ECO-INFO-SOCIETY
Strategies for an Ecological Information Society

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Abstract

Changing patterns in the way we process information require a new approach to problems pending in our society. There is a general opinion that Internet, or more generally said, the new Information Society, has brought and will bring many benefits to the people. The euphoria is very wide, but other voices have recently started to challenge this too positive view of the future. As it grows in the actual socio-economic context, the Information Society is likely to bring higher mobility, and increased consumption patterns, possibly increasing the global material and flows even though information is itself immaterial.
We assume here that the development of the Information Technologies in society cannot be stopped or reversed. The dynamics are by far too strong. From this assumption, we analyse and define strategies and needs to adapt these technologies so that they lead us toward a different, greener, more sustainable society: the Eco-Info-Society.

After analysing the ambivalence of today's society, the current trends are pictured based on available statistical data. On one hand the social developments during the last years are analysed, on the other hand the dematerialisation and the rebound effect, broadly defined, are discussed. The *Rebound Effect* could be defined as *the increase of consumption linked to the reduction of limits to use a technology*. These limits might be monetary, temporal, social, physical, linked to efforts, spatial, organisational…

The third part deals with the micro-level: consumers and industry. It is very important to develop sets on data on the impacts per Euro of materials, products and services to deal with the transfer of money savings to consume other goods (the income effect). The data inventories should also include information on the economy-wide and transformational effects at least qualitatively. Data linked to non-economic type of rebound effect: impacts linked to other types of consumption limits (like the energy or material input per hour of activity) would be important to further develop.

The last part based on the macro-level, points out some policy strategies that can lead to an Ecological Information Society including reducing quotas for resource extraction and reduction of working hours to favour non-material welfare.

Keywords: Rebound Effect, Ecological Information Society, and Information Technology, Internet

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There is a general opinion that Internet, or more generally said, the new information society, has brought and will bring many benefits to the people and environment. But other voices have recently started to challenge this too positive view of the future. As it grows in the actual socio-economic context, the information society is likely to bring higher mobility and increased consumption patterns, possibly increasing the global material and flows even though information is itself immaterial.
The development of the information technologies cannot be stopped or reversed. The dynamics are by far too strong. From this assumption we analyse and define strategies and needs to adapt these technologies so that they lead us toward a different, greener, more sustainable society: the Eco-Info-Society.

The Contradictions of the Information Society
Only some years ago, a factor 10 reduction of material input per unit of service [i] seemed utopian. Today we experience a technological development as well as business solutions that make important steps possible. Electronic equipment weighs often only some percent of what similar devices weighted 10 years ago: take mobile phones, video cameras and recorders, MP3 audio equipment and the like. Mercedes Benz gives 30 years of warranty on some of their cars. Resource productivity is sharply rising – *per unit of service.* Monetary values (turnover, profits, income) are also rising on micro and macro scales.
Hence, absolute physical flows activated by economic activities [ii] should decline. But such a tendency (which would be a precondition for an environmentally sustainable development) cannot be observed empirically. The reason is, of course, that people do not use the productivity gains to use fewer resources; they use it to enjoy (or be stressed by) more products and services.
Let S be the number of services (or "functional units", however measured) derived from the use of material resources R, then R will decline if and only if the increase in S falls short of the increase in resource productivity S/R. This follows >from the simple tautology

$$R = S \cdot \left(\frac{R}{S}\right) = S \Big/ \left(\frac{S}{R}\right)$$

or

$$\delta \cdot R = \delta \cdot S + \delta \cdot \left(\frac{R}{S}\right) = \delta \cdot S - \delta \cdot \left(\frac{S}{R}\right)$$

where R/S denotes the resource intensity and S/R the resource productivity.
The nature of Information Technology gives the feeling that resource productivity may be close to infinite. This is due to the important trend of miniaturisation and transfer of impacts in the life cycles. It is true that in comparison with other *perceived*[*] time-saving technology like the car, information technologies do not *a priori* create *more* impact per functional unit than other communication means [iii]. The burden of an Internet connection is complex to analyse and far from the point of consumption. Who is really aware of the masses of material that are moved for the extraction of rare metals that are needed for the electronic products along the internet networks? For a review of literature on the impacts of the Information Technology, please refer to the paper of Andrius Plepys in this workshop [iv]. Furthermore, the trend is not always in the direction of miniaturisation. Giant TV screens, gigantic loudspeakers are for example becoming commonplace in western households.
Who knows exactly the increase of the km travelled by information since the beginning of the information revolution? Clearly the impact generated in the present or future situation is far lower

