Chapter 7

GSSD-ARABIC

Innovations in Multilingual e-Networking

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Introduction

In many ways we can consider the previous chapter as the context and the situational logic for the issues addressed in this chapter. We begin by examining the thirst for knowledge in the Arab world and the demand for greater access to existing sources of knowledge. This demand pertains to knowledge in general, and to knowledge about sustainability and sustainable development in particular.[1] To some extent there is notable digital content in the Arabic language, but it dwarfs the knowledge needed to build knowledge economies throughout the region.

The first part of this chapter extends the earlier discussion of Information and Communication Technologies (ICT) in the Arab region and focuses on the current status of Arabic language content in the Global System for Sustainable Development (GSSD). The purpose of this section is to highlight central tendencies and dominant patterns, not to signal problems for their own sake. At issue is the nature of the *demand* for Arabic language content on the Internet. Against this background, the remainder of the chapter addresses the *supply* side, presenting a *project-profile* of our experiences in the course of developing an operational GSSD-Arabic. The challenge before us is to reduce barriers and to transcend obstacles in order to develop an e-presence in the Arabic language. If this can be done effectively – given current technology – then the access to global knowledge content, the provision of local content, and the participation in knowledge e-networking strategies, can all be used to contribute to the emergence of a knowledge economy in the Arabic-speaking countries of the world.

[1] See the chapters in Part I of this book for definitions and context.

N. Choucri et al. (eds.), Mapping Sustainability: Knowledge e-Networking and the Value Chain, 123–141.

This chapter must be seen in the context of Part I of this book, where both the theory and implementation of GSSD is presented. Most of the issues addressed here – and the implied evolution of the sociology of e-knowledge pertaining to worldwide multilingual knowledge networking – can only be appreciated with prior understanding of the 'history of design' for GSSD. On a more practical vein, many of the challenges and dilemmas addressed further along can be better understood in institutional and organizational context discussed in Chapter 5. Also relevant is the experience reported in Chapter 8 by the China team for GSSD-China.

It is in this multiple context that we present a synthesis of the GSSD-Arabic experience and show the type of problems, conceptual and computational, that needed to be resolved in order to create an operationally-reliable knowledge e-networking system for use by Arabic-speaking users. Given the innovative nature of GSSD-Arabic and the absence of precedent for such an initiative, this chapter details the historical development of GSSD-Arabic since the inception of the GSSD initiative. It constitutes an important step for closing the knowledge gap in the region, for enhancing knowledge about sustainable development and for providing a voicing-venue for Arabic-speakers in the region and elsewhere.

7.1 Digital Arabic Content

7.1.1 The Current Status

While Arabic speakers represent 5% of the global population, Arabic web pages constitute a very small segment of what is available on the web. Indeed, it is so small as to further reinforce the marginal presence of Arabic on the Internet. There are 1,583 speakers per one Arabic web page compared to 1.5 speakers per one English web page (Warschauer, 2003). Statistics of this sort underline that the Arabic presence is far less than even the very small rate of Arabic speakers among total world Internet users, which stands at some 1.8% (ESCWA1, 2005). Despite these low figures, there are notable and successful initiatives that seek to contribute the level of Arabic content on the Internet. Arabic was added in 1997 as a new language for GSSD. Earlier chapters of this book were devoted to the theory, method, and operation of GSSD and need not be repeated here. Another initiative of note is ArabDev, a project whose main objective is to improve economic and social development of local communities in Arab countries through applications of ICTs. Today in the Arab world, all media organizations have their own websites where consumers can get access to different kinds of information and news. These projects and many others in the Arab world still represent a

very small fraction of the total web content, and cannot as yet make a difference in the content ratio of Arabic to non-Arabic websites. The frail presence of the Arabic language on the Internet, coupled with weak regional Arab e-commerce activities, has limited even weakened further the Arabic-language software development efforts, especially those related to Arabic search engines, archiving, information retrieval, and machine translation.

