Chapter 4

# GLOBAL e-PARTNERSHIPS AND STRATEGIC COLLABORATION

Nazli Choucri, Farnaz Haghseta, and Carlos I. Ortiz

## 4.1 The Fundamentals

This chapter focuses on three fundamental and interrelated issues. The first pertains to the *roles and functions* necessary to maintain and sustain distributed knowledge e-networking worldwide. The second focuses on the nature and types of *cyber-partnerships* that constitute GSSD as a global e-knowledge networking system. And the third revisits the strategy we developed to *transcend e-barriers* in the deployment of knowledge for sustainable development.

Addressing the first issue, we show the organizational system and the management division of labor required to make a distributed knowledge networking system work effectively, while maintaining a necessary degree of autonomy, flexibility, and adaptability. In other words, we address who does *what*, *when*, *how*, and *why*. Through a review of role-based responsibilities, we illustrate the basic system functions for the collaborative operations. The roles presented here – in terms of definitions, functions, and responsibilities – hold irrespective of the specific partnerships or modes of collaboration that may be in place at any one point in time or in any part of the world.

Addressing the second issue, we highlight specific challenges of partnering by focusing on select activities and deliverables (with examples for illustrative purposes) and uses flow-diagrams to represent the processes involved in customizing each type of partnership. In addition, we offer guidelines for enabling new GSSD partners by translating the roles and functions described in the first part of this chapter into the specific activities that must be undertaken by different partner types such that the individual as well as the collectivity benefits from the collaborative enterprise.



*N. Choucri et al. (eds.), Mapping Sustainability: Knowledge e-Networking and the Value Chain*, 67–82.

Addressing the third issue, we revisit the issue of e-barriers to knowledge for sustainability and the strategies we have developed to reduce these barriers. By definition, distributed knowledge e-networking and collaborative management involve decentralization, diversity, and differentiation, as well as addressing complexity, emphasizing clarity, and facilitating coordination.

While sustainable development as a knowledge domain is the focus of this book, we recognize that the standard economic growth paradigm still remains dominant nationally and internationally. It continues to shape the types of *human activities* undertaken and pursued as well as the *content of knowledge* about human activities. At the same time, however, fundamental changes worldwide are creating new conditions and shaping new perspectives that may well call into question the robustness of the basic economic growth paradigm. For the first time in human history, pervasive e-connectivity enables the articulation of a wide range of views and the voicing of alternative perspectives. When coupled with new e-technologies, these powerful enablers create possibilities for framing alternatives to the dominant perspectives in national policy and global strategy.

Of the many features of contemporary realities, at least two are especially relevant for our concerns. One is appreciating the *complexity* around us. The other is recognizing the *diversity* in all domains of human life, in social as well as natural arenas.

## 4.2 Managing a Global e-Knoweldge System

Given that GSSD provides the user with choices of language as well as server location, the screen view of the system's home page, shown in Figure 4.1, signals the choices at the point of access. This figure also conveys the distributed nature of the system as a whole. We now turn to the roles and functions to support distributed e-collaboration, the responsibilities that must be put in place for sustainable met, and the ways in which these enable collaborative e-networking. The discussion proceeds from the collaborators' point of view, namely those institutions or individuals responsible for making GSSD functionalities available to their constituencies, and not from the general user's point of view.[1]

[1] Such modes reflect the various activities required for the establishment, maintenance, and routinization of an evolving knowledge system. Also addressed here are key features of GSSD's current operating system (based on Lotus-IBM technologies) and basic system requirements for operation of the system.


***Figure 4.1*** **Screen view of GSSD home page.**

### 4.2.1 Roles in Modular Terms

By focusing on the issue of *roles* in the management of a distributed knowledge system, we consider not only *who* are the key actors, but also *what* is it that must be done (and by whom) so that the users can be well served. In this context, the w*ho* consists of the knowledge partners serving as founding partners of this global e-network. On balance, the major role-types consist of the following:

- *Content administrator*
  Responsible for managing the static and dynamic content and overseeing the workflow process
- *Content provider and reviewer*
  Supervises and reviews knowledge content by applying the GSSD knowledge rules to enable user effective access and retrieval
- *Content translator*
  Translates all abstract-content into GSSD-supported languages and resolves the ways in which differences in meaning especially when the basic glossary vocabulary for expressing or representing aspects of a new issue or technology is not yet fully developed
- *System designer*
  Designs the key operating functions that enable the system to be altered as needed in order to accommodate different languages, contexts, and requirements, while still retaining overall system cohesion

