Ulrich Riehm
Thomas Petermann
Carsten Orwat
Christopher Coenen
Christoph Revermann
Constanze Scherz
Bernd Wingert

June 2002

E-Commerce

Summary

TAB Working report no. 78

TAB
Office of Technology Assessment
at the German Bundestag

SUMMARY

The growing global importance of e-commerce and the processes of transformation expected in business and society prompted a proposal by all the parliamentary groups in the Committee for Industry and Technology to commission the Office of Technology Assessment (TAB) at the German Parliament to carry out a study on »Economic prospects of e-commerce«. The TA project duly designed by TAB was commenced in late 2000 following approval by the Committee for Education, Research and Technology Assessment and completed in mid 2002. The study focused on the level of implementation of e-commerce in various sectors of the economy, the likely diffusion processes and structural changes, and the consequences of these. The study also looked at factors inhibiting and promoting further development, and the possible political options for regulation and action.

E-COMMERCE: DEFINITION AND GENERAL STATE OF DEVELOPMENT

For the purposes of this study e-commerce is understood as a commercial transaction conducted in publicly accessible markets through an interactive electronic medium (section I.1). As such, e-commerce is part of e-business. However, e-commerce is distinguished from forms of tele-business which uses non-interactive media, e.g. teleshopping. The main forms of e-commerce are business-to-business (B2B) and business-to-government (B2G), business-to-consumer (B2C), and consumer-to-consumer (C2C). Besides the Internet, other media (proprietary networks, mobile radio networks, interactive TV) can be used as the technical medium of communication.

Based on currently-available data (section I.2), with its admitted gaps, we can present an initial overview of the evolution of e-commerce:

In the B2B segment (section I.3), Germany has made up considerable ground in international comparison. The share of companies distributing their products and services over the Internet is 20%, even higher than the figure for the USA. Almost 50% of companies handle procurement through the Internet a slightly lower share than in the USA, but ahead of Finland and the UK. There are figures for the value of B2B commerce for 2000 in the USA. The share of e-commerce was 18.4% in manufacturing industry, 7.7% in wholesale and 0.8% in selected service industries. There are no comparable figures available for Germany. The potential of e-commerce in the B2B segment lies primarily in integrating the pro-

curement and distribution processes with other intra-company and inter-company information systems.

As the number of Internet users rises, so does the number of those buying online. In 2002 almost 50% of the population in Germany had used the Internet at least once, while the proportion of those who had purchased something over the Internet at least once was 30%. However, the share of those who frequently buy over the Internet is small at around 6%. In all, annual growth in Internet use is falling significantly (section I.4.1).

Even so, the total value of B2C e-commerce (section I.4) was 4.3 billion in Germany in 2001. Particularly frequently purchased products and services are books, clothing and shoes, audio recording media, computers and accessories and tourist company products. The absolute figures for e-commerce turnover should not, however, blind us to the fact that the share in German retail turnover in 2001 was only an estimated 1.0%. This means there is little difference between the situation in Germany and the USA, where official statistics show e-commerce as having a share of 1.1% in retailing in 2001. There is no reason to expect that these figures will increase dramatically to double-digit levels in the foreseeable future.

INDUSTRIES AND SECTORS OF THE ECONOMY IN TRANSITION

Distinctions within e-commerce. The precise form of e-commerce varies according to the industry, product category, traditional forms of commerce and regulatory environment. As a result, it is necessary to take a nuanced approach to estimating development potential and consequences. The TAB study focuses on eight economic sectors. Their selection is based on a series of criteria (section I.5). The aim was to cover not only the traditional manufacturing industries (automotive) but also new, information-centred industries (securities trading), industries where e-commerce is already relatively far advanced (music industry) and those where it is in its infancy (food), industries where circumstances heavily restrict commerce (liberal professionals, pharmaceuticals) and those with relatively unrestricted commerce (videos, food), industries with tough competition (food) and those with limited competition (books), industries with physical products (automotive, food) and industries with products which can be digitised (video).

COMMERCE IN FOOD

Commerce in food (section II.1) represents an economic sector characterised by very heavy competition, strong concentration processes, tight margins and high customer demands in terms of product quality and supply. The conditions for e-commerce in food are particularly difficult, as the products to be transported are sensitive and perishable, with resulting constraints on distribution and delivery.

Electronic markets have established themselves at and between virtually all stages in the added-value chain between manufacturers, retailers and major customers (B2B). The most successful are the neutral markets for producers and dealers. Here, auctions are held, outline contracts negotiated and extensive added-value services offered.