7.1.2 The Significant Barriers

Some of the obstacles facing the development of digital Arabic content on the Internet include the low penetration and a premium that consumers are expected to pay for access to e-information. In addition, there is a very low level of e-government projects, little importance given to Arabic content on the Internet, absent or insufficient legislation on digital copyright and e-commerce, and heavy censorship and filtering of digital content in many ESCWA countries (ESCWA1, 2005; ESCWA2, 2005). All of these factors inhibit a 'take-off' in then e-domains. The observations in Table 7.1 show the share of Arabic web pages in ESCWA countries. This distribution also shows the value that different countries place on the use of Arabic in e-venues,

Table 7.1 **Share of Arabic web pages in ESCWA countries.**

Country or territory	Share of Arabic Web Pages to Total Arabic Content in the ESCWA Region	Share of Web Pages in Arabic Over Total Web Pages
Syrian Arab Republic	2	94
Palestine	11	83
Saudi Arabia	37	67
Kuwait	3	51
Yemen	1	47
Bahrain	3	39
Qatar	2	34
Jordan	4	33
Oman	1	29
United Arab Emirates	18	22
Egypt	18	12
Lebanon	1	5
Iraq	0	0
Average ESCWA	8	28

Based on data from ESCWA(1), 2005.

while at the same time highlighting some notable paradoxes. For example, Syria has 94% of all its web pages in Arabic, while its share of Arabic web pages to total Arabic content is only 2%. Also, Saudi Arabia has the highest share of Arabic web pages to total Arabic content in ESCWA region. Saudi Arabia and Palestine have the highest share of web pages in Arabic (ESCWA1, 2005).

7.2 Toward a Knowledge Economy

Of the many definitions of the knowledge economy – this chapter borrows the World Bank view, namely that of "an economy that makes effective use of knowledge for its economic and social development. This includes tapping foreign knowledge as well as adapting and creating knowledge for its specific needs." In this context, the knowledge economy is based on four critical pillars as specified by the World Bank, namely (i) *Education and Training:* an educated and skilled population is needed to create, share and use knowledge. (ii) *Information Infrastructure*: a dynamic information infrastructure – ranging from radio to the Internet – is required to facilitate the effective communication, dissemination, and processing of information. (iii) *Economic Incentive and Institutional Regime*: a regulatory and economic environment that enables the free flow of knowledge, supports investment in ICT, and encourages entrepreneurship is central to the knowledge economy. (iv) *Innovation Systems*: a network of research centers, universities, think tanks, private enterprises and community groups is necessary to tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new knowledge. These pillars imply the existence of modern telecommunication infrastructure as one of the basics of knowledge economy. Hence, the existence of a digital divide is contingent on the preconditions in place supporting transformations toward the knowledge economy.

7.2.1 The Wake-up Call?

In its stark review of the Arab region, the *Arab Human Development Report* (2003) sent shock waves across the world about its assessment of the region and most notably regarding the status of knowledge-related factors (UN, 2003). The *Report* highlighted three cardinal challenges facing the region: first, its growing knowledge gap, internally as well as in relation to the outside world; second, the cultural, economic, societal and political context influencing knowledge acquisition in the region at this critical junction in its history; and third, the need for a strategic vision that delineates the landmarks of a deep social reform process for establishing a knowledge-based society.

As indicated earlier, the entire ICT environment, readiness, and usage in all sectors in most countries are poor. Except for Gulf rich countries, most of the Arab countries suffer from a lack of an advanced ICT infrastructure and low PC and Internet penetration rates. In addition, all Arab countries have very low spending on research and development, and the educational systems in most of the countries still need considerable efforts. All of these factors are among the most in hindering expedient adoption of knowledge economy transformation strategies. The knowledge economy transformation is clearly championed by the UAE and Bahrain. Also, Jordan, Qatar, and some other Arab countries are addressing this issue very strongly. According to the World Bank ranking, the UAE is ranking first among Arab countries in terms of readiness to transform to Knowledge Economy (MRG, 2005). These differences are important as they highlight some emergent cleavages within the region whose implications are not yet fully understood.

7.2.2 Literacy, ICT, and Knowledge Access

There are many similarities in patterns of literacy, ICT and knowledge access. They are all important in building the knowledge economy. Knowledge access is as important for the development of today's knowledge capital driven era just as ICT access for informational capitalism era and as literacy for industrial capitalism era. Table 7.2 summarizes the differences and similarities between literacy, ICT, and knowledge access with respect to sources of information, which get expressed as content within or via that physical artifact, skill level sufficient to process and make use of that information, as well as it. Finally, the table also notes the different 'divides' that prevail, namely the literacy divide, the digital divide, and the knowledge divide (Warschauer, 2003).

Table 7.2 can thus be seen as 'mapping' of the knowledge-related features, with special relevance clearly to the Arab region. The very last 'row,' with its entries across each of the columns, signals one of the most controversial issues regionally as well as globally, namely the nature of the critical *divides*.

