Environmental information on the Internet – a tool for sustainable development?

A study of two Internet-based environmental information products:

The Baltic Region GIS, Maps and Statistical Database

and

The Earth Negotiations Bulletin

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Submission for Masters Thesis Assessment, January 2001
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ABSTRACT

From an explorative study of two Internet-based environmental information products, this paper investigates the benefits and constraints of using this medium for information dissemination, and whether or not it can contribute to the process of sustainable development. From the producer perspective, the speed, cost and reach of the Internet are attractive characteristics. For users, the convenience and timeliness of the Internet can enable more immediate and effective access to environmental information. However, there are many constraints. For producers, there is the difficulty of knowing who is using the information, as well as the problem of obtaining valuable feedback. For users there are problems related to 'information overload' which inhibits the ability to actually find information, a problem which will increase as the Internet grows in terms of content. It is concluded that the Internet has the potential to be a powerful information tool for sustainable development, if the constraints are recognised. Working against this potential is the fact that the Internet has its own environmental impacts – due to the use of computer and electronic equipment – and that information communication technologies seem to contribute to the overall process of globalisation, a significant driving force of environmental degradation. If the Internet is to be of significant use, then it must be employed so as to try and create a clearer idea of how environmental information influences the decision-making process. The provision of information in a one-way sender-receiver manner is not sufficient for this. Instead there is a need to create wider networks between different users of information that rely on a more equal exchange of information. The paper ends with two further examples of how the Internet can be used in this capacity.

ACKNOWLEDGEMENTS

The successful completion of this paper would not have been possible without the assistance of several people, to whom I am very grateful. First and foremost I would like to thank Terri Willard from the IISD for her unending enthusiasm and assistance. Additional thanks go to Victoria Kellett (also from the IISD) and Nikolai Denisov and Sindre Langaard from GRID-Arendal who all gave their time unselfishly.

The many others who assisted in some way include all participants of the survey and interviews that I conducted, as well as the random individuals whom I found on my many travels around the electronic universe.

Further thanks go to my supervisors – Matt Svenson and Karin Bäckstrand – as well as my other group 'members' – Max, Mirna and Marisa. The same goes for my other friends and colleagues at LUMES – in particular Roberta, Björn, Trudy, Willem and Phil. Thanks for the memories, and may we all succeed in what we do.

Final thanks go to the one person who really made this all happen – Mum, you're a star.

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Acronyms and Abbreviations

Baltic Online Interactive Geographical and Environmental Information Service	BOING
Baltic Region GIS, Maps and Statistical Database	BGMS
Causal Loop Diagram	CLD
Climate Change Knowledge Network	CCKN
Earth Negotiations Bulletin	ENB
Geographical Information Systems	GIS
Global Resource Information Database (in Arendal)	GRID-Arendal
Information and communication technologies	ICTs
Non-Governmental Organisation	NGO
International Institute for Sustainable Development	IISD
United Nations Conference on Environment and Development	UNCED
Universal Resource Locator	URL
World Commission on Environment and Development	WCED

INTRODUCTION

Reliable and timely information is fundamental to good environmental decision-making, and is valuable as a means to increase awareness in society. The availability of information is seen as a way to better manage environmental risk, and as a means of increasing transparency in society – a step towards a more participatory form of environmental governance. In an era when modern communications media are continually increasing the amount of information that can be collected, processed, stored and disseminated, there are potentially significant benefits for increasing the availability of environmental information. This paper investigates the influence of information and communication technologies on environmental information production and use by taking the example of two Internet-based environmental information products. Interviews with the producers and users of these information products show that there are a number of benefits and drawbacks with Internet-based information. Benefits include the availability and timeliness of obtaining information online, whereas drawbacks include the problem of information overload, and the problem of establishing some kind of influence of information on decision-making processes. Further limitations are created by the distribution of those with access to the Internet – weighted disproportionately in wealthy countries – and the long-term environmental implications of a reliance on technological means (e.g. the impacts associated with the technology itself), and the way that technology shapes the way we think about environmental problems. It is concluded that the medium (in this case the Internet) is subordinate to the message, but that there are ways that a medium such as the Internet can be used, in some circumstances, to enable the sharing of information and knowledge where physical or logistical boundaries have previously made it difficult. As to whether this will help to create a more explicit 'impact' on decision-making, and ultimately the state of the environment, is uncertain. However, it is stressed that for any information system to be successful, it is the individuals in control of these systems rather than the technology itself that will make the real difference.

AIMS AND OBJECTIVES

The aim of this study is to reach a conclusion about the utility and application of Internet-based environmental information as a tool for sustainable development. This conclusion will be based on both conceptual information, and information gained from the case studies. Within this broader goal, there are three main objectives, defined as follows:

1. To explore the connections between information and sustainable development, as well as the influence of technology on communication, focusing on the Internet.

2. To investigate from the user and producer perspectives the benefits and constraints of two different Internet-based environmental information products, assessing the common assumptions that the Internet:

    a. provides fast, timely access to information
    b. allows widespread access to information

c. is a cost-effective means of obtaining and disseminating information
d. can promote environmental savings (material and energy)

3. To assess the likelihood that the 'information society' will contribute to a sustainable future.

METHODOLOGY

This paper employs a multidisciplinary approach, with a systems perspective. Thus it draws on information from a variety of disciplines in an attempt to obtain a holistic, explorative picture of the subject of investigation - in this case the implications of the Internet on the dissemination and use of environmental information, as situated within the broader context of the "information society". A qualitative approach is mostly used throughout the paper because of the interpretative and explorative nature of the study. Due to the flexibility of multidisciplinary qualitative research, it is necessary to be clear about the methods used during the research process. This subsection will detail the methods used.

Literature Review

In keeping with the focus of the paper, an extensive search for information was conducted on the Internet itself, which turned up some of the most significant sources – mainly as official reports from 'think-tanks', NGOs (Non-Governmental Organisations) and other research/academic institutions. Literature was from a variety of disciplines such as politics, sociology, media and communication studies, information management, geography and environmental science. The division of literature into primary and secondary sources was fairly even. As interest rapidly increases in the non-commercial effects of the Internet and the wider family of information and communication technologies (ICTs) more and more original studies are being conducted. 'Non-Internet' sources were obtained by conventional means i.e. academic libraries, specialist publications, research institutions and news media.

As a note on reliability of sources, although a great deal of information was obtained from the Internet, the vast majority was information in digital or electronic format which was downloaded as a report rather than sections copied direct from a standard web page. These reports are for the most part readily available in hard copy report form. There is still much uncertainty in academic and research circles about the validity of information taken direct from a web page. That said, in certain circumstances a value judgement has to be made about the credibility of a given source, and information direct from a web page may be just as credible as a 'professional' looking document, using attractive formatting. The benefit of downloadable documents is that the reader doesn't have to be online whilst reading them.

Case Study Research

The original intention for the case study section was to use at least two environmental organisations, ideally more, specialising in the production and dissemination of environmental information. The chosen organisations would partake in a survey, and a number of follow-up interviews. It was quickly realised that two organisations was the maximum (due to strict space

constraints), and that interviews should be conducted based on a specific information service – one from each chosen organisation – as most of the suitable organisations had a wide range of different services. The criteria for selecting both the organisations and the services were:

1. The organisations had to be using the Internet in interesting and creative ways to support the provision of environmental information
2. The information they were providing had to be freely available
3. The organisations had to be providing some kind of unique information service, available on the Internet
4. This service had to be available in English (although not exclusively)

Due to the second criteria (i.e. information had to be free) the resulting organisations were NGOs (non-governmental organisations) - one based in Norway and the other in Canada. They were, more specifically

1. GRID-Arendal, Norway (the Global Resource Information Database) [1]:
2. The IISD, Canada (International Institute for Sustainable Development):[2]

And the information services were:

a. the *Baltic Sea GIS, Maps and Statistics Database*[3] (GRID):
b. the *Earth Negotiations Bulletin*[4] for climate change (IISD):

The survey and interviews

The online survey used a combination of structured and open-ended questions. Online surveys can save a lot of time and paper in that participants simply go to a specified URL[5], complete a form and submit answers when finished. The survey was completed by 24 people, 11 from GRID-Arendal, and 13 from the IISD. For the interviews, all arrangements were made using e-mail and telephone due to the wide geographical dispersion of the interviewees – the participants were located in Canada, the USA, Norway, Sweden and Lithuania. In total, 13 interviews were conducted, all by telephone. Copies of the survey and interview questions, as well as a list of all interviewees are in Appendices I & II.

Systems Boundaries: Scope and Limitations

The information and subsequent analysis and discussion of the survey and interviews do not claim to be representative for all Internet users.

There are two main limitations of this paper, which are worth discussing here in brief:

1. Conducting research that touches upon the Internet is made difficult for a couple of reasons. Firstly, the pace of development of the Internet is staggering; therefore any information that has already been written becomes outdated very quickly. Secondly, due to the relative youth of the Internet there is a lack of detailed research, particularly in relation to

[1] http://www.grida.no
[2] http://iisd.ca
[3] http://www.grida.no/baltic
[4] http://www.iisd.ca/linkages/vol12/
[5] URL = Universal Resource Locator. Basically, and Internet 'address' e.g. www.lumes.lu.se

environmental issues. However, studies are increasing, and some of these were made use of in the course of the research.

2. Despite its benefits, the Internet only currently reaches an estimated 5% of the world, more than 90% of which are located in the developed economies of the 'north'. Thus immediately the scope of the discussion is limited to a small section of the world's population. Furthermore, within this 5%, this paper is only relevant to those who have an Internet connection sufficient to both access and download files, sometimes up to several megabytes of data (e.g. GIS datasets and maps). A US survey of connection speeds showed that in 1998 approximately 70% of all Internet users had 'fast' modems - allowing connection speeds between 28.8kbps and 56kbps (Nielsen, 2000: 49). Even at these speeds, downloading large files can be a lengthy exercise. For these reasons, the investigation focused on 'professional' users of information rather than individual members of the public. As such, interviews were sought with decision-makers, researchers and other practitioners, who are more likely to use the Internet as part of a daily working routine, and thus have access to a fairly good connection.

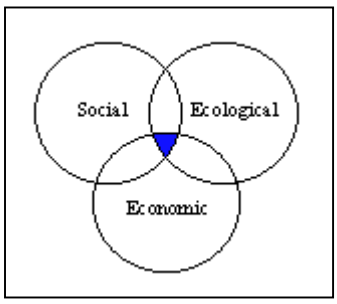
PART I: ANALYTICAL FRAMEWORK

1.1 DEFINING SUSTAINABLE DEVELOPMENT

The concept of sustainable development, as a mainstream political idea, is almost 15 years old. Although discussed before the 1987 meeting of the WCED (World Commission on Environment and Development), it was the 'Brundtland' Report "which established the phrase firmly in the lexicon of environmental politics" (Elliott, 1998: 179). It was in this report that sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43). This is possibly the most oft-quoted phrase in environmental politics, although this is no indication of agreement on how sustainable development should be attained. Instead, sustainable development is "one of the most contested ideas in global environmental discourse" (Elliott, 1998: 179), the main problem being that that the concept is open to interpretation, something that allows all sides of the political spectrum to use the term without it being misused as such.

If the concept were to be broken down, in ideological terms, it could essentially be divided into a 'weak' and a 'strong' definition. The *weak* (Brundtland) definition is that economic goals (i.e. increasing and sustained economic growth) are compatible with protecting the environment. This is broadly referred to as "ecological modernisation", and is the favoured definition of government and industry alike as it requires no major change to the dominant worldview - global capitalism. In other words, the principles of the free market and private enterprise are undisturbed, and in fact are strengthened by environmental protection (Connelly & Smith, 1999; Elliott, 1998). This approach also forwards the "win-win-win" idea of finding a common ground for economic, social and ecological goals, as per the so-called '3 spheres' of sustainable development (see Fig.1, below – the darkened area represents the 'win').

Figure 1 The '3 spheres' of sustainable development



The *strong* definition takes the opposing view, that economic and environmental goals are incompatible as they currently stand. The neo-liberal economic model of capitalism has created the current problems, through short-term exploitation of natural resources so as to create maximum economic benefit, and the Brundtland view of sustainable development only serves to reinforce this. According to Jonathan Porritt, a strong and vocal opponent of ecological modernisation (in the UK), the weak definition of sustainable development "allows politicians and economists to prattle on about 'sustainable growth' even though current patterns of economic growth and genuine sustainability are wholly contradictory concepts" (Porritt 1992 *in* Pepper 1996: 74). Taking a similar tone, an early objector to the 'weak' definition made the following statement:

Because misconceptions surround the term (sustainable development), a few clarifiers should be kept in mind. The adjective is 'sustainable', not 'sustained'. The noun is 'development', not 'growth'. And the word 'economic' does not appear (Brooks, 1973 *in* Meadows & Yuan, 1997: 711)

In the strong sense, sustainable development implies living within certain limits e.g. consuming resources proportionate to their capacity to regenerate, rather than consuming them until they are depleted and then trying to substitute them with something else. Additionally, it implies that only a reform of the world economy and decision-making processes will allow us to begin the long process of trying to reverse the global environmental trends we are now experiencing (Connelly & Smith, 1999).

The aim here is not to go into an in-depth discussion of the concept of sustainable development (others have done this in far greater detail, see for example Elliott, 1998: 179-191; & Connelly & Smith, 1999); instead the aim is to give an outline of what it means, and to highlight that it is a very contested idea. Figure 2 (below) is added to outline the main themes within sustainable development, the finer details of which are open to debate.

Figure 2 Core ideals and themes within sustainable development

1. *Economy-environment integration*: economic decisions to have regard to their environmental consequences

2. *Intergenerational obligation*: current decisions and practices to take account of their effect on future generations

3. *Social Justice*: all people have an equal right to an environment in which they can flourish.

