Chapter 2

GLOBAL KNOWLEDGE e-NETWORKING

Identifying e-Barriers and Introducing GSSD

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Introduction

The purpose of this chapter is to show how the results of the *mapping sustainability* initiative provide the foundations for organizing the substantive materials – the knowledge content – distributed throughout a global e-networking system concerned with sustainable development. The issues addressed here are put forth as seen from the perspective of different user-types. In subsequent chapters, we will show how the architecture of the knowledge system and its conceptual foundations are utilized at the end-of-the-line, so to speak, to meet key knowledge needs and demands in different social and/or institutional contexts.

This chapter proceeds as follows: first, we identify the knowledge objectives that drive the global e-networking initiative at hand. This task presents the broad terms of reference for the book as a whole as well as the logic for its individual parts. Second, we highlight characteristic features of knowledge networking as a form e-interaction and communication, and define the key elements. Third, we turn to the computational context, noting the contributions to information technologies (IT) for transitions toward sustainable development. In so doing, we identify the key e-barriers to knowledge for sustainability, and then highlight the solution strategies we have developed in response to these barriers. Together, these factors define the boundaries of our overall research design. Fourth, we introduce the *Global System for Sustainable Development* (GSSD), a knowledge e-networking system which serves as the computational platform to incorporate the individual solutions to specific e-barriers into an integrated system. Fifth, we then focus on some key user-centered features of the system (front-stage, so to speak) and we note key operational features that reduce the e-barriers to knowledge access in various parts of the world (namely backstage properties). And finally, we

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turn briefly to *who* uses GSSD, *how* it is used, and *why* those who use it choose to do so.

2.1 Knowledge Objectives and e-Networking

Issues and challenges such as these are at the frontier of current practices in knowledge management. They are also at the frontier of prevailing theory in the domain of sustainable development as well as at the frontier of cyberspace. They are especially challenging in terms of collaborative multicultural and multilingual e-networking for knowledge development purposes as well as policy making. These are all critical imperatives since we are dealing with *knowledge* and its *management,* and not with information and its observation; with *evolving* Internet resources and not with static hard copy holdings; with multiple and *decentralized sources* of knowledge generation, organization and provision, and not with the creation of centralized inputs – and all are addressed through an integrated conceptual and computational framework.

2.1.1 Knowledge Objectives

Three sets of objectives shape the implementation-side of a global knowledge e-networking system derived from mapping sustainability. As currently conceived, these objectives are driven by a vision of distributed knowledge e-networking that is framed in theoretical as well as operational terms.

First are the *scientific* goals, namely to improve the prevailing understanding of sustainability issues, contribute to the formation of a sustainability model, and facilitate access to evolving cutting edge scientific and technical information, applications and innovations.

Second are matters of *e-participation* and *outreach*, specifically helping to generate, support, and maintain an integrated and adaptive perspective on sustainability issues at all levels of development, and to enable better voicing of multiple views and diverse perspectives from all parts of the world.

Third are the *policy-centered* goals at all levels. Nationally, the policy-related purpose is to engage in assessment of progress in implementation of international initiatives, as framed for example in *Agenda 21*. Internationally, the main goal is to facilitate international e-collaboration, in large part by contributing to the reduction of e-barriers to pertaining to sustainability and enhance modalities for e-networking.

Framed thus, these knowledge-related objectives are both general in scope and specific in applications. They are compelling as well as necessary if we are to take seriously the challenge of developing knowledge-based

trajectories toward sustainability. Individually and jointly, these goals frame essential tasks for the international community as a whole; they are part of a basic must-do package, the contents and details of which will be addressed further along.

2.1.2 Knowledge e-Networking

Knowledge networking involves active participation by the members (or users) of the network. Based on our actual practice, empirical strategies, and operations on a global scale, we define the properties of effective e-knowledge networking as:

> A computer-assisted organized system of discrete actors (a) endowed with knowledge producing capacity, (b) combined through the use of common organizing principles, (c) retaining their individual autonomy, such that (d) networking enhances the value of knowledge to the actors and, accordingly, (e) the stock of knowledge is further expanded.[1]

Jointly these seemingly incompatible properties generate patterns of interaction, which then create multiplier effects throughout the entire knowledge system. At each point, there could be barriers or impediments, but there could also be enabling factors.[2] In select chapters of Part II in this book, other definitions are put forth. However, they are all consistent with this basic statement.

In practice, effective knowledge e-networking facilitates two mutually reinforcing outcomes: the *globalization* of knowledge via greater diffusion, and the *localization* of knowledge via representation of distinct local technical and linguistic features. In both contexts, networking is a *critical enabler* for harnessing the value of knowledge (cross border, cultures, disciplines, etc.) and transforming knowledge into practical applications or implementations. Here, of course, there is the presumption of added value associated with knowledge e-networking.