- *System administrator*
  Maintains both content and physical integrity of the e-network, ensures the smooth flow of communication across mirror sites, partners, and distributed locations, and is directly responsible for managing responses to system problems and undertakes 'trouble shooting' activities, as needed

At the same time, however, distributed knowledge systems are often managed by individuals operating in more than one role.[2]

### 4.2.2 Knowledge of e-Management

Table 4.1 shows role types, descriptions, and tasks, as well as the Lotus-IBM software components utilized in the current GSSD version.[3] Three of the five essential roles pertain to *knowledge issues* in terms of content and management, while two relate to *system operations* and network management, We stress, however, that the system as a whole – its intellectual features, concepts and theory, as well the overall architecture and operations – are independent of the platform or software at hand.[4] Given that our goal is to facilitate knowledge management capabilities and operating practices, not to build note briefly only two operational conditions and system requirements central to the Lotus environment.[5]

The first of the role types is the *Common Platform-Client Environment* which consists of the Lotus Notes client software, a Notes *user ID file* and *password*, and the appropriate access to relevant databases.[6] These elements are fairly straightforward in nature and once routinized, they remain operative as long as needed.

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[2] For example, one individual may be responsible for undertaking multiple roles (e.g., as both a content provider and translator) or multiple people may be responsible for fulfilling the functions assigned to one role.

[3] Table 4.1 represents the operators of the system, and as such may not be of interest to users or readers.

[4] Since administration of all GSSD mirror sites currently relies on the Lotus operating platform, there are some common problems and challenges often encountered that require some attention at this point, these are largely of a technical nature, bearing on the features of the commercially available software which GSSD currently uses.

[5] Earlier versions of GSSD were written in Mac Common Lisp with an application system developed at the MIT Artificial Intelligence Laboratory. The Lotus system is commercially supported and available worldwide, thus providing relatively robust support for GSSD applications. When GSSD was conceived, designed, and implemented, and the initial test phase completed, the only platform to support its operations was that provided by Lotus-IBM. There was no alternative at the time, and the Lisp system developed at the MIT-AI Lab neither served as our test bed, had little documentation and no previous tests of robustness, nor was there any evidence that the system could scale.

[6] For more on the Notes application, please refer to technical documentation provided by Lotus-IBM Corporation.

***Table 4.1*** **GSSD operational roles and functions.**

| Role Type | Role Description | Functions and Regular Tasks | Software Currently Used |
|---|---|---|---|
| Content Administrator | Manages all content on GSSD | Submit, modify, and review abstracts, and edit static pages | Lotus Notes |
| Content Provider and Reviewer | Enters and reviews content (abstracts) on GSSD | Submit, modify, and review abstracts | Lotus Notes |
| Content Translator | Translates content on GSSD | Translates content between English and local languages | Lotus Notes |
| System Designer | Designs database elements and web pages | Creates databases, templates, and agents | Lotus Designer, Domino Global Workbench |
| System Administrator | Manages the users, databases, and servers connected to the GSSD Network | Installs and manages servers on the local network; manages user access control and security features | Lotus Notes Administrator |

The second pertains to the identity of the *GSSD Documents in the Lotus System*. In the *Notes* environment, documents are defined as individual sets of information, which are analogous to index cards. In this context, each document contains a variety of fields with content (knowledge type, information, etc.). The GSSD design relies on two basic document types, static and dynamic. Static documents include content that rarely changes once it is incorporated into the system, such as *Reports* and *Slide Shows*. Dynamic documents include content that require period updating and/or maintenance such as *Abstracts*, as well as any information or knowledge that require dynamic representation, in its content or its display.

These dual features appear quite simple. However, the actual operations of the system and its reliability are directly related to the discipline and diligence exerted at the system installation phase and initial implementation phases.

The issues addressed so far in this chapter constitute of the view of key features, behind-the-scene, required to support knowledge e-networking ane strategic knowledge management. They also pertain to the human and physical infrastructures that enable the knowledge content on sustainable developed to be created, distributed, translated, and located in the GSSD knowledge-base.

## 4.3 Partnership Essentials

GSSD exists due to the commitment of the global partners who contribute to the technology, content, design, and translations necessary to make the system operate. In each case, the partners establish a formal relationship with GSSD at MIT, which helps enhance the entire GSSD network without undermining their own individual autonomy. Given there are few precedents for such activities devoted to sustainable development as a knowledge domain, we consider this effort as a powerful learning-by-doing initiative and highly dependent on the commitment and contributions of the partners.