Fundamental to all of the foregoing – and to the matter of knowledge creation and diffusion in all regions and at all times – is basic literacy. Table 7.3 shows literacy rates around the world and signals that the Arab countries have low rates compared to developed countries. Therefore, while this chapter focuses on digital issues and challenges, it is clear that we cannot forget, nor can we put on the proverbial back burner, the basic deficits in literacy. Clearly, the rates of literacy must be increased if we are to anticipate a growth in the use of digital facilities in the Arab world or if we are to seek an increase the demand for ICT and knowledge access (UNESCO, 2006).

Table 7.2 **Literacy, ICT, and knowledge access.**

	Literacy	ICT Access	Knowledge Access
Communication stage	Writing, print	Computer-mediated communication	Internet and Intranet
Main economic era	Industrial capitalism	Informational capitalism	Knowledge capitalism
Physical artifacts	Books, magazines, newspapers, journals	Computer	e-Books, e-magazines, e-newspapers, e-journals
Organization of content	Novels, short stories, essays, articles, reports, poems, forms Reading	Websites, e-mail, and instant messages	Organizational memory, best practices, and lessons learned
Receptive skills	Reading	Reading and multimedia interpretation, searching, navigating	Understanding and accessing the needed knowledge
Productive skills	Writing	Writing and multimedia authoring and publishing	Knowledge creation and dissemination
Divides	A great literacy divide?	A digital divide?	A knowledge divide?

Based on data from Warschauer, 2003.

Table 7.3 **Literacy rates around the world 2000–2004.**

	Adult (%)			Youth (%)		
	Total	**Male**	**Female**	**Total**	**Male**	**Female**
World	82	87	77	87	91	84
Arab States	63	74	51	78	85	72
Central and Eastern Europe	97	99	96	99	99	99
Central Asia	99	100	99	100	100	100
East Asia and The Pacific	91	95	88	98	98	97
Latin America and The Caribbean	90	91	89	96	96	96
North America and Western Europe	99	99	98	100	100	100
South and West Asia	59	70	46	73	81	65
Sub-Saharan Africa	60	68	52	72	77	67

Based on data from UNESCO, 2006.

7.3 GSSD-Arabic

Even though the Arabic speaking countries represent 5% of the world population, Muslims around the world represent about 20% of world population. Being Muslim means that they have to learn some Arabic and many of them do read, speak, and write the language. The reason is that the Koran is in

Arabic. Today, most international organizations have multiple languages on their websites and Arabic is one of them. GSSD was one of the e-knowledge networking systems that took the leadership role to adopt the Arabic language as one of the major languages on its website in addition to English and Chinese.

Early on, GSSD also made a decision to focus on distributed and decentralized knowledge provision and to emphasize the contribution of local knowledge into global networks as well as the diffusion of global knowledge into local networks. The ultimate objective is to reduce the knowledge gaps that are created by language differences and most notably by English dominance on the Internet, in a world that is not English-speaking. Figure 7.1 shows the home page of GSSD-Arabic.

Figure 7.1 **GSSD-Arabic home page.**

7.3.1 GSSD-Arabic: Background

Despite the absence of convergence around the concept of *sustainable development*, it is generally understood in roughly the same ways in various parts of the world. Nonetheless, the fact remains that different societies may assign different linguistic expressions to the core concepts. At this point in time, the Arabic language has developed its own vocabulary related to various

facets of sustainable development and a considerable portion of that vocabulary was developed by the scholars working on GSSD-Arabic.

In many ways, a central feature of this initiative, in its pre-computational or foundation phase, involved clarification and codification of concepts that have over the years become the core sustainability-vocabulary and a representation of its ontology. This pre-computational phase (an essentially conceptual exercise) was an essential prerequisite for building cross-language computational representation as well as all the functionalities of access, input, search, navigation and the like that are fundamental to the GSSD system.

7.3.2 Building GSSD-Arabic

This challenge consisted of a range of specific tasks that had to be completed such that the system's various functionalities that could be operated seamlessly. The most important of these are the following:

(1) Building the Arabic-language user interface and presenting the Arabic knowledge-base on the GSSD system, including appropriate letter-rendition, word formation, and sentence structures that are consistent with conventions of the Arabic language. As indicated earlier, in Part I, it is important to note that for many letters in the alphabet, individual letter looks different – and is rendered differentially – if it is located in the beginning of a word, the midst of word, or the end of a word. These conventions have to be respected in order to render an individual word accurately. Moreover, the sentence is presented from right to left and not, as is conventionally the case with the Latin-rooted languages, from left to write. Finally, selecting, and assuring the sustained use of the correct font transcends all of these issues and remains central to the entire effort – from its inception to its implementation.

