

## **Sustainable Business Strategies in the Internet Economy**

Klaus Fichter<sup>1</sup>

### **Abstract**

As to the environmental effects of e-commerce and Internet use, three levels can be distinguished: direct environmental effects of the information technology infrastructure (energy use etc. of networks, servers, receiver systems, PCs etc.), secondary effects caused by Internet use, and tertiary effects due to subsequent and rebound effects.

Until now, positive environmental effects brought about by Internet use and e-business have generally been unintended coincidental side-effects. The growth in significance of e-business and Internet for the economy and environment means that companies in future will have to take environmental demands into specific consideration as part of their innovation strategies. E-business provides four environmental strategies for sustainable company development: 1. Greening of ICT: environmentally friendly production, use recycling of information and communication appliances and technologies, 2. E-substitution: Substitution of physical products by electronic and environmentally friendly alternatives for products, mail order services and uses; 3. E-support: Use of the Internet and e-business for the safeguarding and dissemination of environmentally friendly products and services and 4. E-services: use of Internet based services, business models and networks for safeguarding the environment and improving eco-efficiency.

### **Growing importance of e-business**

The initial euphoria over the new economy has in the meantime given way to more realistic valuations after the failure of many Internet start-ups and the still low proportion of e-commerce in the overall trade turnover. E-business will not be the be-all and end-all in the future, but e-commerce and Internet use will certainly gain in importance. According to forecasts of the European Commission there will be 500 mil-

---

<sup>1</sup> Klaus Fichter, Ph.D., is director of the INF Institute for Innovation and Sustainability (Institut für Innovations- und Nachhaltigkeits-Forschung), a Berlin-based, not-for-profit research institute. One major focus of the INF-research agenda is on the digital economy and its impacts on the environment. Contact: Klaus Fichter, Institut für Innovations- und Nachhaltigkeits-Forschung (INF), Lyckallee 26, D-14055 Berlin, Germany, Tel. +49.30.342 31 04, Fax +49.30.30 10 85 55, E-Mail: fichter@snafu.de

lion Internet-users worldwide by 2003 and a rapid increase in e-commerce turnover, especially in the area of business-to-business. However, when looking at the objectives of sustainable development the expected effects of the Internet revolution are uncertain. The following article looks into the environmental effects resulting from e-commerce and Internet use and where the strategic starting points lie for companies to use the potential of the Internet revolution for sustainable development.

### Environmental effects of e-commerce und Internet use

As to the environmental effects of e-commerce and Internet use, three levels can be distinguished: direct environmental effects of the information technology infrastructure (energy use etc. of networks, servers, receiver systems, PCs etc.), secondary effects caused by Internet use, and tertiary effects due to subsequent and rebound effects. This distinction is suitable to classify environmental effects of information and communication technologies in general.