### 4.3.1 Modes and Activities

In this context, 'modes' means the contribution and style of operation and 'activities' refers to the specific tasks in question, as displayed in Table 4.2. It is important to make a distinction between general GSSD roles and requisites, on the one hand, and operational GSSD partnership responsibilities, on the other. The former addresses more general functions that must be performed for the system to operate effectively. GSSD Partners contribute to all of these functions. The latter looks at the higher-level significance of Partners to the operation of GSSD and describes current operating partnerships.

Two of the five partnership types at this time, namely, the *Content* and the *Translation* partnerships, focus on content-related issues, and two others, the *Mirror Site* and the *Development* partnerships, deal mainly with system operations and management. The fifth type, the *General Supporters* partnership, reflects a more general collaborative rubric, reflecting the interests of the partners in question.

### 4.3.2 Illustrating Three Cases[7]

The GSSD system manages left-to-right phonetic character sets (such as Russian or Latin), right-to-left phonetic character sets (such as Arabic or Hebrew), and ideographic character systems (such as Chinese or Korean). Even mixed character systems can be used, such as Japanese, which utilizes two separate phonetic character sets (Hiragana and Katakana) as well as an ideographic set (Kanji). Three cases illustrate the current partnerships:

[7] The fourth case, not covered here, involves GSSD-France, located initially at Ecoles des Mines at St. Etienne in France. The project leader jointed the French government as a Cabinet member, thereby placing networking matters on hold pending organizational adjustments.

***Table 4.2*** **GSSD partnerships by types[8].**

| Partnership Type | Description of Partnership | Example of Partner |
|---|---|---|
| **Content Partner** | Locates appropriate content for the GSSD knowledge-base, then abstracts, indexes, and publishes to the web. Also reviews submissions from local web users, and may be responsible for their own organizations' content. | Ministry of Science & Technology, Beijing, China |
| **Translation Partner** | Translates both GSSD interface design elements, static pages, abstracts, and documents. | American University in Beirut, Lebanon and Écoles Des Mines, St. Étienne, France |
| **Mirror Site Partner** | Maintains a Live Server, and integrated into the GSSD system, which contains a replica of the GSSD system. | University of Tokyo, Tokyo, Japan |
| **Development Collaborator** | Provides development support, in terms of technology, expertise, collaboration, etc. | Lotus-IBM, USA |
| **General Supporter** | Provides general support in terms of participation ('equity sweat'), in-kind or financial contribution. | Baker & McKenzie, AT&T, and Xerox Corp. |

(1) *GSSD-Arabic*: At the American University in Beirut, Lebanon is one of the leading educational institutions in the Arab World and in the Middle East region as a whole. It has long been a pioneer in the region, and as the host of Arabic GSSD, it serves as the focal point for the provision of local knowledge in Arabic and the subsequent incorporation into the overall GSSD knowledge-base.[9]

(2) *GSSD-Chinese*: The core GSSD partner is the Ministry of Science and Technology, Administrative Office for Agenda 21 (ACCA21), responsible for the management of China's own national strategy for sustainable development – at local, regional, and national levels. ACCA21 oversees the provision of local knowledge, the distribution of global knowledge, as well as all aspects of mirror site in China.[10]

(3) *GSSD-Japanese*: GSSD-Japan mirror site located at the Tokyo University in conjunction with the *Alliance for Global Sustainability* (AGS), and is at early stages of development. The system operates in English

[8] Partner examples are of August 1st, 2000.

[9] See Chapter 7 for a more complete discussion of GSSD-Arabic.

[10] See Chapter 8 for a more complete discussion of GSSD-China.

but its Japanese language function, as well as all multilingual capabilities, multilingual functionalities are yet to be rendered operational.

By way of illustrating the operational logic of e-partnering, the following section presents a 'walk-through' of system operations. In so doing, we trace the path undertaken by a new collaborating institution.

## 4.4 Forging New Partnerships

Entering into a new partnership with GSSD, with the general expectations and responsibilities associated with involves the application of relatively broad guidelines.[11] The general steps, summarized in Figure 4.2, serve as an outline for tracing the key steps for different partnership types. The flowchart logic in Figure 4.2 defines the key elements in the process. The partnership types are noted at the top of the figure, and the relevant steps are signaled accordingly.