The important point is that the diffusion of knowledge networking makes it functionally possible to engage in multidirectional and multiparty interactions (i.e. top-down, as well as bottom-up). It facilitates the flow of knowledge generated at various levels in the social order, both within and across different communities. Moreover, access to interactive knowledge networking empowers stakeholder groups to express their preferences and make explicit their inputs into decisions, while giving decision-makers access to multiple

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[1] I am grateful to Steven Millman and Gerard McHugh for insights into the formulation of this definition. See Choucri, McHugh and Millman (1999).

[2] Of relevance here is Strogatz (2001) on the subject of exploring complex networks (p. 268). To the answer for the question: "why is network anatomy so important to characterize?", Strogatz responds: "Because structure always affects function."

stakeholder communities. None of this assumes that all e-interactions are unrestricted, that filters and censorship do not exist, or that governments are not intervening in e-processes. e-Networking venues may provide new empowerment opportunities – for everyone and everywhere – that were not available earlier.

While networking in general, and knowledge networking in particular, are important for public and private enterprises, the evidence remains to be codified systematically. There is a large literature on these issues, but a limited amount of empirical evidence, and an even more limited amount of empirical evidence in the domain of sustainable development. Later on, in Part III, we address these issues in greater detail for the firm, for international corporations, and for extended enterprises. Here we highlight only the tip of the proverbial iceberg.

One inquiry is particularly noteworthy. In a recent study of fifty enterprises in developing countries, Wheeler et al. (2005) found that informal networks – including business, not-for-profit organizations, and various community-based groups – play a large role in performance, especially in relation to formal networks and established institutional mechanisms. Distributed in Africa, Latin America, Asia, and worldwide, these enterprises span a range of different economic sectors. These include agribusiness, energy, financial services, Internet and communications technology, manufacturing, and others. These cases are pre-selected as a sample of 'self-reliant' endeavors that arises with and without association with high level or multinational corporations. While sustainable local enterprises of this sort create value, what is important here that the actors are united by a shared view of "what is valuable" and this view is fundamental to their success. Even more important, however, is the related finding that networks allow for "the idea that members may define value in different ways" (Wheeler et al., 2005: 38). Noteworthy in this context is the value attributed to tangible as well as non-tangible resources and assets.

In this connection, we posit that *networking* is the operational mechanism for enabling the value of knowledge through the diffusion of its content The term *new knowledge* refers to the emergent demand for knowledge about matters that were not previously salient, on the one hand, and also implies the recognition that prevailing knowledge about salient matters is no longer as useful or relevant as previously thought, on the other.

This brings us once again to knowledge as an input into economic activity, a source of value added and a domain of understanding in its own right. The *content* of knowledge constitutes the utility of interest to us. The provision of, and access to, knowledge can amount to a major source of co advantage in non-commercial contexts. In addition, however, we need to consider *conduit* (the infrastructures and related facilities required for Internet access) as well as *capacity* (the ability to utilize e-functionalities). These

are critical features that bear directly on the computational context for the challenges at hand.

2.2 Identifying E-Barriers

So far, we have focused on conceptual and knowledge-related issues – not on operational ones. In Chapter 1, we presented the potential gains from mapping. We now address the transmission mechanisms, and how knowledge flows through the conduits, made possible by advances in Information technology.

2.2.1 Synergy of IT and Sustainability

Almost everyone agrees that innovations in IT somehow contribute to growth, but there is considerable disagreement about the nature of the evidence and the ways in which those contributions make their way through the society and economy. Recent studies showing the increasing knowledge intensity of economic activities in almost all of the industrial countries contributed to an accelerated interest in e-venues for growth in the developing countries. National and international institutions alike appear to be focusing on the e-potentials for growth in private as well as public sectors, and almost every developing country is now mounting a national IT development plan.

The World Summit on Information Society (WSIS) placed IT-related issues at the center of global politics.[3] So, too, for every argument one finds about IT supporting democracy and participation there is a counterargument, namely that IT enables governments to impose, control, or limit access to the Internet. Nonetheless, the availability of cyber venues clearly increases rather than decreases to the retrieval of information, the availability of choice, and the potentials for individual as well as group 'voicing' of views and preferences.

It was John Seely Brown and Paul Duguid (2000) who first drew attention to the potential contributions of information technology for achieving sustainable development. By focusing on four specific functions in the operations of IT – namely, *de-specialization*, *de-centralization*, *de-massification*, *and de-materialization* – the relevance to sustainable development becomes more evident. In principle, therefore, IT constitutes one class of technologies that can improve rather than impede the quest for sustainable development. Some other, second order, contributions are often cited, namely the possibility of substitution functions (such as shifting from physical transformation to IT-based communication) or reducing key disconnects (notably

[3] See Allenby (2001) for one of the earliest discussions of the mutually reinforcing relationships of IT and sustainable development.

structural and policy gaps). Common among such disconnects are, for example, those between information use and the value of information re-use; between stakeholders and government; or between formal plans and actual implementation.

