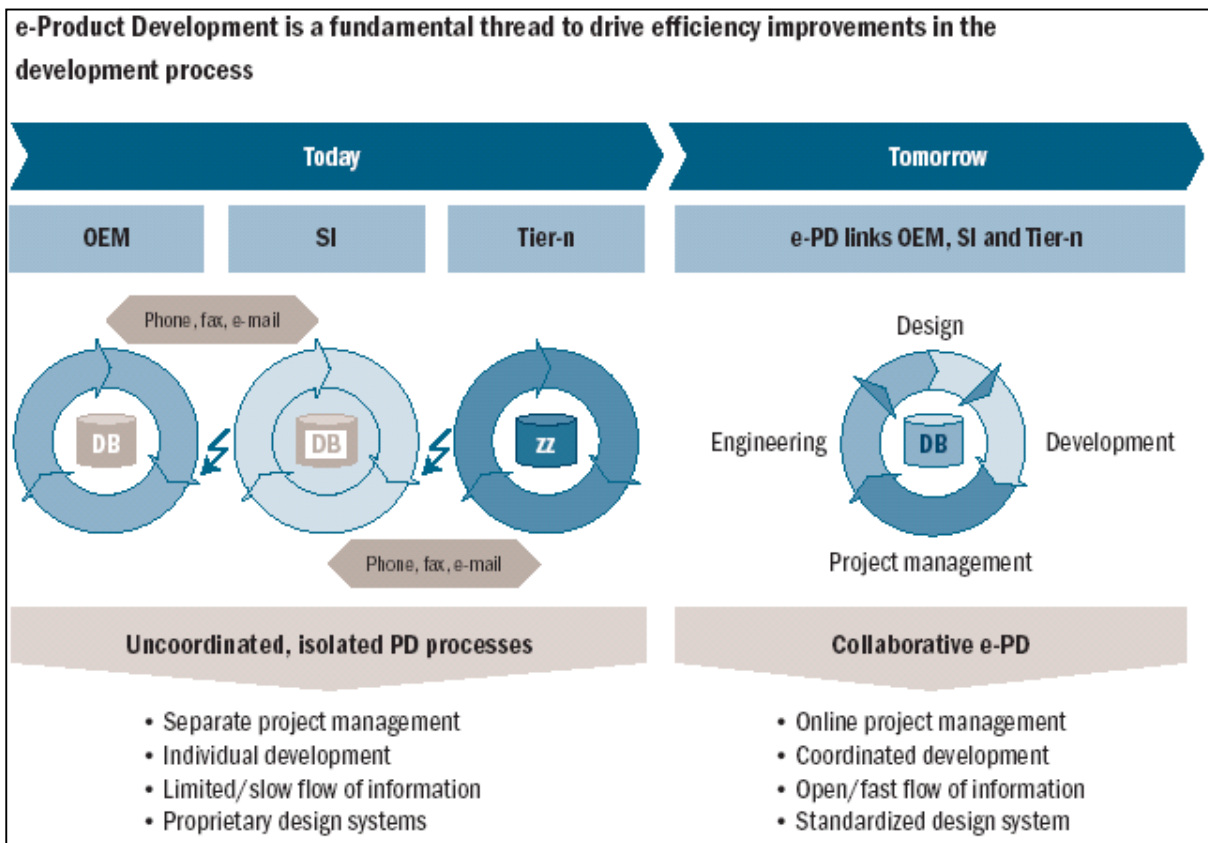
2.3.1 Impact on product development

Automobiles, aeroplanes, space rockets and other products manufactured by the transport equipment sector comprise thousands of different parts and modules often engineered and produced by dozens of different firms. All these products tend to be extremely engineering-intensive and large cost shares can therefore be attributed to product development. Intensive co-operation between n-Tier suppliers, System Integrators and OEMs in the development of new products is very common and much of the engineering competence for a new car or aeroplane is held by suppliers and System Integrators. Considering this type of close co-operation between business partners in product development and the large amount of time and money invested in engineering efforts, the implementation of e-technologies in product development is receiving much attention, as it promises significant benefits.

E-enabled product development can incorporate a broad range of different tools, including web-enabled CAD/CAM, online project management, 3D design and product data management. These solutions promise a variety of benefits. First of all, significant time savings can be realised. For example, it is estimated that overall product development times could be reduced by 20 to 50% in the automotive sector. This corresponds to a reduction in product development times from the current 24 to 36 months to 12 to 29 months by 2004. Consequently, product development costs could be reduced by 10 to 25%. Cost savings will result from the overall reduction in development time, the reduction in the number of engineer hours required for a specific development project, the increased reuse of existing designs and a reduction in the number of prototypes required. Further cost savings could result from lower direct costs for communication (OSAT 2001, p. 6).

Increased transparency in the engineering progress may lead to fewer mistakes and better products. In addition, e-product development tools can be used for increased global collaboration, which is an important argument in a global industry. Last but not least, a well-functioning web-based product development environment could significantly increase the "ease" of engineering. This is comparable to the ease of using e-mail instead of sending fax messages or "snail mail" in the office environment. For example Web-based product development allows the real-time exchange and simultaneous use of CAD/CAM files without having to deal with data formats or the delivery of files from one office to another.

Figure 2-3: Advantages of e-Product Development



Source: OSAT; Roland Berger – Strategy Consultants

These are powerful arguments in favour of e-collaboration in engineering and product development. However, there remain a number of barriers to be overcome.

The question of power

In the past there has been a continuous shift in the balance of power from OEMs to System Integrators. As the OEMs have delegated the responsibility for system design and engineering, they have weakened their capabilities to execute these systems in-house. This gives System Integrators more control of the process. There seems to be a fundamental difference between what System Integrators and OEMs see as the ultimate result of e-product-development initiatives. While many System Integrators see it as a way to gain more power from OEMs, their customers see it as a chance to delegate more engineering and design responsibility, whilst still being able to control the entire process. While it is not clear how this battle of power between the OEMs and System Integrators will be resolved, there is broad consensus that the lower Tier suppliers will lose power. However, lower Tier collaboration remains important for System Integrator success in e-product-development and could be a barrier to implementation (OSAT 2001, p. 23ff.).

Transparency issues

Transparency is needed to realise benefits from e-product development tools. In fact, transparency and free access to real-time information between business partners are integral to most of the advantages promised by e-technologies. However, questions of intellectual property rights, data security, and the “commodity threat” act as barriers to full-scale transparency.

Intellectual property rights: Sixty% of the interviewees in a survey of automotive System Integrators mentioned concerns about the security and confidentiality of their proprietary data. Due to the importance of protecting proprietary knowledge, full transparency is an unrealistic goal even in the long run (OSAT 2001, p.6).

Data security: Even if System Integrators trust their OEM customers not to abuse their intellectual property, there is a real fear about system designs and data “leaking” to competitors. As one interviewee put it, “if we put our product development files on the web, we will be the target of every hacker from here to Timbuktu.” (OSAT, p.20)

The “commodity threat”: There is a fear that the transparency around e-collaboration in product development will hasten the process of commoditisation of engineering and research outputs. One interviewee in the OSAT study said that “anytime people become too knowledgeable, the know-how becomes too highly spread and quickly turns into a commodity” (OSAT, p. 20). Surely a scenario every engineering firm will want to prevent in order to preserve its basis for generating revenues.

Standardisation issues

A wide variety of incompatible proprietary CAD/CAM and EDI systems have emerged in the past, with cost disadvantages for all parties involved (except the software providers). This scenario is unlikely to be repeated, but the industry still lacks an accepted data standard for e-product development systems. Data and communications standards that are commonly agreed upon and widely used are a prerequisite for the widespread use of Internet-based engineering collaborations. Yet firms are reluctant to relinquish what they consider to be a source of competitive advantage – their proprietary product development tools. And neither OEMs nor System Integrators have so far stepped up to take the initiative for a common data standard. The emergence of a powerful third party such as Covisint might create an industry standard, thus overcoming the reluctance of the OEMs, and one of the large software providers could end up defining a standard supported by the industry. If such a standard were to emerge, it could be adopted by the lower Tiers first, because at this level only a few suppliers are already tied to an e-product development tool or have enough resources to implement one on their own. (OSAT, p. 21)

These issues show that although the Internet could play a major role in collaborative engineering in the near future and would very likely yield significant benefits and returns for those who used it, there are still a number of obstacles to be overcome. It seems likely that, even in the future, the majority of electronic product development will use proprietary networks.

The Standardisation Dilemma

“Our interviews show that there is a clear contradiction: companies want standardisation for using external data, but want proprietary systems for their own data. The primary hurdle for standardisation is the belief that proprietary product development systems offer companies a competitive advantage. As one OEM interviewee put it, ‘there is still a debate about whether having your own CAD system is a competitive advantage or not.’”

Source: OSAT, p. 20

2.3.2 Impact on procurement and supply

Procurement and supply undoubtedly play a major role for firms in the transport equipment sector. They are essential for everyday business and directly impact on balance sheets. In the transport equipment industry, many companies typically find materials making up nearly 50% of their overall cost-structure (Fine & Raff 2000, p. 15). The significance General Motors placed on the services of the Spaniard Ignacio Lopez, as well as the ferocity with which it fought his being poached by VW in the mid-1990s, provides a crude measure of how important the sector considers optimising procurement and supply functions to be.

The OSAT survey showed that 59% of automotive System Integrator interviewees feel that e-procurement is still the most advanced e-business function. The main reasons are: there are already tools available to implement it; it is relatively easy to conceptualise; it promises (and delivers) immediate and real advantages and cost savings. In addition, many firms have already experienced just-in-time systems, and thus have the infrastructure and technological basis needed for e-procurement and SCM.

One year into various e-procurement initiatives, the industry is still moving along a learning curve. The hype has been tempered by the recognition of the limits to what e-procurement can and cannot deliver. Mistakes have been made by both buyers and sellers. E-procurement tools, on the other hand, are rapidly becoming more robust. E-procurement has already faced the tensions that confront other areas of e-business applications and can to a certain degree function as a guide to how those other web threads might be expected to advance (OSAT, p. 38ff.).

E-procurement, supply chain management, and online market places like Covisint significantly affect the economic structure of supply networks as well as the costs of the underlying activities. This takes place on a number of different levels:

- The automation of purchasing steps reduces transactions costs. Simple work steps (like filling out forms, aggregating orders, identifying needs etc.) become automated and thus faster, more reliable and cheaper.
- Orders from different business units and departments can be consolidated and aggregated, making use of favourable purchasing conditions with preferred suppliers.
- Information about supplier capabilities and performance can be easily stored and made available to all business units. This can be used to aggregate orders and concentrate them on the most efficient suppliers. If information about the whole supply chain was available in a transparent way, OEMs could use the scale of their overall orders to obtain advantages from their suppliers at all n-Tier levels as well as extending the use of advanced scheduling software.
- Another advantage of seamless web-based information flows, both up and down the entire supply chain, is the lower cost of obtaining and using current information on demand. This leads to greater forecasting accuracy and in turn to fewer (high-cost) rush orders and a reduction in inventory costs.
- Finally, it is simple, transparent, and efficient to place calls for tender on the Internet. It also increases the likelihood of receiving comparable and lowest cost bids, eg in auctions. These represent a huge opportunity for reducing the prices of parts at the commodity end of the spectrum and create huge advantages for best-in-class suppliers to capture high market shares by exploiting economies of scale. In addition, auction mechanisms can also be used to sell excess production capacity.

Despite all these benefits, a problem still remains. The question of power between OEMs, System Integrators and n-Tier suppliers in the e-procurement and SCM area is extremely prominent, probably because the implementation of these tools has been well underway for a while and many of its effects and possible mistakes are already clearly visible. One of the major obstacles is that many suppliers fear that their margins will be squeezed more effectively than in the past if OEMs run auctions, levying fees on participating suppliers, and benefiting during price negotiations from a degree of information transparency that could reveal supplier cost structures. The following case is a good example (cf. box).