(2) Building the Arabic language Convergence Glossary consistent with the Unicode conventions, in order to enable cross-language search and navigation operations.

(3) Constructing the Arabic language ontology for sustainability, by providing the condition for each concept and sub-concept for the fourteen domains of sustainable development and the four dimensions (see Chapter 1).

(4) Developing the Lotus Notes software for use with Arabic language applications, which required new solutions to problems emerging in the course of adapting the core software to Arabic.

(5) Translating from English to Arabic of all knowledge-content abstracts of the GSSD knowledge-base at the onset, as well as all relevant pages, including directives for user interface, menus, and related factors.

(6) Augmenting the GSSD knowledge-base, by locating and then submitting Arabic-language sites, as well as providing Arabic-to-English translation of select knowledge-content abstracts.
(7) Providing routine and consistent system management (including confirmation of replication and synchronization across mirror sites worldwide).
(8) Creating the relevant materials for posting on the "Reports" page of GSSD.

7.3.3 System Administration

It is worth noting the Lebanese team took the leadership role of GSSD-Arabic at early stages in thinking about the possibility of an Arabic language GSSD. Following some initial 'testing' at MIT, it became clear that a large-scale rethinking of design and implementation strategy was needed, and a comprehensive and redoing of what had already been put in place was required. Errors in applications and incompleteness in initial conditions in the Arabic language necessitated a near-complete overhaul of the system to that point.

Moreover, the knowledge-base had not yet been developed with any Arabic inputs regarding concept equivalence, nor had checks been undertaken on the few content translations that had been done. Early on, it became clear that different functions required different operational strategies. This means that the process of rendering static pages into Arabic was different than required for the dynamic pages, and different still from that required for the knowledge-base itself (that is, for the library of e-abstracts).

Before turning to details about these functions, it is worth mentioning the reason why a GSSD-Arabic mirror site was not initially built in Lebanon. In the late nineties, most Arabic countries, including Lebanon, did not have local Internet infrastructures. Internet connections were done through satellite through Europe and United States, or sea cables through Cyprus. Internet connection was very slow, very unreliable, and very costly. Despite recent advances, the legacy of these early conditions is powerful.

Today, Arab countries, especially in the Gulf region, are building the most advanced Internet backbones. This will increase the speed of the Internet and, therefore, it will be more practical to start thinking of building a mirror site in Lebanon or any other country in the region. At the same time, however, as we consider the future we still need to take into account the implications of the *Arab Human Development Report* as well as the nature of the evidence about ICT capacities and e-performance reviewed in Chapter 6.

7.3.4 Arabic-to-English Translation

When we joined the GSSD team and took the leadership role of Arabic section, our first mission was to start working on translation. Translation was done through e-mail by sending us documents related to the dynamic and static pages of GSSD. In essence we had to develop our own workflow process and interactions with MIT. (Later on we also had to consider the nature of communications with the GSSD-China team.)

When we started working on the translation, the Lebanese team never had any earlier experience with the Lotus system, nor had it benefited from any prior training on Lotus Notes and Domino. (And the Arabic language version of this software was not fully developed.) In fact, as pioneers in this domain, the team had to 'decipher' Lotus operations from inadequate documentation and to 'infer' operational solutions from less than adequate support services – long distance – via MIT team discussions with the Lotus system developers. Interestingly, at the time Lotus (early in its IBM integration) had not had an Arabic-language experience and the entire Global Workbench had not been 'debugged.' The early efforts to put in place a functional translation system as part of operating system was fundamentally flawed, to the extent that these had to be 'scrapped' and entirely redesigned.

Another type of challenge arose from the disconnect between concepts and Arabic-representation in relation to sustainable development terms. This was due in part of a relatively underdeveloped vocabulary of this domain at the time, and in part to the inconsistencies introduced in the absence of reliable vocabulary.[2]

It was at this point that both sides – in Lebanon and in Cambridge – realized the importance of the difference between 'static' and 'dynamic' pages was fully understood. No one in the GSSD-MIT team had signaled that there may be a difference between such pages. As such, a unique protocol had to be designed for both static and dynamic pages. At this point, the GSSD-MIT team allowed the AUB team to take over entirely. The AUB team had to address two challenges. The first was undoing the errors, as well as faulty designs and abortive implementation. The second was putting in place a new set of functionalities.[3]

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[2] For example, we received the whole document in MS-Word from GSSD administrator at MIT with some special format, with the request that it be translated in Arabic in the same format. In the absence of precedence – on either the MIT or the AUB side – the latter did had little clear understanding of how this information are entered in the system to begin with, nor was it given any particular hints from the MIT team.