At the same time, there is a growing literature pointing to the downside of increased use of IT, ranging from concerns about the nature of the content that is being transmitted, or the service that is being undertaken, or the impacts that either of these might have on the user. There are also are questions about the precise amount of energy saved in due to the deployment of information technology for meeting social needs. Then, too, despite the many contributions to economic performance and the increased dependence of the global economy on knowledge products and processes, it comes as no surprise that fundamental disparities in cyber-access persist and that powerful e-barriers to knowledge access remain in place.

2.2.2 e-Barriers and Solution Strategies

Of the many observable e-barriers that impede transitions toward development, six sets are especially compelling. Devising strategies for their resolution amounts to a major challenge, one that is addressed throughout Part I of this book.

First is the range of conceptual ambiguities in the knowledge domain itself. The complexity of sustainability is demonstrated in research and policy circles, as is he diversity of views and definitions generate a range of contentions surrounding both the concept and its uses for research, policy, or strategy. By *mapping sustainability*, we presented a conceptual framework and ontology to guide our understanding of the overall issues and of their constituent elements to the extent feasible – in order to help organize existing knowledge pertaining to the broad domain of sustainable development.

Second is the explosion of information about sustainability. This explosion is giving rise to access problems and attendant difficulties of selecting relevant materials on any specific set of issues. The dilemma is basically one of managing *information flow* (or overflow), on the Internet where quantity dominates and quality is sacrificed. Our solution is to put in place a knowledge provision process that includes with quality controls and reality checks.

Third is the set of powerful infrastructure constraints that impede access to the Internet, fostering digital differences between rich and poor. Such digital differences clearly restrain sustainable development. Our solution is to establish a set of operational *partnership with knowledge providers* in order to generate a greater variety of potential knowledge for users of e-materials. This solution involves a mirror-site strategy, so that individuals are able to access knowledge-systems and knowledge-bases by connecting to servers closer to them.

Fourth is the reality that the Internet – a largely English-speaking venue in a world that is non-English speaking – generates systematic disparities in assigning meaning to e-materials. Our solution to this very real problem is to engage in multilingual knowledge e-*networking* in order to enable users and providers from various parts of the world to express themselves in appropriate language, idiom and terms.

Fifth is the set of strong biases in knowledge-provision. Given structural impediments to Internet access and the dominance of English, e-materials and resources are highly concentrated at both source (input) and retrieval (output). This means that the voices heard are mainly those from the 'north' while voices of the 'south' remain relatively silent. The solution we have developed to address this problem is the creation of *workflow strategy for content provision worldwide* based on the dual principles of global collaboration, on the one hand, and protection of individual and institutional autonomy, on the other.

Sixth, and finally, is the set of usual impediments due to cost and price. The economics of Internet access make it difficult for most people, in most places, to participate in the new cyber domain, thus compounding the implications of variability in infrastructure conditions throughout the world. Our solution strategy consists of a *pragmatic in-kind cost-sharing approach* that reduces the burdens borne by collaborating partners.

Each of these types of e-barriers is significant in its own right. Jointly, they create powerful obstacles to the effective knowledge e-access. By the same token, each of the solution strategies noted above contributes to the reduction of attendant impediments. Together, they enhance e-knowledge retrieval and provision and, by extension, strengthen the overall capacities of diverse users.

2.3 Global System for Sustainable Development

The computational strategy designed to address the six sets of e-barriers is embedded in the architecture and workflow of GSSD. More specifically, GSSD is an adaptive and evolving global knowledge system dedicated to sustainable development. A set of knowledge management, provision, search, retrieval, and navigation functionalities allow users to customize their knowledge-inputs and/or to tailor specific retrieval queries over the GSSD knowledge-base.

In partnership with collaborating institutions and colleagues worldwide, GSSD seeks to focus on selective knowledge of recognized quality supported by institutions or organizations that serve as certified knowledge providers. In other words, one of the key functions of the GSSD knowledge-base is to

make it easier for users to locate knowledge of interest and, by the same token, to facilitate their provision of knowledge into global networks. The following chapters turn to these issues in greater detail. Here we note only the key features of GSSD in the most general terms.

2.3.1 Mission and Objectives

Computationally, GSSD is designed to:

(1) make evolving knowledge about sustainability more accessible to agents of change for public policy, business strategy; and creative ventures by facilitating access to cutting-edge analysis, innovative technologies, and multidisciplinary knowledge;
(2) facilitate knowledge sharing through customized search engines, quality-controlled knowledge retrieval tools, non-diverse multilingual capacities, and decision-tools to identify options available in technologies, policies, and strategies;
(3) provide theoretical context and framework for use of advanced information and communication technologies to support sustainable development by strengthening capacities for knowledge, decision, policy and practice.