### 4.4.1 The Content Partnership

The Content Partners are the core of the GSSD knowledge-base. They are responsible for producing the submissions and/or screening new entries submitted by web users. Content Partners may be interested in populating a particular issue area of sustainability, such as conflict or energy, or a particular industry or industrial process, or may be responsible for incorporating their own organization's site materials into the GSSD knowledge-base.[12]

### 4.4.2 The Translation Partnership

Human-translation is undertaken for the following types of documents: (a) static and dynamics pages when a language is added to the system and (b) individual abstracts when new abstract items are submitted are routine features of GSSD operations. Retrieval of any items in the GSSD knowledge-base can be done through the use of any of the system's languages. Given that the 'founding languages' for GSSD are Arabic, Chinese, and English, the Translation Partners help to maintain the GSSD web interface and keep the knowledge-base current in each of the GSSD supported languages.

[11] Information about operational features of the partnerships and/or the nature of the guidelines for each of these partnership modes can be obtained from the authors.

[12] The exact steps for becoming a Content Partner vary from organization to organization, but the general steps that follow provide a good guideline.

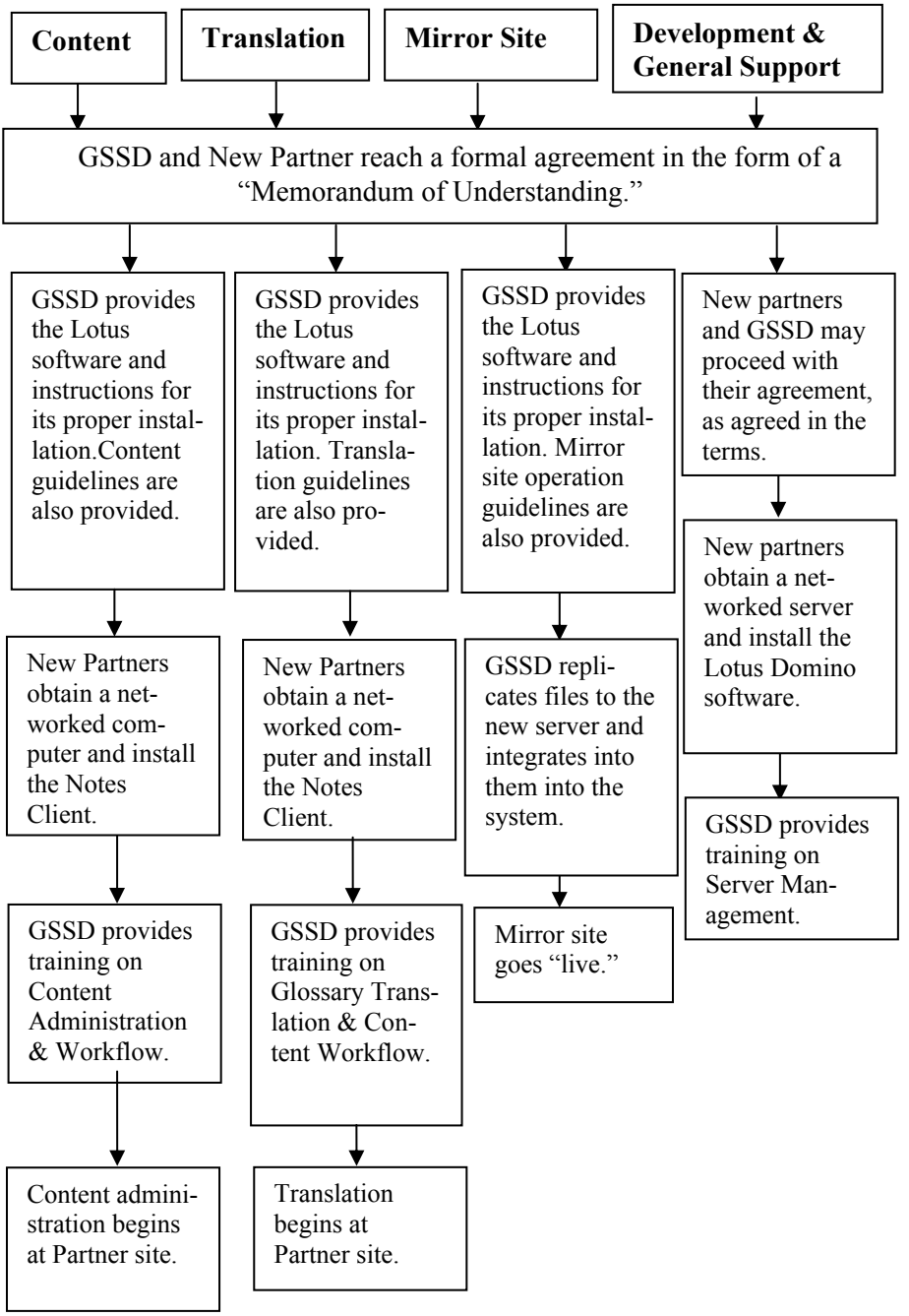


***Figure 4.2*** **General steps for forging new partnerships.**

The translation of GSSD abstracts-content into multiple languages reduces the impacts of an important e-barrier to knowledge access. Typically, the cost of full-document translation is too high for standard web surfing. The ability to obtain synopses of site content in one's own language reduces significantly the financial and human resources necessary to access e-resources available in cyber venues. By exploring the contents of knowledge-abstracts, the user can identify in advance the sites of interest and select the materials for translations, as relevant.[13]

### 4.4.3 Mirror Site Partnership

Mirror site partners establish and maintain a server which houses an exact duplicate of the GSSD application, in all supported languages. The duplicate files, or replicas, are scheduled for automatic update updated in order to ensure that all mirror sites contain the same system functionalities and knowledge-base. In some cases, the mirror site strategy helps to overcome some problems associated with intermittent Internet connectivity, by providing better access to the GSSD system closest to of the user. In China, for example, early in the collaborative profess, we found that bandwidth (the speed with which information moves over an Internet connection) was relatively good within its borders, but bandwidth between China and other countries often less so. In such cases, an English speaker in China would use GSSD-English on the Beijing mirror server rather than seek access to the MIT mirror in Cambridge, Massachusetts. Similarly, a Chinese-speaking user in Europe may probably prefer to use the GSSD-Chinese on the mirror server in France.