Cost savings through auctions

In one dramatic example, a car manufacturer buys plastic parts through FreeMarkets.com (GM's original B2B partner, before the announcement of Covisint). It paid \$745,000 for the last, pre-auction batch of parts. This time, after 33 minutes of bidding by 25 suppliers, the price comes down to \$518,000. That auction was one of five that day run by the same car manufacturer. Parts that would have cost \$6.8 million under the old procurement system sold for \$4.6 million after the auctions.

(Helper & MacDuffie 2000, p. 26-27)

Just as those companies conducting the auctions benefit from lower prices (and the end customers if part of the advantage is passed on to them), suppliers will feel a threat, especially if they do not have the ability to compete entirely on price (the case for many SMEs). Whether they accept conditions of auctioning or not might be a quite limited decision, since large firms at the end of the value chain can clearly make this a "take it or leave it" decision for their suppliers of commodity parts. Not surprisingly, some auction activities by the giants have led to tensions with suppliers who were wary of paying the price for more efficiency and competitiveness at the end of the value chain.

It should be noted that auctions are not used for all components and products. In fact, the information-intensity of interactions between suppliers and their OEM customers has increased tremendously in recent years, as design responsibilities are outsourced to suppliers and as the product architecture becomes more modular. The e-procurement of complex modules does not take place through auctions. These parts are rarely sourced entirely on the basis of price. Bids for such parts are not often sought, since relationship-specific knowledge must be extensive for suppliers to fulfil customer requirements (Helper and MacDuffie 2000, p. 27).

In the end, the relationship between business partners along the value chain is not determined by technology, but by common sense and business strategy. The path taken by e-procurement depends on which type of supplier relations is dominant. Briefly, two different modes of supplier relations can be found: "exit" and "voice" (Helper and Sako, 1995).

In the "exit" model, OEMs solve problems with suppliers (for instance regarding price or quality) by replacing them with another supplier. In the "voice" model, the OEM works with the original supplier to resolve problems. The advantage of the voice model has been a rich flow of information that can lead to improvements such as the elimination of unnecessary or expensive process steps. The disadvantage has been that the trust required for such information exchange makes it difficult to switch suppliers. Conversely, the advantage of "exit" for the manufacturer is that it is not locked into any supplier (Helper and MacDuffie 2000, p. 15ff.).

E-technologies can end up reinforcing either the exit or the voice model depending on the nature of the product architecture, the corporate strategies of OEMs and their suppliers and on their traditional relationships. Technology and software are just tools that can be shaped to a considerable degree to the needs and wishes of those using them. Therefore, the re-configuration of the value chain is not *determined* by technology, but *enabled*. The ultimate decision of what direction to choose lies in the hands of the industry's corporate leaders. This is a lesson that applies not only to e-procurement but to many other e-initiatives (e.g. e-product development) as well.

As already mentioned, e-procurement is among the most advanced e-business applications in the transport equipment sector, based on its level of implementation and acceptance. Its development can shed some light on how the challenges of transparency, standardisation and the question of power may develop in other areas, such as e-product development.

Transparency

E-procurement has made sharing data a central issue. Many suppliers feel that reverse auctions force them to share too much proprietary data and are therefore unwilling to put their best technology out to auction. On the other hand, some suppliers enjoy participating in reverse auctions because it gives them a glimpse of their competitors' pricing. Through trial and error, System Integrators have started to identify what types and levels of data they are comfortable sharing. If an auction is run for new technology, or the bid requires too much proprietary information, they may even decide not to participate. OEMs must be careful about what they ask for and how they ask for it. (OSAT 2001, p. 39)

Standardisation

The standardisation dilemma has not been fully resolved, but the OSAT study revealed two emerging trends:

1. Public exchanges are being used primarily for MRO and commodity products. Business partners feel that there is little security risk in conducting these transactions in a public forum.
2. Private (proprietary) exchanges are still being used for high value, engineered parts. Business partners are wary about putting this information in the public domain using standard systems.

Again, the implication for the industry seems to be that System Integrators and OEMs will only use public exchanges in areas where they do not feel their proprietary knowledge is at stake. Data with higher value will still flow through proprietary systems, even if a third party creates a powerful standard (OSAT 2001, p. 39ff.).

Interestingly, many System Integrators were initially introduced to e-procurement by simply following the OEMs' initiatives without taking a leading role themselves. Later, System Integrators began to take control themselves once they had started replicating the process throughout their own supply chain. For example, Robert GmbH, Continental AG, INA Werk, Schaeffler oHG, and ZF Friedrichshafen AG agreed in April 2000 to start a European marketplace (www.supplyon.com) by suppliers for suppliers, thus taking a pro-active approach. The marketplace went online in July 2001 and saw its 1000th transaction in January 2002.

Question of power

At first glance, the power issue in e-procurement seems to favour OEMs. They led the e-procurement initiatives in the early phase, designing solutions that allowed them to maintain maximum power over the level of information required, the pricing pressure and the expansion of the supplier pool. While System Integrators have ceded power to OEMs in the above areas, they have since been able to regain some power through their own supply base (OSAT 2001, p. 40).

The role of third party marketplaces has become evident in e-procurement initiatives in the automotive sector in particular. Players such as Covisint and Freemarkets have emerged to facilitate e-procurement interaction, standardising it and making it more affordable for the lower tiers. They accelerate the widespread use of e-procurement in the industry in a proactive way, although not without shifting power in their direction. On the other hand, big players like Volkswagen, FIAT or BMW have successfully established and run their proprietary market places and e-procurement solutions, keeping sensitive information away from direct competitors and implementing their own strategies and supplier-relationship-philosophies online.

The case of e-procurement initiatives proves that e-business tools in general are not a one-size-fits-all solution. The tools are available to everyone, but each player will use them in a different way to shape his own competitive advantage.

Supply Chain Management

SCM can be seen as being closely related to e-procurement. However, SCM takes the integration of information sources beyond company borders and along the entire supply chain, which is going beyond mere e-procurement. Ideally, fully implemented SCM solutions allow OEMs to connect all their suppliers (ranging from System Integrators to n-Tier firms supplying minor parts) into a transparent, standardised, web-based information system. This would allow all parties to optimise inventories, shipping, scrap and rework based on shared data and improved demand forecasting. Some of this has already been realised with just-in-time initiatives, which mainly allowed OEMs to reduce their input-inventories. However, SCM takes the approach one step further by connecting firms at all different levels of the supply chain and integrating them into a coherent information network that allows all firms in the value chain to optimise their production plans, inventories, and delivery schedules.

The potential effects of this collaboration among firms at different stages along the value chain could be enormous. Net savings of between 20 and 40% of the aggregated costs of holding inventory stakes in the supply chain add up to billions of Euros of potential savings for the entire industry (Roland Berger 2000). Critical to achieving the expected reductions in inventory is the more rapid distribution of data and demand forecasts promised by SCM. An additional benefit is the reduction of costly rush orders and expedited freight. Better capacity tracking allows firms to improve the utilisation of their supply chain, by levelling production across their suppliers and plants.

SCM is considered a long-term project, since it involves many partners with partially conflicting interests and a range of technological issues that have not yet been completely solved. If SCM succeeds, the cost and efficiency advantages for the entire industry promise to be substantial. But whoever masters the supply chain will eventually gain enormous control. This makes it difficult for companies to work together to develop e-SCM solutions. Once more, transparency, standardisation, and power issues need to be resolved to implement SCM successfully.

SCM offers the opportunity for all levels of the supply chain to be visible to all their partners. But diverging strategic interests lead to conflicting goals for the different supply chain partners. Some of the lower Tier suppliers for example might want to shield some of their inventory data from OEMs and provide them only on a “need-to-know” basis to protect some of their bargaining power from the OEMs, and so forth.

The issues of power and achieving data standards are inseparable. The biggest promoters of standardisation in this area appear to be OEMs who see the opportunity to gain control of the supply chain through transparency, thus diminishing the negotiation power of their suppliers. For this reason, some suppliers might be reluctant to adopt these standards and continue to create and preserve their own proprietary systems. A third party like Covisint might overcome this hurdle if it is able to convince the industry that it will remain neutral and provide strong enough security means to protect customers’ data (OSAT 2000, p.42 ff.).

Overall, e-procurement and SCM solutions give a good impression of what effects e-technologies can have on cost structures, collaboration schemes within the supply chain, overall industry structure, shift of power, and challenges to be dealt with. It would be naive to argue, however, that productivity can be boosted by simply buying these e-technologies and switching them on. In fact, as stated earlier, technology does not determine anything by itself. It is a tool that has to be used and strategically shaped to achieve desired results. To a large extent the outcome therefore depends on the visions, knowledge and competence of corporate leaders.

2.3.3 Impact on customer information, product order and delivery

Almost all firms now have a website that at least gives some basic information about the firm’s contact details, activities and products. At a basic level it is used for marketing and public relations purposes, but there is huge potential on the sales-end side of Internet-enabled firms.

In the car industry, the appeal of the made to order scenario has been widely discussed (see e.g. Helper & McDuffie 2000). The basic idea is that customers can individually configure and order cars completely online and have them delivered to their local dealer or doorstep within a couple of days. Modules from different OEMs might be assembled to truly individual and unique products, e.g. a family-friendly Volvo chassis with a sportive BMW engine and a Bose sound system. Completely new firms, like an imaginary “buildyourowncar.com” might emerge and compete with traditional OEMs and car dealers. Firms from other sectors like Amazon.com or the computer manufacturers Dell or Cisco may serve as examples for a made-to-order scenario for the car industry.

A fully realised made-to-order system would dramatically transform the car industry structure from the status quo, raising the prospect of car manufacturers who focus only on design and marketing, suppliers who control key elements in the dominant design, contract assemblers who build vehicles for multiple car manufacturers, and new kinds of intermediaries for retailing and distribution of “mobility solutions” instead of cars that the owner completely owns and maintains (see Helper & MacDuffie, p. 4 ff.). If this scenario should come true, product designs and production would have to change dramatically. The current dominant product architecture for cars is still substantially integral rather than modular, closed rather than open. This would have to change in order to facilitate a pure made-to-order design.

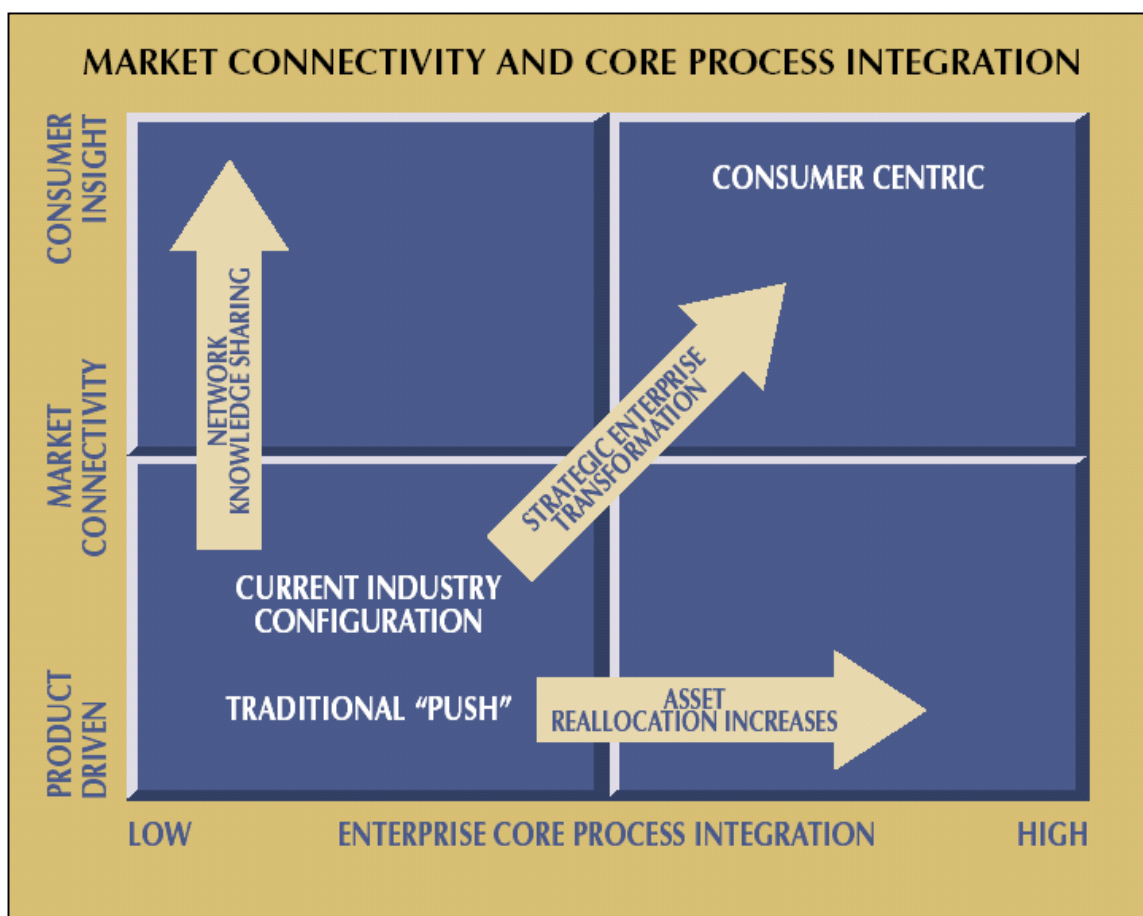
However, cars are extremely complex products that consist of thousands of different parts. Not all of them are modularised or easily exchangeable. Parts are often intensively tested and configured, in many cases even custom-engineered, in order to match other parts and to