[*] Whitelegg in „Transport for Sustainable Europe" has shown that the car is not time-saving anymore when one accounts the overall time spent for the car, especially working hours to pay for the car expenses. The rebound effect linked to time saving, the overall time losses linked to the increase of use of a "fast technology", might completely annihilate the direct time savings. This might also be true for Information Technology.

than the impact generated if all these messages were transported by horse (or plane!). But this would have never happened. Moreover the impact should not only account of the direct consequence in the same sector, it should also account of the increases of consumption in other sectors, due to the income saving but also of more complex effects like the increase of transportation or paper use and further societal effects. We have to acknowledge the uncertainty that prevails concerning the global consequences of the Information Technology, because even small effects can become tremendous when multiplied by millions. And even if we could have mass communication with very little energy and resource consumption, the increases into "hypermobility" may create societies more polarised, more dispersed, more anonymous, less culturally distinctive, less physically healthy, more crime ridden, and even less democratic [v].

The increases of consumption linked to behavioural responses associated with technological improvements refer to the rebound effect [3]. It was earlier thought that increases of efficiency could automatically lead to a decrease of impact. At best eco-efficiency leads to a *potential* for improvement but might very well lead to a worsening if the effects of consumption increases are too strong.

Definition of the Rebound Effect

We consider here a wide definition of the rebound effect, not only limited to the direct rebound accounting of the increase of the demand for the same type of good due to the cost reduction linked to efficiency increases. The price of computers or mobile phones, linked to efficiency of the economy of scale, allows more people to acquire one. We consider here a wider meaning which has been defined as "the overall effects of technical, organizational and social progress, which increase the efficiency of the economy and give room for more consumption"[vi]. It includes indirect rebound or income effect: the savings may allow a consumer to buy other types of goods, creating a new increase of material and energy use. It includes general equilibrium shifts and transformational effects where effects on social organisation are taken into account [vii].

The concept of efficiency and rebound can be extended to non-economic matters. Efficiency can mean the development of the Information Technology was supposed to save time. However, it seems that the lack of time has not really improved, and people are more than ever confronted with stress at the work place [viii] (the last remaining limit?). This saving of time (to send 100 messages at the other side of the globe for example) has led to tremendous increases of communication that have to be assessed.

The concept of rebound has been conceptualised for money and for time. One can buy more if costs are reduced, one can do more if time is saved. But the concept can be easily extended to other aspects. The rebound effect could be defined as such: this is the increase of consumption linked to the reduction of limits to use a technology. These limits might be monetary, temporal, social, physical, "effort", spatial, and organisational…

In general the Information Technology tends to reduce:

- Cost limits, which leads to the typical type of rebound.
- Time limits.
- Effort limits, computers generally save efforts, for example by programming automatically the coffee machine. This can lead to higher consumption because less effort is demanded and it would have set a limit to the amount of coffee that we drink (!). Screen saver might encourage people to leave computers on all day, possibly creating more energy consumption than would be saved by switching off the computer more often.
- Limits to weight/volume, which now allows us to bring one or more computers all day with us and give computers to every member of the family. The early computers requiring a whole apartment would never have become as numerous as the nowadays pocket computers
- Limits to the ability to process information: new software is designed that allow to process large amounts of information, that means that we can process even more information in the future.
- Limits to Health/security: helmets might give enough security for people to travel with higher speeds on motorbikes, or air bags on cars might allow car drivers to travel faster and

to take more risks endangering themselves and other street users even more. In the sector of Information Technology, there might be a small rebound with health with computers as screens become more users friendly, but this is a minor aspect.

We have lost limits because the concept of sufficiency has been overlooked. There should be a limit to the needs that we have. How much is enough? How can we use less products or services while increasing our quality of life? Being aware of all the limits before acquiring a product is an important step in this direction.