In the food trade there is virtually no replacement of conventional stages in distribution (disintermediation). Instead, we see that traditional wholesaling and intermediaries are making particularly good use of the opportunities offered by e-commerce, and are duly strengthened.

Of the some 1,500 food suppliers on the Internet (B2C), very few have the classic full product range offered by a food retailer. Suppliers of ecological products are particularly active. Delivering food products is a service which has a track record going back many years in some cases, quite independent of the Internet. For these companies, the Internet acts simply as an additional channel for orders, although most orders are placed by phone.

The relatively high costs of delivery are, however, one of the core problems for e-commerce in food, particularly if the aim is to cover the whole German market. People are accordingly experimenting with delivery concepts where the consumer does not need to be present, which also increase the delivery coverage and facilitate the actual transfer of goods. Initial estimates were made on the transport and ecological consequences of various delivery concepts.

4.5% of consumers in Germany have ordered foodstuffs over the Internet in the last six months. The average value of a purchase in tele-business was DEM 125, greater than that in stationary food retailing, where the value varied between DEM 28–44, depending on the type of outlet.

Overall, forecasts today assume that the share of Internet commerce in food will not exceed 10% of total food retailing.

AUTOMOTIVE TRADE

The automotive industry (section II.2) is a representative of the established »old economy«. At the end of the 90s it accounted for around one-fifth of GDP. It has consistently been a pioneer in IT innovations. The Internet and e-commerce fitted smoothly into this technology-oriented process of innovation. However, the automotive industry also faces specific challenges in terms of distribution structures, with free competition seriously constrained to date by heavy regulation.

In the B2B segment the Internet has substantial potential for cutting transaction costs. B2B trading platforms will enable suppliers and manufacturers to make full use of this potential. As a result, the pressure on suppliers from producers will increase.

The creation by producers of new online distribution channels means a growing trend to compete with their dealers. However, the stationary trade is currently involved in these activities, primarily as strategic partners in contract fulfilment and customer service.

In the B2C segment it is unlikely that the Internet will establish itself in future as the dominant distribution channel for new cars independent of the classic distribution channels. Forecasts suggest that the share of private direct purchases over the Internet will not reach 3% in five years. However, as an information tool it is likely to be used by at least 70% of all new car buyers by that point. The Internet is firmly established in the pre-owned car segment. Currently, more than half of all the pre-owned cars on the market in Germany are on independent electronic marketplaces. The main function of these pre-owned car exchanges here is to create a relationship between seller and buyer (brokerage). Conversely, even in five years online sales are unlikely to account for over 2% of all title transfers.

In the automotive industry, e-commerce is establishing itself among the technical and organisational innovations as at most a reinforcing factor rather than a driving force. The structural transformation is driven to a much greater extent by global and production technology developments. Changes in the regulatory environment will also have substantial impact on the industry. For example, the liberalisation of the current highly regulated distribution system is expected to lead to improved opportunities for e-commerce, but will also have a significant impact on the structure of car retailing through increased competition both within the industry and from new actors from outside the industry.

PHARMACEUTICAL TRADE

In the pharmaceutical trade (section II.3), technological advances in Germany are currently being constrained by legislation (pharmacy monopoly). Mail-order pharmaceuticals are prohibited in Germany at consumer level. In fact, however, it does occur (although to a limited extent) with online mail-order pharmacies in other countries.

One argument against licensing the online trade in ethicals in Germany is that this could reduce the security of supply and erode the medical and commercial protection of consumers. However, the consequences of licensing electronic trading in pharmaceuticals depend to a considerable extent on the (legislative) environment. Proposals have been advanced to allow competition while at the same time ensuring (through regulatory measures) that the high qualitative and quantitative standard of supply in Germany is maintained. This could enable online trading to contribute towards lowering the cost of drugs in Germany.

The possible consequences of licensing e-commerce in pharmaceuticals are relatively mild for the pharmacies. If we assume a relatively large share of Internet trading in the total pharmaceuticals trade of at most 26%, this would probably result in the closure of some 3,000 pharmacies (14% of the total number). This would still leave adequate coverage by pharmacies and ensure security of supply.

COMMERCE IN MEDIA PRODUCTS

Electronic commerce in media products (section II.4) occurs as electronically-assisted mail-order in physical media products and also fully electronic commerce in digital media products. Online trade in physical and digital media products is basically limited by specific shopping habits, e.g. browsing through special offers in local shops or outlet shopping. The potential for online commerce in media products (books, music, video) accordingly requires a differentiated approach.