build a high-performance end-product that can cope with the high and multi-dimensional demands of customers. Supply chains are deep and wide, and dealers still play a major role in selling the final products and providing purchase-related services. All of this makes the extreme made-to-order scenario for cars more difficult, if not impossible, to realise.

Still, made-to-order has significant potential for the industry, if customers are willing to pay a premium for unique and customised products. In addition, inventories, scrap, and on-stock production can be reduced (each having direct impact on the balance sheets of producers) if the potentials of the Internet as a customer interface and sales channel are used.

As figure 2-4 shows, the Internet-interface with the consumer could also be used to transform car manufacturers from a traditional “product-driven push” industry to a consumer-centric industry, based on consumer insight and a high level of integration between all core business processes within business alliances.

Figure 2-4: Automotive-to-Consumer Strategic Migration Framework



Source: PWC (2000)

The B2C channel has already had an impact on today’s car industry. The Internet provides customers with a wealth of information about product specifications, for instance about new and used car prices, safety test results or consumer-based quality rankings and judgements. OEMs have begun to implement a range of Internet-based “buying-services” with information about products in stock at various dealers that most closely match consumers’ search specifications, including prices. Consumers may browse the offer by using advanced “car-configurators” that allow them to choose and experiment with different product options such as engine, internal and external colours and accessories. The customer gets a feel for what

is possible and available, how much it costs, and what it will look like, as well as list prices and financing options. Configurations can be saved and worked on later. If a customer is satisfied with his configuration, his order is transferred to his nearest local dealer, where he test drives the product and signs the papers. Producers not only use these features as powerful marketing tools, but also as a means to collect information about customers and their preferences.

In theory, with better information about customer preferences, substantial savings could be achieved. Currently, dealers allow 75 days for inventory on average for each car, for a carrying cost of \$431 per vehicle. If the use of e-commerce cut this in half, \$200 per vehicle could be saved (Lapidus 2000, p. 13).

The potential of made-to-order is much less for the aerospace, ship, or railways sectors. Made-to-order small lot sizes are already the rule in these sectors instead of mass production. The sectors mainly supply corporate or institutional customers who do not expect "home delivery" within 24 hours. Additionally, purchases are mainly based on trust and long-term business relationships rather than on factors steered by marketing features. The potential of the Internet to revolutionise production from the sales side in these sectors is perhaps not be as great as in the car industry. However, the marketplaces for used Airbus aircraft or Airbus spare parts run by Airbus industries show that the Internet can play a role as a sales channel in these sectors as well (www.airbus.com).

2.3.4 Impact on human resource management

An area that is often neglected when analysing the impact of e-technologies is the entire field of human resource management. Most of the solutions in this field help to make procedures faster, cheaper, and more flexible for the employees involved. The potential of this field should not be underestimated, especially when considering the size and the importance of the sector for the European economy. One out of seven employees in Germany, for instance, works directly or indirectly in the car industry, which highlights the importance of e-HR tools. The scope of e-solutions for this field is wide, ranging from recruitment, training and knowledge management to payroll accounting and travel expense management solutions.

Recruitment

The main e-tools for recruitment are Internet job postings, online-applications and online-communication with applicants. Online job postings are a relatively cheap yet effective way of getting in contact with a large number of potential employees. Firms not only post job offers on their corporate website, but many also make use of one or more online job-portals such as monster.com. Applications and pre-interview screening procedures are often routine tasks that can easily be automated online, yielding significantly shorter response times and cost savings. Communicating standard matters (such as acknowledgement or rejection letters for applications) can be done quickly and cheaply via e-mail. Meanwhile, almost all car manufacturers use the Internet and their corporate homepage for recruiting purposes, with the larger firms showing a visibly stronger engagement than SMEs.

Training

Many jobs in the transport equipment sector are knowledge intensive. Complex engineering tasks, day-to-day business using computer software and international work environments require ongoing qualification schemes for employees. E-learning has come to be a powerful yet established way of saving costs and time in training employees in a variety of different topics, covering issues like software, languages, product or process related issues (Köllinger

2001, p. 18 ff.). The automobile industry (together with the financial services, retail and the ICT sectors) has been identified as one of the most e-learning friendly industries (Berlecon Research 2001, p. 67ff.).

Knowledge Management

E-Knowledge Management (KM) solutions are technical tools that support the systematic aggregation, storage, and accessibility of internal company knowledge assets. This could be, for example, the experience of engineers in dealing with a specific material, surveys about customer preferences, or case studies in how to deal with a specific government institution. Internet-based KM-tools can reach, connect, and aggregate the knowledge and experiences of a geographically diverse work force and are therefore often found in international companies with establishments in different countries. Although hard to quantify, the “soft benefits” of KM, such as the diffusion of knowledge and experience leading to less work or mistakes being repeated, or unleashing additional creative potential from employees, can yield significant returns for companies.

The automotive sector was among the first to adopt KM solutions. A good example is the DaimlerChrysler Corporate University. It offers a high-performance e-learning and KM solution that mainly targets the 7,000 internationally dispersed managers of DaimlerChrysler. It combines e-learning modules from reputable content providers like the Harvard Business School, INSEAD, or the University of Sankt Gallen and serves as a structured yet customisable communication and knowledge sharing platform for its users. E-learning modules are used to support, supplement and partially substitute classroom seminars, whereas the KM functions are used to share important information and experience and to create expert-networks company-wide and across national borders. DaimlerChrysler reports that significant cost savings and quality improvements were realised with the Corporate University (case study based on a powerpoint presentation by M. Mueller, DaimlerChrysler AG, at Learntec 2001 in Karlsruhe).

Payroll accounting and travel expense management

These administrative and book-keeping related tasks are another area where web-based services and solutions can save costs. The activities are usually routine tasks that nevertheless require in-depth knowledge of accounting principles, laws etc. A number of web-based service providers have specialised in these tasks, and offer them to their business customers at significantly lower than in-house costs. These web-based service providers are especially interesting for SMEs, who cannot afford the huge overheads that accompany fully staffed accountants departments. These solutions (like Lohndirekt.de) are a good example for e-tools that are affordable and that generate instant cost savings, even for smallest firms.

2.4 Differences in e-business adoption

The previous chapters have already pointed to some differences in the degree of e-business adoption. Most notably, there are differences in e-business adoption among the sub-sectors and among larger and smaller firms that need to be further discussed.

Differences between sub-sectors

Among the sub-sectors of the transport equipment industry, the car sector is the most advanced in making use of e-technologies. E-business is a major topic at associations of the European automotive industry (e.g. VDA). There is also extensive coverage of e-business

issues related to the automotive industry in the press, at conferences, in the sector research community (e.g. MIT IMVP and OSAT) and among management consulting firms. Moreover, OEMs and large SIs in the sector are all more actively engaged in a variety of e-initiatives than the other sub-sectors.

The “giants” in the automotive sector are presently the most prominently involved in market exchange activities such as Covisint, or the proprietary exchanges by BMW, VW and FIAT. E-procurement appears to be the most widely accepted e-solution at present. However, it is still a long way to go from these first steps in e-business to the point where “e-potentials” will have been fully realised. For example, there still is a lack of the end-to-end value chain integration necessary for full-scale SCM solutions. The visionary power and management skills of enterprise executives will determine how to cope with the challenges and barriers that have been highlighted in this report.

Manufacturers in the other transport equipment sectors (aircraft etc.) still appear to be far behind the automobile industry in e-business adoption, not only in terms of actual application, but probably also in terms of awareness. Among the more noticeably initiatives are the EADS procurement system and AIRBUS used aircraft auctions in the aerospace industry.

The railway sector is currently experimenting with different initiatives to implement e-business solutions, for instance in B2C projects in the area of ticketing. Furthermore, railway companies plan to restructure their communication infrastructures and to streamline the supply chain. UNIFE (Union of European Railway Industries) has founded an e-business working group to identify the benefits and disadvantages of e-business in the rail sector.

One of the reasons why the other sub-sectors lag behind the automotive industry is likely to be found in the particular industry structures and the types of products they produce. There seems to be a natural limit to the potential benefits of e-business solutions for industries with no mass production features and a smaller amount of routine everyday tasks.

Differences between large and small firms

In general, SMEs lag behind large companies in adopting e-business, mainly because the cost-benefit structure of advanced e-business solutions is less favourable for them. Economies of scale arise from the fact that e-business solutions tend to require substantial investments (i.e. fixed-costs) into consulting, technological development and implementation processes before they are “up and running”. Software has to be installed on servers and desktops, data interfaces have to be programmed, roles and processes need to be defined and eventually re-engineered. Once implemented, the solutions often require additional and continued fixed expenses for maintaining the system. Variable costs comprise training users, licence costs and usage and access fees. With more users, incremental costs tend to fall (mostly through bulk discounts). All this implies that large enterprises are at an advantage.