[3] All of this was achieved with very limited assistance from the product developers, namely Lotus-IBM, since the GSSD initiative served as their global test-bed undertaken by 'real' users. Exceptions to this characterization are noted as relevant. See also Chapter 5 for added analysis of organizational challenges.

7.4 Charting New e-Spaces in the Arab Region

7.4.1 Challenges in the Development of GSSD-Arabic

Many of the challenges noted above are largely intellectual in nature, and required an intellectual response – such as rendering of concepts and meanings in coherent and internally consistent terms. At this point we turn to another set of challenges and problems encountered in the course of creating and implementing GSSD-Arabic. This set is technical and operational, rather than conceptual or intellectual. Interestingly, problems of the latter type pertained to product development for the Lotus software, and thus beyond our own scope of work since we were 'users' of this software in an application that we designed, developed, and implemented – and not originators of the software itself.

Many of the problems that we encountered were embedded in the computational products themselves, those of Lotus and IBM and presumed to have been resolved long before GSSD-Arabic was initiated. The fact that they were not, and that we had to resolve them ourselves, was certainly an unexpected exploration of uncharted terrain – one that we were not eager to pursue.

To be fair, however, Lotus-IBM had never before experimented with the concurrent application of two non-western languages (Arabic and Chinese) in an application that was conceived as a distributed e-networking system. We note some of these issues, by way of sharing with the others the development experience as transparently as possible and providing a backstage view of system development. In many ways, these are all features of an innovative process in the course of putting in place a distributed multilingual knowledge e-networking application.

More specifically, we address three issues: first is using Lotus Notes to provide translation functions; second is the development of Arabic Lotus Notes itself, most notably the accurate visual rendering of Arabic characters; and third are some aggregate effects pertaining to the hidden costs of e-collaboration in the knowledge networking domain. Each of these issues represents a distinct set of challenges. Each posed unprecedented problems that required the forging of novel solution. Once again, we note that this chapter is as much about problem-solving as it is about innovations-as-solutions.

7.4.2 Using Lotus Notes for Translation

As put forth in Part I of this book, the strategy of GSSD is to devise and utilize a common frame of reference and shared workflow system for the processing of knowledge and information, and, in this process, to build an e-system to decentralize knowledge provision, distribution, and sharing, and

to accommodate the needs of various e-providers and users from different parts of the world through a customized and workflow process. In other words, the general method and the processes undertaken are in common – shared by all partners – but the individual task is and their implementation operations are localized. Recall that once synchronization and replication takes place, all mirror sites are identical.

In order to use the Lotus Notes software, an Arabic language version had to be installed first on a desktop computer in Lebanon at the American University of Beirut (AUB). This was the easy part. The next step was how to establish Internet connection with GSSD server at MIT. Recall that in an earlier chapter, we noted the difficulties associated with Internet access in the Arab region during past decade. In addition to 'normal' problems, there were security concerns. AUB has a firewall established around its network for protection. Assistance was requested from AUB Computer and Network Services (CNS). CNS technical assistants tried hard to establish connection with MIT server using socks. The connection failed because the CNS team had little knowledge about the Lotus Notes software. Both the name of the server and its IP address were tested unsuccessfully.

In order to solve the problem, a telephone conference call was established between GSSD technical director at MIT, a Lotus Notes technical advisor, and the GSSD-Arabic director in Beirut. One of the major problems with the connection was in selecting the wrong port, 1352 instead of 80. After the connection was established, it was easy to install the software on any desktop computer. The initial version of Lotus Notes that was used by GSSD-Arabic team at AUB was 5.0x. The connection to MIT server was important because all the GSSD-Arabic work is done online on the "GSSD-Arabic Content" database that exists on the GSSD server at MIT.

When the connection issue was solved, the next two major tasks were to start translating the abstracts in the "GSSD-Arabic Content" database, and to edit the translation of the dynamic and static pages that were initially uploaded into the system. We had no idea that these two tasks would open the door to new challenges with Lotus Notes software, to recognize that the system could not operate effectively for Arabic, and that some changes had to be made to make it more suitable for the Arabic language. The technical challenges that were faced with the software are discussed in more details in the next section.