As consumers regard the stationary book trade as having a particularly good range of products, quality of advice and regional coverage, the share of the online book trade has been relatively small to date (3.4% of total sales in 2001) compared to audio recordings and videos, and is likely to increase only slightly in the short and medium term.

In the online trade in audio recordings and videos, one explanation of the relatively high share of online sales (audio recordings 6.4%, video 13.6% of total

sales in 2001) is the comparatively poor structure of supply through stores. In the long term the share of online trade in total sales of video cassettes and DVDs could rise as high as 30%.

A range of factors is hampering the establishment of a market for digitised media products. In the physical media segment and even more on the Internet consumers are already accustomed to free availability of media products financed by advertising; the copy protection mechanisms for digital media products are increasingly limiting established habits (e.g. lending, collecting, long-term storage), and private online exchanges have already set standards for product range, availability and use options which commercial online dealers would first have to improve on. Exploitation of the commercial potential of e-commerce accordingly depends decisively on whether consumer-friendly distribution models can be found which are also profitable.

COMMERCE IN ELECTRICITY

Commerce in electricity (section II.5) has only been possible in Germany since 1998. In principle, as a commodity which is tied to the supply network with automatically-logged delivery and use data, electricity is particularly suitable for electronic commerce. Even so, little use has been made of this potential to date. This is due particularly to inadequate implementation of market liberalisation. There is still substantial need for action in creating market and information transparency and access to the distribution networks and electricity meters and in standardisation. Another inhibiting factor is the customer, who is more concerned with supply than purchasing. Very few customers have a clear motivation to bargain over electricity prices.

If we consider the individual segments of electricity trading, electronic trading is relatively well established in electricity wholesaling. Here, the electricity generating companies negotiate with each other to balance unforeseen capacity excesses and shortages. Trade with major customers is also developing through electronic market places and the new electricity exchanges. In electricity retailing with private consumers, it is currently impossible to enter into contracts (change electricity suppliers) through the Internet alone, as the existing electricity supplier insists on written notice of termination.

The volume of electricity traded with corporate customers will continue to rise (wholesale and retail). In this segment, the share of trading handled electronically could grow to over 50%. By contrast, the volume of electricity traded at the

retail level will not grow to the same extent. Here, the share of e-commerce is expected to be below 10% for the foreseeable future.

SECURITIES TRADING

Securities like electricity as a commodity are also particularly suitable for electronic trading by virtue of their intangible nature. In securities trading (section II.6) there is very heavy use of interactive media, both in the phase of gathering information and in the phase of closing the deal.

The general trend in the last few years towards buying securities was promoted by the new opportunities to order shares directly over the Internet. There were 2.5 million securities accounts managed online at end-2001, although the number of transactions fell sharply during 2001. This led to a crisis among online brokers as their business model is based primarily on commissions for securities purchases. Several suppliers are accordingly trying to reposition themselves by offering increased advisory services again, moving away from concentration on the Internet and shifting to the telephone and stationary forms of distribution. Established suppliers with extensive branch networks have a considerable strategic advantage in competition with the new suppliers from the Internet.

The interactive possibilities of the Internet are utilised for investors to function not only as information seekers but also as information providers (e.g. in the relatively popular chat rooms). There is no review of the quality of the information supplied in this way. The danger of manipulation by anonymous participants is correspondingly great. Self-regulation, government measures and the establishment of quality standards by information brokers all aim to counter this danger.

Mergers between the electronic stock markets are also occurring at the international level, which can result in regulatory problems. The difficulties of international regulation arise out of the international marketability of securities and the fact that the stock market operators are international companies.

SERVICE AND E-COMMERCE: LAW AS AN EXAMPLE

The service sector (section II.7) is highly diverse, ranging from the distributive trades, banks and insurance companies through public administration to the liberal professions (doctors, engineers, lawyers). Essentially, services are to be understood as useful services linked to individuals supplied on the basis of years

of professional formation. Services cannot be stored or transported, and production and consumption necessarily coincide. As a result, services are marketable but cannot themselves be traded. All that can be traded is the rights to a service the contract for legal advice, but not the legal advice itself. However, with growing technological access specifically through telecommunications and computers, but also through other rationalisation processes these differences are losing their importance, and the nature of work in services is changing. This is investigated more closely through the example of legal services.

First steps are being taken in e-commerce particularly in the fields of legal information and legal advice: the database operator Juris sells legal information to experts, legal portals on the Internet offer information to all, free and for payment. Three forms of electronic legal advice are offered: »instant advice« by e-mail and phone (lawyer hotline), interactive advice and advice through videoconferencing. These are areas of application which are currently still experimental, but they are increasingly important in the context of growing electronic legal relations.

