ENVIRONMENTAL SCANNING

By

Theodore J. Gordon and **Jerome C. Glenn**

Acknowledgments

Some contents of this report have been drawn from other methodology and issues papers in this series, as well as prior work of the Millennium Project. The sections on collective intelligence were drawn from research funded by the Foundation for the Future and published in the *2008 State of the Future*. Some sections on early warning systems were drawn from Millennium Project work with the Kuwait Oil Company. Appendix A gives an example of an Emerging Environmental Issues monthly report for the Army Environmental Policy Institute. Discussion of expert panels drew on research from the first phase of the UNU/Millennium Project Feasibility Study, funded by the United States Environmental Protection Agency (EPA). In addition, the Methodological Working Paper, titled *Notes on Environmental Scanning*, provided important background on scanning approaches contemplated by the United Nations Development Programme/African Futures; the elements of which were created during a training program conducted by one of this paper's authors (Glenn) for UNDP/African Futures. An abridged version is Appendix C of this chapter.

Also this chapter has been improved by the peer review comments of Jack Park of SRI International; Joseph Coates, former President of Coates & Jarrett; Robert Smith, President of the Futures Group; and William Renfro, President, Issues Management Association and President of his own firm, Policy Research in Washington, D.C. Susan V. Poyneer added sections on Internet scanning and data bases. Finally, one of this paper's authors (Gordon) contributed to the design of a similar scanning system for EPA. Some of the suggestions offered in this report are derived from the earlier EPA work.

Elizabeth Florescu, Neda Zawahri, and Kawathar Nakayima provided excellent project support, Barry Bluestein and Choungkyu Ryu provided assistance with computer operations and graphics, Sheila Harty provided skillful editing, and John Young did the final proof reading. Thanks to all for your contributions.

I. HISTORY AND INTRODUCTION: OBJECTIVES OF ENVIRONMENTAL SCANNING

From the earliest days of social organization, some people scouted ahead to find opportunities and dangers for the group. Ancient sailing ships had a "crow's nest" on the top of the mainmast from which one could look out at the sea to find safe passage in uncharted waters. Today, civilization is said to be moving into uncharted waters ranging from global financial crises and climate change to artificial biology and nanotechnology; hence, we need more than ever to identify change and assess implications.

Since plans are based on forecasts and forecasts are based on assumptions about the future, scanning the horizon is always prudent to identify new developments that can challenge past assumptions or provide new perspectives about future threats or opportunities. Environmental scanning systems provide early warning about important changes and detect "weak signals" that indicate plans should be amended.

All futurists do environmental scanning—some are more organized and systematic, all try to distinguish among what is constant, what changes, and what constantly changes.

"Environmental scanning" is the term most futurists used in the 1960-1970s, but as the environmental movement grew, some thought the term might only refer to systems to monitor changes in the natural environment due to human actions. To avoid this confusion, some have called them "Futures Scanning Systems", "Early Warning Systems[1]" and "Futures Intelligence Systems." Increasingly the output of such systems is being called "Collective Intelligence.[2]" MIT created a Center for Collective Intelligence in 2007. I prefer to define collective intelligence as "an emergent property from synergies among data/info/knowledge, software/hardware, and human minds (experts) that continually learns from feedback to produce 'just in time knowledge' for better decisions than these elements acting alone." Facilitating this emergent property should be the purpose of environmental scanning.