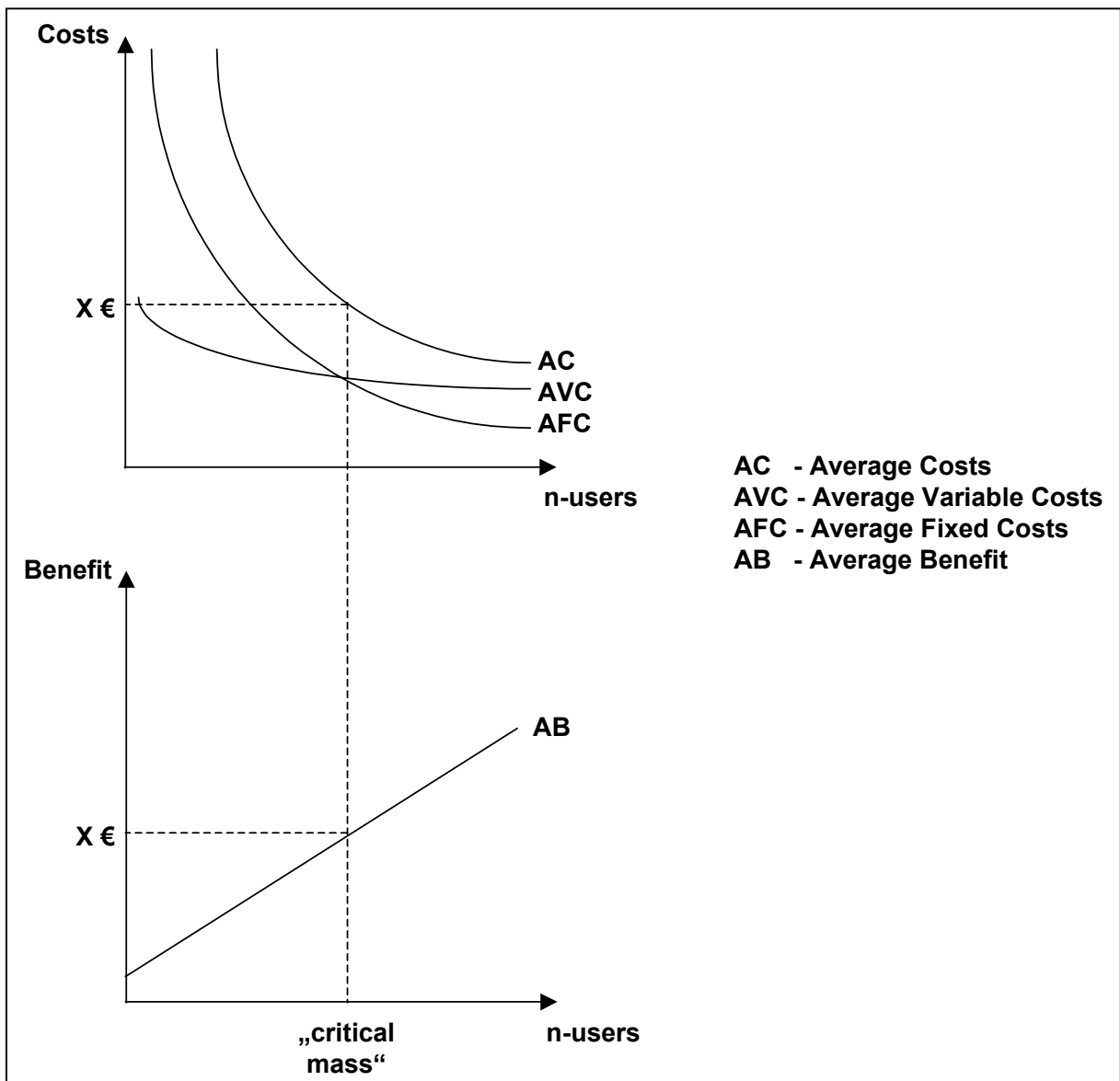
In addition, network effects usually allow the benefits of e-business to increase along with the number of users of each particular company specific solution. If more people are able to use the company’s system, the potential for scaling positive effects (such as aggregating orders) increases.

These arguments would imply that a critical mass of users within a company needs to be reached for many e-business solutions to be a profitable investment for an enterprise (cf. Figure 2-5), as the average costs curve (the sum of average fixed and average variable costs) decreases as the number of users increases. If we assume that all the costs and benefits of an e-business solution could be correctly and extensively expressed in monetary terms, then a point X exists where average costs and average benefits per user are equal. This point can be called the “critical mass” of a specific e-business solution. This implies that

such a solution is only a profitable investment if it reaches more users than the critical mass requires.

These inherent characteristics of many e-business solutions may be a reason for the slower uptake of e-business in SMEs and probably constitute a natural “upper limit” for e-business uptake in SMEs. In other words, since in smaller firms a variety of routine tasks is usually carried out by a much smaller number of people, the “critical mass of users” is not available. If this size limit is not reached, potential benefits become too small compared to the costs involved with implementing such solutions. In such a situation it is a perfectly rational decision not to adopt an e-business solution. Why buy a super truck if a wheelbarrow does the job better? This consideration has important consequences regarding policy interventions, as it would offer a plausible explanation for slower e-business adoption in SMEs.

Figure 2-5: Hypothetical Cost / Benefit Structure of an E-Business Solution



Source: DIW

2.5 Opportunities and risks

This chapter summarises findings based on the analysis of e-business adoption, by contrasting generic (i) opportunities and risks and (ii) barriers and enablers that apply to most of the e-business applications and are largely independent of the sub-sectors considered in this report.

Opportunities

- Potential for significant **cost savings**: there seem to be increasing returns to scale for e-business investments, meaning that most e-business applications promise the biggest cost savings when they reach a wide base of users. The combined potential for cost savings can be tremendous.
- **Greater speed and efficiency**: e-technologies allow real-time access to data, leading to reduced “waiting times”, uncertainties, and improved information for decision making. This applies for instance to engineering, manufacturing, logistics, inventory management and forecasting customer demand.
- Potential for **better collaboration** between OEMs and suppliers: advantages can be gained from outsourcing, specialisation, and building strong strategic partnerships in an industry group. E-technologies can be efficiently used to connect globally dispersed business units or partners, creating a globally coherent information network and efficient communication platform.
- **Transparency** leads to reductions in shadow engineering, errors, and inventories
- **Reduced overheads** result from the automation of routine tasks. This has positive effects on cost structures as well as unleashing an enterprise’s internal resources for core business activities and value-adding tasks.
- A variety of e-solutions can be used to **enable strategic changes** in a company or industry-group. For example, the potential for the car-industry to re-shape their business activities from traditional push-mass-production to customer-centred, demand-driven mobility solution providers.

Risks

- **Implementation risk**: There is always an inherent risk that after making the investment the system will not function as proposed or that the training received by employees will be insufficient for effective use. The new system might also prove incompatible with other existing systems and processes.
- **Early adopter risk**: The risk of serving as the beta tester for the industry, leading to a “wait-and-see” approach by many firms. This involves high costs for experimental stages where efficient solutions do not yet exist.
- **Opportunity costs**: The risk that the considerable investments required for many e-business solutions could be better spent on other areas of operation.
- **Risk of eroding profit margins**: This risk is especially common for suppliers and producers of commodity parts and products.

2.6 Barriers and enablers

Enablers

- **Large firms** have the financial resources needed to implement e-solutions and to spread them over a wider area to enable a positive ROI. The transport equipment industry is strongly concentrated – a few large firms account for a very large share of the overall industry turnover. These industry “giants” are quick to implement e-solutions wherever they promise significant potentials and create a knock-on effect on the smaller firms; n-Tier suppliers to do the same.
- **Intense competition** creates pressure to experiment with new ways to improve cost structures, production and engineering, products and customer service. E-business is a set of powerful tools for these objectives and is seen by many as an important part of corporate strategy.
- **Access to technology** does not appear to be a problem. The necessary communication infrastructures are widely implemented, ranging from high-quality telephone networks, computing hardware and a range of competing software and network access suppliers that court for business. Many e-business solutions are already technically robust and have been tested in real-world environments. A variety of powerful industry-specific software solutions are available that can be further customised.
- **Government and military investments in e-business** solutions could have a knock-on effect on firms in the transport equipment industry that frequently do business with these customers.

Barriers

- **Implementation costs** are a major barrier for e-business initiatives, especially for firms with constrained budgets. A KPMG survey among global automotive leaders revealed, for instance, that 51% of interviewees cited costs as barrier to e-business (KPMG 2001a).
- **Need to re-engineer business processes:** Although re-engineering of processes is often considered a virtue, as it offers an opportunity to save costs and improve overall business performance, in reality it often involves changes to the work routines of many employees that can easily result in difficult to resolve conflicts.
- **Lack of e-business skills:** 45% of the respondents in the KPMG survey said that a lack of skills slows down e-business adoption. This points to the fact that the implementation of new technologies and work processes requires extensive advertising and training: this is costly, time-consuming, and obviously an additional opportunity cost to doing “productive work” (KPMG 2001a).
- **Security issues** are still a widespread concern and act as an e-business barrier. However, part of the problem seems to be based on misconceptions, misunderstandings, and a biased hype surrounding the issue. Of course there is a risk of being attacked by hackers or of losing data to competitors, if the appropriate security actions are not taken. The national industry director of KPMG’s automotive division in the US reports that “there is a misperception out there that smaller Internet projects don’t need security protection by the nature of size. But security is one of the first e-business investments and one of the wisest. No one needs to have proprietary designs stolen or a production line shut down because of network penetration” (E-Commerce Times, 11/01/2001). In other words,

powerful security tools are available – they just need to be actually used, just like locking the door when leaving the house. Of course, one can never be 100% safe. But security issues can be solved in a plausible manner, and need not be a serious barrier to e-business.

- **Opposition from suppliers** also slows down e-business adoption. There seems to be a widespread fear of increasing pressure on prices and margins if OEMs begin to buy on the Internet. This is what the OSAT study also referred to as “the question of power”: utilising e-business initiatives can enable suppliers to take control of their supply chain; however, the same technology provides OEMs with the opportunity to continue and even accelerate the delegation of responsibility while using the increased transparency to maintain full control. Balancing the interests of the different parties involved is a way to cope with this barrier.
- **The standardisation dilemma:** the approach to standardisation is contradictory. The industry does not want to recreate the inefficiencies it experienced with the adoption of multiple CAD/CAM systems and recognises the need for common data standards and protocols; however, no one seems to be ready to give up the security and advantages of proprietary systems (OSAT 2001).
- **The standards risk** is a universal barrier to the adoption of new technology, not only in the transport equipment sector. The term describes the risk of investing in an early version of technology that does not subsequently become the industry-wide norm.
- **“Old guy” resistance** and cumbersome organisational cultures also frequently slow down innovations and change. This is a situation quite frequently experienced in almost all kinds of organisations. It’s simply the notion of “if it ain’t broke don’t fix it”.
- **Transparency dilemma:** data sharing is central to how much value e-business initiatives create. However, protecting proprietary knowledge is what provides System Integrators and other suppliers with negotiating power over their OEM customers.
- **Return on Investment issues:** investments in e-business initiatives have to be justified by calculating a business case that shows positive return on investment (ROI). On the other hand, business cases that rely purely on cost saving arguments often underestimate the potential benefits of an initiative and thus slow down e-business adoption.

2.7 Case studies

2.7.1 Covisint

Company Profile

Covisint is currently the largest and most prominent online marketplace for the automotive industry. Founded as a joint venture by Ford, General Motors, DaimlerChrysler, Renault Nissan, the PSA group and the technology providers Commerce One and Oracle, it has operated as an independent company since December 2000 with its headquarters in Southfield, Michigan (USA). In 2001, Covisint Europe B. V. was founded in Amsterdam (NL). Further offices are located in Tokyo (Japan), Paris (France), and Frankfurt (Germany). Another office is also planned for Brazil. Covisint currently employs 270 people worldwide. To date more than 7600 companies from the automotive industry have registered as members. The company is planning to break-even by the end of 2002.

Concept and aims

Covisint represents an automotive e-business trading and information exchange, which attempts to provide a complete value-added network for the industry. Despite evolving e-business activities throughout the different companies, no e-solution has yet set a common standard in the automotive sector. Some car manufacturers, e.g. BMW and VW, have launched their own marketplaces despite the launch of Covisint by their rivals.

Fearing to be confronted with a number of competing e-business solutions serving the same purpose by different OEMs, suppliers have urged OEMs to create a uniform and easy-to-apply industry standard solution for online B2B transactions.

The concept and aims of such a joint e-marketplace for the automotive industry were discussed in consultation with both suppliers and car manufacturers. In order to make existing software solutions compatible, Covisint is also negotiating with other online marketplaces such as Supply-On.

Products and Tools

Covisint offers collaboration solutions, e-procurement, supply chain management and product development solutions:

- Collaboration solutions allow team members from different companies or different geographic regions to work together in a virtual workplace to create and manage projects and get access to vital information. The interface offers, among other things, document storage and a discussion forum.
- Covisint offers different solutions for online procurement: using the auction tool, a buyer can establish an online event and invite suppliers to submit bids. Product information can be converted into electronic catalogues from which buyers can access the information easily using a keyword or category search. Suppliers can upload, manage and modify catalogue data in a central repository. Electronic document management and storage helps co-ordinate communication between buyers and suppliers. The asset control function manages the internal re-deployment or sale of company assets.
- Supply Chain Management solutions create a connection between buyer and supplier allowing them to share critical information like inventory levels and shipping plans.