A study on the liberal professions and e-commerce identified two typical attitudes which can also be interpreted as ideas about the long-term impact. First, there is that attitude that e-commerce will not affect the heart of the liberal professions (highly-qualified advice with a specific professional code), which professionally means supporting non-technological forms of communication. Second, there is the committed exploitation of the new possibilities and their intrinsic potential, such as rationalising communication with clients, and an instrument for profiling and accessing new markets.

PUBLIC SECTOR PURCHASING

Public sector electronic purchasing (section II.8), which is often called »public e-procurement« (PEP) in Germany as well, is still in the first stage of development, but is currently displaying considerable dynamism. The picture is currently dominated by numerous projects at local authority, state and federal level. At the federal level, an outstanding example is the key project »e-contracting«, which is part of the larger project »public purch@sing online« At the local authority level, which plays an important role in public sector purchasing generally, the range extends from relatively small implementations (preferred by individual local authorities) through local authority purchasing cooperatives to a comprehensive in-house implementation. As in-house implementations are relatively cost-intensive, many local authorities prefer to adapt implementations

developed by other public institutions or to rely on cooperation with external service providers from the private sector.

The initiatives in electronic public sector purchasing are integrated into a comprehensive strategy for modernising government and administration procedures with a range of goals, including cost savings. The exact amount of potential savings is, however, disputed. The majority of experts, together with the Federal government, expect that this can save up to 10% of total costs. There is general agreement that PEP can considerably speed up and simplify public procurement procedures.

Important legislative prerequisites for electronic procurement have been implemented in the last few years. There is further need for action due to individual problems and current developments at EU level. However, technical solutions and various operator models are now available in principle. Based on what has been achieved to date, the next stage is to intensify information and communication about PEP.

The current PEP initiatives at the various levels of the public sector can be regarded as experiments and learning processes. Naturally, the emphasis here is on technical and organisational questions. However, appropriate consideration is already needed of the effects on small and medium-sized enterprises, creating greater transparency, data protection, qualification requirements and rationalisation effects for public sector employees and the Europeanisation of public procurement.

Ideally, public procurement offices and the state will act as pioneers for future developments in e-procurement. The first requirements for public sector electronic procurement to function as the driver for e-commerce generally have been met. Development is not, however, far enough advanced to enable us to estimate if e-procurement really will play this pioneering role.

E-COMMERCE IN THE CONTEXT OF MODERNISING THE ECONOMY

E-commerce is one element in the steady evolution of the structures in the economy. Its forms are as diverse as the various goals. However, there will be no e-commerce revolution. The stimuli it provides for structural transformation are clearly apparent in individual segments, but overall have relatively moderate force.

DIVERSE GOALS AND STRATEGIES

E-commerce has very different goals (section III.1.1). The focus is on solving specific problems, depending on the industry, positioning of the firm or commodity being traded for example, process integration, creating greater transparency, improving the effectiveness of order processes for mass commodities or customer-specific configuration of high-end goods. These goals have different relevance for the various economic sectors studied.

In the case of process integration, the aim is (inter alia) to integrate the e-commerce components into the corporate IT and to coordinate the supplier and purchaser systems of those involved in e-commerce. In this case, e-commerce acts as an element in comprehensive strategies for networking companies.

The problem in creating market transparency typically appears in market situations with a large number of fragmented suppliers and customers. Here we see that long-term established cooperation between enterprises is often preferred over market-intermediated and flexible trading relationships. E-commerce only enters into the picture if demand peaks, temporary bottlenecks or special requirements arise. In such situations, e-commerce systems can create transparency in chaotic market conditions and also, in the short term, match demand with existing supply. Under some circumstances, price-fixing and contracting can then be automated. Such electronic bourses and spot markets reflect the special potential of e-commerce. However, as these specific requirements occur only rarely, e-commerce will play a correspondingly minor role in these segments.

Trade in everyday commodities which are low in price and needed relatively often in large quantities is particularly suitable for e-commerce between producers and wholesalers or retailers. Comprehensive electronic product catalogues accessible online are a central element in such systems. The focus is on rationalising the ordering process (and only secondarily on choosing a supplier or product). It is already apparent that B2B e-commerce in this segment (e.g. in ordering books or pharmaceuticals) accounts for a high proportion, tending towards 100%.

The situation is different for up-market goods which are purchased infrequently (cars, furniture, clothing, insurance policies, travel etc). Because of the significantly higher value of the orders, the focus is not on rationalising order processing. Where electronic sales systems are used, these are more likely to be concerned with customer-specific configuration of the product (colour, features), showing availability of a product, or negotiating terms.