All of this will undoubtedly change over time, with better bandwidth and infrastructure and lower cost of Internet access. Overall, providing users worldwide with access to alternative locations and languages is a powerful enabler for enhancing knowledge e-networking.

### 4.4.4 Development and General Partnerships

The relationship between sponsoring partners and GSSD takes many forms. System supporters often prefer to select their own modality. Development and General Partners can provide the experience, labor, hardware, software, and/or financial support necessary to keep GSSD moving forward. Notable examples include the then Lotus Corporation, which provided GSSD with software and technical expertise, the *Alliance for Global Sustainability* (AGS), which facilitated research with financial support, and MIT's Department of Political Science, which continues support the GSSD initiative in notable ways.

[13] The decision to engage in full-translation of any text can be made by the user at any point and is outside the GSSD scope.

## 4.5 Transcending e-Barriers

At this point, we revisit the e-barriers introduced earlier in Part I and we highlight ways in which the overall GSSD strategy is designed to reduce their impacts. The goal is to transcend attendant constraints on user-access to e-knowledge pertaining to domain of sustainable development, broadly defined.

A combination of factors impedes access to knowledge and e-networking pertaining to sustainable development. Some are due to the nature of the domain itself; others are related to the often cited digital divide, and still others reflect the reality that knowledge provision on cyber venues is usually dominated by the industrial countries. Earlier, we identified and addressed six sets of e-barriers. These consist of (i) conceptual ambiguities related to 'sustainable development'; (ii) explosion of materials on the Internet; (iii) constraints created by realities-on-the-ground; (iv) dominance of English on cyber venues; (v) biases in knowledge provision; and (vi) financial burden of cyber access. Proceeding sequentially, we now review key features of our strategy for transcending each of these e-barriers.

### 4.5.1 Developing a Conceptual Design

Given well documented conceptual ambiguities surrounding most if not all aspects of 'sustainable development' – including disagreements about basic definition and critical features – the provision of conceptual clarity emerges as a necessary requisite for moving forward. The complexity of definitional issues is evident in both in research and policy circles, as is the diversity of views and definitions generate a range of contentions surrounding both the concept and its uses. The challenge, therefore, is to provide internal consistency, coupled with clarity of conception and definition.

By undertaking a detailed *mapping* initiative, presented in Chapter 1, we put forth both the logic and the framework for representing the knowledge domain, as well as the rules for generating *ontology for sustainable development.* The ontology helps to guide our understanding of the overall issues and of their constituent elements to the extent feasible and organize existing knowledge pertaining to the broad domain of sustainable development.