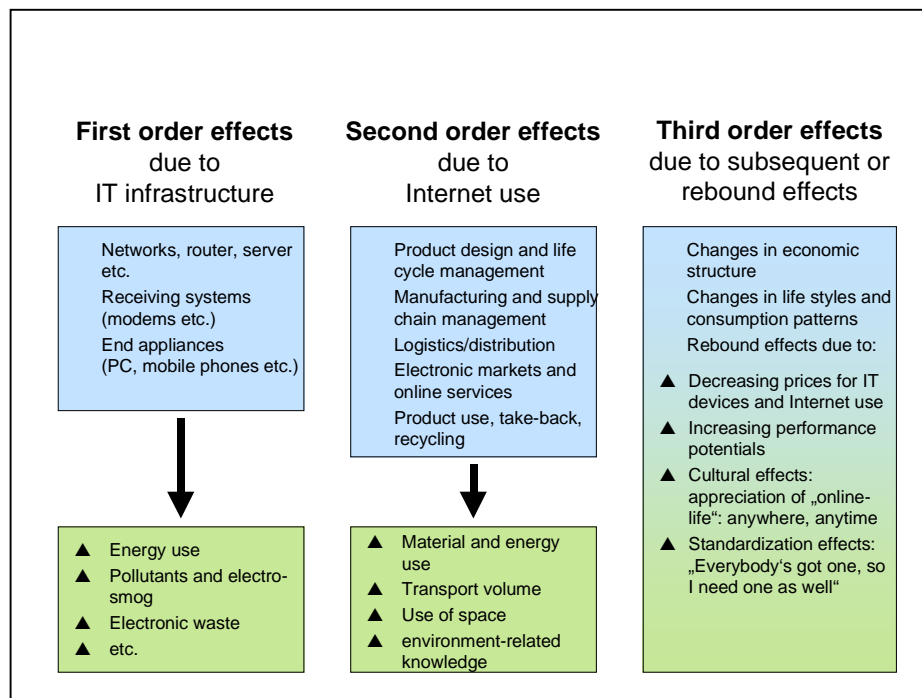


Fig. 1: Environmental effects of e-business and Internet use. Source: the author

The core insights of the so far available studies<sup>2</sup> may be summarized as follows (Fichter 2001):

- There is no general answer to the question whether the use of new media will lead to increased or decreased environmental impacts.
- New and classic media each have their specific advantages: so, for instance, with respect to selective search for information, electronic media are usually more efficient and more environment-friendly (time-saving search functions, energy use and environmental exploitation crucially dependent on use). With respect to entertainment and unspecific background input, conventional media are often more advantageous.
- Electronic media often are not so much a substitute as rather a supplement for printed or other media, thus tending to increase environmental exploitation. There is the risk of summation effects and incomplete substitution.
- Digitalization of products (music, news, e-mails etc.) does not automatically lead to dematerialization but often rather entails subsequent effects. So, for instance, digitalized music files downloaded from the Web (e.g. via Napster) are often stored on CDs, received e-mails are printed out on paper etc. These are re-materialization effects.
- Side-effects of digitalized media, like packaging of CDs, or printed user manuals, do considerably influence the eco-balance.
- Environment-friendliness of Internet use and electronic media does heavily depend on the way of electricity production, hence on the respective shares of the technologies used for current generation. As to printed media, the aspect of paper recycling does strongly influence environmental effects.
- Of considerable relevance for energy consumption and environmental exploitation is, apart from the terminals, the network infrastructure (server, router etc.).
- Potentials for increasing resource productivity are presumed to lie above all in the business-to-business area. American studies<sup>3</sup> point at considerable potentials in the fields of reducing stocks, flawed products, energy consumption and floor space occupied for retail and office businesses.
- Any assessment of the environmental effects of e-commerce on traffic and environment is linked to multiple assumptions and requires complex modelling. The results of respective analyses of environmental effects are thus extremely dependent on the underlying assumptions.

---

<sup>2</sup> The number of empirical studies is rapidly increasing today. The following are examples of presently available studies: Kortmann/Winter 1999; Greusing/Zangl 2000; Reichart/ Hischier/Schefer 2000.

<sup>3</sup> Cf. Romm/Rosenfeld/Herrmann 1999; Cohen 2000.

- Online orders tend to accelerate the delivery of goods and to change the structure of shipped freight towards smaller units, thus lead to an increase in courier, express, and parcel deliveries.
- On the other hand, Swedish studies show that e-commerce does not necessarily entail more traffic<sup>4</sup>. Under certain preconditions, online shopping contains a potential of pollution and traffic reduction. The realization of that potential depends crucially on: the respective population density as to home delivery service, the share of e-commerce users, the delivery distances, and the modal split of the respective region.
- Rebound effects are not considered in any of the existing studies! All respective studies reflect only the effects at a certain point in time.

To sum up, the overall pattern of environmental effects of Internet use on transport, material and energy use, as well as on environment-related knowledge is composed of a variety of positive, neutral, and negative effects.