2.3.2 GSSD Functional Capabilities

GSSD provides seven types of e-capabilities (or functionalities) that constitute an integrated and evolving knowledge system. Simply put, GSSD can be seen as:

- a strategy for integrating and organizing knowledge related to the domain of sustainable development, in multidimensional, multisector, and international terms;
- an integrated and wide-ranging international as well as multidisciplinary knowledge-base on sustainable development;
- a method to represent this knowledge by a plurality of interrelated concepts, and interrelationships that are organized in internally consistent and hierarchical form;
- a set of selection and retrieval functionalities consisting of search engines and browsers which operate over the system's quality-controlled knowledge-base;
- enhanced capabilities enabling alternative multilingual knowledge provisions, search, and navigation venues;
- a workflow consisting of synchronization and replication providing a 'cloning' process for all mirror sites;

- a platform for housing reports on new and innovative approaches to the management of sustainability at all levels and in all contexts.

These functional capabilities are integrated in a computational system. The system itself is anchored in a set of human–machine relationships, including material features, physical properties, human operators and management skills.

2.3.3 GSSD Physical Structure

A view of the human–machine features of the system is useful at this point. Figure 2.1 shows the raw building blocks that enable the key functionalities. It is often difficult to envisage *who* does *what* and *how* and *when* as we refer to the functionalities of any computational system. Since GSSD operates as a network of networks and can only be implemented as a set of mirror sites in collaboration with partners and institutions in different locations, the elements in Figure 2.1 are intended to convey the physical requirements for e-networking at each and every one of the mirror sites, in each and every location. This feature is a central to our overall strategy for 'leveling the playing field.'

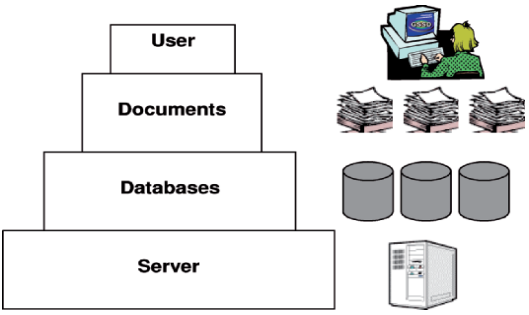

Figure 2.1 **Raw building blocks of GSSD.**

2.4 GSSD e-Networking Functionalities

In order to provide a more informative view of GSSD functions we use an integrative visual representation, presented in Figure 2.2. The remainder of this chapter reviews the functions available to a user by organizing this discussion around a multiple screen view. At the center of Figure 2.2 is the

GSSD English language home page.[4] Each of the individual screen views can be called via the select buttons.

Figure 2.2 **Multiple screen view of key GSSD functions.**

The diversity of functionalities provided – to be reviewed in some detail below – reflects not only the features of the system as a whole, but far more important, the strategy of seeking to respond to the needs of different types of users. Alternatively, one may envisage the same individual user seeking to access a range of different functionalities the specific requirements at the time.

While the intellectual value of GSSD clearly lies in its knowledge-base and domain content, the operational value added is due to the multidimensional perspective available to the user in any given issue. Of relevance in the following discussion is not so much *what* one sees if one opens the site, but rather *why* one sees the presented material, and *what else* is available by navigating through the system.

[4] As we note elsewhere, access to the English Language homepage is undertaken via the GSSD system home page. In the example, the user has located the home page and has selected 'English' as the language in the mirror site closest to him or her.

2.4.1 Overview and Guide to System Functions

A brief note on the separate views in Figure 2.2 provides some orientation for the remainder of this section. Starting from center-left and moving clockwise, we begin with *Using GSSD* that covers in more condensed and short cut fashion some of the most important conceptual issues addressed critical to the domain of sustainability. Here we define what is 'sustainable development,' and point to the core concepts and their constitutive elements, the organization of the knowledge-base, the search options and functions, as well as other features of the site.

Search takes the user (or reader) to the options available for navigation and retrieval, as well as browsing over the GSSD knowledge-base.

What's New is used periodically for sharing materials of special relevance for various uses and users.

Reports points to select papers and research reports generated by the GSSD researchers and collaborators as a means of reducing the gap between the availability of new research and results, and their diffusion and transmission to others.

Submit Site provides the mechanism for knowledge provision, indexing, cross-referencing and housing in the system's knowledge-base. *Submit Site* and *Search* are companion functions – connecting knowledge provision and providers (supply) with knowledge uses and users (demand).

Contact Us is designed to do precisely that – to facilitate communication and exchange. It also maintains a record of individual and institutional contributors and collaborations over time.

Given the rapidly changing nature of content, technology, and strategic interests, this record provides a view of the GSSD initiative since its inception in terms of a history as well as sociology of knowledge

2.4.2 Using GSSD

This segment highlights the conceptual, theoretical, and functional features of GSSD. It can be viewed on a stand-alone basis as well as a pointer to other sections of the site and other functions. It is the core of the system's intellectual backbone or nerve structure. A screen view of *Using GSSD* is in Figure 2.3. Again, the figure is largely for recognition purposes.