Recall that the framing rules consist of two sets of features for each item of knowledge content – namely *domain* and *dimension* – as well as a detailed content differentiation within each of these features. Jointly, they provide an indexing system for organizing knowledge about ways in which human activities generate problems, and the nature of the solutions that are framed in response. In addition, we introduced a third, overarching, framing feature that encompasses the forgoing, namely, the representation of knowledge about

*coordinated international actions* designed to help manage transitions toward sustainable development. These actions consist of the multilateral initiatives and moves designed to address and help manage sustainability problems at all levels and in all parts of the world.

Coordinated international actions include legally binding commitments (i.e. international treaties and conventions), as well as non-binding understandings or expressions of desired directions of policy (such as *Agenda 21* and the *Millennium Development Goals*). Earlier, in Chapter 1, we noted the most salient types of coordinated international actions to date. Over time, of course, we would expect these actions to reinforce emergent trajectories toward sustainable development.

Framing sustainable development as a knowledge domain serves as the foundation for the entire GSSD computational design and its implementation. It consists of the directives for indexing knowledge-content and for enabling search and retrieval of content. Thus, while this initiative may not entirely resolve the conceptual ambiguities surrounding sustainable development, it does provide considerable order in the knowledge domain and its representation.

### 4.5.2 Managing the Explosion of e-Content

A rapid Google-search for *sustainable development*, undertaken on April 26, 2006, yielded 197,000,000 returns. This fact signals the volume of materials at hand, but it provides no information about nature, type, quality, content, reliability, and so forth. It is not unusual for a user to spend considerable time online searching for relevant materials on any specific set of issues. From a knowledge management perspective, the generic dilemma is basically one of designing discriminating categories for dealing with what appears to be information overflow. In response, we developed a *knowledge provision process* to help the select relevant content, guided by quality controls derived from *mapping sustainability.*

This entire initiative is predicated on the explicit intent of protecting intellectual quality and institutional integrity. This means that we utilize specific criteria for selecting content-materials and self-consciously discriminate in favor of reliability. Some observers might construe this approach as a censorship strategy. Yet users can always opt for Google or other search engines in order to caste a wider net, unconstrained by GSSD quality controls.

In short, the knowledge-provision process, presented in Chapter 3, consists of specific criteria and decision-rules for all content-providers and content-submissions. Once submitted to GSSD, any knowledge item is reviewed for content and for completion in the fields in the submission form. This process helps to routinize the knowledge provision process and contributes to consistency in knowledge representation, retrieval and integrity.

### 4.5.3 Recognizing Realities-on-the-Ground

Powerful infrastructure constraints often impede access to the Internet in many parts of the world. These are well recognized and well documented. Digital differences between rich and poor are routinely noted in any review of the global economy, and almost every international institution dealing with developmental issues has noted these differentials as obstacles to change. Even with robust infrastructure prevailing organizational may be such as to impede access to cyber venues.

Our approach to this type of e-barrier is to implement a mirror-sited strategy, whereby the GSSD-MIT system that resides physically on an MIT server is replicated in other locations worldwide. And, as indicated earlier in this chapter, GSSD computational and organizational technologies ensure that the mirror sites remain identical in system operations and knowledge content. Mirror sites also allow users to connect to the server closest to them, to download materials as needed and even to keep the entire knowledge-base offline for detailed search – and then connect to the Internet for retrieval of the full document, if required, or to engage in further search and retrieval. Such a strategy is contingent on a set of operational partnerships with GSSD collaborators so as to facilitate overall knowledge provision, on the one hand, and enhance the utility of knowledge use on the other.

Earlier in this chapter we noted the various partnership types that sustain a distributed system as GSSD, as well as the types of roles of functions that must be undertaken in order to provide the institutional or organizational foundations for computational efficacy. Much of the management of a distributed knowledge networking system involves the goodwill and efficiency of individuals with different skills and interests, and of institutions with differing missions and priorities.[14] This diversity amounts to a valued resource in its own right.

### 4.5.4 Transcending the Dominance of English

As we are often reminded, about 385 million people in this world speak English as their native language; but roughly 6.5 billion speak something else. The Internet is an English-speaking venue – in a world that is non-English speaking. Differences among languages invariably involve differences in *understandings* created by linguistic disparities, as well as differences in expression and articulation.