Without any real documentation as yet on how to use the system, the GSSD-Arabic team struggled to try to figure out the correct menus in order to reach the abstracts for translation. In fact, it had to generate the very documentation that it actually required. There were many e-mail exchanges and telephone calls between MIT and AUB just to figure out how to use the system. Eventually, the efforts paid off.

7.4.3 Arabic Development of Lotus Notes

When we started using the early version of Lotus Notes 5.0x, problems with the software began to appear. Whenever we solved one problem another one popped up. This section discusses the major problems that were faced with the software and their fixes. These were idiosyncratic to our own case, but they are of a generic nature, as they are likely to be relevant to any non-western language.

7.4.4 Seeing the Arabic Characters

When the "GSSD-Arabic Content" database was opened, any item that was supposed to be an Arabic word appeared as dots ("……"). The reason for that was that "BiDi" was not enabled on the desktop computer. BiDi is a styled text editor that supports multiple languages, including English, Arabic, and Hebrew. The problem was corrected by going to the Control Panel Regional Settings and localized the Arabic language. In addition, one line, "EnableBiDiNotes=1," was added to the "notes.ini" file to enable the Arabic language in the software. In the following version of the software 5.03, only "EnableBiDiNotes=1" was needed. Finally, all the Arabic fonts were added to the system because early versions of the operating system, Windows 95 and 98, did not support Arabic fonts. One additional step was needed in case the Arabic font problem persisted: the "Enable Unicode Display" was selected from the File menu (Preferences and user Preferences). The later versions of the operating system, Windows 2000 and XP, solved the font problem and the new version of Lotus Notes 6.5 solved the "BiDi" one.

7.4.5 Practical Strategy

One of the most severe and recurrent problems arose when the first prototype was received from MIT, which was the computational rendering of some basic functions yielded Buttons that were not linked together and were ordered backward. Unlike English, Arabic reads right-to-left. The main page, as well as some subsequent pages of GSSD, included many action buttons that signal user access to the mechanisms required for enabling system functionalities. These problems only occurred with the Arabic language as noted earlier. The same was true for the search module which consisted of graphical search tools.

Given that the design and the drawings were completed at MIT using desktop computers that did not have drawing software that supports Arabic,

the logistics were seriously challenging. We immediately recognized that making Arabic-enabled software more available would be an important step for closing the knowledge gap in the region, for enhancing knowledge about sustainable development, and for providing a voicing-venue for Arabic-speakers in the region and elsewhere that issue was not recognized as salient at the time.

In addition, the MIT operating systems were not Arabic-enabled.[4] In retrospect, all of this sounds simple, but at the time, the challenges were near-overwhelming. Indeed, there was no manual to consult and no technical help to recruit. The AUB team had to define and design an operational solution. Accordingly, we developed a computational procedure to eliminate the problem as shown in Figure 7.2, and thus display the Arabic language correctly in relation to itself, and to the Buttons.

The procedure devised by the AUB Team to generate correct and functional Arabic graphics was as follows:

(1) Copy and paste the graph of any key or shape, using graphic software, to an MS-Word Document.
(2) Write the text on top of the key using a text box, make it transparent, and bring it to the front so that the shape of both the key and text appear well. Use any font color and size to suit your need.
(3) In order to transform both the graph and the Arabic text to an image, some specific steps must be made in the correct order.[5]

These procedures were developed on a trial and error basis. Only through experimentation was it possible to converge on consistent results. Therefore we consider it important to share the results of such experiments, so to speak.

We are able to make graphics compatible with Arabic, and we can use graphical software that does not support the Arabic language. Over time, however, we hope that all software used by the GSSD-team in all locations will be able to support all of the operating languages. Until such time, the procedure now in place serves this function.

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[4] This means that the systems cannot accommodate the idiosyncrasies of a script where the representation of an individual letter is physically different if it is located at the beginning, in the middle, or at the end of a word. This is not an issue in any of the western languages. But for languages like Arabic or that requires the Arabic alphabet representation, this is a fundamental feature of system operation.

[5] The steps are as follows: (1) Confirm that the location of the graphic in the MS-Word document is in the top left-hand side of the screen. Push "Print screen" of the MS-word document. (2) Open Microsoft Photo-editor and "Paste" the printed screen from the previous step. Use the Photo-editor to edit the image and save it. (3) Use cut-and-paste to move the image to the GSSD database, but make sure not to confuse the links with other pages.