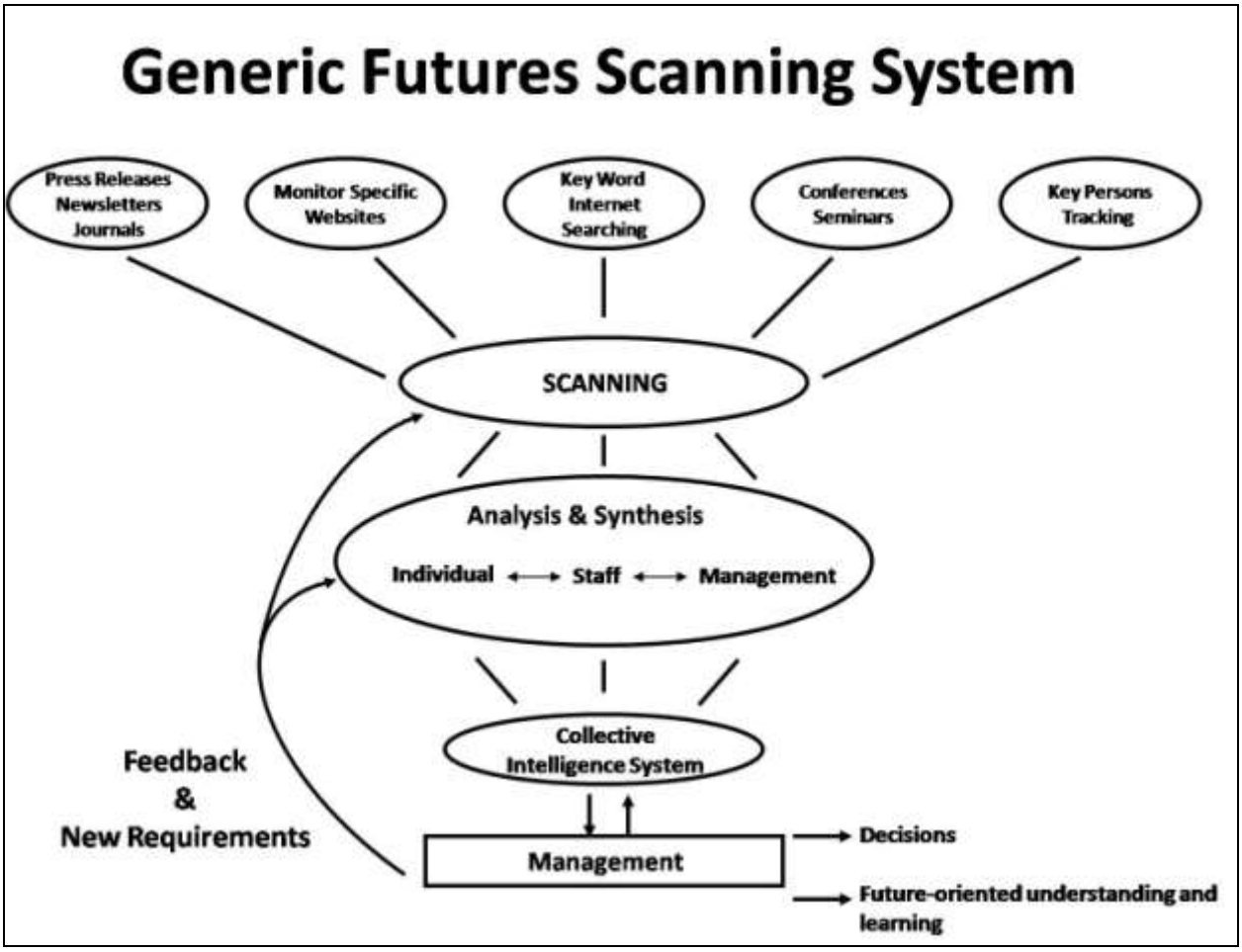
Whatever the term or definition, no system will be able to eliminate all uncertainty; the objective of a scanning system is simply to find early indications of possibly important future developments to gain as much lead-time as possible.

[1] The Kuwait Oil Company contracted with the Millennium Project to produce their "Early Warning System" to help track global change that might affect their long-term strategy. Software was produced that integrated the advantages of relational data bases with the ability to comment like blogs to produce a dynamic system that could "learn" through feedback with multiple definitions of users and authors for the entire organization.

[2] The term *Collective Intelligence* may have been first coined in 1983 by Peter Russell

II. WHAT IS ENVIRONMENT SCANNING

The following is a generic model for a scanning or early warning system developed for the Kuwait Oil Company by the Millennium Project:



A key element is the feedback and new requirements given to the scanning team. If information just flows unidirectionally through the system, without management feedback, then the system does not "learn" how to perform better and produce the most cogent knowledge, while avoiding information overload.