4. *Environmental protection*: conservation of resources and protection of the non-human world.

5. *Quality of life*: a wider definition of human well-being beyond narrowly defined economic prosperity.

6. *Participation*: institutions to be restructured to allow all voices to be heard in decision-making

(Connelly & Smith, 1999: 3)

Despite, or rather because of its ambiguity, sustainable development has created a great deal of debate since it was adopted in the late-1980s, and it is gradually rising up the political agenda as environmental degradation becomes more widespread. The follow up the Rio 'Earth Summit' – Rio+10, in 2002 – will be an indication of the progress that has been made in the global attempts at creating a more sustainable world. Whilst there have been successes in some areas, there are still many persisting trends. Figure 3 (below) lists a selection of indicators of planetary and societal 'health':

Figure 3 Indicators of planetary and societal 'health'

GLOBAL POPULATION	• Doubled since 1960 (currently around 6 billion) • Predicted to reach 9 billion by 2050
GLOBAL GDP	• material wealth is increasing (World GDP rose by 4.1% in 1997 alone) • a recent World Resource Institute (WRI) report concluded that: "*as long as continued growth in economic output implies continued growth in material inputs to and waste outputs from the economy, there is little hope of limiting the impacts of human activity on the natural environment*" (WRI, 2000)

GLOBAL INEQUALITY	• Approx. 1.3 billion people: Live on less than US$1 per day Have no access to clean water • World's richest 5th account for >90% of all Internet users • World's poorest 5th account for <1% of all Internet users
CO2 EMISSIONS	• Since 1959, atmospheric CO2 concentrations have increased by 17%

Source: UNEP, (2000), WRI (2000), UNDP (1999), World Watch (2000)

1.2 ENVIRONMENTAL INFORMATION AND SUSTAINABLE DEVELOPMENT

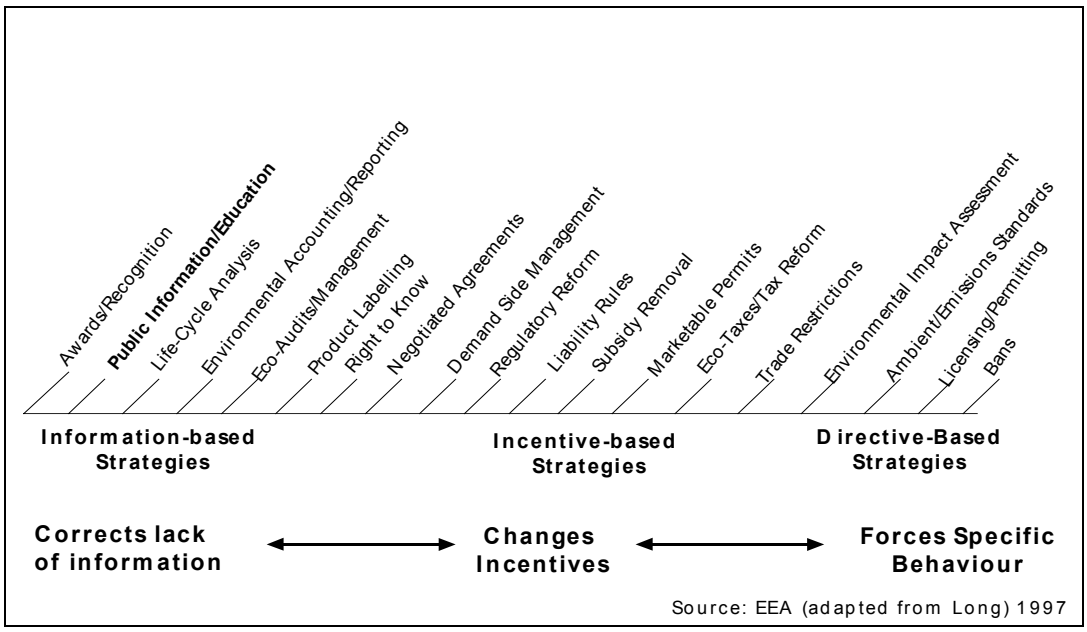
1.2.1 Definition of environmental information

The term 'environmental information' is difficult to define succinctly due to the breadth of activities that it includes - Article 2, §3 of the Århus Convention gives a 154-word definition (UN/ECE, 1998: 5). A somewhat abridged version of this definition states that environmental information is that "regarding the state of the environment, planned or operational policies and measures, international conventions and other relevant documentation, institutional mandates, as well as information on institutional performance" (Petvoka & Veit, 2000: 4). Any mention of environmental information in the following pages will refer to this definition. As much as possible, the term 'environmental information' is used appropriately, but on occasion information and environmental information may be used interchangeably.

1.2.2 Why is environmental information important?

There are a number of reasons why the availability of environmental information is important. Firstly, timely, relevant and reliable information is the foundation of sound environmental decision-making, not just in policy terms but for all members of society as we try to make the transition to a more sustainable way of life. Gee (2000) describes it thus: "As the focus of environmental policy shifts from 'end-of-pipe', point source pollution problems to sustainable production and consumption, information becomes more important in raising awareness and contributing to behaviour change" (Gee, 2000: 208). So, in this sense, information is an important tool for encouraging behaviour in many people, rather than the traditional policy approach of forcing the actions of a few (e.g. forcing polluter behaviour via regulations) (ibid.). Figure 4 (below) shows a range of instruments for environmental policy that helps to illustrate this point. At one end of the spectrum (on the right) are the instruments that govern behaviour – such as outright bans and regulations – and at the other end (on the left) are the more passive, information-based approaches that try to correct information gaps – such as information campaigns and environmental reporting. The discussion in this paper is situated mainly within the "Public Information/Education" context (at the left of this scale).

Figure 4 Range of Instruments for Environmental Policy



Secondly, the availability of information promotes transparency throughout society. As Bruch (2000) puts it: "access to [environmental] information allows citizens to know about possible environmental threats…educates the business community about the environmental and social impacts of their operations…and assists the government [by improving] the credibility, effectiveness, and accountability of governmental decision-making processes by encouraging transparent decisions" (Bruch, 2000:1). Encouraging awareness through transparency is an important factor in promoting change – if it can be seen that both government and industry are making sincere and open efforts towards sustainability, then it is more likely that the public will lend their support and make similar efforts themselves. This brings us to the third point, which is that through the processes of transparency and awareness raising, the availability of environmental information creates the conditions for participation. In this sense, participation refers to the involvement of all interested parties (stakeholders) in the debate over sustainable development and the decision-making process. This aspect of access to environmental information is addressed frequently in international environmental agreements - from the Rio Declaration and Agenda 21 in 1992, to the Århus Convention in 1998. In these agreements, the empowering effect of information is accorded high status. Chapter 40 of Agenda 21 ("Information for decision-makers") begins with the following statement:

In sustainable development, everyone is a user and provider of information considered in the broad sense. That includes data, information, appropriately packaged experience and knowledge. The need for information arises at all levels, from that of senior decision-makers at the national and international levels to the grass roots and individual levels (UNCED, 1992: 2)

Similarly, the preamble to the Århus Convention says that:

"in the field of the environment, improved access to information and public participation in decision-making enhances the quality and the implementation of decisions, contributes to public awareness of environmental issues, gives the public the opportunity to express its concerns and enables public authorities to take due account of such concerns" (UN/ECE, 1998: 2)

Both of these statements address the need to have environmental information available to the public – considered in a broad sense as "any natural or legal person" i.e. individuals and organisations (Wates, 2000: 3). This paper is concerned not so much with the legal mechanisms and procedures of making information available, but rather the *means* – or media - by which this can be done. The case studies in Part II take the example of Internet, or Web-based methods of disseminating environmental information as a way to investigate how such methods may represent an alternative method of environmental information dissemination and retrieval.

1.2.3 Non Governmental Organisations - a vital source of environmental information

Environmental information is produced nowadays by many different organisations, for many different reasons and in many formats – e.g. corporate environmental reports, environmental impact assessments, scientific studies, policy analysis, newsletters, e-mail lists etc. Many of these types of information are freely available to the public, but also much of it is not. This is a paradox of the "information society" – the production of information is increasing pace, yet so is the commercialisation of information production, thus restricting access:

> The sale of information through database services has doubled over the past decade and the number of actual databases has increased threefold. An entirely new industry has grown up around the collection and dissemination of information (UNEP, 1997: 1)

As Harvey (1990) points out "accurate and up-to-date information is now a very highly valued commodity" which then creates a situation wherein "vast profits stand to be made on the basis of privileged access to information" (Harvey, 1990: 159). This increasing commercialisation could have significant effects on the availability of important and useful environmental information, and has been recognised as such (see UNEP, 1997 & UNEP, 2000). An important task, especially for information users with a low willingness or ability to pay, and as the Internet becomes more and more widespread, is to find out where free information is.

Fortunately for information 'seekers', a lot of environmental information is not commercially attractive. As such, a great deal of information is generated and disseminated by governmental and non-governmental organisations (NGOs), who according to UNEP play key roles in such non-commercial situations (UNEP, 1997: 1). In fact, in a European-wide study in 1999, 40% of all respondents claimed that that NGOs exerted the greatest influence in the production of environmental information compared to 16% for governmental organisations (EEA, 1999: 11). NGOs, it would seem, perform a key service in the area of sustainable development in the production and dissemination of environmental information. In fact, NGOs are generally credited with promoting transparency and accountability within processes such as decision-making, negotiations and policy implementation, and are often seen as the 'voice' of the environmental movement (Elliott, 1998: 131-133). According to Rowland, NGOs "create channels of communication, inform public opinion, help to create new international norms and contribute to the scientific debate" (Rowlands *in* Elliott, 1998: 143). They work in at least three ways to improve the provision of information – by applying pressure to public and private authorities to disclose information, by producing new (independent) or 'repackaged' information for a wider audience, and by

creating networks which facilitate the provision of information. Although NGOs are not affected directly by the agreements discussed above (i.e. Agenda 21, Århus Convention), many NGOs respect the spirit of such agreements, because access to information is fundamental to the values they are promoting.

1.2.4. Information and communication: one-way and two-way methods

Using information to increase awareness (e.g. of environmental issues) in specific groups is not a new concept. Grunig and Hunt (*in* Windahl et al, 1992) refer to it as the 'Public Information' model of communication, an approach that has been used for over 100 years (see Fig. 5). This one-way communication of 'truthful' information is essentially that adopted within the 'Public Information/Education' strategy mentioned above (see Fig. 4, p.10). It is the technique followed by many government institutions and NGOs as a way of providing objective, credible information to raise awareness or educate a certain group on a given topic e.g. environmental decision-makers

Figure 5 Characteristics of four models of communication (Grunig & Hunt [1995] *in* Windahl et al, 1992)

	Model			
	Press Agentry/Publicity	***Public Information***	***Two-way Asymmetric***	***Two-way Symmetric***
Characteristic	Propaganda	Dissemination of Information	Scientific Persuasion	Mutual Understanding
Nature of Communication	One-way; complete truth not essential	One-way; truth important	Two-way; imbalanced effects	Two-way; balanced effects
Communication Model	Source ⟶ Rec	Source ⟶ Rec.	Source ⇄ Rec.	Group ⇄ Group
Emerged…	Late 1800s	Early 1900s	Early 1920s	Late 20th Century
Where Practised Today	Sports, Theatre, Product promotion	Government, non-profit organisations, Business	Competitive business; agencies	Regulated business; agencies

Some claims are made that the Internet and other ICTs open up a new paradigm of two-way communication which will implicitly have benefits for society and the environment alike (e.g. EEA, 1999b; Stonier *in* Lyon, 1988). This is based on the assumption that the balance of power is somehow even in two-way communication as opposed to one-way (Windahl et al, 1992: 7) – which of course it frequently isn't. Two-way communication occurs daily, in many situations, and does not always result in a mutually beneficial outcome. Additionally, the above claim suggests that technology can somehow open up the process of communication, encouraging us to engage in dialogue. As Melody explains, "if history has taught us anything it is that new technologies will not solve old social problems…In fact, new ones area created" (Melody, 1994: 255). Grunig and Hunt try to make a distinction between balanced and imbalanced two-way communication by classifying them as *asymmetric* and *symmetric* [see Fig. 5, above] (*in* Windahl et al, 1992). As will be seen later, both the IISD and GRID-Arendal use elements of two-way communication practices to improve the information services they provide, and as a means of creating a more balanced exchange of information and ideas between various stakeholders and decision-makers. These methods are assisted and made easier by the Internet but are not necessarily created by it. The two-way symmetric approach to communication identified by Grunig & Hunt, with its basis on 'mutual understanding' would support a more participatory

approach to environmental decision-making, but whether the Internet can help to promote this remains to be seen.

1.3 THE 'INFORMATION SOCIETY', ICTs AND THE INTERNET

1.3.1 The 'information society'

The 'Information Age', 'Information Society', 'Digital Age', 'Age of the Net', 'Network Society' – these are just some of the terms that are now frequently used to describe the current era that the industrialised economies of the West are entering. The world, it seems, is gripped by a feeling that it is experiencing something special, something revolutionary. This revolution, as one commentator has described it, "which began in the 1970s, has been at once less obvious and more far-reaching than a mere change in a regime or even than in a whole political system. It has been a revolution in our way of living, which, directly or indirectly, has affected every human being on the planet" (Feather 1994: 1). The driving element of this revolution has been the computer, the electronic tool that has the ability to "simulate skills and attributes which we once thought were unique to ourselves: memory, logic, communication" (ibid: 2). Consequently, the pervasiveness of the computer, in its myriad applications, has prompted comparisons with the last great era of technological change – the Industrial Revolution of the 18th Century. The sociologist Manuel Castells makes the following comment:

> The prophetic hype and ideological manipulation characterising most discourses on the information technology revolution should not mislead us into underestimating its truly fundamental significance. It is at least as major a historical event as was the eighteenth-century Industrial Revolution (Castells 1996: 30)

However, Castells is keen to point out that "the preeminent role of information technology is often confused with the characterisation of the current revolution as essentially dependent on new knowledge and information" (ibid: 31). According to Castells, the Industrial Revolution was just as dependent upon the application and generation of information and knowledge to technological change. However, the difference between the current era and the previous is the increasing speed at which we are able to process information and knowledge, generating new information and knowledge as a result. For example, advances in computer power have made it possible to process vast amounts of information in a comparatively short amount of time – the recent decoding of the entire human genome sequence being one example; a task only made possible by the immense processing power of modern computer technology. In Castells' own words, "the feedback loop between introducing new technology, using it, and developing it into new realms becomes much faster under the new technological paradigm" (ibid.) It is this context of the increasing capacity to generate, store and disseminate information that the 'commodification' of information has been taking place (as discussed in Section 1.2.3, above).