Towards a new Society

Information Technology has accelerated the movements of goods, information and people around the globe and increased the variety of services available to consumers throughout the world. Internet-based "e-commerce" is growing rapidly. While Information Technology has the potential to reduce material consumption, there is no empirical evidence of such an effect to date, mainly due to the fact that consumer habits have not changed. For example, electronic mail and improved communications have not reduced the volume of conventional mail or the number of people travelling, resulting in a continued rapid increase in the demand for transport, with its accompanying environmental impacts. In some instances, improved technology has even increased energy and material consumption. Global paper consumption is expected to grow by about 50 per cent by 2010, with the largest increase in developing countries, as a result of both increased literacy and expanding use of information and communication technologies. Since the development of personal computers, paper use has increased with a factor 2 to 3 in Holland [ix]. It is also difficult to assess of the causes of the increase of car use but at least no signs of decrease have appeared with the development of the Information Technology. On the contrary, the development of information technologies might lead to important increases of road use and aviation if previous trends continue. In the last century the number of messages sent in France has followed the increases of person-km in France [x]. And most of us have witnessed the temptation to travel to meet counterparts met in the web. The Estonian State chancellery has recently ordered an assessment of its consumptions. The important use of computers in governmental decisions the development of a so-called "E-government" has not yet enabled a decrease of the important paper use and transportation needs with the exception of a few limited successes [xi].

Globalisation and the new information and communication technologies provide opportunities to shift to more sustainable consumption and production patterns, but this will not happen automatically. Change in behaviour, at the level of industry and regions are required. Policies and programmes need to be developed to ensure that the new technologies help shift consumption and production patterns to reduce resource consumption and environmental damage.

Consumers and lifestyles

Currently the percentage of households with Internet connections (even broadband) is sharply rising. In the United States, the amount of people that shop online has nearly doubled in only two years. Although these online shopping activities decrease personal trips by car, there are no consistent figures yet about the amount of resources used by the delivery by parcel distributors. Selling desktop computers over the Internet in a business-to- consumer electronic storefront can have worse environmental impacts than traditional sales practices, especially if the equipment ordered by e-mail is shipped by air [xii].

In the house, there are all the possibilities of computer support to reduce the amount of material and energy used. One example is the heating management in households, to heat the house only when it is really needed. Local computer networks have the potential to redevelop local networks for organising public transport, share of products and services, local information exchanges, access to more ecological products and services, increases in the lifetime of products by exchanging unused products, creating local economies. Internet forums, Internet second hand markets, and later sustainable TV [xiii] can all contribute. And at another level, social encounters can potentially be helped and everybody knows that this type of immaterial activity is the most enjoyable and the least material intensive. The only condition: that Internet is used as a tool for face-to-face social

encounters and cooperation and not as an escape. But linking Internet with small distance is the challenge.
The very positive aspect of creating local networks is that they can begin to act on the local norm that dictates that consuming more material has more value.

Although "face to face" meetings will always be necessary, there is also a good opportunity to develop **Internet conferences**:
They could reduce the amount of travelling and the impacts associated at least per conference
Some characteristics are clearly positive improvements, like the saving in costs, the increased time available to react to one's contribution, the easier diffusion of results
All areas of research, including sociology, psychology environmental science, economy could be represented, as well as all other actors like governments, NGOs, citizens, unions, industry, media, land use planners…
The characteristics of conferences could be adapted to the Internet context, while taking advantage of new opportunities. In addition to typical "official" introductions, short papers on defined subjects would be presented and used as basis for discussions. Panel discussions would take place where a group of expert would be committed to discuss and answer issues and questions raised by the participants. Reports of other meetings, calls for conferences, actual information on experiences and news would be announced. When relevant, all these contributions would be published. In parallel, "Chats", informal discussions not leading to publications could take place.
In this area also the rebound effect could be very important. The amount of travelling per contact might decrease, as a higher share of communication would be possible with Internet conferences, and other digital communication. But as a part of the communication will also need face-to-face meetings, the increase of communication is likely to create an overall increase of travelling.

According to the European Environment Agency (EEA) one Euro of production or consumption in Europe requires on average by and large 2 kg of materials activated somewhere in the world [xiv]. That means that a shift to less material intensive products and services (with, say, only 0.5 kg per Euro) would reduce the overall material use. If these products and services, however, are reduces in price, not only the less material-intensive products will be bought with the saved amount, but also other products and services, which increases the material intensity again. On the other hand, if the trend would go towards relatively expensive high-quality goods the change would gradually reduce the material productivity as well as the absolute material consumption. However the problem of equal access to these more expensive goods needs to be addressed.