- A quality planning tool allows manufacturers to access critical quality information in order to avoid any defects.
- Covisint's Portal provides a library service, a supplier bulletin, content management functions as well as messaging functions.

At present, each of these tools has been technically completed and has at the very least undergone a test run. All solutions have been developed by different software partners in order to find the best possible one. As a special service, Covisint will conduct a market analysis and if necessary a pilot project in order to help its potential customers choose the most appropriate software package. The company also offers adjustment and consulting services as well as software training.

Experiences

Irrespective of the high expectations that evolved from the e-business hype, Covisint is satisfied with the platform's performance and acceptance, as transaction volumes and active users will further increase in 2002.

In 2001, 5000 companies registered with Covisint. The auction site has been the most frequently used tool handling \$ 51 billion of transactions in more than 1,400 bidding events. 200 catalogues have been put online leading to 95,000 transactions. The Virtual Project Workspace and SCM-solutions have been used almost 3000 times.

OEMs have benefited from working with Covisint. For example, Daimler Chrysler purchased materials worth 10 billion Euro (DCX newsletter) in 512 bidding events. By using Covisint solutions, throughput times (time span between sending out a request for quote - short RFQ - and the final bid) could be reduced by 80%. Savings in material purchasing prices and lower process costs can reduce the costs per car by \$800 - 2000.

However, suppliers still remain partially reluctant to use Covisint's solutions as they fear too high a degree of transparency and price dumping. To date, only 2000 of the registered suppliers are said to use Covisint actively (Bennet, Jeff 2002). Both suppliers and OEMs have an interest in keeping their company-specific information and processes behind a firewall. It is vital for example to keep the design and development of new cars and components under wraps.

Future

The future development of Covisint is regarded as a role model for e-marketplaces not only in the automotive sector but in all manufacturing industries. The company's first task was to establish itself and to create a trustworthy presence in the market. So far, Covisint has focused on reaching OEMs. In 2001, OEMs were the main generators of the company's revenue.

The next step is to get OEM members to commit to moving more of their e-business applications outside the firewall and to persuade even the smallest n-tier suppliers to join the platform. If Covisint's future performance is successful, its executives could also consider offering e-solutions to other sectors, for example the aerospace or machine-building industries.

2.7.2 E-Procurement at EADS

Company Profile

The European Aeronautic Defence and Space company (EADS) was founded in July 2000 through merging the German DaimlerChrysler Aerospace AG, the French Aerospatiale Matra and the Spanish CASA. Today EADS is the largest firm in the European aerospace and defence industry. In 2001, EADS achieved revenues of 30.8 billion Euro. Approximately 80% of these revenues came from the civil market and 20% from the military market. The company employs more than 100,000 people in 70 business locations, primarily in Germany, France, Great Britain and Spain.

Being the second largest aerospace company in the world, EADS is a leading producer of commercial space rockets (Ariane), helicopters (Eurocopter), civil aircraft (Airbus), strategic missiles (MBDA military transport aircraft and satellites (Astrium) and military aircraft (Eurofighter and Dassault).

E-Procurement Initiative

The EADS e-procurement project is derived from the EADS sourcing strategy and consists of three major modules - sourcing support, negotiation support and process support – which address the requirements defined by EADS Business Units (BU's) and lead buyers.

Sourcing support is provided via a dedicated sourcing information system called Sourc(e)IT, a data warehouse for procurement functions. Once a month aggregated spend information from the ERP-Systems of all EADS BUs is forwarded to the Sourc(e)IT system and consolidated in the business warehouse to answer the question: Who (which BU) procures what (material key) from whom (supplier) and where (region) and how much (turnover and order volume). In addition the following information and functions are provided by the system:

- EADS frame contracts
- EADS common wording definition
- EADS commodity code, BU commodity codes
- EADS procurement organization
- News board
- Supplier alert information
- Supplier evaluation and development
- Reporting engine

Negotiation support is provided via the RFx and auction tool-set Portum on an ASP basis and customised to EADS lay-out requirements. ASP means that Portum owns the software, hosts the applications and is responsible for support and maintenance. Only a browser and Internet access is required on the EADS side. The Portum toolset supports

- Requests for information
- Requests for quotation
- Reverse auctions and several other negotiation mechanisms.

Process support is provided via two cooperating application packages:

- SAP Enterprise Buyer Professional (EBP) eProcurement software. The SAP EBP software is implemented in the respective Business Units and configured according to the BU's process requirements and approval rules.

- POET eSupplierSolutions: there is a central catalogue repository for the whole EADS group named “EADS Catalogue Centre” (ECC). The ECC is the central entry point for all catalogues and uses the POET tools “eBuyerCatalogue” as its search engine and “eSupplierPort” as its catalogue management system.
- Access from the various EBP systems to ECC is facilitated via the Open Catalogue Interface (OCI) of SAP.

E-Procurement Experience and Status of implementation

The sourcing support tool has been up and running for more than a year now and the experience is highly positive. Nine hundred buyers participating in EADS are trained both directly and via a computer-based programme. Due to the fact that the tool is completely based on the Internet, technical roll out requirements were negligible and focus has been laid on training and administrative issues.

Negotiation Support: Due to the fact that the Portum tool set is provided on an ASP basis, no time was lost in implementing and testing the software and it began to be used after the contract was signed. User feedback is positive for both the tool functionality and user support provided by Portum. The target for 2002 is to increase the usage of the tools and broaden the user-basis in the EADS buyer community.

Process support is operational in 4 BUs; 5 BUs should be operational and connected to the ECC by the end of 2002 and an additional 5 in 2003.

The target for the next 12 months is to assess the opportunities for integrating the different applications wherever meaningful and to allow the exchange of data between ERP-systems, RFQ/Auction tools and the ECC. The response from suppliers is so far mostly positive. Suppliers that were invited to participate in an RFQ and auction did so. Most of the suppliers who have been approached to provide electronic catalogues for the ECC already had experience in that area and have provided their catalogues as requested.

2.8 Scoreboard of basic e-commerce indicators

This Sector Report is a part of the first series of seven sector reports published by the *e-Business W@tch*, six months after its launch in 2002. Since desk research and interviews for this report and editorial work paralleled the preparation and field work of a European enterprise survey about electronic business launched by the *e-Business W@tch*, it was not possible to use the results of this survey for this edition of the Sector Report. Instead, we present in this chapter

- (1) a brief outlook on what type of e-business statistics can be expected for the forthcoming edition of this Sector Report (expected for January 2003), and
- (2) an initial benchmarking of industry macro-sectors based on other sources, namely on data collected by (i) the Eurostat enterprise survey on e-commerce in 2001 and (ii) by a survey carried out by the "SIBIS" EU project (www.sibis-eu.org) in 2002. It must be noted at this point, however, that due to differences between these surveys in terms of survey methodology and sample there is only limited comparability of data, particularly on a sector level (cf. information below), to the statistics which the *e-Business W@tch* survey will deliver in the forthcoming issues of sector reports.

2.8.1 Forthcoming: Results of the European e-Business Survey

The European e-Business Survey is a cornerstone to the monitoring activities of the *e-Business W@tch*, as it is the key instrument to collect e-business indicators on a sector level which are not yet otherwise available, and certainly not in a comparable manner across sectors. The fieldwork of this enterprise survey was carried out in June and July 2002 (parallel to the desk research and editing of this Sector Report). Data are currently being processed and analysed. Results will be reported in the forthcoming edition of this sector report and in the European E-Business Report (both expected for early 2003). A first overview with a benchmarking of the 15 sectors covered by the *e-Business W@tch* based on a number of key indicators may be available earlier in the form of an electronic e-Business Pocket Book on the website of this observatory (www.ebusiness-watch.org).

The European e-Business Survey has been carried out by computer-aided telephone interview (CATI) technology. CATI was given preference to alternative survey methods, in particular postal surveys which are sometimes used for company surveys of this kind, mainly for reasons of guaranteed number of interviews. The decisionmaker in the enterprise targeted by the survey was normally the person responsible for ICT within the company, typically the IT manager. Alternatively, especially in small enterprises which do not have a separate IT unit, the managing director or owner was interviewed. In total, about 10,000 interviews with decision makers in European enterprises were conducted. The questionnaire used for the survey interviews will provide data for the following ICT and e-business indicators:

Table 2-3: Indicators of the European e-Business Survey

Area	Main indicators
Computer and internet usage by enterprises	<ul style="list-style-type: none"> • Percentage of companies using computers • Percentage of companies having access to the internet / not yet online but planning to have internet access (12 months) • "Refusers": Percentage of companies not online and not planning to get online • Type of internet access
Usage of network applications	<ul style="list-style-type: none"> • E-mail / WWW / Intranet / Extranet / LAN / WAN / EDI • Plans of non-users to use network applications (same as above)
Size of IT and web department	<ul style="list-style-type: none"> • Average number of employees in IT and networks maintenance • Average number of employees in company website maintenance
IT skills gap	<ul style="list-style-type: none"> • Percentage of companies having recruited IT skilled staff • Percentage of companies having experienced some / great difficulties in recruiting IT specialists
Employees' access to ICT	<ul style="list-style-type: none"> • Employees' access to e-mail for internal / external communication • Employees' access to the WWW / to the intranet
Website	<ul style="list-style-type: none"> • Percentage of companies with / planning to have website
E-commerce: selling online	<ul style="list-style-type: none"> • Percentage of companies selling / planning to sell online • Starting point of selling online (> 2 yrs/ for 1-2 yrs/ for < 1 yr) • E-commerce by website, electronic marketplaces, extranet • EDI / mobile e-commerce • Online share of total sales • Method of processing online orders (orders are fully integrated with the back-end system / online orders generate an automatic e-mail)
E-commerce: procuring online	<ul style="list-style-type: none"> • Percentage of companies procuring / planning to procure online • Starting point of procuring online (> 2 yrs/ for 1-2 yrs/ for < 1 yr) • Online share of total procurement
Barriers to e-commerce	<ul style="list-style-type: none"> • Barriers to selling online • Barriers to procuring online
E-business: external business processes	<ul style="list-style-type: none"> • Online collaboration with business partners for designing products / to forecast product demands • Online management of capacity / inventory • Electronic exchange of documents with suppliers / customers • Online negotiation of contracts • Participation in B2B e-marketplaces / Type of activity undertaken on e-marketplaces
E-business: special solutions	<ul style="list-style-type: none"> • Implementation and usage of special solutions in the company / plans to implement: SCM / CRM / KM / ASP/ ERP
E-business: internal business processes	<ul style="list-style-type: none"> • Sharing documents/ to perform collaborative work • Tracking working hours and production time • Supporting the human resources management • e-learning
Impact of e-business	<ul style="list-style-type: none"> • Impact of selling online: Volume of sales / Number of customers / Sales area / Quality of customer service / Efficiency of internal business processes / Costs of logistics and inventory • Impact of procuring online: Procurement costs / Relations to suppliers / Internal business / processes / Costs of logistics and inventory / Number of suppliers • Perception of general importance of e-business today • Impact on organisational structure and work processes • Impact on offer of products and services • Expected beneficiaries of e-business (SMEs vs. large enterprises) • Satisfaction with e-business • Trend in expenditure on e-business technologies

2.8.2 The Eurostat survey on e-commerce



Since data from the *e-Business W@tch* observatory's own survey are not yet available, we present in this edition of the report some key indicators and a preliminary benchmarking of sectors based on data provided by the Eurostat survey "E-Commerce in Europe".²

The survey was conducted in the context of an effort by DG Enterprise to develop and carry out regular data collections in the area of e-commerce. DG Enterprise therefore supports Eurostat and the National Statistical Institutes to carry out such surveys. In a first step, a pilot survey on e-commerce was undertaken by 13 of the EU Member States and Norway in 2000. It was carried out as a questionnaire survey. More than 100,000 enterprises were contacted and the response rate was close to 50%. In the follow-up survey ("Community e-commerce survey 2002") all 15 Member States will participate and, in addition, several Candidate countries (Czech Republic, Estonia, Latvia, Poland) intend to carry out pilot surveys in 2002 based on the Eurostat questionnaire.