1.3.2 ICTs, the Internet and the 'Web'

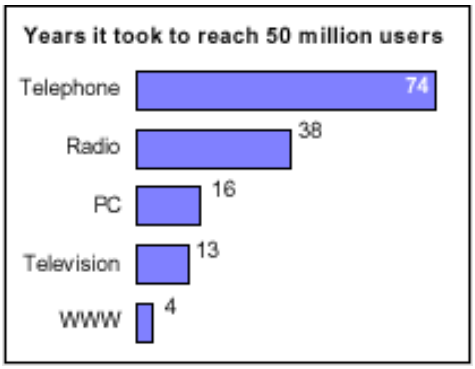
Much of the discussion in this paper takes place within the broad concept of what are commonly referred to as ICTs (information and communication technologies), which are defined by Heeks thus: the "electronic means of capturing, processing, storing, and communicating information" (Heeks 1999a: 1). More specifically, the discussion focuses on the use of the Internet –

a "distributed network of computers designed to survive the failure or removal of one or more of them" (Winston, 1995: 324) - for the dissemination of and access to environmental information. It should be noted here, that the terms 'Internet' and 'Web' (referring to the World Wide Web[6]) may be used interchangeably throughout this paper. It is recognised that the Web, "though sometimes used synonymously…is but a subset of Internet content" (Bergman, 2000: 1), is what is generally referred to when people discuss 'the Internet'. For a more in-depth and authoritative discussion of the Internet and its various protocols, readers should refer to Winston (1995).

1.3.3 A brief overview of the Web

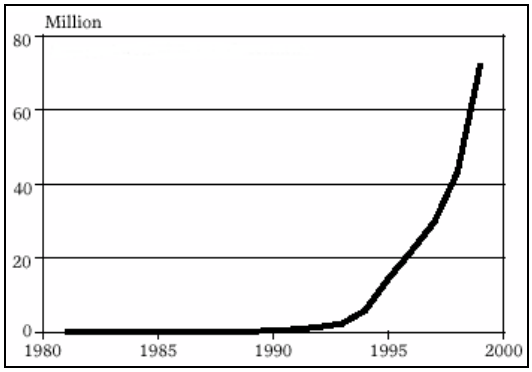
To give an idea of how rapidly the Web has grown, consider the following figures: the telephone took 74 years to reach its first 50 million users, the Radio took 38 years, and television 13 years. In contrast, the Web took just 4 years to reach its first 50 million users (see Fig. 6, below). The size of the Internet, in terms of content, is also growing rapidly. It currently holds approximately 1 billion pages, with 1.5 million pages added daily (Bergman, 2000: 1).

Figure 6 Uptake of different media



Source: ITU, 1999

Figure 7 Internet Hosts



Source: World Watch Institute (2000)

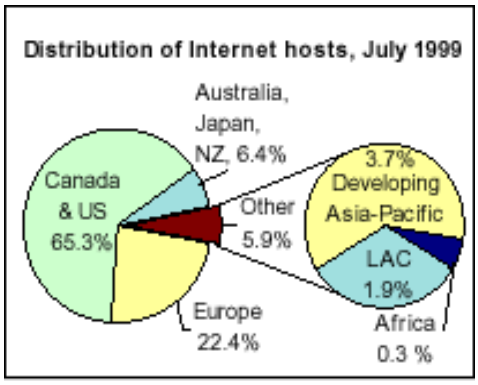
Although the growth rate of the Internet has been much greater than other media, such figures should be treated with caution. Firstly, in absolute terms, radio and television are far more pervasive than the Internet. There are around 3 billion radio sets currently in use around the world (O'Meara, 2000: 122), compared to some 400 million computers (ITU, 1999). Also, it is difficult to know exactly how many people use the Web. Current estimates put the number of 'hosts' (a computer connected to the Internet) at approximately 72 million (ITU, 1999) [see Fig. 7]. Actual users are then assumed to be anything from 4 to 6 people per host, this puts (estimated) absolute figures for users in a range from approximately 200 – 400 million (ITU, 1999; Nua Internet, 2001), depending on which method is being used. Hosts are therefore considered to be a more accurate indicator of the size of the Internet.

1.3.4 A regional 'revolution'?

If estimates are to be believed, the Internet is currently being used by around 4 - 6% of the world's population. Of this tiny sector of the world, almost 90% are made up of Europeans and North Americans (see Fig. 8). These two continents also own around 70% of all the PCs in the world (approximately 266 million in 1999 [ITU, 1999]), and account for approximately 2/3rds of the world's GDP (a combined figure of US$20 trillion in 1998 [ITU, 1998]).

[6] the Web is distinguished by the 'http' prefix (e.g. http://www.lumes.lu.se)

Figure 8 Internet host distribution



Source: ITU, 1999

Not only that, but "the typical Internet user worldwide is male, under 35 years old, with a college education and high income, urban-based and English-speaking – a member of a very elite minority" (UNDP, 1999: 61). It can therefore be seen that the 'virtual' world is divided along similar

"…creating parallel communications systems: one for those with income, education and—literally—connections, giving plentiful information at low cost and high speed; the other for those without connections, blocked by high barriers of time, cost and uncertainty and dependent on outdated information" (UNDP, 1999: 63).

This should be a sign for those who tend to ascribe a democratising or revolutionary effect to technologies such as ICTs and the Internet. Whilst there is potential for using the Internet as a tool for sustainable development, for example in its capacity to make information available to a wide audience, there are limitations that need to be highlighted. Additional, more use-related constraints are also identified in Part II, and are discussed in this section.

1.3.4 Benefits of ICTs and the Internet for Sustainable Development

Despite the barriers in access to these technologies, there are some very real benefits that ICTs, including the Internet, have in the protection of the environment. Firstly, as Miller explains, "powerful information technologies are helping us to understand how the earth, economies, and other complex systems work and to evaluate how such systems might be affected by our actions. They also illustrate that we are globally interconnected with one another and with nature" (Miller, 2000: 28). Satellite technology, combined with computer-based GIS (Geographical Information Systems)[7] software allows us to "examine pollution and other environmental hazards, identify areas rich in particular resources, and model changes to the environment" (O'Meara, 2000: 131). Additionally, with the networking of large databases and other information sources, the Web allows users to obtain information relatively quickly to be used as an input to decision-making as well as a method of improving general awareness. It is this latter aspect of the influence of technology on society – i.e. the use of computer networks to increase access to environmental information - that is the main concern for the remainder this paper.

It must be remembered however, that ICTs have an uncertain influence on the environment. On the positive side, some analysts are predicting that "there will be a shift from an emphasis on the provision of goods and services to an emphasis on information, technology and knowledge, [accompanied by] a move from mass consumption to mass knowledge creation with

[7] GIS can be defined as an "integrated computer tool for the handling, processing and analysing of geographical data" (Johnston et al. 1994: 219). Data is typically viewed as an electronic map on a computer terminal. The user is able to create customised maps according to different 'themes' e.g. population density, air emissions and urban areas. The ability to view different spatial data simultaneously on a single map makes GIS a powerful tool for analysis and synthesis of geographical data (ibid).

information networks and databases playing a key role in environmentally sound decision making for all sectors of society" (UNEP, 1997: i). Others are more cautious, saying instead that:

"the net environmental effect of the use of information technologies is far from clear. On the downside, computers require electricity and use paper, while radios, televisions, and the Internet broadcast advertising and programs that may drive people to buy resource-intensive products" (O'Meara, 2000: 121).

A study in the US has predicted that between 1997 and 2005, some 55 million computers will be landfilled, occupying approximately 170 million cubic feet – an area of "one acre piled 4,000 feet high" (Matthews et al, 1997: 6). Another sobering comment is that "there is no known example of a new technology leading to a significant reduction of environmental pollution" (Arnfalk, 2000: 25).

1.4 SYSTEMS THINKING AND THE ENVIRONMENT

A system is "a group of interacting, interrelated or interdependent components that form a complex and unified whole" (Anderson & Johnson, 1997: 2). The earth is made up of systems – ecological systems, social systems and economic systems – which represent, overall, an astounding array of complexity, not just *within* them but also *between* them. The most fundamental of these are natural (ecological) systems as without these there would be no other life and no other systems. Recognising the interrelated nature of all systems provides us with a base from which to start thinking about environmental problems. As part of the overall 'web of life' humans are intimately connected to natural systems – water, the atmosphere, the biosphere etc. – and our actions will ultimately impact upon them. As our influence on natural systems increases, we then feel the effects of our own actions through the dynamic of feedback that exists in all systems. For example, decreasing fish stocks (from over fishing), global climate change (from industrialisation) and species extinction (from forest clearance and hunting) are all either created or exacerbated by human influence. One of the problems with environmental degradation is that the feedback from human (i.e. social) causes, to a particular causal event can take so long that we have difficulty realising what caused the event to happen. Forrester claims that this is because:

The human mind is not adapted to interpreting how social systems behave. Evolutionary processes have not given us the mental skill needed to interpret properly the dynamic behaviour of the systems of which we have now become a part (Forrester, 1973 *in* Ford, 1999: 6)

However, the ability to think in a more long-term, systems manner may prove essential to the longevity of the earth's natural systems and so too, therefore, the social systems which we have created.

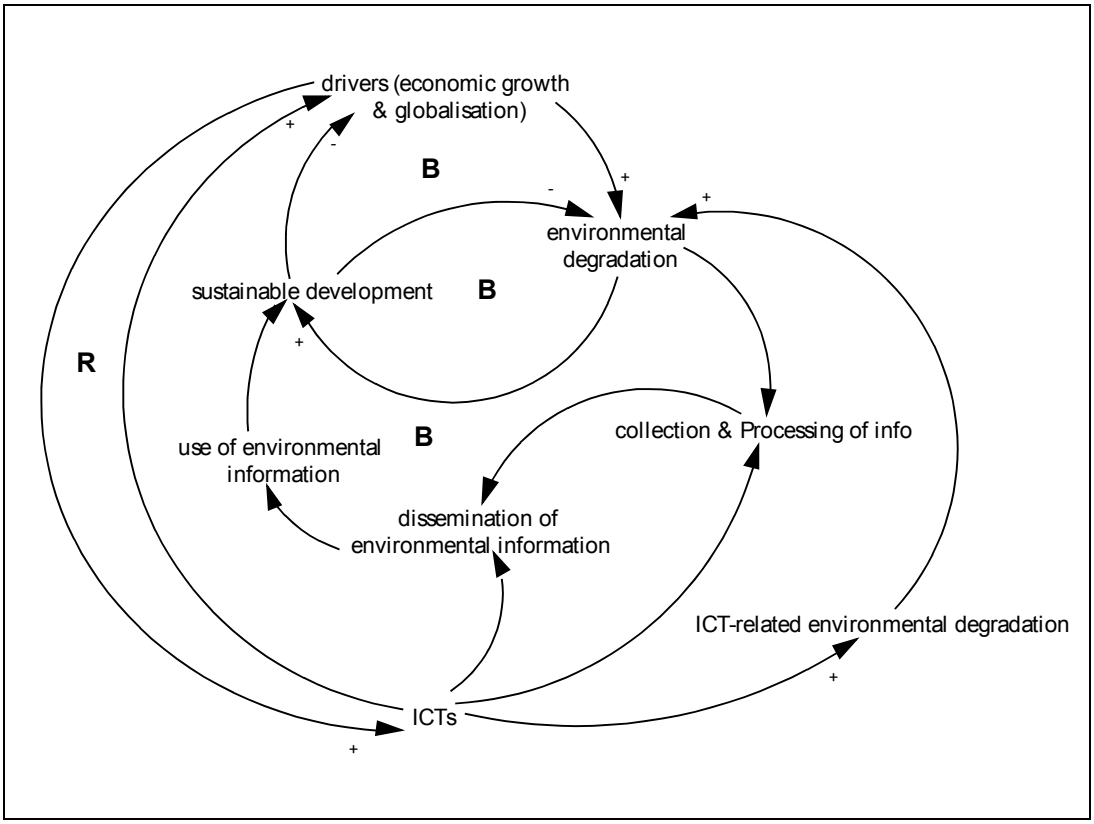
1.4.1 Causal Loop Diagram

Despite our seeming inability to conceptualise long-term complex phenomena, we instinctively think in a circular, causal manner, constructing individual pictures of reality that help us to interpret the world around us - these can be called 'mental models' (Ford, 1999). At times, these mental models can be sketched out to aid our understanding of a particular system -

e.g. to highlight how a particular action can lead to an unintended effect within a system (such as with human impacts on natural systems). A method of doing this is used in this paper with what are known as causal loop diagrams (CLDs). Fig. 9 (below), shows a basic CLD for some of the fundamental ideas within this paper. As models, CLDs are imperfect representations of reality, but they can be useful for visualising elements of a system from a wider perspective.

The CLD below outlines some of the basic ideas expressed so far i.e. that there is a tension between the provision and use of environmental information using ICTs, and the direct and indirect impacts that these technologies have on the environment.