To borrow a notable vision from the late Karl W. Deutsch's famous book, *The Nerves of Government* (1963), it is fair to say that *Using GSSD* provides viewers, readers, and users with a guide to the substantive and operational nerves of the system. From the user perspective, the sections on *Introduction, GSSD Function and Architecture,* and *Guide to Core Concepts* are perhaps among the most substantive in terms of showing how the frame

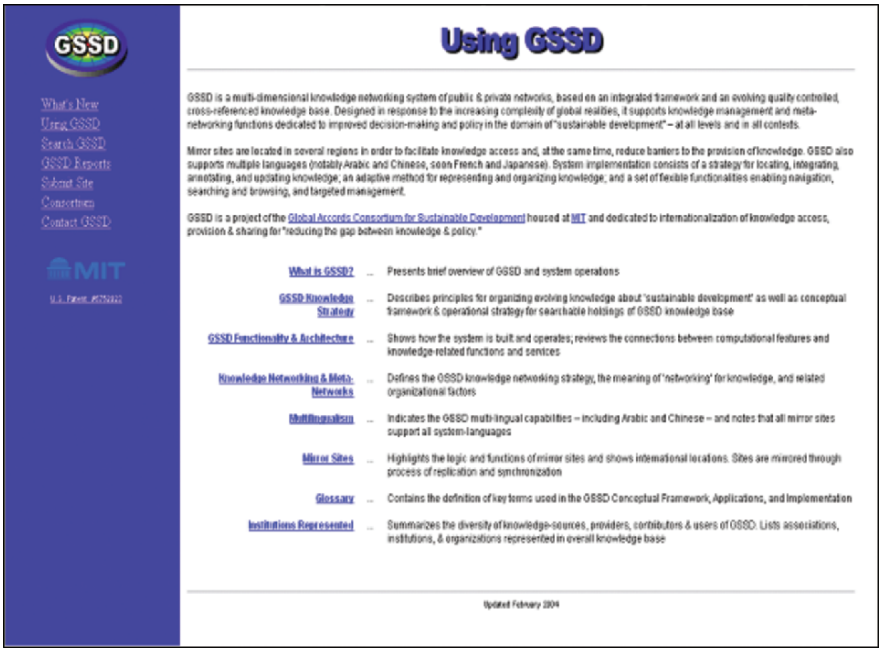

Figure 2.3 **Screen view of *Using GSSD.***

system of mapping sustainability, developed in Chapter 1, serves as the intellectual structure for knowledge e-representation and e-organization. In other words, these site-segments focus on the knowledge-domain of the system. It notes to the user why the subject of sustainable development is important at this point in time, and what are its theoretical implications and contributions.

Much of the actual applications of the foregoing for purposes of identifying, using or contributing to the rapidly growing Internet resources bearing on sustainability – most broadly defined – is summarized in *GSSD Functionality and Architecture.* The *Guide to Core Concepts* essentially consists of the ontology for the knowledge domain. It is reproduced in Appendix A to this book. The static-format of knowledge profiling – the detailed contents for each of the fourteen topics or slices, organized issues or rings, as well as cells, concepts, and sub-concepts – is used operationally as the indexing mechanism for populating the e-knowledge materials on sustainable development. It is also used for interactively for purposes of knowledge provision, search, retrieval, and other system queries.

More specifically, there are two major contributions derived from the *Guide to Core Concepts*. First, we provide a detailed knowledge standard for indexing of the contents of each of the fourteen slices (essentially a subject profile which represents the elements in the ontology). Second is to use this indexing standard or convention in order to (a) search for relevant Internet

resources as potential candidates for inclusion in the GSSD knowledge-base; (b) provide a standardized method for referring to, and reflecting, the contents of selected resources; and (c) enable systematic cross-referencing across topics that are usually treated in disparate or unconnected contexts.

Jointly, these factors constitute the overall standards for addressing multidisciplinary knowledge with diverse forms of knowledge representation. Overall however, on strictly intellectual grounds, the most powerful source of value-added is the knowledge-domain ontology for sustainable development.

2.4.3 Search GSSD

The retrieval of knowledge from the GSSD repository can be done in a content driven manner. For example, for the user who wishes to use GSSD largely as a selective cyber-library, *Search GSSD* puts forth a number of strategies and options, as well as information about the conceptual framework, the indexing system, abstracting procedures and so on. The screen views here are seen from the reader's or user's perspective. He or she may not wish to know the details pertaining to conceptual issues or technical matters, so the bare minimum is covered to enable educated usage.

Users who call upon *Search GSSD* may have a wide range of interests and motivations.[5] They often range from highly focused and knowledgeable in their own domain, seeking to explore adjacent domains of sustainability, on the one hand, to those that have broader interests and use the search options for exploratory or experimental purposes – and possibly every variation thereof. To facilitate any knowledge-driven search process, it is helpful to have access to alternative options with different degrees of specificity and different extent of conceptual guidance. Figure 2.4 shows the basic screen view of the first order options. Again, the view is for recognition purposes.