COST SAVINGS THROUGH E-COMMERCE?

One of the most controversial aspects of e-commerce is the question of the cost saving potential. Given the diversity of the forms of e-commerce and the goals associated with it, no general answer is possible (section III.1.2).

The literature is most likely to contain figures on cost savings through electronic procurement. This data refers to the procurement process itself and also to the prices of the goods purchased. Generally, savings are expected to be higher in percentage terms in process costs than in product costs.

However, there are also frequent statements (of dubious value methodologically) on the costs of different distribution channels, with e-commerce described as very cheap. Given this often uncritical faith in the potential for cost savings, two things need to be said: the potential productivity and cost-effectiveness of e-commerce are completely irrelevant if customers do not accept this distribution channel or if products are unsuitable for this distribution channel.

There is much to suggest that the frequently voiced expectations for e-commerce are currently no more than e-commerce illusions. So far, neither the elimination of the intermediate and retail stages nor the transfer of brokerage operations to electronic platforms has led to the expected high cost savings. The hope that online traders could get by without their own inventory has also proved largely illusory.

NEW CUSTOMER POWER?

E-commerce claims to offer a high degree of selectivity, interactivity and individuality overall, a promise of increase customer sovereignty (section III.1.3). The Internet opens up the whole world of trading to the customer. They can use comprehensive electronic product catalogues to locate the desired product, which can then be adapted to their specific wishes, manufactured on demand and delivered. Customers not only become their own purchasers, but also become co-producers with the manufacturer.

Generally, however, private users see the Internet primarily as a medium of communication and information and only secondarily as a medium for transactions. Acceptance of e-commerce is accordingly enhanced if the buying transaction can be linked to everyday communication and information behaviour. Linking everyday behaviour and purchasing processes is particularly promising if this

opens up possibilities for buying at favourable prices. However, products on the Internet are by no means generally cheaper than those in conventional outlets.

For all these considerations of the appeal of e-commerce for customers, we should not lose sight of the fact that the electronic medium itself may be one of the biggest barriers, particularly for occasional users unfamiliar with it. It is accordingly not surprising that in the classic mail-order business the telephone has become the dominant medium for orders, rather than the Internet. The concept of expanded customer sovereignty has its pitfalls and its limits. This is because the customer in self-service mode is faced by an extensive range of tasks which they are not accustomed to and do not wish to perform.

STRUCTURAL TANSFORMATION THROUGH E-COMMERCE?

The structural transformation expected from e-commerce in industries and markets (section III.1.4) involves a range of closely-linked aspects.

It is too early for a definitive answer to the general growth potential of e-commerce. It is, however, possible to consider generally how e-commerce could influence economic growth.

There is a clear positive contribution to GNP from innovative products or services which can only be marketed electronically. It is difficult to assess the effects of substitution between distribution channels and e-commerce, and the latter s role in shifting trade flows on the international level.

Given the significance of sales of pre-owned goods on the Internet, there will be an element of substitution for buying new goods (negative influence on economic growth) and another element of meeting a demand which previously could not be satisfied (because of the lack of transparency in or complete absence of supply). In the second case, we can expect a positive contribution to economic growth.

The development of e-commerce is also judged against the ideal of a »frictionless market«. In such high transparency markets, competition is particularly intense (or so it is assumed) and prices accordingly approximate to marginal costs. However, empirical studies show that despite e-commerce there is considerable variation in price between different online suppliers, and prices on the Internet are not generally more favourable than those in stationary retailing.

With the help of the Internet, e-commerce creates the possibility of overcoming more easily separation in geographical and communications terms between manufacturer and customer. (Intermediary) stages in distribution could be eliminated, and the margins at these stages could flow directly to producer and consumer. Although such direct sale concepts do exist in various sectors of the economy, the opposite trend seems to dominate, with existing intermediaries being strengthened and new (cyber)intermediaries appearing.

General considerations lead us to conclude that the »Internet economy« is more likely to promote trends towards concentration than to hinder them. In the case of digital products and services, in comparison with conventional products and services, there is a shift in balance from variable costs to overheads. This implies major economies of scale, which large companies are better placed to exploit and which further promote trends towards concentration. Ongoing monitoring will accordingly be necessary for trends towards concentration through e-commerce and possible restraints on competition, together with better international cooperation between cartel regulators, given the strongly international interdependence of e-commerce.