Once an item is entered into the database, it came become accessible in several ways, in addition to being part of normal searching. It can be part of summary pages, latest scanning items, and/or emailed as a headline to those who request headlines of new items. This will give managers a window into new developments within the system.

In addition to the staff that scans all the sources, this process allows others (as they are willing) to click on the headline, get the complete item, and then add their comments. For example, a manager might add that the item should be part of the monthly meeting, or that the item has been

countered by some other development.

In the system designed for the Kuwait Oil Company each piece of information or record includes the following fields that could be edited by preselected individuals:

1. **Category or Domain**: Technological, Economical, Environmental, Political, and Social Assumptions and Risks
2. **Leading Indicator**: what would tell you that change in this item is possible
3. **Source:** where did the information come from?
4. **How to access the source:** if a person, their office telephone number, or e-mail, and anything special one should know, like she goes to the annual meeting of the strategy institute and is open to discussion at their meetings.
5. **Other Comments:** anything that should be included, but just did not fit in any of the other fields.
6. **Significance or importance:** Even if completely obvious, included anyway, so that it will show up in a search of the database later when the item could be important in a pattern analysis for an early warning report.
7. **Potential consequences or impacts** of this particular item: we don't know the future, but we can make educated guesses. What is the range of possible consequences of the item. You might do a Futures Wheel (as an individual or in a group) on the item.
8. **Current and future status:** What is the current status of this item; e.g., early social movement, laboratory testing, sales volume, percent of the public involved, or other way to specify current status. Future status (Will there be some event planned in the future relevant to the item; e.g., date to be addressed at next WTO meeting, date of conference, date a UN treaty is to go into force, date of election, etc.)
9. **Actors:** Who are the actors affecting the indicator? If it is a new line item in an R&D budget, then the actor would be the research lab that will conduct the research. If it is an environmental terrorist act, then it would be the organization that initiated the act. Where possible add the network(s) in which the actors act.
10. **Date:** The day the information was entered and the name of the scanner are automatically entered by most software.

Using a template like this allows computer-generated reports of patterns to be produced. Each field can be searched for certain key words of interest to the scanner. For example, one might search field number 7 for consequences using the word "health" and generate a report of all items with impacts on health that have been entered. Further, one might generate a report of all the entries under actors and then determine if any patterns exist. In this way, additional "weak signals" or new elements can be found within the pattern of previously identified issues, trends, or potential future events. Also various types and styles of reports can be generated. Some managers may want a quick summary page with just the headlines by category with a brief summary of the item.

The following approaches should be considered in creating environmental scanning systems:

1. Expert panels can be created to "look out" for changes on the horizon that could be important to implement or accomplish plans via Delphis, listservs, and various other forms of collaboration software. It is probably worth considering a host of emerging technologies that are similar in terms of promoting potential "active" participation (e.g. Delphi). There are candidates such as facilitated dialogue mapped face-to-face meetings, "world cafés"[3], and even prediction markets (see chapter on this method in this series).
2. Database literature reviews provide access to a broad range of information useful to policy makers, planners and strategists
3. "Google Alerts" http://www.googlealert.com allows one to pre-select terms that are searched daily and delivered to your e-mail address. "Web crawlers" can search for sites with new versions that can provide early warning or alert to new information
4. Many Websites on the Internet offer press releases available to the public. You should know the best ones for your interests, as these identify issue-related information and emerging trends
5. Hard-copy literature reviews of selected periodicals could also be scanned to detect important incipient changes; however, they are increasingly being replaced by electronic versions
6. Essays by experts could explore critical long-term issues for recommendations on policy and strategy. These essays could use contemporary software such as issues maps.
7. Key person tracking (who knows the most, and how do you keep track of their new insights) and monitoring of key conferencing on your special interests, in person or on-line via streaming or archived video