7.5 Dynamic and Interactive e-Arabic

7.5.1 Translating Abstracts Online

The translation of the abstracts was done online as compared to the initial offline translation of dynamic and static pages. After fixing the Internet connection problem and accessing the "GSSD-Arabic Content" database, the next challenge was to access the abstracts to start the translation process of thousands of abstracts. The user interface was so confusing and without any training on the system, the abstracts were located after several telephone calls and many e-mails. At the same time, many problems with the abstract text editor occurred in addition to other ones that were mentioned in this chapter. Again in the absence of documentation and precedent, we had to proceed by trial and error, and, in this process, we literally had to develop the documentation that is (or would have been) required.

The text editor in the Abstract was a major challenge. Whenever Arabic text was typed, especially in an abstract with long strings, the system would crash and all entered information would be lost. The problem was communicated to MIT and then forwarded to Lotus Notes. The GSSD-Arabic team was put in direct contact with a programmer in Ireland who is familiar with the Arabic language. The problem was with the string length and it was fixed.[6]

7.5.2 Using the Arabic Text Editor in Dynamic and Static Pages

Editing the dynamic and static is now done on-line after local installation of the Lotus Notes. Besides the graphics problem that was discussed earlier, many problems occurred during the editing process. The two major problems were the Arabic text editor, and text and graphic links.

As indicated earlier, the Arabic language is read from right to left and the majority of the text that was loaded to the GSSD-Arabic database was aligned incorrectly, as shown in Figure 7.2 on the left side. In addition, the font selected by the system was a default font that is small and hard to read.

Also, the system did not allow the editor to make all the needed changes in the type and size of the fonts, and the alignment of the text. After several communications with Lotus Notes, all the fixes were done to 5.0x version and we received all the new updates. The new Lotus Notes version 6.5 had no problems.

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[6] Other text editing problems occurred in the translation process and were solved after several communications with MIT and Lotus Notes system programer, then located in the Lotus-IBM Dublin office.

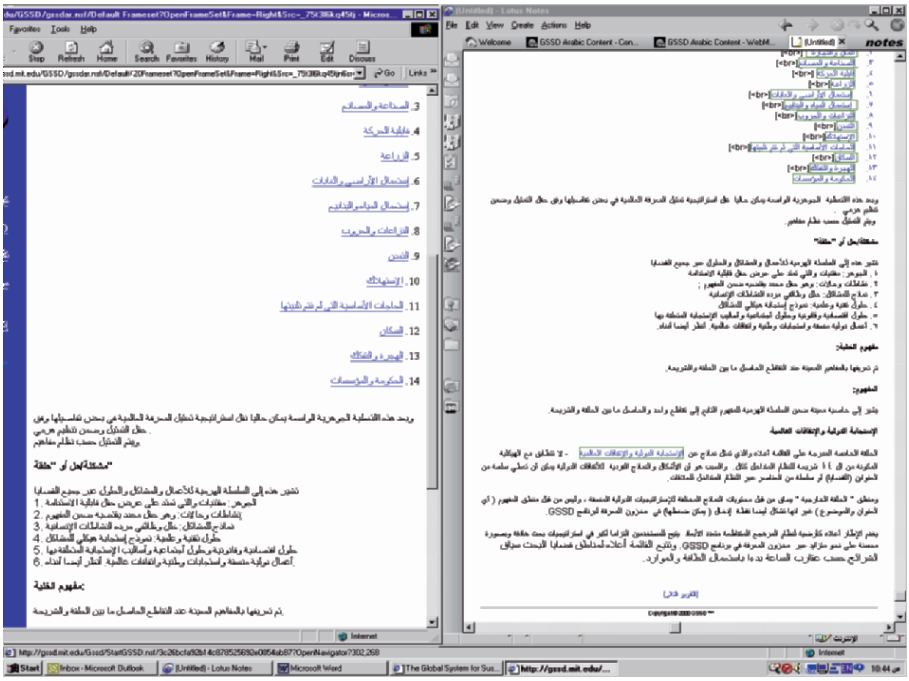

Figure 7.2 **Left-to-right Arabic text rather than right-to-left.**

Many of the links in the Arabic text in the static pages and graphics (especially in the search mode) were not correct. This is a very important point, since in the absence of correct links, different part of the GSSD system – and different pages – the equivalence across languages will not take place. Therefore, the process of correcting the links was not simple due to the fact that no training was provided on creating hypertext static pages with graphical links.

Finally, editing the dynamic pages was and still remains the hardest task to do because these pages are controlled by MIT, in order to retain consistency across sites during debugging phases – and the language barrier in terms of English versus Arabic conditions – makes it hard to communicate problems. Many of the fixes were done face to face during occasional travel of GSSD-Arabic team members to MIT. It is through this process that the customized workflow for Arabic language materials – referred to in an earlier chapter – was developed.