Figure 9 Causal Loop Diagram



Beginning at 'drivers' (the socio-economic driving forces of environmental degradation) the CLD can be read as follows: environmental degradation creates a response in society in that decision-makers try to remedy a given environmental problem – this can generally be denoted as 'sustainable development'. This is done either by focusing on the outcomes of degradation (e.g. water pollution) or, more fundamentally, the root causes (or drivers) of the degradation (e.g. industrial production) – this is similar to the 'weak' and 'strong' versions of sustainable development discussed above.

With environmental degradation comes the collection and processing of environmental information. This can be processed and stored, or communicated further to a range of information users such as scientists, the media, decision-makers etc. Use of this information is assumed, at some level, to have an influence on decision-making. This may be either directly through the use of information by decision-makers, or indirectly through pressure from other users – such as the public – who have used the information themselves

(e.g. public reaction to GMOs[8]). This may eventually create a change of some kind.

However, there are also forces working against this. ICTs have helped to increase the pace of globalisation by enabling the international flow of information to increase (e.g. in financial markets). In response, investment in and use of ICTs increase, reinforcing this dynamic. Additionally, the increased use of such technologies exacerbates the negative environmental effects e.g. use of toxic chemicals and substances in computer manufacture, and a growing stockpile of 'dead' computers and electronic equipment.

[8] Genetically Modified Organisms

PART II: THE INTERNET IN PRACTICE - SURVEY AND CASE STUDIES

2.1 INTRODUCTION TO THE CASE ORGANISATIONS

2.1.1 The International Institute for Sustainable Development (IISD)

The IISD was founded in 1989 as the Canadian response to the WCED ("Brundtland") report *Our Common Future*, with a mission to "champion innovation, enabling societies to live sustainably" (IISD, 1999). Since its inception the IISD has been using "policy research, information exchange, analysis and discovery" to promote this mission, specialising on trade and climate change issues.

The Internet has always been a central method of communicating knowledge, information and expertise for the IISD. As well as a popular website[9] (content was downloaded more than 3 million times in 1999) with in-depth resources on many aspects of sustainable development, the 'Reporting Services' division of the IISD produces the *Earth Negotiations Bulletin* – a widely respected daily coverage of international environmental negotiations (see Case Study section).

2.1.2 The Global Resource Information Database (GRID-Arendal)

GRID-Arendal was also founded in 1989, as a follow-up to the recommendations from the 1987 'Brundtland' report. The mission of GRID-Arendal is to "provide environmental information, communications and capacity building services for information management and assessment" (GRID-Arendal, 1999: 5). The main function of GRID-Arendal is to give support to UNEP (the United Nations Environment Program), of which it is a part, by providing credible, science-based knowledge in an understandable format for the public and decision-makers (ibid.).

Specialising in communication services, the Internet is an integral part of the operations at GRID-Arendal. Since 1995, traffic on the GRID-Arendal website has increased dramatically, with around 4 million 'hits' received in 1999. Of the range of services available, the most popular is the 'State of the Environment report for Norway, and the *Baltic Region GIS, Maps and Statistical Database*. This latter product is one of the case studies featured in this section .

2.2 INTRODUCTION TO THE SURVEY

As a pre-cursor to the case studies, a survey was conducted with the IISD and GRID-Arendal. The idea was to obtain information about how staff perceived the Internet when used in the context of supplying environmental information to a wide audience. The results of the survey are presented below, followed by a discussion of the main elements that emerged, in terms of the benefits and constraints that Internet use poses. Together with information obtained from a series of interviews, this section aims to draw out some common points of note when using environmental information in a age increasingly characterised by rapid communication systems and increasing environmental degradation. The discussion ends by asking the question – is information provision enough? And how, if at all, can the Internet help us to

[9] http://iisd.ca

move beyond information provision to a clearer idea of the influence of information on decision-making.

2.3 SURVEY RESULTS: 'SNAPSHOT' OF INTERNET-RELATED ISSUES IN TWO ENVIRONMENTAL NGOS

The sample population was quite small, at 57 individuals. The response rate to the survey was 42%, although response between the organisations was not equal – 54% of the respondents were from the IISD, and 46% from GRID-Arendal. The gender division was 50-50, and 62% of respondents were within the 25-35 age group (see Fig.10 below).

Figure 10 Origin, Gender and Age of respondents

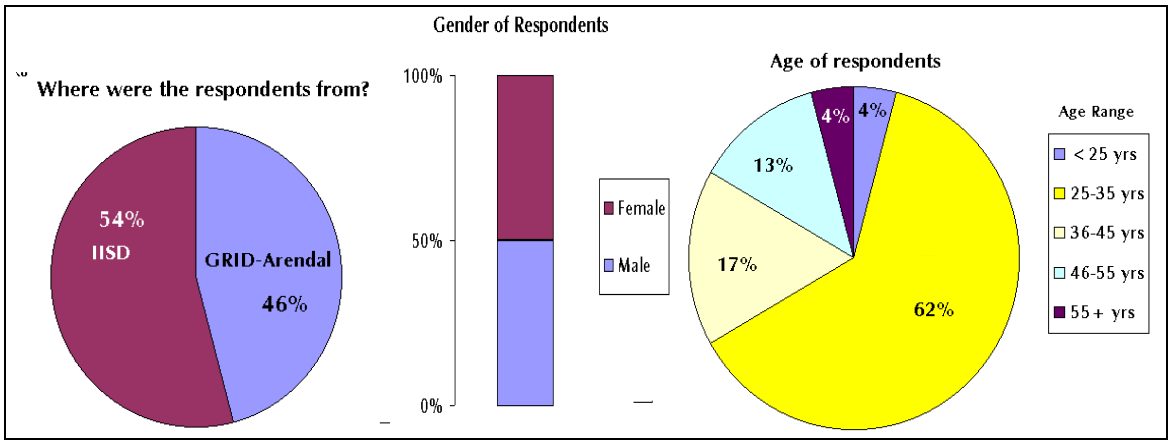
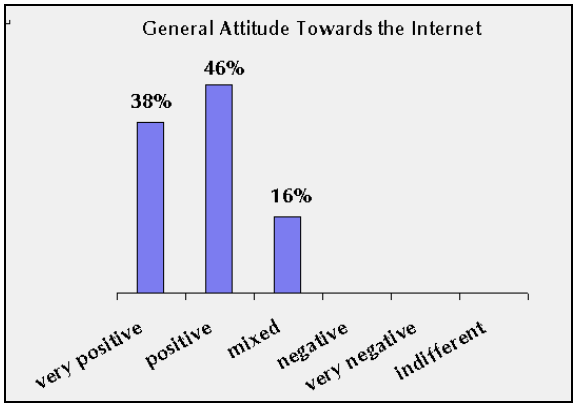


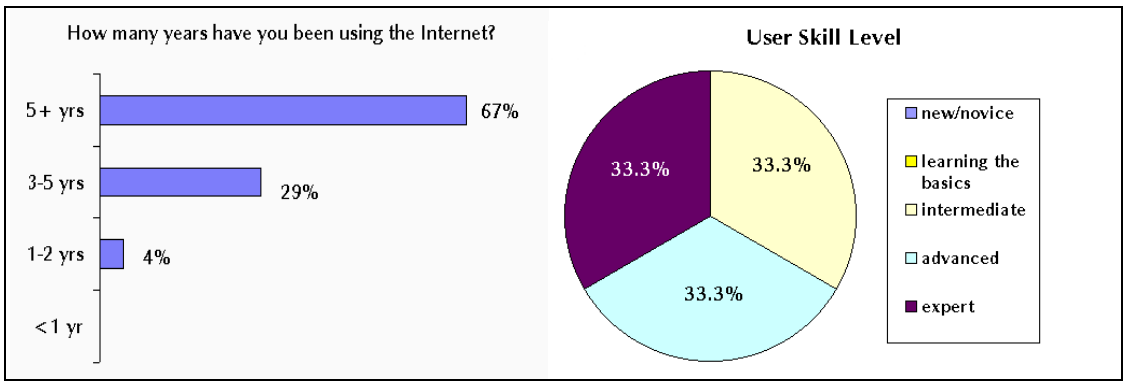
Figure 11 General Attitude Towards the Internet



Attitudes towards the Internet were positive, with 84% of the respondents saying they felt either 'positive' or 'very positive' about the Internet. 16% had 'mixed feelings', with no-one saying they had negative feelings about the Internet (Fig.11, left). Considering

slightly different ways), it is unlikely that any employees would have overly negative feelings about the Internet. Also, the fact the survey was conducted online will have undoubtedly affected this, with the likelihood that only those employees who are familiar with the Internet partaking in the survey. This idea appears to correlate with the results, as 96% of all respondents have been using the Internet for at least 3 years, and 67% for 5 years or more (see Fig. 12). Similarly, an equal third of respondents describe themselves as 'intermediate', 'advanced' or 'expert' users of the Internet (see Fig. 12).

Figure 12 Years using the Internet and User skill level



When asked the question "why do you think your organisation uses the Internet?" over 80% of respondents replied that it was 'to make environmental information available to as wide an audience as possible (see Fig. 13). However, although this was given as the main reason, just under half of all respondents also commented that it is not possible to isolate a single reason – stating that all or most reasons were relevant in some ways. Following on from this, when asked if they considered the Internet to be an improved means of 'accessing, obtaining and disseminating information', 96% of respondents answered 'yes' (see Fig. 13).

Figure 13 Input of the Internet to organisational aims

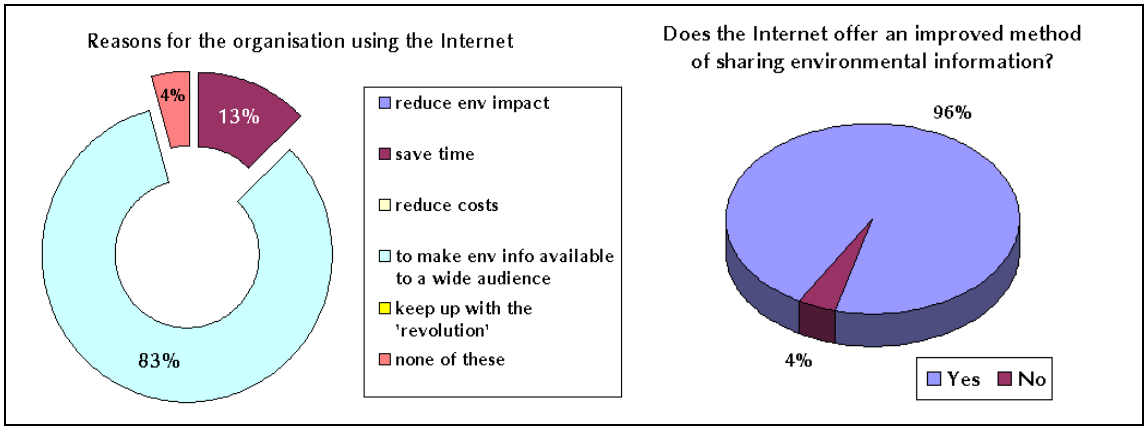
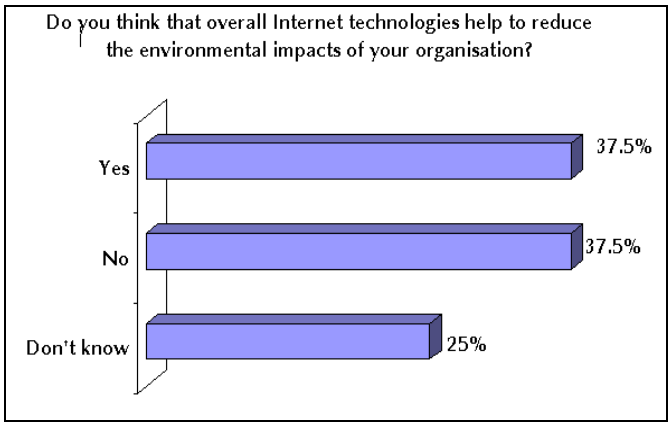


Figure 14 Influence of the Internet on environmental impacts

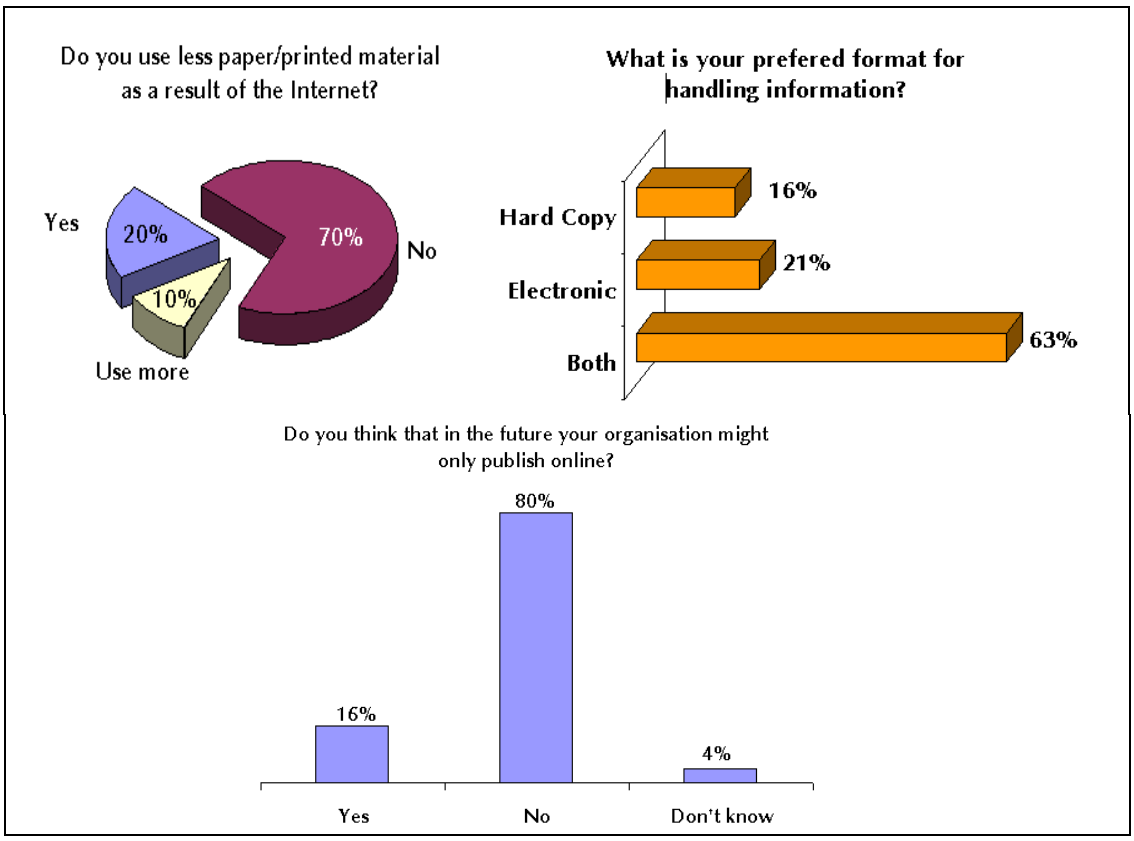


In terms of the environmental effects of using the Internet for information purposes, the overall feeling was uncertain. In response to the question "Do you think that Internet technologies may help to reduce the overall

Despite some claims that it will help to create the 'paperless society', the Internet clearly hasn't reduced the need for paper - when asked if they use less paper as a result of the Internet, almost 60% answered 'no'. Only 16% answered 'yes' (see Fig. 15, below). However, 8% thought they used *more* paper as a result of Internet use.