While the strengths of this survey are certainly the large sample size and the broad coverage of countries (in 2002), it must be noted, however, that there are some serious limitations with regard to the comparability of the data delivered by the (first) pilot survey across industry sectors, which is the main dimension of analysis and comparison for the *e-Business W@tch*.³ Taking this into account, the scoreboards presented below should therefore be regarded as an initial presentation of figures only which will be largely complemented and, for the sake of a coherent methodology, substituted by the more recent data from the sector survey that has just been carried out by the *e-Business W@tch*. Summarising, the following table shows the main differences between the two surveys by Eurostat and by the *e-Business W@tch*:

² Eurostat: E-Commerce in Europe. July 2002. Download: <http://europa.eu.int/comm/enterprise/ict/studies/lr-e-comm-in-eur-2001.pdf>. A summary of main findings is available in an edition of Statistics in Focus: "E-commerce in Europe" (11 April 2002). This summary as well as a number of other resources can be downloaded from <http://europa.eu.int/comm/enterprise/ict/statistics/e-commerce.htm>.

³ For many variables covered by the Eurostat e-Commerce Survey there are considerable differences between 'global' figures broken down by size (category 'All') and 'NACE averages'. The most likely explanation is that this occurs because of gaps in countries' reporting on sectors, as Eurostat confirms: "The data with the breakdown by NACE have often been compiled with a more restricted country coverage than the global (and size class) figures because of weaker data availability. Hence, a direct comparison between the data by activity and the global figures can not be made. For this reason, most of the tables and figures providing data by activity include a second global figure called the 'NACE average'. (...)" A closer look at the coverage of NACE sub-sections shows that in general figures Germany, Finland and Sweden are missing in the NACE related statistics altogether. For some sub-sections other countries are not included either, and for some variables yet another different set of countries is considered. In some tables footnotes state that the UK is not included (for example, Table 2.3.9: Internet e-sales processes). For many of the sectors monitored by the *e-Business W@tch*, however, Germany and the UK account for a substantial part of the production value (often over 40%) in Europe. Hence information that excludes these two countries has only limited value for a sector analysis, for instance in the chemicals or the transport equipment sector where Germany is the largest industry in the EU. This problem becomes evident when figures for the category 'all' are compared with 'NACE averages' which tend to be far below the 'global' averages. This is not surprising when considering that Germany belongs to the countries with the highest e-commerce activity in Europe.

	 European E-Business Survey	 Survey E-Commerce in Europe
Method	CATI (telephone interview)	questionnaire mailings
Focus	e-business sectors	e-commerce countries
Sample	~ 10,000	~ 50,000 (returned questionnaires)
Time (field work)	June/July 2002	1 st half 2001
Field work organisation	Inra (based on contract with the e-Business Watch)	National Statistical Institutes in participating countries

The following table presents the findings for six basic ICT and e-commerce indicators broken down by business activity (cf. note under table). A vast majority of companies in all NACE sections use computers. In e-business surveys, this indicator is consequently mainly used as a filter for follow-up questions about e-commerce and e-business in order to get a second optional computation base for more significant indicators.

Table 2-4: Basic e-commerce indicators for industries

% of enterprises using / having implemented	Computers	intranet	EDI	Web access	e-purchasing	e-sales
Manufacturing	89	27	12	68	13	8
<i>Food, beverages and tobacco</i>	88	25	17	66	7	9
<i>Textiles</i>	73	16	7	49	6	4
<i>Leather</i>	78	11	3	51	4	3
<i>Wood</i>	90	16	7	61	6	5
<i>Pulp, paper, publishing and printing</i>	95	34	14	77	23	13
<i>Coke, refined petroleum, nuclear fuel</i>	94	54	37	87	27	24
<i>Chemicals and man made fibres</i>	97	43	15	86	16	10
<i>Rubber and plastics</i>	96	31	12	75	19	12
<i>Other non-metallic mineral products</i>	91	25	8	72	7	4
<i>Basic metals, fabricated metal products</i>	91	26	12	66	11	6
<i>Machinery and equipment n.e.c.</i>	95	37	13	82	17	8
<i>Electrical and optical equipment</i>	94	40	14	80	28	12
<i>Transport equipment</i>	94	37	20	74	17	12
<i>Manufacturing n.e.c.</i>	89	24	11	64	11	7
Distribution	94	34	18	71	20	11
Hotels and restaurants	72	12	6	47	11	15
Transport, storage and communication	87	31	18	67	17	12
Business services	93	35	16	73	29	9
Nace average	89	29	14	68	18	10

Source: Eurostat / own presentation

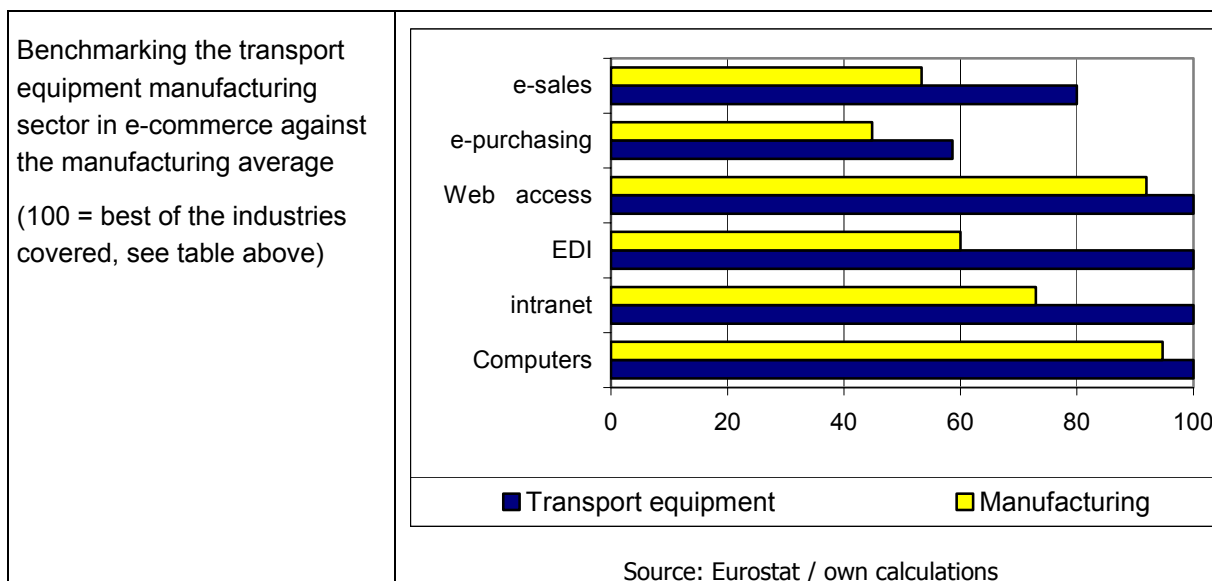
Note: The Eurostat survey presents "NACE average" figures based on the NACE Rev. 1 Sections D (Manufacturing), G (Distribution, i.e. mainly wholesale and retail trade), H (Hotels and restaurants), I (Transport, storage and communication) and K (Real estate, renting and business activities). Since J (Financial intermediation) was not included in a number of national surveys by the NSIs, the "NACE average" does not include this section.

In the following table, the NACE sections and the sub-section "Manufacture of transport equipment" are benchmarked according to the same six indicators as presented above. For each indicator, the highest penetration has been indexed as 100.

Table 2-5: Sector benchmarking for Manufacturing transport equipment (best = 100)

Benchmark = 100	Computers	intranet	EDI	Web access	e-purchasing	e-sales
Transport equipment	100	100	100	100	59	80
Manufacturing	95	73	60	92	45	53
Distribution	100	92	90	96	69	73
Hotels and restaurants	77	32	30	64	38	100
Transport, storage and communication	93	84	90	91	59	80
Business services	99	95	80	99	100	60
Nace average	95	78	70	92	62	67

Source: Eurostat / own calculations



The transport equipment manufacturing sector belongs to those with the highest adoption rates of ICT infrastructure. About 37% of all enterprises in this sector use an **intranet**, which is clearly above the average of 27% among manufacturing sectors. The variations in intranet usage across industry sections are in part due to industry structure, since large enterprises are much more likely to make use of the intranet than small enterprises. Furthermore, the value of an intranet is inherently higher for enterprises with a large number of office workers and/or teleworkers and mobile workers who need to access company information from abroad than in businesses with a smaller share of office workers. This helps to explain, for instance, the low percentage of intranet usage in the "hotels and restaurants" sector.

EDI usage is also very high in this sector. About 20% of all enterprises use EDI, compared to 14% as the NACE average. EDI was implemented already during the 1980s in many transport equipment industry firms. However, the lack of a standard solution or even a uniform data standard led to an extremely fragmented field of "island solutions" often unable to communicate with each other. Nevertheless EDI is still widely accepted.

74% of the companies manufacturing transport equipment report to have **web access**. Here again, the type of activity partly explains the lower demand for web access by enterprises from this section. "Web access" must not be confused with the frequently used indicator "having a website", which is a basic requirement for conducting e-commerce on the internet. The Eurostat survey reports that 29% of enterprises had their own website (NACE average) at the end of 2000 and 11% planned to have one in 2001. Business services was the most advanced section in that respect with 40% of enterprises having a website, while the other sections showed very homogenous figures between 24 and 29%.

Online selling and purchasing, obviously highly correlated activities, are key indicators for the maturity of electronic business and cornerstones in all surveys on this topic. While ICT diffusion is far above the average in the transport equipment sector, its application for e-purchasing or e-selling is only slightly above the manufacturing average. 17% of the enterprises in this sector report to conduct e-procurement and 12% say they sell online. In fact, a KPMG survey of automotive executives conducted in 2000 found that e-procurement has actually had little effect on the industry so far, according to the majority of respondents. These companies indicated that what electronic business they do conduct consists of purchasing and supply-chain management through closed communications networks, like EDI, or sending drawings and quotes to business partners using PC-based design software. Some said that their e-commerce activity was limited to maintaining websites for information purposes or online catalogues.

In general, the Eurostat survey – taking into account all the methodological implications discussed above – suggests that almost twice as many enterprises practise e-purchasing (18% NACE average) as e-selling (10%). This is in line with the general observation that B2B electronic commerce has developed faster than B2C e-commerce. Companies are more likely to buy electronically from their suppliers than to sell online. Comparing the industry sections reveals some interesting results. While enterprises in business services are most likely to procure online, hotels and restaurants – the "laggards" in many of the other indicators – are most advanced in selling online (15% of enterprises). Tourism was clearly one of the forerunners in establishing online reservation systems, and this is probably one of the factors reflected by this figure. It is also interesting to see that the distribution sector (NACE G) which could be expected to be a leader in online selling is only slightly above average (11%), but in fact makes more use of online purchasing (18%). Hotels and restaurants are the only sector where online selling outperforms online purchasing, which again reflects the nature of the business.

2.8.3 The e-readiness of industry sectors

The "e-readiness" of an industry sector (or, alternatively, of a country or size class) can be described by the percentage of enterprises that have implemented a certain level of ICT infrastructure and actually apply this infrastructure for e-business purposes. empirica has developed an e-commerce typology by using an ordinal scale of six levels ranging from "off-liners" (level 1 – companies without a website that do not have access to the Internet or e-mail) to "all-rounders" (level 6 – the most advanced companies that sell online and practise value chain integration).

The model distinguishes between "front office" applications and "back office functions" as regards achieving full e-commerce potential. Companies that concentrate on the development of e-commerce for front office applications use the internet, often in combination with other ICTs, for marketing and conducting online sales to customers. Companies that concentrate on back-office functions exploit the Internet as a way to integrate business processes (also involving suppliers and distribution partners) along the value chain.