[14] Select chapters of this book are authored by such individuals – located in such institutions – recording their own views and experiences, as well as suggestions for next generations of initiatives such as GSSD. Other chapters address the challenges of retaining the replica strategy for the mirror-sites.

Our solution to this very real problem is to develop a strategy for *multilingual knowledge* e-networking. First, a shared understanding of core concepts must be established across languages. Second, a computational logic is needed for rendering consistency across languages for each of the knowledge-items in the database. Third, computational capabilities must be available in order to implement search and retrieval across languages.

All of these elements are essential in order to enable users and providers from various parts of the world to express themselves in the appropriate language, idiom, and terminology, and these elements enable the computational features of the system to recognize the differences among languages. If these requisites are met, then the synchronization and replication of content across all mirror sites can be undertaken and rendered robust.[15]

### 4.5.5 Reducing Bias in Knowledge Provision

In general, e-barriers such as those addressed above reinforce prevailing biases in e-knowledge-provision. For example, given structural impediments to e-access and the dominance of English, e-materials and resources are provided by users in industrial countries. This conjunction of factors means the voices expressed and the messages that are heard come mainly from the 'north.' Aside from the issue of equity in global expression – so critical in its own right – the bias of overrepresentation creates an echo effect about the nature of the problems and the types of solution, irrespective of empirical foundations.

The approach we developed to address the bias problem consists of the design, development, and implementation of a workflow process coupled with a systematic knowledge provision process. In Chapter 3, we introduced a customization strategy for the workflow process in response to different situations on-the-ground and different realities facing the various collaborators. The workflow itself constitutes (a) a key element of the collaborative process, (b) an essential requisite for computational purposes, and (c) a fundamental feature for content-consistency across multilingual databases.

Also in Chapter 3, we put forth guidelines for knowledge provision, as well as computation and organization capacity to allow anyone to participate creating the GSSD knowledge-base, and to engage in retrieval, search, and knowledge access in languages other than English. While the *workflow*

[15] Recall that much of the discussion in Chapter 3 addressed these issues, and the appendices to that chapter provided added information.

*process* is designed to support global collaboration, it also protects individual and institutional autonomy for all participants.[16]

### 4.5.6 Designing Cost-Effective Strategies

The sixth and final impediment addressed in this book pertains to matters of cost and price. Despite trends toward homogenization (not necessarily harmonization), the costs of Internet access vary greatly across countries as does the cost of hardware and software. The economics of Internet access make it difficult for most people, in most paces, to participate in the new cyber possibilities, thus compounding the impacts of infrastructure variability and reinforcing any prevailing bias in provision.

Shaped by differences in government policy, economic conditions, structural features and other factor, we cannot reduce such variability at-the-source, so to speak. What can be done, however, is to structure collaborative partnerships in ways that build upon pragmatic in-kind cost-sharing approaches. Contributions of this sort reduce burdens borne by the collaborating partners. For the most part, such cost-sharing supports all human and machine requirements for operating the mirror sites.

## 4.6 End Note

This End Note serves as a conclusion to Part I of this book. Focusing on *mapping sustainability,* Chapter 1 provided the conceptual framework for the design and development of sustainable development as a knowledge domain. The subsequent chapters presented the computational features that support the operations of a global knowledge e-networking system. Overall, Chapters 1–4 are theoretical and analytical, as well as methodological and computational. Jointly, they report on our strategy for transcending the barriers to e-knowledge and implementing a collaborative e-networking system with global reach.

The chapters of Part I all contribute to the theory, methodology, and strategy for supporting a collaborative of knowledge e-networking system predicated on the view and vision introduced earlier. Recall that this vision defined the knowledge e-network as:

[16] Recall that in Chapter 2, we defined the key elements of a global e-knowledge e-networking system in ways that include a common framework as well as supports collaboration while at the same time, reinforce, the individual autonomy of the participants in the networked.

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

Part I provided an overview of the ways in which we have addressed some fundamental e-barriers to knowledge bearing on sustainable development – in conceptual and computational terms, as well as application and implementation. Accordingly, we put forth the ontology of sustainability, along with a detailed a profiling of the domain content. In terms of method, we concentrated on applications of e-technology as well as computational issues, the design and management of a distributed workflow process coupled with key organizational requisites for worldwide e-collaboration.

Part II presents a closer look at some of the challenges associated with applications and implementation, and the ways in which the conceptual design is transformed into operational venues of knowledge e-networking.