A contributing factor in this, reflected in the results of the survey, is that many people do not like reading from a computer screen, although this does depend on the particular situation. For example, when digesting information or checking through written material, many people still like to have a printed copy in front of them - 63% of respondents like to use both printed and electronic formats. A third of all respondents stressed the need, at times, for this interaction with the printed page.

Figure 15 Factors influencing localised environmental savings

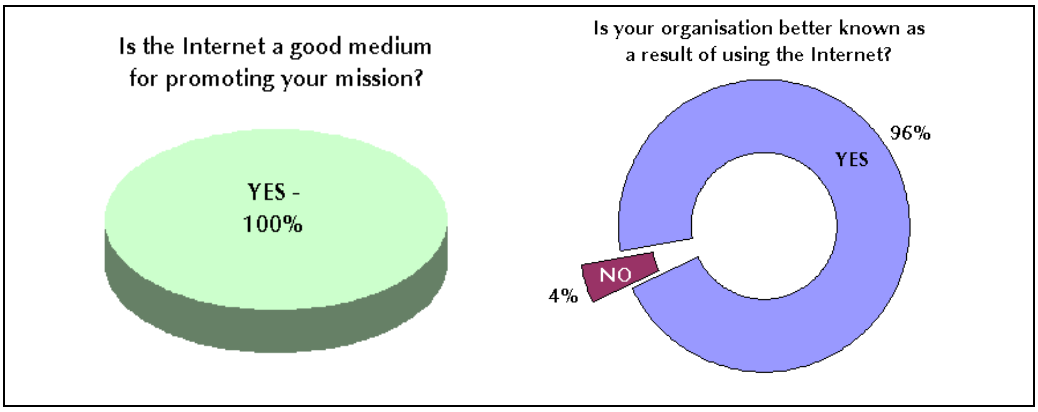


Additionally, printed material will not be replaced by electronic information, or so say 80% of the respondents when asked "Do you think that in future your organisation might only publish online?" This reflects the fact that at present, many users of information from these organisations are in areas where Internet access is limited, thus requiring them to continue hard copy publication. Nevertheless, 16% thought that the future may see online only information products.

As a conclusion, the Internet seems to be having a positive influence on the two organisations - 100% of respondents thought that the Internet was a good medium for promoting the 'mission' of their respective organisation (see Fig. 16, below). Additionally, 96% of all respondents feel that their organisations

are better known as a result of using the Internet – only one respondent felt that this wasn't the case (see Fig. 16, below).

Figure 16 Organisational benefits arising from Internet use



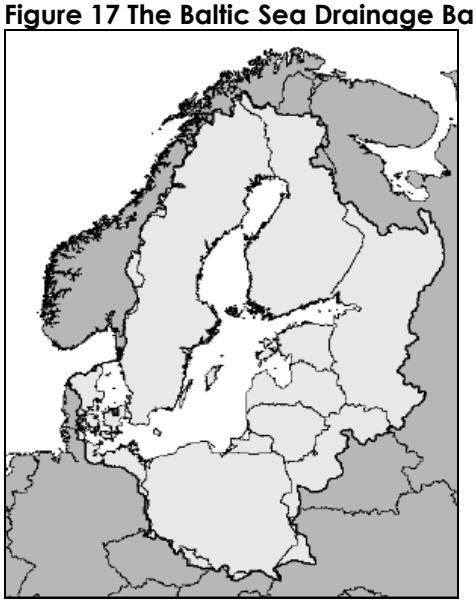
2.4 THE CASE STUDIES

2.4.1 The Baltic Drainage Basin GIS, Maps And Statistical Database

The *Baltic Drainage Basin GIS, Maps and Statistical Database* (http://www.grida.no/baltic) (hereafter the BGMS) is a Web-based database containing, as the name suggests, various maps, GIS datasets and statistical information. It was created as a means of distributing the output of an EU-funded project from 1993/4 – the 'Baltic Drainage Basin Project'. The original project sought to create a GIS-based information source to highlight contributing factors to environmental problems in the Baltic Sea region (Langaas, 1998: 3). The main focus of this initiative was the causes and effects of eutrophication,[10] as related to various themes - population, administrative boundaries, land cover and land use. The BGMS is the only GIS-based environmental information product for the whole of the Baltic Sea drainage basin available on the Web and at no cost to users. And since its launch on the Internet in August 1995, it has been one of the most popular sub-sites of the GRID-Arendal web site (Ahlenius, 2000: 12). In September 2000, an 'interactive atlas' function was also added to the BGMS (available at http://maps.grida.no/baltic), allowing users to create their own multi-layered maps (i.e. combining different information types e.g. population and land cover) as a means of giving users a more flexible method of viewing the information.

[10] This is the process whereby excessive nutrients (from e.g. agricultural leaching) increase biomass (algae) production which gradually depletes oxygen levels and undermines the basic source of all marine life

Figure 17 The Baltic Sea Drainage Ba



The Baltic Sea & Environmental Problems

The Baltic Sea region is unique for a number of reasons. Firstly, covering an area of 400,000 sq. km it is the largest body of brackish (semi-salty) water in the world, with an entire drainage basin area of 1,745,000 sq. km. The Baltic coastline passes through nine states – Finland, Russia, Estonia, Latvia, Lithuania, Poland, Germany, Denmark and Sweden (see map, left). There are also five peripheral states – Belarus, Ukraine, Slovakia, the Czech Republic and Norway. The total

serious environmental problems in the region, such as eutrophication. By using a themed GIS-based database, the BGMS provides useful information on selected indicators of pollution in the Baltic Sea (Ahlenius, 2000: 7). By allowing users the option to download maps etc. over the Web, the BGMS provides useable and freely available data that would otherwise be costly and time consuming to obtain.

2.4.2 The Earth Negotiations Bulletin (ENB)

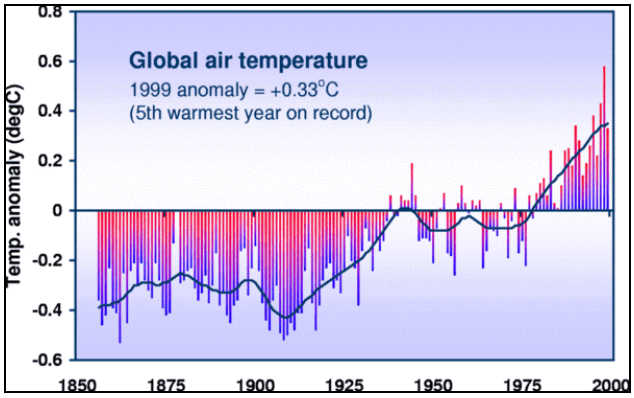
The ENB (available at http://www.iisd.ca/linkages/vol12/) is produced by the *Reporting Services* division of the IISD, and provides daily coverage of international environmental negotiations. It is described as "a world wide service of environmental information that uses new technologies and participatory procedures to spread data about the planet's state of the environment" (EEA, 1999: 52). These daily reports are then available in 3 different formats:

- **Hard copy**: a basic 'no frills' one page paper document. Available at the conferences for the delegates, and sent to some readers around the world.
- **Electronic copy**: as either basic text (ASCII) or as a higher quality PDF file (portable download format). The two choices allow those with slower Internet connections to have the possibility to download the reports. This version is available every day on the website, and can also be automatically e-mailed to readers.
- **Online Archives**: all the back issues of the ENB are stored online as part of the *Linkages* web site (http://www.iisd.ca/linkages/). A Linkages magazine is also published (electronically) each month providing a holistic overview of recent negotiations as well as relevant material linking the environment and development agenda to other relevant issues.

The ENB and the climate change debate

The ENB covers 11 of the major ongoing environment and development negotiations. Of interest here is the coverage of the UNFCCC (United Nations Framework Convention on Climate Change) process. Global climate change.

Figure 18 Global air temperatures 1850-2000



Source: GRID-Arendal (2000)

Global climate change is one of the most important and widely known outcomes of human activity on the natural environment. Although still debated in scientific circles, there is now convincing evidence that since the industrial revolution,

In the 2 years 1996-98 the average global temperature rose by almost 0.5 degrees Celsius, or 0.8 degrees Fahrenheit (Brown, 2000: 5), and if current trends continue it is likely to rise even further (see Fig. 18, above). The potential outcomes of global climate change if temperatures continue to rise are rising sea levels and an increased likelihood of extreme weather conditions e.g. flooding, droughts and severe storms. Such climatic changes will affect biological diversity, agricultural production, soil erosion and human health (Carpenter & Kellett, 2000: 3; Miller, 2000: 508). Thus, climate change has the potential to affect all human activity from economic activity to basic human welfare, as well as the entire global ecosystem. As such, we all have an

interest in access to the content of the climate change negotiations – for those that are interested, the ENB provides this access.

PART III: DISCUSSION

The discussion section is divided into two main sections. The first discusses the results of the survey (Section 3.1), and the second discusses the feedback from a series of interviews that were conducted with the producers and some of the users of the two information products described above (Section 3.2). The discussion is broken down into main themes - organised into benefits and constraints of the Internet in the context of environmental information provision. The section is then summarised before the whole study is concluded in Part IV.

3.1 DISCUSSION OF SURVEY/PRODUCER EXPERIENCE

This section discusses some of the benefits and constraints that emerged from the survey results, as well as including some of the more pertinent comments received by the survey respondents. On the benefits side, there are essentially two main types: '*informational'* and *organisational*. In terms of constraints, there are uncertain time/productivity aspects, problems related to knowing what kind of influence ('impact') information has as well as the problem of obtaining user feedback, and the fact that environmental impacts both locally (i.e. in the workplace) and in a general sense do not seem to be reduced.

3.1.1 Producer benefits

Benefits of Internet use identified from producer/sender side	
'Informational': • timely • far-reaching dissemination } information • cost-effective	*Organisational*: • Improved visibility • Promotion of mission • Cooperation and networking

Informational benefits

The ability to transmit information (be it text, images or sound) from one side of the globe to another in seconds is one of the chief benefits of the Internet. For environmental NGOs such as the IISD and GRID-Arendal, engaged (amongst other things) in the production and dissemination of environmental information, this can help to reduce both time spent on dissemination activities and the costs of doing so, whilst at the same time increasing the reach of the information they are producing. One respondent summed it up with the comment that:

"The main reason we produce PDF[11] downloadables is that we can thus reach people we don't even know. Also, releasing a working paper is a lot easier if all you're doing is a mass mailing of an email message with a URL.[12] This takes about half an hour and costs only staff time. Hard copy mass mailing is much more expensive and no more effective, in my view" (IR, 2000)

This is pertinent when one considers the costs and staff time needed for printing and posting the equivalent of several thousand documents every month. For example, to disseminate the ENB in print form would require around 40,000 documents to be posted on a monthly basis. This is clearly

[11] Portable Download Format
[12] URL = Universal Resource Locator – an Internet 'address' e.g. www.oneworld.com

impractical, especially when you consider the yearly online "readership" of organisations such as the IISD or GRID-Arendal. The cost of creating an electronic version of a given document or information product and making it accessible on the Web will generally be significantly less than the printed equivalent. There are of course costs involved in setting up a computer-based infrastructure within an organisation and maintaining Web servers, but for many organisations, the IISD and GRID-Arendal included, this infrastructure is a prerequisite for most day to day activity. As Heather Creech[13] of the IISD explained, the cost of printing and posting millions of documents a year far exceeds the cost of setting up a web server (HC, 2000).

Organisational benefits

Of additional benefit to the two organisations is the way that an Internet 'presence' has helped to promote their respective organisational goals, and also help to gain wider acknowledgement (see Fig.16, p.21). Approximately 90% of all respondents felt that the Internet allows for more cooperation and collaboration with other environmental organisations. This particular attribute is an excellent way to 'multiply' the effect of the Internet in both creating visibility for organisations, and in linking different centres of expertise that may have been previously impossible due to physical distance. For example, a respondent from GRID-Arendal commented that:

"the Internet has allowed us to work in a team for map production while [different team members are] located in Norway, Kenyia and the United States" (GR, 2000).