Environmental scanning can be thought of as the central input to futures research. All futurists do it in one way or another. It also feeds the processes of issues management and strategic planning. William Renfro, President of the Issues Management Association, has identified four stages for the issues management process:

1. Identifying potential future issues by scanning the horizon (and beyond) of the corporation's [or nation's] current and planned operating and peripheral environments
2. Researching the background, future, and potential impacts of these issues
3. Evaluating issues competing for anticipatory operations and action programs
4. Developing strategies for these anticipatory operations[4]

Renfro goes on to say: "These different stages are often seen as comprising a cycle, usually an annual one timed to the strategic planning cycle. Though usually run in an interlocked cycle, these stages are unique enough that at first they are examined separately and then in the context of a cycle."

3 World Café: http://www.theworldcafe.org
4 William L. Renfro. *Issues Management in Strategic Planning*. Quorum Books, Westport, 1993. p.67.

III. HOW TO DO IT—SOME SCANNING TECHNIQUES

1 Expert Panels

One approach to scanning the environment for incipient changes is the use of an expert panel. Participants in such a panel could be asked, systematically, to provide observations and judgments about important developments that are underway or expected. Panelists would be contacted by computer communications, fax, mail, or telephone and asked to scan their fields for observations about new or intensifying issues or opportunities that could affect, say. African countries. They would also be asked for judgments about developments suggested by other panelists as well as for policies to consider in light of these developments.

The United Nations University (UNU) was funded by the U.S. Environmental Protection Agency (EPA) during the Millennium Project Feasibility Study to design such a panel.[5] Among the key findings of this study relative to an African Futures panel were:

Candidate panelists can be identified through systematic literature searches, nomination by two or more peers in "daisy chain" fashion, and recommendations of professional organizations.

Panelists should be compensated for their time and reimbursed for the cost of communications.

Important qualifications of panelists are their discipline, experience, work, and interests; search mechanisms should also seek out creative thinkers, with diverse viewpoints from around the world.

The composition of the panel should change over time, with rotation encouraged to bring fresh minds and views into the process.

Communications media should include all forms—electronic mail, telephone (voice), post, and fax—as electronic mail is not available to all invitees and fax is expensive.

Questions of fact should be directed to panelists who are experts; panelists should be able to excuse themselves from answering questions beyond their expertise.

Panelist responses should be anonymous when fed back to the group as a whole, although the list of participants should be known to all.

In any practical design, the number of respondents will be small; therefore, an environment "lookout" panel cannot produce statistically significant results. The results provided by the panel will not predict the response of a larger population or even the findings of a different panel. They

5 Theodore J. Gordon and Jerome C. Glenn, *Issues in Creating the Millennium Project*, UNU October 1993. This report also conducted a "test run" using an international panel to identify and evaluate some important future environmental developments as well as to produce a forecast of population size in several countries and regions.

will represent the synthesis of opinion of the particular group, no more nor less.

Since the value of a "lookout" panel will depend on the knowledge and cooperation of the panelists, persons who are likely to contribute valuable ideas are essential to include. In a statistically based study, such as a public opinion poll, participants are assumed to be representative of a larger population; in panels of this sort, nonrepresentative, knowledgeable persons are needed. Representatives of various national and international organizations, and others might be invited to participate.

Such a panel is envisioned as on-going and continuous, probably consisting of 75 or so carefully selected people from various disciplines. Questionnaires would be initiated by African Futures or national planning staffs and sent to the panel on a regular basis. The first question of each could ask, essentially, "What newly perceived, high-impact future developments in your field should be included in plans being developed by sub-Saharan African countries?" Cross-impact analysis (discussed elsewhere in this collection) could be an aid in discovering causative chains of possible additional impacts to add to the list of answers. A second question might present the items newly suggested by others and ask for judgments by other knowledgeable panelists, as follows: "In the last round, some panelists contributed observations about future developments in their field; please review these and provide judgments from your experience and knowledge about the likelihood and impacts of these developments." A final question might ask about policies under consideration by the planners and judgments about likelihood of implementation (and if not, why not), and effectiveness if implemented.