Summarising our conclusions for structural transformation, we can say that the sectors of the economy generally represent a more or less evenly-balanced system, which in some cases is buttressed by statutory arrangements (book price fixing, pharmacy monopoly, group exemption regulation in the automotive sector) or internal arrangements within the industry. While e-commerce may bring about a shift in the balance between actors in one instance or another, e-commerce is hardly the main lever for drastic change in an industry s structure.

LABOUR MARKET

Little attention has been paid so far to the impact of e-commerce on employment (section III.1.5). It is, in fact, difficult to estimate this impact, as extensive innovation in processes and products seldom happens quickly. Experts feel that e-commerce is likely to lead to growing employment in manufacturing, housing and public and private service providers. Employment cuts are appearing particularly in the credit and insurance sector and retailing. Jobs will also probably be lost in trading in pharmaceuticals and media products. Overall, taking into account both positive and negative effects, there is little reason to expect e-commerce to make a positive contribution to employment on balance.

TRAFFIC

In many of the sectors studied, e-commerce has had an impact on traffic (section III.1.6) and is changing the logistical added-value chain. It can be assumed that e-commerce will result in increasingly direct contact between manufacturers and retailers and also between the distributive trades and consumers. Deliveries are more customer-oriented, and intermediate stages in distribution are reduced. If e-logistics succeeds in meshing all the actors and process chains efficiently, it could have effects reducing the volume of traffic.

In principle, purchases through the Internet with direct door-to-door delivery could replace private shopping trips. However, this would also give rise to delivery traffic with small shipments which have to be distributed to a large number of constantly-changing recipients. This will increase the number of trips with smaller vehicles. It will also increase the kilometrage in transport, as orders and deliveries are made over longer distances. Online transactions with private consumers tend to lead to atomisation of delivery traffic. The result is a certain increase in traffic. However, this growth will stay within narrow bounds: the volume of the anticipated shift from stationary trade to e-commerce is no more than 5% of total purchases in consumer goods retailing.

The future development of traffic will also be determined by the efficiency of the delivery systems. In view of the high costs of delivering shipments to households, bundling of deliveries seems necessary. An expansion of B2C e-commerce could make implementation of corresponding logistical models (cooperation, collective deliveries, pickup points etc) increasingly possible.

B2B e-commerce will make a relatively minor contribution overall to growth in traffic. Growth in traffic and kilometrage independent of e-commerce will continue to be determined more by growth in industrial bundling of deliveries and economic growth generally.

ECOLOGY

There is growing interest in research in the ecological effects of e-commerce (section III.1.7). Initial results come from studies on the environmental impact of the information and communications technology infrastructure generally. To date, the studies have focused on energy consumption and material flows involved in Internet use. On the whole, they are concerned with the general use of the Internet (rather than specific use for e-commerce) and the telecommunications

networks and terminals. For Germany it is estimated that Internet-related energy use accounts for c. 0.8% of total electricity consumption.

There are extensive expectations that e-commerce will enhance resource productivity. The primary way this can happen is through improved management of the entire process chain from the supply of goods through to shipment. However, greater individualisation of products (»mass customisation«) also helps avoid overproduction and reduce inventories. In terms of product recycling and product life extension, recycling exchanges for pre-owned goods on the Internet and on Internet platforms can reduce burdens on the environment if they promote additional recycling or contribute towards increased purchase and reuse of pre-owned capital goods.

More complex indirect impacts on the environment and feedback effects may have greater ecological dimension than the direct impact. The structural change in the economy initiated by the Internet and e-commerce may have a positive effect on total energy consumption, e.g. because e-commerce promotes tertiarisation. Alternatively, the gains in efficiency resulting from e-commerce also help lower prices, which in turn can stimulate demand. If tickets are offered more cheaply in online sales, this can result in more and longer journeys. Finally, e-commerce can increase international trade, and hence global traffic.

Summarising, we can say that research into the ecological implications of e-commerce is still in its infancy in theoretical, methodological and empirical terms.

MARKET REGULATION AND E-COMMERCE

A close look at the conditions of commerce in individual industries and economic sectors reveals a series of special arrangements which restrict free commerce and worsen the prospects for establishing e-commerce (section III.1.8). A couple of examples by way of illustration are the ban on mail-order pharmaceuticals and the retail price maintenance in the book trade. Particularly obstructive for e-commerce are all restrictions on commerce involving local monopolies, limiting or preventing price competition and preventing specific forms of distribution and provision.

However, e-commerce is not just subject to existing arrangements it can affect the process of regulation or deregulation itself, e.g. by reinforcing a process or change or even initiating change in the regulatory regime. The result of the industry-by-industry analysis suggests that e-commerce is having a variable impact

on market deregulation. Generally, its effect is either neutral or reinforcing existing trends. The interesting case where e-commerce is a change agent essentially occurs where there is a possibility of circumventing existing (national) regulations de facto, and forces within the industry support deregulation. However, it is going too far to say that national regulations have no chance of being implemented in the Internet age and for Internet commerce generally this depends on the markets in question and the forces involved.