Similarly, the IISD has:

"established 3 'Knowledge Networks' (long-term institutional relationships) and 1 expert consultative group on specific sustainable development issues. Since these involve people all over the world, the Internet enables the day-to-day operations of the networks" (IR, 2000).

These are examples of the kind of opportunities that are opened up by working with the Internet. This isn't to say that cooperation didn't exist previous to the Internet (or wouldn't exist now if we didn't have the Internet), but the Internet seems to be a particularly good means of removing some of the barriers to working across borders and time zones. For organisations like the IISD and GRID-Arendal this also allows partnerships to grow between 'North' and 'South' thus engaging and assisting organisations that may have previously been a lot more marginal and isolated in their efforts towards sustainable development.

3.1.2 Producer constraints

The constraints highlighted on the producer side are listed in the box below.

Constraints of Internet use identified from producer/sender side
• Time requirement vs. productivity • 'Impact' of information and • knowing your users & obtaining feedback • Environmental aspects

Saving time – creating work?

[13] Director of Knowledge Communications, IISD

There are of course downsides to such efficient and widespread delivery of information from the organisational perspective. An uncertain aspect of using the Internet is that for the producers, working with the Internet consumes time as well as saves it. The Internet is adding to the already multiple forms of human and organisational communication thus increasing our ways of reaching each other. With this comes an increased time requirement if these new means are exploited. According to one respondent:

"Internet technologies intrinsically create more work since they enable me to communicate and work with more people around the world" (IR, 2000).

But this isn't a bad thing in itself, as working relationships can be fostered where previously not possible. However it is uncertain if the Internet actually increases or decreases efficiency. 60% of all respondents felt that the Internet saves them time and made them more effective at their job, but as one respondent commented, "e-mail traffic has grown considerably [and] this may actually reduce the overall efficiency of work" (GR, 2000). As another respondent puts it, there is a fine balance:

"The increased speed of information does create more work. It demands that we process information more quickly. And the increased ability to network means we need to spend more time on communicating and networking. Of course this means that more gets done, so it's not a question of less efficiency. But it also means that more is demanded, and it denies us the time to be truly thoughtful about very many things" (IR, 2000)

Does information have any impact?

A major problem for the producers of environmental information is knowing if their information is having any 'impact' or influence on the decision-making process – the ultimate goal. Much research has been conducted into this issue, but the general opinion within information management seems to be that it is impossible to know exactly what impact a given piece of information has on a particular individual. Meadow and Yuan (1997) clearly summarise this point:

Since decisions are based upon a knowledge base, not necessarily a single message, a person's behaviour depends on a wide range of knowledge and it may not be possible to determine how all the information that came to a given person was used in a decision. We believe this must be accepted as an axiom, something akin to Heisenberg's Uncertainty Principle. It is generally impossible to know all the elements of information that lead to any given decision because digging that deeply into what a person is thinking about, and how, is bound to affect the thought process being monitored" (Meadows & Yuan, 1997: 712)

Therefore, the impact of information can only really be guessed at, or assumed. Heather Creech of the IISD is well aware of this fact. According to her, the inability to know the impact information has on decision-making processes requires other means of influencing policy development. Going further, she stressed that it is not just about providing timely, accurate and authoritative information, but it is also about using technology (such as the Internet) to connect to and influence the policy process in a more explicit way (HC, 2000). We shall return to this point later.

Knowing your users, and the problem of obtaining feedback

Related to the idea of 'impact' of information, is the problem of actually knowing who your users are. With information products such as the ENB or the BGMS, which are freely available over the Internet, potentially anyone with an Internet connection could be a user. The IISD and GRID-Arendal have an

idea of who the primary users of the ENB and the BGMS are, but knowing exactly is difficult. Hugo Ahlenius (hereafter HA) of GRID-Arendal described how it is generally a question of deciding intuitively who they are – i.e. asking the question 'who is most likely to be using this information..?' (HA, 2000). Both the IISD and GRID-Arendal also use web statistics to gain a more detailed picture of user origins and user numbers, but this is a very crude way of assessing both of these. But beyond direct feedback from individual users there is very little else that can be done.

Whilst the problem of knowing exact user groups and obtaining feedback is not unique to Internet products – producers of any information media will experience similar problems – there is at least an element of efficacy in the giving of feedback over the Internet. E-mails, possible with just a couple of mouse 'clicks', allow a dialogue of sorts to take place between sender and receiver. This does not seem to make much difference though as users tend to dislike giving feedback of any kind, irrespective of how easy it is (6 out of 8 users interviewed never gave feedback despite the relative ease with which it can be done). Still, this may or may not be a problem depending on the particular information product in question. For Chris Spence (hereafter CS) of the IISD, the high demand for the ENB is feedback enough to know that something is right. But he acknowledged that obtaining more detailed information is difficult – if anything, face to face communication is the best method, but this can only occur if present at the conferences being covered. With regards the BGMS, feedback can be very valuable – information on user experiences can allow for modifications so that information is better presented for user needs - a point made by both Sindre Langaas (hereafter SL) and Lawrence Hislop (hereafter LH) of GRID-Arendal. This is an illustration of how, despite the fact that the Internet can enable relatively immediate 'two-way' communication, it may not occur. For any two-way exchange to take place, both parties must be willing, and in the context of an information service there is unfortunately very little incentive for users to offer feedback. There are ways of remedying this situation – such as mandatory registration or pop-up feedback forms before any information can be downloaded, but these are considered more likely to scare users away than encourage them (HA & SL, 2000).

Environmental aspects of Internet use

A third constraint highlighted by the survey, but not influencing the effective use of the Internet necessarily, is the issue of Internet-related environmental impacts. Although there are many claims to the beneficial influence of modern technologies for the environment (see p.15), there are number of reasons why, at least for the immediate future, some of these potential benefits will not materialise. Firstly, there is an opportunity for localised resource savings - for example saving on paper as a result of producing online rather than printed information. But such savings do not always produce a net overall reduction. For example, many respondents commented that reading from a screen is either difficult or unpleasant, and so they tend to print and then read. LH[14] described how there were intentions to create a 'paperless office' at GRID-Arendal which were quickly realised to be impossible. However, he further explained that most reports and other project 'outputs' are now published solely on the Web whereas before there was much more

[14] Program Manager, Internet and Information Services

printing of documents (Hislop, 2000). Additionally, a respondent from GRID-Arendal made the comment that:

"the Internet makes for more efficient exchange of information and data, but has no effect on the environment as we travel as much as before, and produce even more paper than before…" (GR, 2000).

Secondly, from a practical viewpoint, there are reasons (at least for the short term future) that will hinder any major reduction of printed material in this context. Both the IISD and GRID-Arendal frequently have contacts with developing countries, or those with economies in transition, and as such

"many users still do not have good, or cheap access to the Internet. Therefore hard copies or CD-ROMs are still needed, and will be for some time" (GR, 2000)

Additionally, there is a problem of acceptance by some users of environmental information, as "printed materials (reports) are the only accepted format by many organisations" (IR, 2000). This was echoed by another respondent who commented that:

"there are still a lot of people out there – especially senior policy makers - who won't read stuff that isn't professionally presented in hard copy" (IR, 2000).

So it would seem that until most of the world is connected to the Internet, senior members of government organisations begin to accept more electronic information as 'professional', and computer screens become more 'readable', there will be few paperless offices in environmental organisations such as the IISD and GRID-Arendal. However, short of conducting a detailed audit of office energy and material use, it would be difficult to say exactly whether working with Internet and other ICTs actually helps to reduce or increase workplace environmental impacts, which leaves the question of environmental savings uncertain. Nevertheless, this doesn't negate the significant environmental impacts related to the manufacture and disposal of electronic equipment, such as computers, as described on p.16 (above).

3.2 DISUSSION OF CASE STUDIES/USER EXPERIENCES

This section combines the responses to the (8) user interviews with a discussion of the main themes that emerged from them. Three main benefits arose from the user side – time savings, cost savings and the convenience of online information. On the constraints side, the problem of information overload and reliability emerged. These are discussed in more detail below.

3.2.1 User benefits

Benefits of Internet use from the user perspective
• Time savings • Convenience • Cost savings

It is difficult to completely separate these three factors - time, cost and convenience - as they are all related in some way. Time savings can result due to reductions in the amount of transmission time between source and receiver – downloading or e-mailing a 10-page document will take a matter of seconds, whilst posting the same document could take a matter of days,

depending on where it is being sent from. Convenience results because of a combination of time and format factors. The nature of electronic information means that it can be stored in large amounts in computer equipment that seems not to exist ('virtual libraries') - by turning on a computer and going 'online' the information can be accessed wherever the user is and at any time. Cost savings depend on how one defines the cost itself. If information can be bought through other means or media, then the availability of the same information for free on the Internet will be a clear saving. There can also be cost savings as a result of time savings – if time is valued in monetary terms. Furthermore, the time and convenience factors can promote higher user productivity as information can be obtained faster and, over a fixed period (e.g. a working day), in greater amounts than may be possible with conventional means. Examples of these three perceived benefits are given below. There are however problems with evaluating 'Internet benefits' in such a way, which are also discussed.

As an example of the source-receiver time savings, Darren Goetze[15] (hereafter DG) sees the *immediacy* of access to the ENB as a major benefit, and the electronic format allows fast and easy forwarding of the information to others – a factor that further promotes the sharing of information (DG, 2000). In a more general comment about Internet-obtained information, Nancy Odeh[16] (NO hereafter) described how the Internet is particularly useful when obtaining information from public institutions, such as embassies, which can take a considerable amount of time to process an information request (up to two weeks at times). If the information is available on the Internet, then this whole process can be avoided (NO, 2000).

On the convenience side of things; for Gedas Veitkus[17] (GV hereafter), the GIS datasets available on one database - the BGMS - save him time from collecting and collating data on the whole Baltic region independently (GV, 2000). There was a similar benefit for David Henry[18] (herafter DH). For him, the BGMS provided a convenient, and thus timely input to an EU research project focusing on the Baltic Region (DH, 2000). For NO and Victoria Kellett[19] (hereafter VK), the ability to obtain information 'anytime and anywhere' makes the Web a very convenient medium (NO & VK, 2000). Additionally, VK stated how with the ENB she only has to access it when she has need for it, rather than always having to keep copies to hand (VK, 2000). KB made the same point, saying that it is the fact that the ENB is very easy to find that makes it so convenient – after attending a conference he knows that coverage of all the sessions will be available at the ENB website (KB, 2000). With the BGMS, Anika Tidlund[20] (AT hereafter) finds convenience in that she doesn't have to physically have the information where she works, and can refer to it as and when necessary. For example, she can direct other peoples' queries on Baltic Sea pollution issues straight to the BGMS and thus also save herself time (AT, 2000). Similarly, Nina Munthe[21] knows that a useful overview of various themes relating to Baltic Sea pollution can always be accessed over the Web (NM, 2000).

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[15] Senior Policy Advisor at Environment Canada
[16] Policy Analyst at Environment Canada
[17] Head of the Lithuanian Integrated Coastal Zone Management Centre
[18] previous Polar Region Program Leader at GRID-Arendal
[19] Project Manager: Climate Change and International Development, IISD
[20] Information Officer, Stockholm Marine Research Centre
[21] Environmental Consultant, specialist in water basin management

When it comes to costs, GV is the only user from those interviewed who could be considered to benefit from actual cost savings from using the Internet as a means of obtaining environmental information. As a GIS user, the availability of data on a regional scale in one database means that he doesn't have to go to the original sources, which tend to be commercial data producers and thus charge for the information (GV, 2000). The rest of the users expressed cost savings as a benefit of the ENB and the BGMS, but in a way that is convenience-related rather than the actual saving of costs. This is where some confusion can arise. The idea of cost and time savings when referring to the two information products is not a reflection of their actual value - this idea is explained below.

Most of the users seem to equate 'freely available' with cost savings, which doesn't really apply in this instance. Of course, free information is 'cheaper' than information that must be bought, but for both the ENB and the BGMS there is no comparison against which to show that costs are saved – they are unique products and thus cannot be found anywhere else. Willingness to pay for something that has commercial value is different from the willingness to accept something that is free with little commercial value. The level of interest in both the BGMS and the ENB shows that these products are valued, and it would be safe to assume that they are relevant and useful. But if subscriptions were charged for either service, then a very different picture of user statistics would undoubtedly emerge. The same could be said for the idea of time savings - If information contained on a particular website is also available in, say a library, then time will definitely be saved by downloading it in electronic format. However, if that information is not available in the same form anywhere else – as is the case with the ENB and the BGMS – then time is not being saved as such – instead opportunity is being gained, which has value in itself.

The point being made here is that the value of environmental information products such as the two case studies is not in the money or the time saved, but the opportunity lost if they were not available. There is value therefore in the *availability* of environmental information, providing that the information is relevant. And it is in this respect the Internet has an important role to play. With the BGMS, the Internet is used to good effect to make environmental information with wide relevance and use, available on a scale that gives it a value beyond the time and costs put into its production, or in the time needed to acquire it. With the ENB, there is a similar benefit. Daily reports on climate change negotiations could be kept within a closed circle of delegates and other conference attendees by distributing the document only as print – for whom it would still provide a valuable function. But by using the Internet this information is available to a much wider audience - this is appropriate when it is considered that we are all at risk from the potential effects of climate change, and any means of adding more transparency to the negotiation process is a positive improvement.

3.2.2 User constraints

Constraints of Internet use from the user perspective
• Information overload

- Information reliability

Again, there are limitations as well as benefits to users of online environmental information. Limitations relating to the ENB and BGMS *as products* were very minor - most of the users considered both to be very good for their own purposes. However, there were some general issues brought up which are of interest here: 'information overload' which itself has several related problems, and information reliability issues on the Internet.