### **Approaches for sustainable business strategies**

Until now, positive environmental effects brought about by Internet use and e-business have generally been unintended coincidental side-effects. The growth in significance of e-business and Internet for the economy and environment means that companies in future will have to take environmental demands into specific consideration as part of their innovation strategies. E-business provides four environmental strategies for sustainable company development:

1. Greening of ICT: environmentally friendly production, use and recycling of information and communication appliances and technologies
2. E-substitution: Substitution of physical products by electronic and environmentally friendly alternatives for products, mail order services and uses.
3. E-support: Use of the Internet and e-business for the safeguarding and dissemination of environmentally friendly products and services.
4. E-services: use of Internet based services, business models and networks for safeguarding the environment and improving eco-efficiency.

These strategies may be applied both to providing products or services and to using and recycling them.

---

<sup>4</sup> <http://www.swedenenvironment.environ.se/no0001/0001.html?art13>

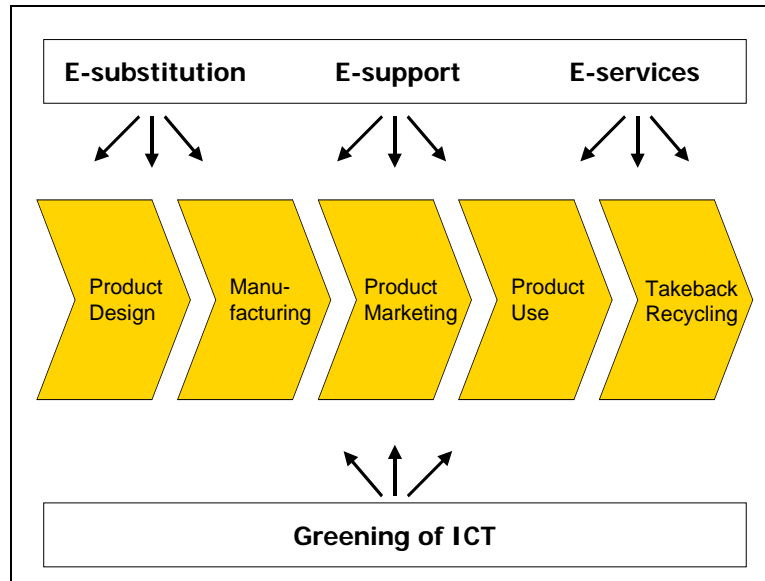


Fig. 2: Sustainable e-business-strategies. Source: the author

### Greening ICT

The ecological effects and problem areas of the information infrastructure, especially of the end appliances, have been an object of scientific examination and a main development focus for many manufacturers of information technology equipment (German Bundestag 1998, Reichl, Griese 2000). The main responsibilities here lie in the development of energy saving appliances, the avoidance of toxic substances such as PCB, mercury or cadmium, the reduction of generated waste through better recycling and the optimisation of the life and use of appliances, for example through leasing and sharing. The manufacturers and suppliers of Internet information and communication technology have the task of including environmental protection as a definite requirement in their development and innovation management and to use the potential for a greening of the information technology.

In the future, sustainability will not only depend on the information infrastructure but primarily on how Internet technologies are used.

### E-substitution

The strategic approach of substituting physical products (telephone books, newspapers, diaries, construction design plans etc.) and transport by electronic alternatives will probably be of minimal importance regarding the potential of safeguarding the

environment. The potential possibilities of traffic avoidance and reduction of material consumption should however be individually examined. The question arises as to whether electronic products or alternative forms of mailing really are better for the environment when the entire life cycle of the product is examined. Since there are no general answers, individual examinations and evaluations must be made. It must be determined how such an evaluation can be justified regarding cost and to what extent real alternative forms of action can subsequently come into force.