Table 2-6: e-Commerce Typology: six stages of sophistication

Level	Type	Description
(1)	Offline	Companies / establishments without access to the Internet, e-mail and without a Website
(2)	Basic Online	Companies / establishments without a presence on the Internet (e.g. Website), but with access to the Internet or e-mail.
(3)	Web Marketing	Companies / establishments with a presence on the Internet (e.g. Website), but none of the following
(4)	Web Sales	Companies / establishments that sell goods or services via the Internet (through own Website and/or via e-marketplaces), but none of the following
(5)	Value Chain Integration	Companies / establishments that use EDI or Extranets for communication with forward or backward linkages in the value chain, but none of the following
(6)	Allround E-Commerce	Companies / establishments that sell online as well as practise value chain integration


```

graph LR
    subgraph FRONT_OFFICE [FRONT OFFICE]
        WM([Web Marketing]) --> WS([Web Sales])
    end
    subgraph BACK_OFFICE [BACK OFFICE]
        VCI([Value Chain Integration])
    end
    Offline([Offline]) --> BO([Basic Online])
    BO --> WM
    BO --> VCI
    WS --> AEC([All round E-Commerce])
    VCI --> AEC
    
```

Source: empirica

The model works for individual companies as well as for aggregates of companies, e.g. on sector or country level. For instance, the higher the percentage of companies from an industry sector is in the more advanced levels, particularly in levels 5 and 6, the higher is the "e-readiness" of this sector. This e-commerce typology has proved to be useful in monitoring progress over time⁴, although the definition of the levels may have to be adjusted in the future once e-business has reached a certain maturity, requiring monitoring activities to focus on other (and probably more qualitative) aspects than simply on whether a company has an internet presence or sells online. For the time being, however, the model can still be considered as a useful tool to benchmark the maturity of electronic business in various industry sectors or countries.

A recent decision maker survey in establishments of 7 EU Member States (Germany, France, the UK, Italy, Spain, Finland and Greece) carried out by the SIBIS project (www.sibis-eu.org)⁵ finds that 13.6% of establishments are e-commerce all-rounders, and

⁴ cf. EC-KMU: Status Quo and Development Prospects of Electronic Commerce in Germany, Europe and the USA 1999 and 2001. Study by empirica for the German Ministry of Economy and Technology.

⁵ SIBIS (Statistical Indicators Benchmarking the Information Society) is a project in the "Information Society Programme" of the European Commission (IST-2000-26276) running from January 2001 to June 2003. SIBIS has taken up the challenge of developing innovative information society indicators to take account of the rapidly changing nature of modern societies and to enable the benchmarking of progress in EU Member States. The SIBIS Decision Maker Survey (DMS) covers 5 topics: e-commerce, telecommunication & access, security, e-government, and Internet for R&D. It is targeted at establishments and carried out in Germany, France, the UK,

another 33.2% have reached the level of value chain integration. Only 6.5% are still off-line. The results are comparable for the macro-sectors covered by the SIBIS survey, especially those for the lower levels. On the highest level, the public and social services lag behind with only 5.7% of establishments being characterised as all-rounders. Financial and business services, on the other hand, are most advanced with more than 50% of establishments having reached levels (5) or (6).⁶

Table 2-7: E-Commerce Typology: the e-readiness of industry macro-sectors (% of establishments)

Type	Manu-facturing	Distribution	Financial & business services	Public & Social services	Total EU
Allround E-Commerce	11,6	20,3	17,9	5,7	13,6
Value Chain Integration	33,2	26,3	35,7	39,5	33,2
Web Sales	5,8	11,9	9,9	5,0	8,0
Web Marketing	18,6	15,1	15,9	26,4	19,1
Basic Online	23,1	16,5	17,0	20,6	19,6
Offline	7,8	9,9	3,6	2,8	6,5
	100,0	100,0	100,0	100,0	100,0

Base: all establishments (N=3139), weighted by employment; EU7 additionally weighted by employment per country. Each establishment is assigned exclusively to one e-commerce type. Macro-sectors as defined by SIBIS:

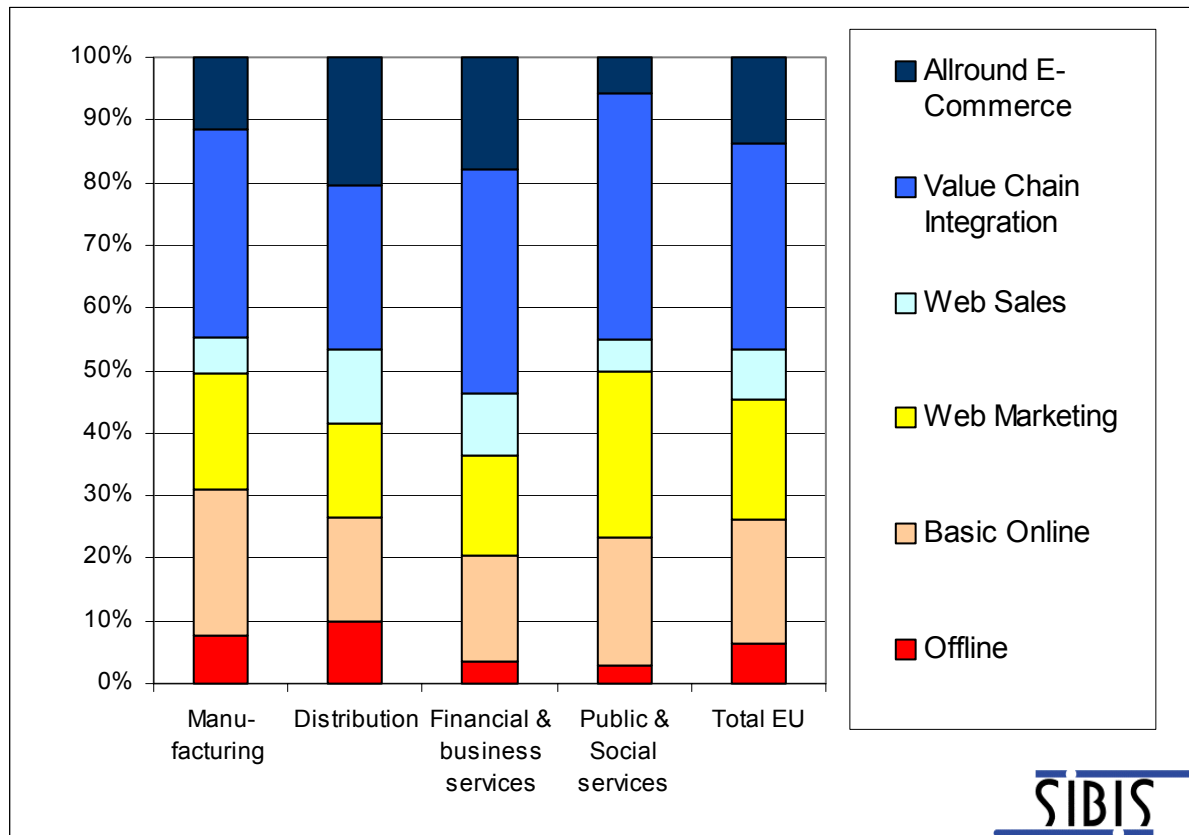
- (i) Manufacturing, energy, mining, construction
- (ii) Distribution, catering, communication & transport
- (iii) Financial and business services
- (iv) Public administration, health, education, other social/personal services

Source: SIBIS (DMS – preliminary data)

Italy, Spain, Finland and Greece. The sample taken is a disproportionately stratified sample reflecting labour force distribution across establishment size bands. Sample sizes range from 300 to 500 per country resulting in an overall sample of 3,100. The survey was conducted via CATI (Computer Aided Telephone Interview).

⁶ Important note: These data are only preliminary (the fieldwork was carried out in April and May 2002) and still need to be consolidated by the SIBIS project. They are not yet officially reported. Data have been technically checked e.g. for consistency and for correct filtering.

Figure 2-6: E-Commerce Typology: the e-readiness of industry macro-sectors (% of establishments)



Source: Source: SIBIS (DMS – preliminary data) / own presentation

Participation in e-marketplaces

An indicator which is not considered in this model, but which may become an important indicator for measuring e-readiness in the future, is the participation of enterprises in e-marketplaces. These are specialized sites on the Internet that allow buyers and suppliers to trade goods and services. Electronic marketplaces can be operated by individual buyers or suppliers, by consortia or by third parties. Access can be public or restricted to selected business partners.

The automotive industries are a forerunner in the usage of electronic marketplaces. Covisint is currently the largest and most prominent of these. It was founded as a joint venture by Ford, General Motors, DaimlerChrysler, Renault Nissan, the PSA group and the technology providers Commerce One and Oracle and has operated as an independent company since December 2000. In 2001, Covisint Europe B. V. was founded in Amsterdam. To date more than 7600 companies from the automotive industry have registered as members. There are other examples as well. On the other hand, big players like Volkswagen, FIAT or BMW have established and run their proprietary market places, on the other hand, the role of third party marketplaces has become evident in e-procurement initiatives in this sector in particular.

The SIBIS survey has investigated whether establishments trade on such electronic marketplaces. As expected, the percentage of establishments doing so is still rather small,

but reaches 9.8% in total if figures are employment weighted.⁷ Initial results suggest that the main activities on marketplaces are catalogue based offering of goods and services (5.2%) and catalogue based selling (4.2%), compared to a lower level of participation in auctioning (1.6% for bidding, 2% for selling), launching calls for tender (1.8%) and answering calls (2.3%).⁸

The Eurostat survey on e-commerce also presents figures about marketplace participation. These are somewhat lower than in the in the SIBIS survey, but considering that (i) the field work of the Eurostat survey took place in early 2001 (compared to April 2002 for SIBIS) and that (ii) presentation of Eurostat data is not employee-weighted, figures stemming from the two surveys are quite consistent. Eurostat finds that already in late 2000 about 10% of the large enterprises participated in e-marketplaces and about 5% of SMEs. Business services seem to be the most active users (6% of enterprises). Furthermore, the Eurostat survey finds that SMEs seem to use marketplaces for procurement purposes more than for selling, while large enterprises were more frequently selling (10%) than buying (7%).

Table 2-8: Use of specialised B2B marketplaces on the internet (% of enterprises using them)

	Purchases through B2B internet marketplaces *	Sales through B2B internet marketplaces *
Manufacturing	2%	1%
Distribution	4%	1%
Hotels & restaurants	2%	3%
Transport & communication	5%	2%
Business services	6%	1%
NACE average	3%	1%

* Note: Activity breakdown excludes D and S – therefore percentages are lower than the figures given for "All" where D and S are included.

Source: Eurostat

The European e-Business Survey of the *e-Business W@tch* will provide fresh data about the usage of marketplaces by enterprises from the 15 industry sectors covered. Considering the high level of attention that the B2B marketplaces receive from policy and industry alike, it will be interesting to see whether trading on marketplaces has actually gained momentum.

⁷ That means that 9.8% of employees work in establishments that participate in e-marketplaces. 1.9% of the establishments surveyed said "don't know", the rest said "no" or was not asked (filter) because of lack of infrastructure requirements.

⁸ Important note: Data reported are only preliminary (the fieldwork was carried out in April and May 2002) and still need to be consolidated by the SIBIS project. They are not yet officially reported. Data have been technically checked e.g. for consistency and for correct filtering.

3 Summary and conclusions – possible policy implications

3.1 Summary of main findings

Up until 2000, the transport equipment manufacturing sector was rather hesitant to adopt e-business compared to other industries such as chemicals, retail, or finance. However, since then all the major actors in the sector have launched a variety of significant e-business initiatives, which are already showing effects on business performance and industry structure. Among the different e-business tools, e-procurement seems currently to be the most advanced and most widely used application. Among the sub-sectors of the transport equipment industry, the car industry is most advanced in adopting e-business.