PROSPECTS FOR E-COMMERCE

In evaluating the further prospects for e-commerce and its consequences, we should restrict ourselves to statements about ranges and orders of magnitudes, as the apparent precision of quantitative forecasting models merely conceals the uncertainties in the data and assumptions used in the models (section III.1.9).

Qualitative estimates were made for three sectors of e-commerce. The first two areas of application involve e-commerce in the B2B sector in the production or post-production phase, the third looks at a segment of e-commerce in the B2C sector.

The special challenge in the classic manufacturing industries is to integrate trade and specifically the purchasing processes into production planning and optimise the results in terms of both cost and time. E-procurement is accordingly inevitable for many companies, both for this reason and because of heavy competition. However, if we consider the restraining factors (e.g. the extremely demanding nature technologically speaking of the task of integrating the various operating IT systems), we cannot expect a 100% share for e-commerce even in the long term. The domination of specific companies and the competitive situation are clearly driving the trend towards integrated e-commerce. Its share will tend towards a level above the 50% mark.

In segments with a broad product range which can be easily described and catalogued, with high order frequency and relatively low price, electronic ordering processes are virtually inevitable. Even today, we find examples of almost totally electronic order processing between manufacturers, wholesalers and retailers consider, for example, how pharmacies order from pharmaceutical wholesalers. In the medium term, e-commerce will be virtually the standard in these segments. Conversely, there are cases where tricky and often highly individual discussion is needed between the supplier and purchaser of a product, which it is virtually impossible to imagine taking completely electronic form. While order processing in

the sense of procurement or re-ordering to restock can be expected to approach a 100% share for e-commerce, it seems impossible to reach this level entirely for inventory and product range ordering. Even a share in excess of 50% cannot be expected in the medium term.

If we consider B2C e-commerce in everyday and mass products such as food, pharmaceuticals, books, CDs etc, we can drawn on experience from mail order and from abroad, which is seen in some cases as more advanced in terms of the economic policy environment. On this basis, even in the long term we can expect an e-commerce share significantly below 10%. There will only be isolated product segments where e-commerce is more important, e.g. because the competing stationary outlets offer poor service, or because it is possible to offer a significantly lower price on the Internet.

NEED FOR RESEARCH, AREAS FOR POLITICAL ACTION

NEED FOR RESEARCH

In the current phase of upheaval, in which the first clear structures of e-commerce can be generally recognised in the context of social and economic transformation, there is great need for research (section III.2). Because the success of e-commerce depends crucially on a functional logistical system, and the roads ought not to become the bottleneck for e-commerce, logistics and traffic are particularly important areas of research. However, the issues of customer behaviour and ecology also have considerable relevance for improving the environment.

- The future success of e-commerce depends crucially on the efficiency of the logistics systems. A central issue for research is which of the e-logistics strategies currently under discussion or being tested has the potential not only to optimise processes in individual enterprises but also to meet transport, economic and ecological policy goals. Models contributing to the competitiveness of manufacturing industry and the logistical sector and to enhancing resource productivity play a central role in this. Research could develop technological and organisational options here. Promising variants could then be tested and evaluated in pilot trials.
- Knowledge of the transport impacts of e-commerce in both the B2B and B2C segments is so far still rudimentary. Methodologically defensible analyses on the basis of current, valid data are needed, inter alia to study the formation of innovative transport chains including eco-friendly transport systems, genera-

ting additional transport based on minimal orders, and door-to-door delivery of consumer goods. Extensively neglected to date are the role of aviation and the potential of rail transport for e-logistics. Quantitative estimates at the macroeconomic level of the impacts of e-commerce on logistics and transport are very difficult, and disaggregation of national statistics would be helpful here.

- Customers, with their preferences and consumption patterns, are playing an increasingly important role in this context. To arrive at a more precise estimate of the future prospects of e-commerce and the prospects of concepts for »customised mass products«, it would be necessary to analyse in greater detail how far and in what form leisure and consumer behaviour of individual customer groups has changed and, specifically, will change as a result of the possibilities offered by e-commerce. Private consumer purchasing behaviour in particular must be seen as highly complex in terms of its determining factors (means of transport, motivations, goals, links with other goals) and should accordingly be analysed for its relevance in these respects for e-commerce.
- To date, the numerous individual studies on the ecological consequences of e-commerce have shown a diverse picture of positive, neutral and adverse environmental effects. There is need for research into the modelling and building on this the application and further development of existing instruments for ecological assessment. In addition, more case studies on resource productivity are needed.