Alternative action is an issue for both suppliers and users of electronic substitutes. Electronic alternatives (virtual mail-order catalogues, electronic construction design plans, electronic manuals, pocket PCs etc.) are not put on the market or bought out of concern for the environment, but because of price, speed and marketing etc. Alternative action by companies is, however, not determined by the issues of whether an economically advantageous electronic substitute can be put on the market, but by the issue of whether this can be done in an environmentally friendly way and in general, this means producing appliances which are energy saving, free of toxic substances and recyclable.

### **E-support**

Internet use to support the production and use of products (e-support) may provide greater potential for safeguarding the environment than electronic substitution strategies. This is shown, for example, in the improvement of communication within eco-efficient mass production designed specifically for the customer.

The US-American chemical company ChemStation, which produces commercial detergents, uses the Internet to find out about customer-specific needs and take them into account when determining the composition of cleaners. In that way, superfluous additives can be avoided and correct dosage can be determined more exactly.

<b>Eco-efficiency through e-support</b>	<b>Example</b>	<b>Environmental effect</b>
Internet support of customer-specific mass production	ChemStation (producer of commercial detergents) ( <a href="http://chemstation.com">http://chemstation.com</a> )	reduction of polluting additives, customer-adequate dosage
E-commerce and built-to-order strategies	Dell Computers	reduction of stocks and excess production
Internet linkage of consumer goods and mail order articles by means of "smart tags"	Electrolux: leasing of washing machines, pay per use, online accounting via Internet	incentives for economic use of household appliances (pay per use)

Table 1: Eco-efficiency through e-support. Source: compiled by the author

Other forms of production that are specifically designed for customers, such as printing-on-demand and building-to-order are interesting strategies. In this way, for example, Dell Computer succeeded in minimalizing the stock of electronic parts with its order service which is specifically designed for customers. Stocks are thus avoided which would quickly lose their value due to accelerating developments in the field of computers. Computers outdate so quickly that electronic parts not only lose their value but there is an increase in the amount of waste to be disposed of and materials are wasted (Cohen 2000, 3).

Transponders (smart tags) are an interesting example of how physical products can be used most favourably through Internet support. They are devices containing a simple microchip and a unit which can both receive and transmit and thus 'communicate' via the Internet. The wafer-thin transponder can be integrated into products such as household appliances or packaging. The drop in the unit price means that their use has now become economically interesting (<http://auto-id.mit.edu>). With the development of Internet-enabled products, there are now new possibilities for improving product use, product life and recycling. Complaining about products and maintenance will be made easier, the communication of updates on the safety of products can be made available more easily and new incentives to use products economically will be developed. Electrolux, the worlds largest producer of household appliances is testing, for example Internet-enabled household appliances which can be rented to the customer and which will be paid by use. This is one way of creating incentives for efficient use. In this context, there are of course questions that need to be clarified, regarding data protection for example.

### **E-services**

An even more important strategy for sustainable e-business solutions lies in the development of Internet based services and company networks (e-services). Internet portals specific for careers and tasks offer information on the latest sector news and technologies and could be used by development engineers or information managers in the search for eco-efficient technologies and service models. Use of the Internet creates new opportunities for substance chaine management. Internet based services are also opening up new potentials for safeguarding the environment in the areas of extending the use of products and recycling, for example, the exchange for the recycling of cars on the Internet by the renet company ([www.renet.de](http://www.renet.de) and Albrecht 2000).

Further electronic services are provided by Internet portals and online shopping guides for environmentally-friendly products and services. One example is [www.GreenOrder.com](http://www.GreenOrder.com), a web-service that helps business and administration to easily find eco-labelled products on the Internet.