Depicted in this figure from left to right are the Text Search (available in Simple or Advanced forms), All Holdings (spanning the entire knowledge-base), Industry Holdings (referring to a customized knowledge-base focusing on industrial sectors of economic activity, and the search over the *Alliance for Global Sustainability* (AGS) materials. With the exception of the *Text Search*, the other options are all graphical in form.

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[5] Parenthetically, recalling Figure 2.2, here we note that the Consortium Button links to the institutions and collaborators that were instrumental to the development and implementation of GSSD throughout its early experiments and pilot phase. Consisting of governmental institutions, corporations, research foundations, and academic institutions, its informal core constituted the founders and core contributors of GSSD, including the Global Environment Facility, MISTRA (Sweden), AT&T, Xerox, Sony Environment Center (Europe), and others.

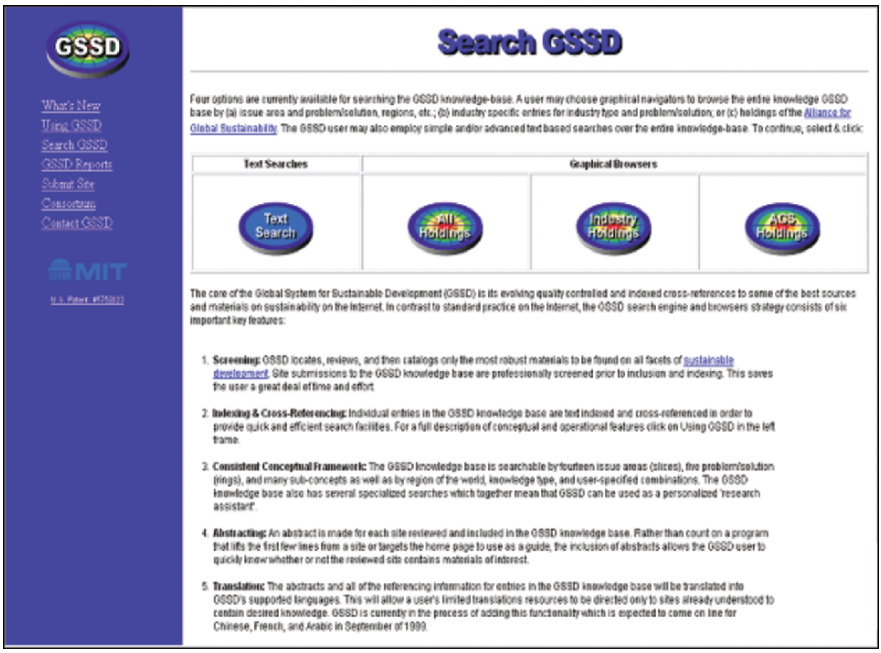

Figure 2.4 **Screen view of *Search GSSD*.**

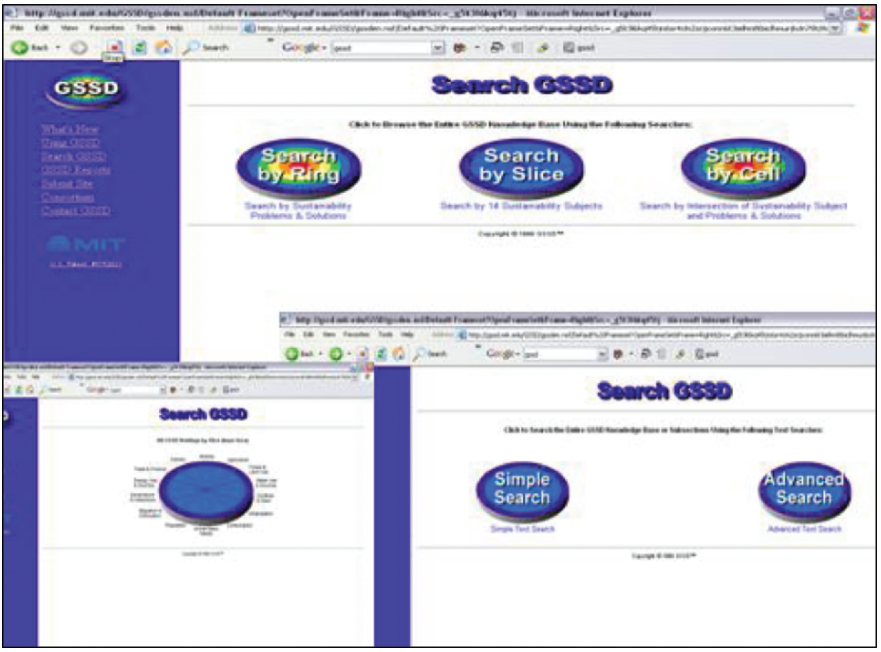

Figure 2.5 **Screen view of more detailed graphical browsers and search options.**

An added view of the search options is represented in Figure 2.5, derived from a combined screen shot. The top part of the figure shows which concepts-driven search, that is, by *slice* (domain), *ring* (dimension) and *cell* (concept).[6] These options are graphical in nature, used as browsers, and generally applied to *All Holdings* (unless specified differently by the user). The lower segment of this combined screen view shows the dedicated search for industry holdings on the left, the two text-based searches on the right.