7.5.3 Arabic Search Engine

The search engine in GSSD, and its distinct forms of applications, is one of its major functions. Therefore, we had to make sure that it is working effectively when users are searching for knowledge materials pertaining to

sustainability in the Arabic language. The search engine was correctly working after the continuous development of the GSSD portal and the Lotus Notes software. More testing is needed to make sure that the search engine is bug free.

7.6 International Collaboration

7.6.1 MIT Collaboration

Since MIT values student-staffed research initiatives – as part of the educational system – most of the MIT researchers working as part of the GSSD team are both graduate and undergraduate students. Therefore, turnover of staff was a problem because whenever a member becomes familiar with the system and with team members in Lebanon or China, then this individual leaves GSSD team after graduating from MIT.

In addition, no one except of the GSSD Director has knowledge of the Arabic language. For example, the GSSD main page, a dynamic page and has lots of graphics, had many spelling mistakes and it took more than three years to fix them. This was only done during the presence of the GSSD-Arabic team while at MIT because of their understanding of the Arabic language. In the past eight years, most of the communication was done through e-mails using "Print Screen" option on the keyboard to convey problems. This mode of common-communication became sufficiently well developed such that we could reduce the instances of miss or missed-communication.

7.6.2 The Lotus-IBM Connection

The other side of the operational collaboration required sustained communication with the Lotus product developers since ours was the first case of the Global Workbench in operation. We have obtained extensive collaboration with key developers on the Arabic language side, but these were always embedded in and connected to the MIT-Lotus collaboration. In this connection, it is useful to review Chapter 5 whose lead author is a former GSSD system administrator. That chapter highlights the challenges involves in collaboration between a research and educational institution, on the one hand, and a product-development global firm on the other. While the mutual advantages are many, realistically, however, it should come as no surprise that systematic delays in communication impeded rapid problem solving. In addition, given the developmental status of the entire initiative, it should come as a surprise that the GSSD-Arabic team had to solve its own problems

rather than wait for the Lotus-IBM developers, with a range of other priorities, to generate the solutions.

7.7 Conclusion

Since its completion and launching, GSSD-Arabic evolved remarkably well from a user point of view. In retrospect, it is safe to say that the GSSD-Arabic team was a pioneer in more senses than one. More specifically, the team had to render operational the Lotus Notes and the Global Workbench itself to make the very tools and technologies that were designed to render the Arabic language actually operational. Arabic users can now browse the system-site to learn more about sustainability, its mapping in Arabic, and a platform for hosting Arabic language materials. They can search the web for all relevant information. To their surprise, users will discover that there is limited sustainability knowledge that exists in the Arab region and most of it must be imported from other regions.

At this writing, there are signs that things are changing. The first came with the publication of the *2003 Arab Human Development Report*, which gave a clear indication about the need for knowledge creation and dissemination. In addition, the previous chapter, ICT in the Arab World, showed the revolutionary progress of ICT development. Still, the Arab World has a long way to go, but it is on the right path. Of course there are many critical prerequisites that should be important to the successful creation of knowledge societies in the region. These are economic and political reforms. Clearly, the eradication of political corruption should be a priority because it will destroy any hope of economic prosperity in the future. In addition, Arab countries could learn from the Asia Tigers to complement each others and not compete between themselves because many resources will be wasted and many countries cannot afford that. This is hard to accomplish without reforms, and, most of all, without a clear vision about the future and the direction of the knowledge societies in the region.

Every country in the region is unique and has its own identity, culture, and heritage. Each country has to identify its role in the regional knowledge economy and work on fulfilling this role with the help and support of neighboring and/or regional countries.[7] We have to decide what knowledge will best drive the regional economies and what technology tools to develop

[7] For example, since its inception, Lebanon has been well known for tourism, education, banking, and healthcare. Lebanon can build on this by creating knowledge hubs in these areas that are related not only to Lebanon but also to all relevant countries in the region. A strong e-commerce activities and good marketing service can help reduce information cost in the long run. Lebanon can go into partnerships with countries that have similar interests.

further. Many individuals are calling for investments in high technology and especially in research and development without a clear vision. If we cannot learn from our past and present to build our future, then we will fail. Past experience should play an important role in the direction of our future knowledge economies. Afterward, we can decide what high technology investments and research and development are needed to support our vision of knowledge societies.

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