<b>Approaches</b>	<b>E-Substitution</b> Substitution of physical goods by electronic goods	<b>E-Support</b> Internet support of production and product use	<b>E-Services</b> Internet based services and networking
<b>Functions</b>			
Product and service development	<ul style="list-style-type: none"> <li>Product and manufacturing simulation by Internet engineering</li> <li>Digital construction design plans/ documents</li> </ul>	<ul style="list-style-type: none"> <li>Internet-based learning programs for sustainable product design</li> <li>Internet based benchmarking</li> <li>Virtual customer communities</li> </ul>	<ul style="list-style-type: none"> <li>Internet based R&amp;D networks</li> <li>Career &amp; task specific Internet portals for providing information on innovations</li> </ul>
Purchase and production	<ul style="list-style-type: none"> <li>Use of shopping-robots for purchase of products which are both eco-friendly &amp; socially acceptable</li> </ul>	<ul style="list-style-type: none"> <li>Built-to-order and printed-on-demand strategies</li> <li>Internet based co-operation regarding material flow along the value chain</li> </ul>	<ul style="list-style-type: none"> <li>Internet based markets for surplus materials (e.g. Henkel)</li> <li>B2B-platforms for surplus equipment and sites</li> </ul>
Marketing	<ul style="list-style-type: none"> <li>Virtual showroom and shopping-malls: labelling and benchmarking products according to environmental standards</li> </ul>	<ul style="list-style-type: none"> <li>One-to-one marketing strategies on the Internet</li> <li>Internet based consumer communication for mass customisation</li> </ul>	<ul style="list-style-type: none"> <li>Internet portals and online shopping guides for eco-friendly products and services</li> </ul>
Optimisation of product use and recycling	<ul style="list-style-type: none"> <li>Software upgrading of household and office appliances</li> </ul>	<ul style="list-style-type: none"> <li>Online support for leasing and sharing models</li> <li>Virtual eco-communities</li> </ul>	<ul style="list-style-type: none"> <li>Internet based recycling exchanges (e.g. for car parts)</li> <li>C2C-markets for second hand products</li> </ul>
Management of knowledge and information	<ul style="list-style-type: none"> <li>Manuals on the Intranet</li> <li>Reporting on environment and sustainability on the Internet</li> </ul>	<ul style="list-style-type: none"> <li>Training support through online learning modules</li> <li>Internet based environmental accounting and controlling</li> </ul>	<ul style="list-style-type: none"> <li>Internet communities specific for careers &amp; tasks</li> <li>Online data banks with product life cycle data</li> </ul>

Tab. 1: Approaches for sustainable e-business solutions. Source: the author

The approaches described in the strategy areas e-substitution, e-support and e-services show the variety and potentials of sustainable e-business solutions. It must



be emphasized, however, that the outlined approaches do not guarantee environmental protection. Whether the strategies really do lead or could lead to eco-efficient or environmentally-friendly solutions must be examined on an individual basis.

## **Conclusion**

As a future medium and form of market transaction, Internet and e-commerce are of central importance for sustainable development. At the moment, three clear conclusions can be made:

1. There is a scarcity of available statistics and facts on the environmental impact brought about by e-commerce and Internet use, but research on this topic is developing rapidly. Soon we will have reliable empirical data on environmental effects of e-business-applications.
2. Reliable forecasts estimate that the use of new information and communication technologies will have both damaging and beneficial effects on the environment but the overall ecological net impact cannot yet be predicted.
3. In spite of the high level of inherent dynamism in the development of information and communication technologies and the rapid increase in Internet use, the digital revolution is not deterministic but in many areas it is still evolving and there is therefore a possibility of guiding and controlling it.

It is not the medium of the Internet which determines sustainability but the way in which it is designed in an environmental and intelligent way. It depends on suitable political prevailing conditions and also the intelligent use of the Internet and e-business by companies. This includes looking in advance at the environmental impact of information and communication technologies, e-business models and Internet based products and services as part of innovation management. Additionally, it depends on how the potential of the Internet is used for eco-efficiency, service-design, dematerialisation, recycling and a sustainable knowledge management.