Other people should be included who might not function well on such review panels but are nevertheless reliable sources of information about change in specific areas, make change themselves, and/or often have new ideas and insight into the processes of change. Talking with these individuals one-on-one is helpful to explore their views more fully. In this way, one is not only keeping track of issues but of thoughts and behaviors of key individuals who are leading indicators themselves.

2. Database Literature Review

There are thousands of general and specialized databases that can be used to identify issues and trends of concern to policy makers, planners and strategists. The *Gale Directory of Databases* (http://www.gale.cengage.com/pdf/facts/GDofDatabase.pdf) can be used to select appropriate sources for environmental scanning. The directory covers more than 20,000 databases and database products on all subject areas produced worldwide in English and other languages.

The most popular databases are subscription services delivered through the Internet. They are often composed of individual files which focus on specific topics, and subscriptions may cover all or selected files. Some of these databases are available to the public through university, college, and public libraries.

Databases may be limited to citations or citations and abstracts that require follow-up with hard-copy periodicals or other full-text databases. Increasingly, however, databases are providing the

full text of documents in either HTML and/or .pdf format. While the coverage of most databases begins after the early 1980s, an increasing number now provide more retrospective coverage.

Most databases allow simple keyword searches and complex searches in which multiple terms can be searched within specified parts of a document (fields). They utilize boolean searching techniques (rules for building search strategies using connectors such as *and, or* and *not*) and provide detailed instructions on their use. Searches limited to the title, abstract and first paragraph fields usually produce the most relevant results. In many databases, searches also can be limited to professional, peer-reviewed documents.

The following is a sampling of databases that are useful in environmental scanning:

LexisNexis provides numerous full-text databases of documents and other materials from newspapers, business and general interest magazines, company reports, public records, and tax and regulatory publications.

Nexis.com provides access to the full text of three billion documents on more than 1,200 topics in multiple languages. It is a comprehensive collection of domestic and international sources of current and archived news, company and financial information, public records and legal documents.

Current Issues provides access to "grey literature" not commercially published. It indexes more than 8,000 full-text reports, conference proceedings, official documents, organizational newsletters, fact sheets and briefing papers produced by advocacy groups, private think tanks, professional and trade associations, government agencies university research centers, and international organizations. Designed for academic research, the database provides editorials from major newspapers and opinion polls from the Roper Center for Public Opinion Research on topics such as crime and justice, economy, education, environment, government, health, international relations, population, science and technology and science and culture.

Country Analysis provides access to global business content on 190 countries, 157 industries and consumers trends. It includes hard-to-find information on emerging markets in Africa, the Middle East, Asia, and Latin America.

factiva provides full-text content from the Dow Jones and Reuters newswires, the Wall Street Journal and nearly 8,000 sources worldwide. The database includes local and regional newspapers, trade publications, business newswires, press release wires, media transcripts, news photos, business-rich websites, investment analyst reports, market research reports, country and regional profiles, company profiles and historical market data. More than 900 non-English sources from 118 countries are included.

ABI Inform provides citations, abstracts and/or full text of documents from more than 1,000 professional publications, academic journals, and trade magazines published worldwide. It covers virtually every aspect of business, including company histories,

competitive intelligence, business conditions, trends, corporate strategies and tactics, management techniques and new product development. Twenty-five percent of the journals are published outside the United States. (http://www.proquest.com/en-US/catalogs/databases/detail/abi_inform.shtml)

Public Affairs Information Service (PAIS) provides citations of articles on contemporary public issues including economics, finance, law, education, the military, political science, public administration, international law and relations, the environment, science and technology, demography, and public health as well as reports and commentary on public affairs from the general press. (http://www.csa.com/factsheets/pais-set-c.php)

Country Watch.com provides up-to-date information and news on the countries of the world including key sets of political, economic, and business information, daily news and data. The database consists of three files:

> ***CountryReview*** provides 50-100 page reports on 192 countries which are updated biannually and when major events occur. Topics covered include demographic, historical, political, economic, business and environmental background, and contemporary issues.
>
> ***CountryWire*** provides country-specific, comprehensive daily news from 12 international news services with a 12-month archive in a searchable database containing 180,000 stories.
>
> ***CountryWatch Data*** is an on-line international database containing more than 230 time series or cross-sectional data series spanning socio-demographic, macroeconomic, economic sector, environmental and cultural information and allowing for convenient downloading and inter-country cross-tabulating of the numeric data. The database contains FIPS codes to facilitate its use with GIS mapping software.