Information overload – the need for intermediaries

'Information overload' emerged as a significant problem with Internet use. The basic problem of 'overload' is that the more information that is available in general over the Internet, the more difficult it will be to find relevant and useful *environmental* information – Ballantyne and Addison refer to this problem as "information myopia". They also define a number of related problems with using the Internet as information resource, which are shown in Fig.19 (below). Finding solutions to these problems is a major challenge to all users of the Internet if it is going to become a truly effective medium.

Figure 19 Information-related problems of the Internet

- ***Information explosion***. More information is being made available on more topics than ever before, making effective searching difficult.
- ***Internet anarchy***. Information is produced from a greater variety of sources than in the past, making effective tracking, review and selection difficult.
- ***Information scatter***. Most information is scattered across thousands of 'institutional' homes, making searching difficult.
- ***Indexing nightmare***. Despite sophisticated search tools, finding relevant information on issues and topics is largely 'hit or miss'.
- ***Information myopia***. With more choice than ever before, users of the Internet are led to less and less of what is actually available.

Source: Ballantyne & Addison (2000)

Referring to the problem of overload, DG sees the Internet as a 'double-edged sword' in that the it is an excellent way to provide people with wider access to information, but at the same time this brings with it the problem of too much information (DG, 2000). A comment from one of the survey respondents is pertinent here:

"The Internet seems to be perfectly suited to sharing information in a more general way. I think there is a great potential for more information to be accessed by general users, but because the amount of information available out there is so overwhelming, it can be quite difficult to sort through it all. Search engines are only so effective…" (IR, 2000)

From the user perspective, overload should be avoidable because of the ability to 'pull' information as and when needed rather than have information 'pushed' at you, as with traditional mass media. However, this doesn't remove the fact that the Internet is brimming with a wide range of different information types with no real structure, thus making it very difficult for users to locate the information they need – the 'indexing nightmare' referred to by Ballantyne and Addison.

The need to sift through the mass of information held on the Internet influences the nature of time savings because to benefit from reduced time you need to have found the information first. This task in itself may take considerable time, and can often be unproductive unless equipped with a

good knowledge of using search engines. The user experiences show that they tended to be directed by another user rather than finding it independently. AT and NM were both referred to the BGMS through personal contact with its creator, Sindre Langaas. Similarly, KB and NO were referred to the ENB from previous university professors. In KBs case, this professor was actually one of the three original founders. So it would seem that the 'pull' aspect of the Internet is less effective here than the efficiency of being directed to something by a third party. However, there is something of a catch here, because to become efficient at searching for information on the Internet you must have the time to use it and become familiar with search methods, but people increasingly have less time to do this – unless particularly motivated - and so will never improve. A further, and significant point is that even if proficient at finding information online, there is no guarantee that something is available, because even though a lot of environmental information is available, there is a far greater proportion that isn't. AT mentioned this as a drawback of Internet use, as well as the time it takes trying to locate things – factors which discourage her from actually using the Web extensively for her information needs (AT, 2000).

There is a clear need then for ways of capturing the attention of users, especially when environmental information has to compete for space with the far more powerful influence of leisure and advertising content that seems to fill much of the Internet. The importance of information 'intermediaries' will thus have to increase if users are to cut through the fog of information that is the Internet. With time restrictions to the amount of time available for conducting random Internet searches, users need to be directed to content. One way of improving the situation is for producers of environmental information to create "gateways" – large websites that provide a kind of directory of other sites. The benefit of such websites is that smaller organisations can be given extra visibility, and a single issue will have a range of different sources on offer, creating a more diverse selection of opinions. There is however a risk that the opposite may also occur – i.e. as such 'supersites' grow, content requirements for the inclusion of a particular site may actually serve to restrict the overall breadth of opinions. This, however, is not an issue that can be addressed fully here.

The problem of reliability

Information reliability also emerged as an issue for Internet users. It is difficult to explain how people evaluate the reliability of an information source, as it is based on personal experience, beliefs of what is and isn't the correct way of doing things etc. In this instance it appears to come down to the reputation of the organisation that is offering the information – all the users interviewed perceived the IISD and GRID-Arendal as credible and reliable source of information, which clearly informs their reasons for using the ENB and the BGMS. This credibility is important as Internet users seem to have an uncertain belief in the validity of information coming from the Internet, which will be reflected in their use of information found therein. With GRID-Arendal and the IISD, this credibility has been earned through a continual focus on using the Internet as a means of providing environmental information to various users. This has also been backed up with the financial means to do so - for example, in 1999, GRID-Arendal invested US$200,000 into developing their website. Users for both products also stated that transparency in the process of creating and/or presenting the information was also a key attribute (DG, 2000 & DH, 2000). This aspect also represents a problem for the producers of information –

if users tend to opt for information only from known sources, then how can 'new' sources of information obtain that vital credibility and reliability necessary to give them some kind of popularity? It is very unlikely that this would be possible with only Internet-based means of promotion, although it may be possible to create some kind of exposure using these means.

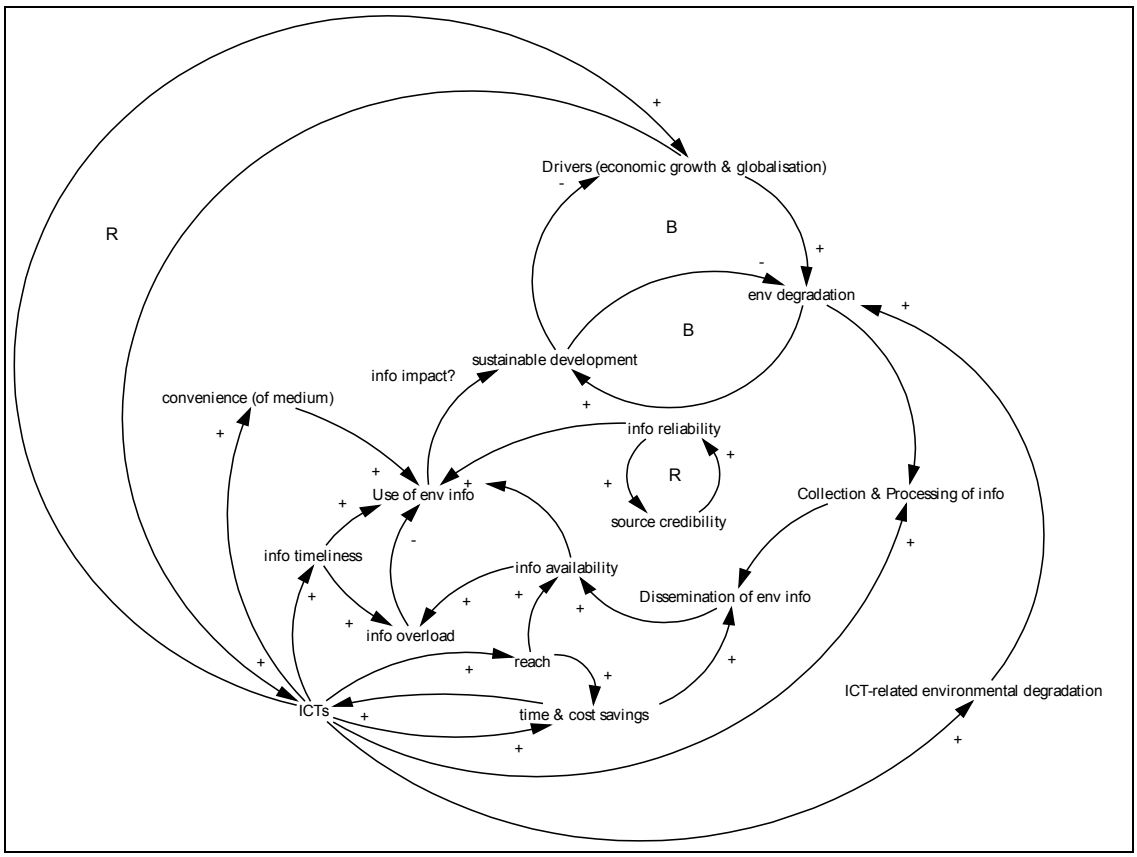
This last point leads us to a fundamental aspect of the Internet as an information media, highlighted by Kevin Baumert, a researcher at the World Resource Institute (WRI). He summed up the nature of the Internet as a source of environmental information in a comment that it *complements rather than replaces* other information media (KB, 2000). This was reflected by the fact that none of the interviewees obtained all necessary environmental information from the Internet. However, many of the interviewees used other online sources, reflecting perhaps a growing amount of good information sources on the Internet as more and more organisations realise the wider benefit of making environmental information available over the Web. Alternatively, it could just reflect a greater willingness, and confidence in using the Internet as a source of environmental information. For example, the interviewees gave other sources such as online newsletters, reports and analysis of issues pertaining to climate change and the Baltic environment (e.g. GV, 2000; NO, 2000; KN, 2000; DH, 2000). Only one of the users - Nancy Odeh, a Policy Analyst at Environment Canada - obtains the majority of the information she works with from the Web (NO, 2000). However, this was a rare example.

3.3 SUMMING UP – 'REVISITING' THE CLD

3.3.1 Revisiting the CLD

As the survey and case studies have shown, there are significant benefits for the producers and users of the Internet in its capacity as an environmental information tool; however there are also certain constraints. In this section, the original CLD is revisited in a slightly revised form, to show these benefits and some of the constraints as resulting from the survey and case study research. The revised version of the CLD is shown in Fig. 20 (below).

Figure 20 Revised CLD, reflecting research outcomes



On the producer side, there are considerable time and cost savings to be had from producing electronic information rather than printed information, which promote the use of the Internet. Along with these savings, environmental organisations are now capable of reaching a wider audience (an increase in 'reach') who are seeking relevant and freely available environmental information – which further creates cost-effectiveness relative to other means of information dissemination (e.g. posting). From the user side, the overriding benefits are those of information availability, convenience and timeliness. Where the ENB and BGMS are concerned, the extra reach provided by the use of the Internet (by GRID-Arendal and the IISD) creates this availability – the main value of these information products. Still, there are numerous constraints. The very availability and timeliness of Internet-based information has a potential knock-on effect to the user, in the form of information overload. This can negatively impact upon information use – a result of the 'myopia' discussed above (Fig.19). There is also the problem of establishing any influence or impact of a piece of information on the overall decision-making process, which must be assumed.

3.3.2 Is environmental information on the Internet a tool for sustainable development?

It is important to recognise that the Internet is just the medium that we have created. In the absence of the Internet, other sources of information would be sought, and other means of disseminating environmental information would be found. Additionally, without the Internet we would not necessarily be any worse off than we are now in terms of the state of the environment. And furthermore, neither are we substantially better off now that we have the Internet – environmental degradation and global inequality continues to grow.

For any change in the state of the environment to take place, it is not the medium that is of central importance, but the message. As explained previously, the ENB and the BGMS are unique, not purely as a result of being available on the Internet, but because of the content they are offering *and* the fact that this content is online. Despite the practical benefits of being online, these information products would not be as popular, or as widely disseminated, if they were not offering a useful and relevant source of information. The Internet in and of itself does not promote sustainable development - in fact, if anything, it has a negative influence because of the vast technical infrastructure it relies upon, and the environmental impacts associated with this (see p.16). Additionally, and contrary to some claims, the Internet does not seem to be creating substantial environmental savings, such as reduced paper use. Moreover, the input that ICTs have to the ongoing process of globalisation is significant.

It is therefore difficult to assess what the overall outcome of Internet use as an environmental information tool. The benefits for both producers and users are significant enough that the Internet will be a key information source for those that have access, for the reasons already discussed. In particular, from an organisational perspective, not using the Internet as a means to disseminate environmental information would be a disadvantage. As such, the Internet is certain to become a major information tool for sustainable development. As more and more information is made available on the Internet, and as user numbers grow, the value of this information will grow. The major limiting factor will be the ability of users to avoid the negative effects of information overload. This will depend on both producer efforts to make information 'visible', and user ability to successfully navigate the oceans of resources – but as discussed above, if users do not already know about a particular information resource, the likelihood of them finding it independently is low.

Yet we are left with the problem that information is a fairly abstract and passive phenomenon. Whilst it is necessary to make environmental information widely available we are fairly ignorant as to what actual use it is being put to – the problem of 'impact'. More information does not necessarily mean that decisions will be better made. Melody (1994) explains how studies of corporate decision-making have shown that decisions made by corporations using sophisticated means to obtain large amounts of information are no better than those made by corporations using much less information (Melody, 1994: 266). Similarly, Burgoon et al highlight how some problems are more fundamental to society, and are not therefore subject to information- or communication-based solutions:

> There are problems between people and problems inherent in systems that have nothing to do with the ability to communicate and that, therefore, cannot be solved by increasing the amount of communication (Burgoon et al, 1995: 6)

This brings us back to the systems element of environmental problems. To be truly effective, sustainable development must recognise the fundamental driving forces of environmental degradation, and work to reduce these. Where the Internet and other ICTs are concerned, they can help in the detection and reporting of different problems, and the communication of a whole range of useful information about the state of the environment and progress in different policies. But if the Internet is to have any significant input to sustainable development, then we must move beyond the traditional, one-

way 'public information' model of information provision (see Fig. 5). In the spirit of agreements such as Agenda 21 and the Århus Convention, it is necessary to find ways to engage users of environmental information and involve stakeholders in the process of environmental decision-making so that, as Heather Creech explained, an *impact* is more explicit. It is necessary then to learn about when and where the Internet is most appropriate as a medium, how to gain the maximum benefits from it in these circumstances, and exactly what its limitations are. Some of these have been discussed here, but there is still much more to be learnt.