## **Literature**

- Albrecht, B. (2000): Auto-Recyclingbörsen im Internet, in: Fichter, K.; Schneidewind, U. (Hrsg.) (2000): Umweltschutz im globalen Wettbewerb, Berlin, Heidelberg, S. 327 - 331
- Behrendt, S.; Pfitzner, R.; Kreibich, R. (1999): Wettbewerbsvorteile durch ökologische Dienstleistungen, Umsetzung in der Unternehmenspraxis, Berlin, Heidelberg
- Berkhout, F.; Hertin, J.: Impacts of Information and Communications Technologies on Environmental Sustainability: Speculations and evidence, Report to the OECD, Brighton, January 2001.

- Cohen, N. (2000): E-Commerce and the Environment, in: Tellus Institute (Hrsg.): Environmental Perspectives, Special Edition "Environment and the Information Age", April 2000, Boston, MA, S. 2 – 5 ([www.tellus.org](http://www.tellus.org)) *see also pp. 41-52 in this volume*
- Enquete-Kommission "Schutz des Menschen und der Umwelt" des 13. Dt. Bundestages (Hrsg.) (1998): Innovationen zur Nachhaltigkeit, Ökologische Aspekte der Informations- und Kommunikationstechniken, Berlin, Heidelberg
- Fichter, K. (2001): Environmental effects of e-business and Internet economy, Working paper for the German Federal Ministry for the Environment, Berlin, April 2001, available as pdf-download at [www.bmu.de](http://www.bmu.de)
- Fichter, K. (2000): Umweltkommunikation und Wettbewerbsfähigkeit, in: Fichter, K.; Schneidewind, U. (Hrsg.) (2000): Umweltschutz im globalen Wettbewerb, Berlin, Heidelberg, S. 263 – 276
- (German Bundestag) Deutscher Bundestag (Hrsg.) (1998): Konzept Nachhaltigkeit, Vom Leitbild zur Umsetzung, Abschlußbericht der Enquete-Kommission "Schutz des Menschen und der Umwelt" des 13. Deutschen Bundestages, Bonn
- Greusing, I., Zangl, S.: Vergleich von Print- und Online-Katalogen: Akzeptanz, ökologische und ökonomische Analyse, IZT-Werkstattbericht Nr. 44, Berlin, 2000
- Kortmann, J., de Winter, S.: On line applications in The Netherlands. Looking up telephone numbers by Internet, IVAM, Universiteit Amsterdam, 1999
- Öko-Institut e.V. (Hrsg.) (1997): Umweltschutz im Cyberspace, Zur Rolle der Telekommunikation für eine nachhaltige Entwicklung, Freiburg
- Picot, A.; Zerdick, A.; Lange, U.T.; Artope, A. (2000): E-Conomics : The Economy of E-Commerce and the Internet (European Communication Council Report), Springer-Publishing, Berlin, Heidelberg, New York
- Plätzer, E.T.; Göttsching, L. (1998): Print media in the Era of Information Technology: How Environmentally Sound are Electronic Newspapers?, in: Das Papier 2/98, p. 56 - 65
- Rauberger, R.; Wissler, J. (2000): Die Reststoffbörse bei Henkel: Rohstoffeinsparungen durch Nutzung von IuK-Technologien, in: Fichter, K.; Schneidewind, U. (Hrsg.) (2000): Umweltschutz im globalen Wettbewerb, Berlin, Heidelberg, S. 333 – 338
- Reichart, I.; Hirschier, R.; Schefer, H.: Ökologische Auswirkungen der Mediennutzung, Studie der EMPA, St. Gallen, Schweiz, 2000
- Reichl, H.; Griese, H. (editors) (2000): Electronics Goes Green 2000+, Proceedings Volume 1, Technical Lectures des Joint International Congress and Exhibition, September 11 – 13, 2000, Berlin und Offenbach
- Romm, J.; Rosenfeld, A.; Herrmann, S.: Ther Internet Economy and Global warming, <http://www.cool-companies.org/ecom//index.cfm>.
- Swedenenvironment: <http://www.swedenenvironment.environ.se/no0001/0001.html>'art13