ISI Web of Science provides seamless access to the citations found in *Science Citation Expanded*, *Social Sciences Citation Index*, and *Arts & Humanities Citation Index*. It facilitates the searching of current and retrospective multidisciplinary information in approximately 10,000 research journals from around the world covering such topics as anthropology, history, foreign relations, information and library science, law, linguistics, philosophy, psychology, political science, public health, social issues, social work sociology, substance studies and women studies. This product provides a unique search method which enables users to navigate forward, backward, and through the literature, searching all disciplines and time spans to uncover all relevant information. (http://thomsonreuters.com/products_services/scientific/Web_of_Science)

3. Google Alerts and Web Crawlers for Internet Searches

"Google Alerts" http://www.googlealert.com allows one to pre-select terms that are searched for daily and delivered to your e- mail address. One should search the Web for "Web crawlers" to find new versions that can provide early warning or alert to new information as new ones and improved older ones are created all the time.

The Internet provides access to government-sponsored sites full of reports and data from news sources, blogs, and corporate websites. General search engines such as Google, Vivisimo, Grokker, and *ixquick.com* are the tools that allow for the efficient location of information or the spotting of trends on the Web. Specialized portals and search engines such as the U.S. government's *www.usa.gov* or the legal search engine *findlaw.com* focus in on specific types of information.

Each search engine employs a unique strategy for pulling and compiling information from the Internet and, therefore, requires users to build searches in ways that will enhance the retrieval of relevant results. Instructions for doing so are provided on each search engine's site. Search Engine Watch http://searchenginewatch.com provides up-to-date information about search engines (including ratings) as well as information and tutorials on searching techniques such as search engine math.

4. Hard Copy Literature Review

Many older periodical articles cannot be found online. In addition, online databases often include only citations to articles, not the full text. In these cases, reviews of hard copies of the literature must be conducted in the periodical collections of college, university, public and/or corporate libraries. However, many projects are scanning old text to be searchable on-line such as one at the Library of Congress. See http://lcweb2.loc.gov/ammem/about/techIn.html

5. Essays on Issues by Experts

When the integration and synthesis of information itself is needed for input for scanning, experts can be selected to write papers on an issue. The UNU/Millennium Project Feasibility Study Phase II work for African Futures prepared a series of issue papers. Each paper dealt with a domain of particular importance to the future of Africa. As intended, this approach led to papers that provided information useful to national long-range planning. However, this approach can have some disadvantages. Some of the administrative lessons learned in producing these six essays included:

Choose experts carefully. Although each of the "managing editors" was encouraged to call on others for contributions to their papers, most became single-person authors and, therefore, their work is quite personal and reflects mostly their individual expertise.

Consider use of staff as managing editors, with experts only contributing specific pieces and or reacting to initial text.

Good intentions notwithstanding, schedules are sometimes missed by the contributors of such papers, therefore adequate lead time should be built into any schedule.

Consider the interpersonal problems associated with the rejection of a paper or contribution.

Pay contributors appropriately for their time; however, bureaucratic engines run slowly and paying contributors when their work is complete is difficult to meet.

Editing and preparation of final copy is very time consuming and labor intensive; such tasks are wrongly perceived as only "clerical," peripheral, and minor, but require professional attention.

Standardize a format for the manuscript, especially the outline, length, footnotes, and bibliography, and create a policy to make all contributors adhere to this format.