Applied research in the three selected sectors could supply useful information for business and politics on the future configuration of the environment for e-commerce.

AREAS FOR POLITICAL ACTION

The areas for political action relating to e-commerce cover a wide range of aspects, extending from the material prerequisites for an easily accessible network infrastructure and the social prerequisites for qualified design and use competence among firms and consumers, through the regulatory conditions to ensure confidence and security to the general conditions and consequences in business, transport and the environment (section III.3.1).

There is need for national political action in numerous areas (section III.3.2).

- In terms of the technical e-commerce infrastructures the political and legal environment requires ongoing further development, and political initiatives to strengthen the Internet need to be continued. In addition, consideration could

be given to a new broadband initiative in Germany.

- A particularly important issue is improving the data available. There is great need for informative statistical data on e-commerce. An important point here is international coordination of the relevant activities of the national statistical offices.
- Small and medium sized enterprises face a range of access barriers to e-commerce. Public organisations can promote their position in e-commerce primarily by increasing awareness of e-commerce, playing a pioneering role themselves, helping improve the standard of information in the enterprises and raise employee qualifications and ensuring that their policy reflects the high requirements of small and medium sized enterprises for capital and advice.
- In competition policy the development of e-commerce gives rise to a range of new needs. For example, the digitisation of products may promote the trend to greater industry concentration. Other issues are corporate links between producers of complementary goods, corporate alliances for promotion on the Internet, and the examination of electronic market places and so-called virtual companies in individual cases.

There is need for action at the international level, inter alia with regard to global commerce in services (WTO, GATS), tax and customs policy, data protection, protection of copyright and IPR and international organisations (section III.3.3).

- With respect to global commerce in services two approaches are currently of particular interest: besides the WTO working programme on e-commerce, there are the GATS 2000 negotiations on progressive liberalisation of commerce in services. The recently-opened negotiations are in principle a suitable forum for solving the outstanding e-commerce problems and the further steps in liberalisation relevant for this.
- With regard to taxes and customs, future technological developments will show how far automatic online taxation procedures can be found which will achieve acceptable and effective taxation of virtual markets with reasonable administrative investment. First, however, political agreement within and between the major economic areas is needed. In the longer term, a lack of agreement on taxation of electronic trade in goods would cement the preferential treatment of e-commerce compared to traditional commerce.
- Compliance with the various data protection regulations is difficult to control and enforce on the Internet, where deliberate collection and storage of person-related data frequently moves in a grey area. To create greater transparency, many e-commerce companies have actively committed to a privacy policy. However, such voluntary commitment does not offer full protection, as it does not establish a legal right and the owner of the data cannot check if the com-

mitment is being honoured. Besides private initiatives by individual companies and awareness-raising among consumers, there is still a need for consistent legislative action by the state.

- Other state responsibilities are seen as amending the legislative framework for copyright and IPR and promoting the development of technological procedures to protect copyright and IPR. However, implementing these technically on the Internet is difficult. As a result, alternative procedures for protecting copyright and IPR owners are also under discussion, e.g. a flat-rate fee for media which can be copied.
- Besides national and international regulatory bodies, several international organisations have a decisive function in shaping e-commerce. Both political organisations and bodies (e.g. the WTO) and private organisations (e.g. the Global Business Dialogue) are included. These perform coordinating functions which could hardly be handled by a single country. The international organisations and particularly the UN system also play a significant role in the areas of access to and expansion of e-commerce. A point for criticism is that the various organisations are active in very similar areas, creating a risk of uncoordinated duplication of effort. As a result, early and more efficient coordination of initiatives on e-commerce is needed, e.g. through thematic working groups covering a number of institutions.

The Office of Technology Assessment at the German Bundestag is an independent scientific institution created with the objective of advising the German Bundestag and its committees on matters relating to research and technology. Since 1990 TAB has been operated by the Institute for Technology Assessment and Systems Analysis (ITAS) of the Karlsruhe Institute for Technology (KIT), based on a contract with the German Bundestag

Office of Technology Assessment
at the German Bundestag

Büro für Technikfolgen-Abschätzung
beim Deutschen Bundestag
Neue Schönhauser Str. 10 · 10178 Berlin
Telefon: 0 30 / 28 49 10
Telefax: 0 30 / 28 49 11 19
e-mail: buero@tab.fzk.de
Internet: www.tab.fzk.de