The IISD and GRID-Arendal are investigating ways that the Internet can contribute to a more participatory form of information provision, and engagement in the decision-making process. By doing this, they hope to find ways of creating a more explicit influence impact with information. This reflects perhaps a move towards the 'two-way symmetric' type of communication model described by Grunig & Hunt, whereby the goal is not just the provision of information, but the attaining of some kind of 'mutual understanding' (see Fig. 5, p.12). However, the success of any Internet-enabled communication, with a desire to influence decision-making for sustainable development, depends more on the people within these information systems than the technology itself. It is only if we are willing and able to use the Internet and other ICTs in ways that assist us and add something to the overall process of sustainable development, that they may become important tools.

This section is ends with two short examples of how the two case organisations are trying to promote a more equal, two-way exchange of information. The GRID-Arendal project is a way of getting more from Internet as a means of obtaining information online about pollution in the Baltic Sea region, building upon the success of the BGMS. For the IISD, a new direction is the use of 'Knowledge Networks' – the creation of networks between institutions engaged in research and learning, using the Internet and related technologies as a way of increasing the flow of ideas and knowledge between organisations in the 'north' and 'south'.

Example 1 – GRID-Arendal and the BOING project: a gateway to environmental information on the Baltic Sea…

The Baltic Online Interactive Geographical and Environmental Information Service (BOING) is a prototype project in the EU aimed at making public sector information on the state of the Baltic environment available to the decision-making, scientific and education communities. It is being developed using direct support and consultation from members of all three of these groups so that the information provided is relevant and immediately useful. The main focus is the problem of eutrophication, and will include the BGMS product used a case study in this paper. However, the BOING project will go much further, incorporating information from a variety of sources, such as the Department of Systems Ecology (Stockholm University), the Finnish Institute of Marine Research and GRID-Arendal. The Internet is intended as being the primary medium by which information can be obtained, including the use of experts in the area of eutrophication who can be contacted for additional information (Anon, 2000). By using such participatory measures, and by creating a gateway-type database, the BOING project hopes to encourage the greater use of the Internet as a means of quickly and efficiently obtaining information about the problem of pollution in the Baltic. The use of ongoing

consultation with the different users of the information is aimed at creating an information source that is useful as well as *used*. The BOING project will be officially launched in the summer of 2001 (for more information see http://www.grida.no/boing).

Example 2 – The Climate Change Knowledge Network (CCKN)[22] – engaging stakeholders through technology…

The IISD currently has three 'knowledge networks', one of which is devoted to Climate Change. The aim is to use ICTs to "bring institutions and people together from all regions of the world and all sectors of society, to exchange information, share views and experience, and create new knowledge" (Anon, 2000b). In the case of climate change, the knowledge network encourages collaborative research, capacity building and the communication of information and knowledge. The aim is to create a more level playing field for institutions with limited resources and who may be more marginal in the overall debate, despite being equally effected by the outcomes of climate change negotiations. All members of the network (currently around 14) are encouraged to use the Internet as a means of communicating both ideas for and results of research projects on specific elements of the Kyoto Protocol (which sets out the means by which reductions in 'greenhouse gases' should be attained), possibilities for private sector participation, and the long-term economic and social implications of climate change. Again, through the use of participatory measures, and the targeting of information and knowledge where it is most needed, the Knowledge Network hopes to use the Internet, and other ICTs as a means of influencing the policy process.

[22] available at http://cckn.net

PART IV: CONCLUSIONS

Considering the information obtained from the research for this paper, and weighing these up against the original aims and objectives, the following conclusions have been reached.

With regards to the connections between environmental information and sustainable development, and the influence of technology on information and communication, it is concluded that:

- Environmental information is a prerequisite not just for environmental decision-making (at the policy level), but it is also the foundation of a more transparent society. Although only one small aspect of a wide range of 'tools' in the move towards a more sustainable form of development, reliable and timely information is necessary if we are to both understand and react to the increasing environmental problems that face us.
- ICTs are increasing the amount of information that is available, as well as drastically reducing the time scales in which it can be collected, processed and disseminated. This timeliness is a major benefit. However, there are many limitations to the use of 'new' information:
    a. access to technologies such as the Internet requires money and skills – computers are not cheap and neither are they intuitive to use.
    b. even after the initial 'access' barriers have been breached, information media such as the Internet require at least a basic knowledge if the contents are to be found – an increasing problem is that of 'information overload' whereby people are swamped by information, or that so much varied information exists that it is difficult to sift through it to what is useful.

With regards to the assumptions under investigation in the case study section, an explorative investigation seems to show that:

- The Internet does provide fast access to information, providing that it is in electronic format. But it must be remembered that most of the world's information is not in this format, and so relatively speaking, content is actually very limited. However, content of good environmental information is growing.
- In terms of cost and time savings, there are definite benefits for the producers of environmental information – such as the IISD and GRID-Arendal. These benefits will encourage more and more similar organisations to use the Internet as a means of making information available.
- For the users of information, time was an important element, but more in a sense of *timeliness* i.e. the ability to obtain information quickly and when it was needed, rather than absolute time savings. Additionally, the convenience of using the Web emerged as a major benefit.
- The 'global' aspect of the Internet means that environmental information, such as the ENB and the BGMS – can be accessed and used from anywhere that has a connection to the Internet. However, the author would advise caution in hailing something as global that reaches only some 5% of the world's population, and is dominated by wealthy, developed countries.

- As to the potential for environmental savings from using the Internet – in terms of, for example, possible paper reductions – this was found to be somewhat of a misnomer at present. User difficulties in working only from a computer screen will restrict any major improvement in this area for the time being.

Finally, with regards to the possibility that the "information society" may lead to a more sustainable society, the jury is out. The fundamental problem in assessing the utility of information-based approaches to sustainable development is that it is near impossible to establish causality between a piece of information and a decision, or a change in behaviour. It may be possible to assume a correlation, but assessing the *impact* of information is problematic. This creates the question – "does information make any difference?". The answer is not straightforward. In isolation it is unlikely that it has any long lasting impact, but in combination with other efforts, information can be a very powerful (and empowering) force. The two examples given at the end of Part III are illustrative of how some organisations are now trying to harness the benefits of a medium such as the Internet for sustainable development. The CCKN is providing the conditions for participation by a range of stakeholders in the international climate change policy process. With credible and reliable information as a foundation, the use of computer networks allows institutions in the 'north' and the 'south' to engage in the decision-making process. The BOING project is an example of an initiative that aims to increase the utility and thus use of information on the Internet. Acting as a 'gateway' to a whole range of different information types – all with the common focus of pollution problems in the Baltic Sea region – this information resource is using reliable and up to date information to engage regional and international decision-makers, educators and the public alike in the task of creating awareness and changing behaviour via the tool of information. By using ongoing consultations as a means to ensure the utility and relevance of the information provided, the BOING project aims to have a more immediate input to decision-making processes.

As a final word, modern technologies are a double-edged sword. On the one hand, they present us with added power to measure and analyse the state of the environment and our influence upon it, as well as the means with which to make this information widely available. On the other hand, they shape our worldview, maintaining a technical focus on environmental problems, with human-focused systems analysing problems that are 'out there', beyond our computer screens and somehow detached from our daily lives. Additionally, sophisticated technology seems to mean sophisticated environmental risk – heavy metals, disposal problems, the fuelling of global economic growth via telecommunications etc. However, there is no reason why technology cannot be more benign, and as eco-efficiency increases, these impacts will hopefully decline. As to the technology itself, the author would agree with the following sentiment - that "we have a responsibility to harness these tools to build a healthier, greener, and equitable future" (O'Meara, 2000:141). Attaining this goal will not be only through focusing on the medium of, for example the Internet, and learning when and where it is most appropriate, but also (and more importantly) on the real driving force behind any information system – the individuals that are creating and using them.

APPENDIX I: SURVEY AND INTERVIEW QUESTIONS

A: SURVEY QUESTIONS

B. INTERVIEW QUESTIONS

#1 'Producer' Interview Questions

SECTION 1: GENERAL

1. When was the ____ created?
2. Was it created in response to a specific information need/gap? **Y/N**
   If Y - What was the reason?

SECTION 2: CHOICE OF CHANNEL

3. Why was the Internet chosen as the 'channel' for providing the ___?

Was it due to… (choose as many as is relevant)

a. Time factors b. Cost factors c. Reach d. Format e. Other _____

4. Do environmental considerations affect the decision to work with the Internet? **Y/N**?
5. Could the ___ be delivered in any other format (i.e. "offline")? **Y/N**
6. Who are the main users/user groups?

   Policy/decision-makers, Research Institutions, Education (schools/universities), Industry, Scientific Community, Other…

7. How do you identify users/user groups?
8. How did you/do you make the intended users/user groups aware of the ___ ?

By publicising it in…Newsletter/Press Release/Home page/Annual Report/ Local/National/International Press/Mailing Lists/Other _____

9. Have these methods been successful? Y/N
10. How many users/readers do you have per month on average?

SECTION 3: EFFECTS AND IMPACTS

11. Do you try to assess the impact of the ___ on the specified user groups? **Y/N**

12. Is it possible to know if the information from the ___ has any effect on the actual state of the environment? **Y/N**

13. Do you obtain feedback from the users/user groups? **Y/N**

14. What are the limiting factors to obtaining feedback?

15. Overall, are you able to obtain enough information to give you a good picture of the overall effectiveness/impact of the ___ ? **Y/N**

SECTION 4: COSTS & BENEFITS

16. How much does it cost to produce the ___ on a monthly/yearly basis? (average figure)
17. How many staff work on the ___ ?
18. How many of these are only employed to work on the ___ ?
19. How regularly is the ___ updated?
20. How important is it, when dealing with such data/information, to keep the data updated/current?

21. Considering the (staff) time and money invested in maintaining the ___ , would you say that the benefits of providing the ___ outweigh the costs? **Y/N**

22. a. Where does the funding for the ___ come from?
    b. Is there any pressure to show cost-benefit?

SECTION 5: FINAL COMMENTS…?

23. In the 10 years since the creation of the IISD/GRID the Internet has grown dramatically in size. How much has the Internet transformed the activities of the organisation (or organisations with a similar purpose)?

24. In your opinion, what aspect(s) of the Internet has the greatest potential to help organisations such as IISD/GRID?
25. Are there any drawbacks for an organisation such as IISD/GRID from using the Internet? **Y/N**

#2 INTERVIEW QUESTIONS FOR USERS

SECTION 1: INTRODUCTION
1. What is your role at ____ ?
2. How do you receive the majority of the information that you use as input to your work?

    Hard/Print Copy, Electronic, Other

3. What are the obstacles to obtaining information for your work? (e.g. cost, availability, timeliness…)
4. Does the Internet remove/help to remove any of these obstacles?
5. How would you describe your general attitude towards the Internet?

V positive – V Negative

6. In your opinion, does the Internet present an improved method for sharing (i.e. accessing, and disseminating) information about the environment e.g. climate change negotiations?
7. Overall do you think that the Internet is a good information communications tool?

SECTION 2: USING THE PRODUCT
8. When did you first start using the _____?
9. How did you hear about it?

promotional material, IISD/GRID website, word-of-mouth, other _____

10. a. Why did you start using the ___ ? (i.e. was it a specific need)
    b. Did environmental considerations contribute to the decision to use the ___ ? (e.g. resource savings)
    c. What input does the _____ have to your work?

    Direct/Indirect data source, other _____

11. How important is source credibility when obtaining information online?
12. In your opinion, is the ___ a credible source of information? + Why?
13. Is it the only source of information that you use for this aspect of your work?
14. Do you use any other **online** information sources? Y/N

Section 3: Costs & Benefits

15. What are the main benefits of having the ___ available online?

    a. Time b. Cost c. Reach d. Format/Use e. Other _____

16. What are the main drawbacks of having the ___ online?

    a. Time b. Cost c. Format d. Other _____

17. Could the ___ be delivered in any other format (i.e. "offline")?
18. All things considered, would you say that the Internet is a good way to obtain the ___ ?
19. Compared to other information media, would you say that that it is easy to give feedback to the people/organisation producing a given information product or service (such as the ___)?
20. Do you ever give feedback on _____? Y/N

#3 Interviews with Heads of Communication

1. What is your role at ____ and what does it involve?
2. How does the Internet fit into the overall communication strategy of IISD/GRID?
3. When did the Internet become an important part of the information dissemination process at IISD/GRID? + Why?
4. Did environmental considerations influence this decision?
5. Are there any drawbacks of using the Internet in this capacity?
6. Is there some kind of method of evaluating how effective the Internet is, in terms of information dissemination?
7. Considering the time and money invested in maintaining a good Internet-based information network, would you say that the benefits outweigh the costs?

How important would you say that information is in the wider project of sustainable development?

APPENDIX II: INTERVIEWEE LIST

INTERVIEWEE NAME & TITLE	Date of Interview
Victoria Kellet Project Manager: Climate Change and International Development, IISD	16th October, 2000
Heather Creech Director: Knowledge Communications, IISD	25th October, 2000
Chris Spence Editor: Linkages Magazine, IISD Reporting Services	27th October, 2000
Darren Goetze Senior Policy Advisor, Environment Canada (Ministry of Environment)	24th October, 2000
Nancy Odeh Policy Analyst, Environment Canada	27th October, 2000
Kevin Baumert Researcher Climate Change Program World Resource Institute (WRI)	26th October, 2000
Sindre Langaas Project Manager, GRID-Arendal	20th October, 2000
Hugo Ahlenius Project Officer, Visual Communication Unit, GRID-Arendal	20th October, 2000
Lawrence Hislop Head of Internet & Information Services	
Anika Tidlund Information Officer, Stockholm Marine Research Centre	1st November, 2000
Nina Munthe	2nd November,

Environmental Consultant, specialist in Water Catchment Management	2000
Gedas Vietkus Head of Lithuanian Integrated Coastal Zone Management Centre, Lithuanian Academy of Science	2nd November, 2000
David Henry (previously) Project Leader: Polar region Program, GRID-Arendal	3rd November, 2000

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