E-business benefits large firms and OEMs to a greater extent than small firms and lower tier suppliers. However, non-adoption of e-business does not automatically point to market failure, but can be a perfectly rational and efficient decision.

Findings presented in this report indicate that the implementation of e-business solutions seems to benefit large firms to a greater extent than SMEs. This has to do with the cost-return structure of many e-business projects, which seem to imply increasing returns to scale. Large firms are therefore more active in adopting e-business and seem to be in an advantageous position to realise the full potential for efficiency gains, reduced costs, and better competitive positions in the market.

The more advanced e-solutions in particular require substantial investments in software, customisation, and user training before they are "up and running" and before they can reach a positive ROI. This is a major reason for the slower adoption of e-business in SMEs. However, none of the arguments presented here suggests a market failure or any irrationality being displayed by economic agents by not adopting e-business. On the contrary, the high costs of implementation together with increased pressure on product margins in e-marketplace environments and the difficulties in keeping confidential information just that are likely to prohibit the adoption of e-business in quite a number of SMEs, even in the medium term.

Large firms and OEMs are currently experimenting intensively with e-business solutions. They take the lead-role in changing the entire supply chain and industry structure. SMEs do not have the necessary strategic position or financial capabilities to take this role. Therefore, they are well advised not to heedlessly adopt any standard industry solutions that are naturally primarily shaped to benefit OEMs or large firms, who are at the forefront of e-business. Negotiations and retention could well be their best strategy to influence the industry's e-transformation to their advantage. After all, an industry-wide e-transformation can only be successful if all partners in the value chain and the final customer profit from it. This is a good example of the importance of wise management decisions rather than a case for public policy intervention.

In fact, this report provides evidence that non-adoption of e-business does not automatically point to market failure. This has a policy implication as unreflecting incentives to support e-business take-up in SMEs may be ineffective or even counterproductive if they do not take into account that non-adoption of certain e-business solutions (especially by SMEs) can be a perfectly rational and efficient decision that does not lead to lower productivity or missed opportunities.

Industry-wide implementation of e-solutions often leads to a battle over a shift of power.

E-business solutions such as e-procurement and SCM often imply a battle over the shift of power within the industry groups and supply chains. Smaller suppliers (especially those of commodity products) fear increased price competition and reduced margins. But this does not have to be the case. The same e-technologies can be used to intensify co-operation and communication between suppliers instead of shifting business relations entirely into a price dimension.

It is not information technology itself that primarily determines the economic impacts of e-business, but rather the visionary power and strategic decisions about how to use it.

One of the important lessons learnt (especially from the e-procurement experiences in the automotive sector) is that the impact of e-business on the industry is not primarily determined by technology per se, but by visionary power and the consequent strategic decisions about how to use technology. Technology offers a set of technologically feasible opportunities. Its potential is likely to expand even beyond the extent currently visible, due to further innovations and technological improvements. However, technology is flexible and the extent to which it is used and the impact it ultimately has, depend on the strategic decisions of firms in the sector. It is very likely that the “pioneer” adopting companies will have a large say in this. The future e-business scenario is therefore less determined by what is technologically feasible, but much more by how the industry and firms are organised and how they deal with the challenges and opportunities that e-business offers them.

3.2 Policy implications

Powerful online market places – a potential challenge for fair competition.

The emergence of powerful online market places goes along with practices that might eventually be a challenge for fair competition. A lock-in of users might substantially increase the costs of changing suppliers and customers, thereby reducing the intensity of competition. A further increased bargaining power for large customers along with mechanisms that put price at the centre of purchasing decisions could (via ruinous price competition) lead to insolvencies and further concentration among suppliers. This does not necessarily have to be the case, as it is subject to strategic decisions about how to use online market places and on how to configure them. However, the standardisation of procedures in electronic market places might lead to a discrimination of weaker partners. Therefore, the impact of powerful online market places on competitive conditions should be watched, and practices that inhibit fair competition should be prevented, if necessary.

Security issues – tackling the "usage gap" between the availability of solutions and their actual application

Security issues are still a widespread concern and act as an e-business barrier. However, effective security tools are already available – they just need to be actually used. Here policy measures might be needed to raise awareness about the dimensions of the problem and the various alternative solutions. Keeping down information costs and promoting the usage of security systems might be a legitimate policy target.

Providing the required e-business skills calls for a change in education strategies and schemes

A lack of e-business skills is often said to slow down e-business adoption. The main difficulty for businesses in this respect is the requirement to train users every time their work routines are changed and new software packages – each with unique functions and properties – are implemented. Re-training of staff and re-organisation of business processes are part of the implementation costs for e-business initiatives. Continuous re-qualification requirements throughout the entire employment biography are an essential characteristic of a knowledge-based economy.

However, this calls for a change in education paradigms. A good basic (university or technical) education is still of high importance, but no longer sufficient for most people to cope with the rapidly changing challenges of modern work life. Therefore, formal education needs to be complemented with "life-long learning". The role of public policy in this matter has still to be defined. Questions of organisation, financial responsibility, quality regulation and certification as well as models of public/private partnership are issues to be discussed in this context.

European-Level Industry Associations

- ACEA** – Association des Constructeur Européens d'Automobiles
Rue de Noyer 211, B-1000 Brussels;
Phone: +32 3 732 5550, Fax: +32 3 738 7310;
<http://www.acea.be>
- ACEM** – Association des Constructeurs Européens de Motorcycle
Avenue de la Joyeuse Entrée, 1, 1040 Brussels, Belgium;
Phone: +32 2 23 09 732, Fax: +32 2 23 01 683;
<http://www.acembike.org>
- AECMA** – European Association of Aerospace Industries
Gulledelle 94-b.5, 1200 Brussels, Belgium;
Phone: +32 2 775 81 10, Fax: +32 2 775 81 11;
<http://www.aecma.org>
- AWES** – Association of European Shipbuilders and Shiprepairers
Rue Marie de Bourgogne 52-54, B-1000 Brussels, Belgium;
Phone: +32 2 230 27 91/32 87, Fax: +32 2 230 43 32;
<http://www.awes-shipbuilding.org>
- CECRA** – Conseil Européen du Commerce et de la Réparation Automobiles
Boulevard de la Woluwe 46, bte.17, 1200 Brussels, Belgium;
Phone: +32 27 71 06 56, Fax:+32 27 72 65 67;
<http://www.nbf.no/cecra.htm>
- CESA** – Committee of European Union Shipbuilders' Associations
Rue Marie de Bourgogne 52- 54, 1000 Brussels, Belgium,
Phone: +32 2 230 27 91/ 32 87, Fax: +32 2 230 43 32;
<http://www.cesa-shipbuilding.org>
- UNIFE** – Union of European Railway Supply Industries
221 Avenue Louise (Bte 11), B-1050 Brussels, Belgium;
Phone: +32 2 626 1260; Fax: +32 2 626 1261;
<http://www.unife.org>

References

- AECMA - European Association of Aerospace Industries (2000): "Facts & Figures 2000", (<http://www.aecma.org>).
- AMM – American Metal Market (2001): "Automobile Industry", (<http://www.amm.com/ref/auto.htm>).
- Bennet, Jeff (2002): Measures of the Auto Industry, 02-19-2002, (<http://www.auto.com>).
- Berlecon Research (2001): "Wachstumsmarkt E-Learning", (<http://www.berlecon.de>).
- COST A10 (2001): project on "Restructuring of the European defence industry", Chapter 10: "Naval shipbuilding in Europe", (www.trenz.de/dateien/10820/navalshipbuilding.doc; homepage: <http://www.sarc.sk/akcie/cost/social.html>).
- DCX Newsletter (02/04/2002): "e-business at Daimler Chrysler is paying off: savings exceed present investment", (http://www.dcx.net/releases/pre_20204.htm).
- Die Welt (07/05/2002): "Flugzeughersteller trotzen der Krise", p. 17.
- Die Welt (18/05/2002): "Luftfahrtindustrie fürchtet Auftragseinbruch", p. 11.
- E-Commerce Times (01/11/2001): "Report: Auto Industry Stumbling on Net", (<http://www.ecommercetimes.com/perl/story/6648.html>).
- Fine, Charles and Raff, Daniel (2000): "Internet-Driven Innovation and Economic Performance in the American Automobile Industry", (http://in3.dem.ist.utl.pt/master/00networks/fine_raff_2000.pdf).
- Handelsblatt (10/09/2002): "Ich brems nicht bei E-Business".
- Handelsblatt (08/05/2002): "EADS drängt mit Militäertechnik in die USA".
- Handelsblatt (15/05/2002): "Fiat's Kampf ums Überleben".
- Handelsblatt (15/05/2002a): "Ein Nationalsymbol wankt".
- Handelsblatt (17/05/2002): "BMW hält sich in der Erfolgsspur".
- Handelsblatt (22/05/2002): "Daimler-Chrysler prüft weitere Hyundai-Zusammenarbeit".
- Helper, Susan and McDuffie, John Paul (2000): "E-volving the Auto Industry: E-Commerce Effects on Consumer and Supplier Relationships", (http://e-conomy.berkeley.edu/conferences/9-2000/EC-conference2000_papers/MacDuffieHelper.pdf).
- Helper, Susan and Sako, Mari (1995): "Supplier Relations in Japan and the United States: Are They Converging?", in Sloan Management Review, 36, no. 3, Spring 1995, pp. 77-84.
- Heseler, Dr. Heiner (2000): "The Shipbuilding Dispute between the EU and Korea", University of Bremen, (<http://www.maritim.uni-bremen.de/yards/korea-e.pdf>).
- IMVP Research - The International Motor Vehicle Program at MIT (2002): "Research Framework 2001-2004", (<http://web.mit.edu/ctpid/www/imvp/frame.html>).
- Köllinger, Philipp (2001): "E-Learning: Eine Marktanalyse für Deutschland", Symposion Publishing, (<http://www.symposion.de>).
- KPMG (2001a): "Momentum in the Automotive Industry", Vol. 1, No. 1, 2001.
- KPMG (2001b): "Momentum in the Automotive Industry", Vol. 1, No. 2, 2001.
- KPMG (2001c): "eBusiness in der deutschen Automobilzulieferindustrie – Stand und Perspektiven 2002", (http://automobile.karrierefuehrer.de/studie_kpmg_e-business.pdf).
- Lapidus, Gary (2000): "Gentlemen, Star Your Search Engines", Goldman Sachs Investment Research, January.

- OESA – Original Equipment Suppliers Association (2001): “Automotive OE Supplier News”, Volume 4, Issue 10, October 2001, p. 10-11.
- OSAT – University of Michigan Office for the Study of Automotive Transportation (2001): “Automotive System Integrators: Spiders or flies in the e-Business web?”, (<http://www.osat.umich.edu/>).
- Porter, Michael (2001): “Strategy and the Internet”, Harvard Business Review, March 2001, S. 63-78.
- PWC - PriceWaterhouseCoopers (2000): “A2C – The Second Automotive Century”, (<http://www.pwcglobal.com>).
- Roland Berger (2000): “Automotive e-Commerce – A virtual reality check”, Roland Berger & Partners and Deutsche Bank, June 2000.
- SBAC – Society of British Aerospace Companies (2000): “Annual Review 1998-1999”, (<http://www.sbac.co.uk/default.htm>).
- SBAC – Society of British Aerospace Companies (2001): “Annual Review 1999-2000”, (<http://www.sbac.co.uk/default.htm>).
- SBAC – Society of British Aerospace Companies (2002): “Annual Review 2000-2001”, (<http://www.sbac.co.uk/default.htm>).
- VDA – Verband der Automobilindustrie (2000): “Marketing und E-Commerce – Ein neues Bild der Automobilzulieferer entsteht”, Frankfurt am Main, 2000.
- VDA - Verband der Automobilindustrie (2001): “Annual Report 2001”, (http://www.vda.de/en/service/jahresbericht/auto2001/auto+maerkte/g_63.html).
- VDA – Verband der Automobilindustrie (2001a): “International Auto Statistics”, Frankfurt am Main, September 2001.