More and more information is developing about the impacts of products and services. From Energy analyses to LCA to MIPS, ecological footprint, information abounds. Very interesting databases are being designed with the impacts per good or services, based on emissions data, eco-indicators, land use, energy use and material input. But most of this information fails to take into account of the dynamics of consumption. Different products or services might produce completely different rebounds. In parallel to the information on ecological impact per unit of product or service, a very important project would be to systematically analyse the different products and services in terms of their rebound effect. This should be done with direct and indirect rebound effects and as well for more complex types of rebound involving general equilibrium and transformational effects including non-economic rebound effects. For the direct and indirect rebound effects, this involves to inventory the impacts per Euro for all types of commodities and activities. This has already been done by the University of Groningen with a very extensive list of goods and services relevant for Dutch households presenting the Primary Energy consumption per NLG [xv]. This type of inventory should be developed for other types of indicators: CO2 emissions per Euro, Material Input per Euro, ha.year (footprint) per Euro and can adequately take account of the income effects.
Furthermore the general equilibrium and transformational effects should also be included at least qualitatively for each type of good. For example buses are sometimes said to be more environmentally friendly than trains, but this is without understanding the complex dynamics of road development. A candle pollutes more per luminosity than a light bulb, but what about the rebound

effect? Are we not going to consume more *overall* when we install electricity, and easily illuminate large surfaces?
Dealing with other types of rebound, the non-economic rebounds, opens the possibility to deal with the equity problem. The incomes are uneven in the world, and focussing only on impacts per Euro, by increasing the price of products and service would make it more difficult for the disadvantaged. It would be interesting to also develop sets of data linked to other types of rebounds, like the rebound on time. This is more egalitarian because everybody has the same time available (at least per day) unlike income. In this direction Mikko Jalas [xvi] presents in this workshop an interesting perspective with sets of data on the impacts per hours of different activities, allowing to deal with the time rebound. It would be important to develop sets of data in relation with all the limits to consumption: the monetary and temporal limits, but also other social, physical, spatial, organisational limits and effort limits.

The information revolution does not come alone. New complex situation prevail with: New service economy, globalisation, improvements of products and processes efficiency, change in structures of housing, work and holidays, increase of communication, new technologies, new interdependence, more availability of "eco-products", modern environmental analytical tools and data and so on. All these changes create new conditions for *lifestyles and more ecological lifestyles*.
This is very important because on the micro-scale acting on the rebound effect, means to improve in the area of sufficiency: to understand "how much is enough". There is a large recognition that lifestyles are fundamental if we ought to reduce the pattern of increased consumerism in which we seem to remain bogged down. And the general perception is that considering social and infrastructure constraints very little environmental improvement is now envisioned as feasible.

The last developments have had the positive aspect in line with the developments of access to information that changes in lifestyles are nowadays more acceptable. Could ecological lifestyles, linked to less (total) material use, be in the future regarded as new innovations to be promoted. One benefit of the Information Technology is that its recent exponential development has destroyed the idea that lifestyles are static. People do change, but still the problem is that most new lifestyles are far from being socially and ecologically sustainable.
Is there room for other visions of "modern" lifestyles, that would be compatible with the modern trends and that could get over the "lock-ins" of increasing consumption?

Equity
All the discussion on the Information Technology have however to be put in perspective. A very important equity problem exists. Currently about 60% of the world's population has never made a phone call [xvii]. Around 5% of the world population is classified as "internet user" in 2000 (www.cyberatlas.com). Much is still to invent to create more democratic society with the help of the Information Technology. And we have to realise that the "information society" concerns in reality only a small minority and certainly still for a long time. The problem of exclusion from technological access has to be addressed but also the usage of the technology. Much has been improved in terms of information flowing, one can potentially find very much information on the web, but the knowledge to access it is often lacking. People without computer access, or without the technical knowledge are joining the illiterates in being excluded. Very much remains to be invented to separate the important from the irrelevant and to use the tools to enlarge the participation to decisions, furthermore for direct democracy, to favour the use for consensus decision making for example instead of using it for computer games. In general other types of knowledge linked to oral tradition have to be recognised. And some communication arrangements have to be invented between the excluded and the "Information Technology minority" if we really want to talk of sustainable "Information Society".