Turning briefly to *Advanced Text* search, Figure 2.6 shows a screen view of the entire mode as the user scrolls down to the items desired. It individual interest, search style, or specific needs tend to be particularistic. For illustrative purposes, we show an example of the knowledge-base queried.

In this illustrative case, we are interested in exploring the database for *Conflict and War. A* couple of moves may provide direct access to materials required. By selecting the Conflict and War slice, fusing *All Holdings* for instance, and the focusing on the 'sustainability problem' ring – we are now doing a slice/ring search.

The following type of results are returned: first a listing of all returns that meet this *general* slice/ring query,' with a brief identification of relevant concepts; then if the user selects the second item on that list, for example, the appropriate *Abstract* is returned. If the abstract is of interest to the user, then the next step is for the user to click directly on the url of the original site itself. At this point, the user has obtained a considerable amount of information about the nature of the relevant e-resources, in both general and specific terms.

Figure 2.7 shows a screen view of the hypothetical retrieval in response to a user query. By clicking on the noted url, the user is directed to the original source.

2.4.4 Submit Site

Given that the knowledge-base for the sustainability domain is evolving, as well as is distributed and dynamic, facilities must be available for submission and quality control of selected material into the knowledge repository. *Submit Site* enables web-based inputs of knowledge-content. The operational protocol (facilitates cross-indexing and cross referencing when *Search GSSD* is called upon. It is the conjunction of *Submit Site* and *Search GSSD* that provides the functionality for the interactive knowledge-base site in ways that directly reflect the user's needs.[7]

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[6] The graphical browsers are designed to follow the GSSD conceptual framework. The *Guide to Core Concepts* provides a useful reminder of the content representation for the knowledge-base.

[7] By referring to the knowledge-base as a cyber-library, we use a conventional idiom to convey non-conventional functions.

Figure 2.6 **Screen view of** ***Advanced Text Search*****.**

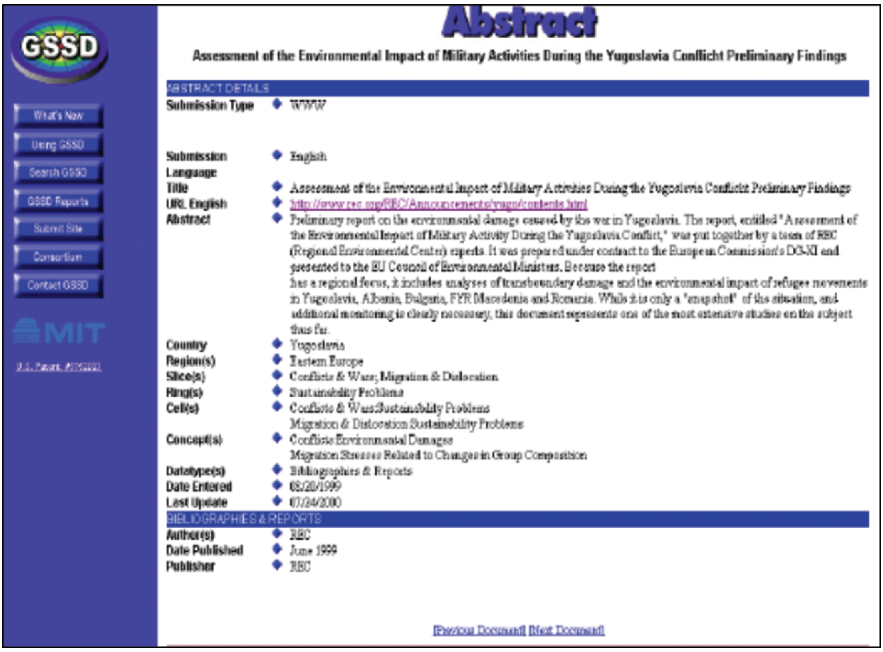

Figure 2.7 **Screen view of** ***Advanced Text Search Result*** **(example).**

2.4.5 Reports

Reports points to the new knowledge and research developments of the GSSD team, its collaborators, and their related ongoing projects. Central among these is the MIT Press Series on *Global Environmental Accords: Sustainability and Institutional Innovation.* This series consists of the most innovative research on environment and sustainability in the social sciences. In many ways, it provides the intellectual correlates strengthened by the contents of the *Series* supports as well as by ongoing research initiatives associated with the entire GSSD enterprise. As such, the knowledge-base is enhanced a regular basis.

The preview of new research undertaken within the broad GSSD context is found in *Research* and in *Science, Technology & Policy.* These are mainly pre-publications reports or phases of ongoing research, and are available to interested GSSD users.

2.5 e-Knowledge Uses and Users

Who uses a global e-knowledge networking system like GSSD? Why and how? Simple as these questions might seem, the answers are somewhat more complex. There are multiple *user-types* with different *goals and motivations* and often using different parts of the system, hence different *system targets*. At the most general level, there are four generic user-types stand out: (a) access users for search, retrieval, or content-related purposes; (b) input users for provision of the knowledge-base; (c) system-wide users who are essentially partners in the global initiative; and (d) co-developers who are users motivated by the challenge of improving performance and creating new functionalities.

2.5.1 Access Users

Professional access-users come from several very different constituencies, each with different goals and priorities, as well as demands and requirements. Among these user-types are (i) researchers, educators and students who use GSSD largely as a cyber library, drawing on search and browse options; (ii) individuals in the public sector, at national, international, inter-governmental levels, who are interested in, or have responsibilities for, program development, policy formulation, or stakeholder assessments, for example, and consult GSSD for the cross-referencing, indexing or conceptual structures, as well as for its Reports; (iii) decision-makers, i.e. persons who are responsible for formulating action-strategies or making choices about policy directions and trajectories, in both the private and public sectors; (iv) policy

leaders, for agenda setting, consensus-building – beyond matters of stakeholder representation – in diverse institutional contexts; (v) professional associations interested in or connected with any of the topics (slices) or issues (rings); and (vi) any of the above who are GSSD current collaborators on theory, content, policy, or practice.

2.5.2 Inputs Users

This set of users consists principally of knowledge providers. They are the participants in and the collaborators for maintaining and improving the evolving knowledge-base. Their principle usage is *Submit site.* They may be known provider, or anonymous web users. They may be one time input users, or multiple time users. *Submit Site* is often shaped by their own concerns following visits to *Search GSSD.* In essence, these are knowledge providers, who seek to use the system to diffuse their knowledge-base, data, information, theory, policy positions and the like. While they do follow the basic *Submit Site* directives into the knowledge-base, they cannot be providers for the GSSD *Reports* section.

2.5.3 System-Wide Users

In the most general sense, system-wide users are (a) mirror site administrators and staff; (b) content participants in GSSD multilingual operations; or (c) managers of local content provision. Chapters 3 and 4 address the organizational and technical requirements associated with system-wide users.

2.5.4 Development Users

Cumbersome as this designation might be, it covers some specific roles and functions pertaining to extension of knowledge management capabilities, inclusion of new languages, adding operational efficiencies, and a range of activities that can best be labeled as frontiers issues. A particular variant of co-development is reflected by system developers who use the intellectual architecture of GSSD as a standard and platform for their own products, which may be distributed subsequently through GSSD. There are also cases where the basic conceptual framework appears to be used by others strictly for purposes of organizing and communicating their own materials.

2.5.5 Partners and Partnerships

By definition, distributed knowledge management involves some degree of collaboration on a worldwide basis. Such collaboration requires a particularly

diverse set of partners, in order to represent different stakeholders in the global system, at different levels of development. The GSSD collaborators are homogenous. They are nearly as diverse as diverse as the configuration of the international community.

For the most part, the partners consist of different user-types (as summarized above), with special contributions, requirements, and responsibilities. In general, however, they are all interested in exchanging information, data and knowledge, exploring common problems encountered in Internet-based information management, anticipating evolving directions in technology and applications, and enhancing ways of expanding GSSD abilities and functions to meet the needs of diverse users which have different demands.

The common goal shared by GSSD partners is to address innovative responses to sustainability challenges – at all levels of development, in all parts of the world. They seek to provide multiple forms of networking facilities across stakeholder communities to help identify innovative approaches, enabling technologies, as well as new institutional, financial and regulatory mechanisms for meeting sustainability challenges that confront us all, in both rich and poor countries. Four of the chapters in Part II are devoted to the challenges of e-partnering.

2.6 Conclusion

This chapter focuses on the other side of *Mapping*, namely the transformation of a knowledge frame into a computational system for the purpose of facilitating access of knowledge about sustainable development. At the same time, however, we fully appreciate the powerful barriers that impede access to the Internet for users in many parts of the world. Aside from matters of censorship, government control, or other politically induced impediments, there are notable e-barriers of a structural nature.

Accordingly, in this chapter we address the characteristics of six sets of barriers, first by highlighting our solution strategies. The computational aspects of the solution-strategy are designed in an integrated form and implemented via GSSD. By way of illustrating the basic GSSD functionalities we presented a multiscreen to help guide a simplified tour of its operations.

Against this background, Chapter 3 focuses on the development and application of a global workflow strategy customized specifically for multilingual knowledge content. The work flow represents the collaborative process in practice. Accordingly, we signal the steps that each partner takes in order to generate an integrated, distributed, multilingual knowledge e-networking system. We consider some key user-centered features of the system and note key operational features that reduce the e-barriers highlighted earlier. In this

way, we address the front-stage as well as the backstage properties of the system. In Part II we focus on the institutional and organizational innovations that have been made in order to routines' the workflow among the e-partners (Chapter 5), and reflect on the same issues as seen by the partners themselves (Chapter 7). The juxtaposition of views and experiences itself is revealing as well as informative.

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