Business and enterprises.
These include on the one hand the traditional business, now beginning to use and explore the new possibilities, second the industry producing and promoting Information Technology and third a new form of enterprises, made only possible due to Information Technology, the so-called *start-ups*.

The rising amount of *users* of information and communication technology has lead to a continuing growth of this industry over the last years. In the Business-To-Business activities the continuing streamlining of production and transport in the industry pared with the availability of liable security protocols for safe online transaction is expected to increase the spending of some industry branches in 2005 by 25 times compared to today.

The information society could theoretically bring lots of positive developments. Some of the travel can be avoided by creating a direct link between the producer and the consumer and between producers: the web can enable to find a local producer. Also the production itself, thanks to the decentralisation can possibly redevelop in small units closer to people. A good example of this is now the possibility to produce high quality CD or publications in virtually every house that possesses a computer.
Cleaner production methods, organic agriculture, sustainable consumption information (and information about the rebound effects associated with different products and services?) can become more easily available to a large audience.

However there is fundamental problem with efficiency organised by economy of scale, as larger centralised industries increase their efficiency, the needs to keep high production level and the low cost per product is an important fuel for rebound. The problem of rebound need to be addressed within industries at a larger level [xviii]

Policies for the Eco-Info-Society

The development towards an information society currently under way means, among other things, an inter- and intra-sectoral change at a speed that has no historical predecessors.
If sustainable development is the goal, the task of policy is to try to influence this change in a direction that uses the enormous decoupling potentials embodied in these sectoral changes. Society cannot (and does so far not want to) reverse the trends toward the information society; hence the goal of sustainability means using these trends for ecological purposes. And science, as we see it, must try and find out about the dynamics (and pitfalls) of such an option.
It is important to stress that structural change takes places anyway - without any political attempts to influence such processes. Innovations and "creative destruction" are intrinsic characteristics of capitalist development. If economic change takes place anyway, the question arises whether and how policy can influence it in an ecological manner. We summarize such systematic attempts to reduce the material input by influencing structural changes under the heading "ecological economic policy", an approach that aims to integrate economic and environmental policy by implementing "ecological guardrails" that serve as a framework for market processes. The substantial reduction of material inputs would be a big step towards a sustainable eco-information-society. Such a policy includes the support of voluntary changes in the individual behaviour of firms and people (such as "Leitbilder", better information, eco-audits and ecologically informed concepts in education) and instruments that focus on changing substantially the socio-economic environment that shape economic decisions and its ecological consequences. There is certainly not one right way to seize the opportunities that the "New Economy" offers. We need a "mix" of instruments for an ecological-economic policy, both traditional and new ones. Examples are (ecologically oriented) taxes and subsidies. A fairly radical instrument is what we call "Material Input Certificates" (MICs).
If we want to transfer the new and old economy into an ecological information society, MICs seem to be the best approach: it is ecologically the most exact instrument, the market will "take care of itself" within such a framework set the relative prices accordingly. Extractors of raw materials could continue make a living but with higher prices per unit linked to the progressive rarefaction of resources. It is almost certain that such an instrument will help to utilize the enormous potentials for de-linking between economic growth and the growth of environmental pressure that the information society offers. Unfortunately, many practical problems arise, especially with respect to the control of the (mis-)use of the certificates. However, the theoretical arguments are very convincing, so it should be worthwhile to figure out how one can utilize its advantages and avoid the pitfalls of practical implementation of such an instrument. One option is also to protect more and more world areas from

resource exploitation. Taxes may be a more market-compatible instrument for directing the information society into a sustainable direction, but it will always be virtually impossible to set the "right" tax rate in order to get the desired environmental effects. How the "mix" of instruments will look in the future is a matter of discourse in which (economic) science plays a significant if not crucial role.

There are however other ways to support the decrease of overall material consumption while preventing an increase through the rebound effects. A project conducted in Germany on "labour and environment"[xix] showed that the reduction of average working time can deliver important support for reducing the material consumption. Increasing immaterial welfare through more leisure time would reduce the potential for economic growth through a reduction (or reduced growth) of (labor) input and labor productivity [xx], [6].

Conclusion

A world economy that secures the livelihood not only of the people of the rich countries but that also substantially increases the living standard in the developing countries and that at the same time secures ecological sustainability - such an economy would truly deserve the title "NEW" economy. Starting to create an eco-info-society in the rich countries would certainly serve such a goal.

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