The peer review process employed in the UNU/Millennium Project Feasibility Study Phase II was also very time consuming and labor intensive. Sometimes peer reviewers contributed long and expert analyses that were themselves appropriate for addition to the managing editors' texts; at other times, the comments were short, whether supportive or critical.

Despite these problems, consider the use of this technique in the future. One place for such an application would be in the expansion and exploration of a potential issue discovered by other means.

6. Key Person Tracking and Conferencing Monitoring

Scanning the scanners is efficient. If you know someone who keeps track of a specific area, then recruit that person to keep on top of changes in that area. Such people are found in a variety of ways. Observations in conferences, Internet searches, and professional profiles are some ways to find them. See who seems to know the most about some specific area. Does that person have a newsletter, website, or some way to keep track of the insights from that person’s scanning? If you have to keep track of five areas, than find out who are the key scanners in each of other areas—and monitor them.

IV. BUILDING AN ENVIRONMENTAL SCANNING DATA BASE AND COLLECTIVE INTELLIGENCE

The first approach to building the data base and collective intelligence for an environment scanning system described below is quite advanced and has not been implemented at the time of this Version 3.0. However, the reader is encouraged to see how some of these elements can help them to build their own system, albeit less global and sophisticated than the project described here.

With a grant from the Foundation for the Future, the Millennium Project created the initial design for a collective intelligence for energy. The basic design described below can be used to build a data base and collective intelligence for any subject for an environmental scanning system. The system designed is called the Global Energy Network and Information System, or GENIS. It is composed of two integrated elements:

- The Global Energy Network (GEN), providing communications and collaboration capabilities for a worldwide community of experts and others working on or concerned with energy issues

- The Global Energy Information System (GEIS), a repository (knowledge base) and associated interactive access facility for as much of the world's total knowledge about energy (actual content, pointers to external systems, and ability to mashup from other databases into one integrated set of outputs) as can be accumulated.

The two components would work together to support a variety of environmental scanning needs, such as for politicians during energy hearings, for policymakers creating national, bilateral, or multilateral energy strategies, for businesses and universities supporting R&D, for media fact-checking, and for the general public.

Global Energy Network

In this example, a large and diverse set of leading energy experts from around the world would be invited to become members of GEN. They would seek recommendations for new members from such sources as national academies of sciences and engineering around the world. In addition, while creating GEIS, citation analysis and interviews will find additional members for GEN.

Peer networking around the world would help keep such experts abreast of the cutting edge of knowledge and hence improve their professional value and augment their own information systems and research. With a small support staff, GEN would create and maintain the GEIS knowledge base and participate as “on-call” resources for consultations.

There would also be a public GEN, or PGEN, for anyone who wanted to participate in the development of GENIS. Any environmental scanning system should have some way to receive

information from unexpected sources. Their contributions would be available—labeled as public contributions—within GEIS and available to GEN for potential inclusion in professionally peer-reviewed information.

Many computer-augmented collaborative systems exist, and others will be invented prior to the establishment of the whole system of GENIS. There are at least four modes of operation for GEN:

- Discussion of the most important global energy issues and associated decisions
- Collaboration to produce distilled information and ratings for priority listings in GEIS
- Identifying the degree of expert consensus, and where there is none, identifying the range of views and pending issues
- Linking on-call experts to support the political hearing example described below, or other "just-in-time" knowledge requirements, in which material is being assembled and presented in real time that would have to be fast enough to prevent a roomful of high-level people from having to wait impatiently.

The first three would also be separate activities within the PGEN, with the addition that, as some public members' contributions are recognized, they could become members of GEN.

Until better semantic technologies are developed for multilinguistic usage, language groups within GEN would have to identify and develop different language areas of GEIS, oversee translation, and provide live translation for real-time work. There would be a Chinese GEN, a Spanish GEN, etc. to address language issues for GENIS.

Global Energy Information System

The central concept of the GEIS design is that a very broad set of energy information would be continuously updated and organized into a single, coherent collection[6] of knowledge, with an interface reflecting the semantics of the field, viewed as a whole, and oriented toward making the knowledge easily accessible to experts and non-experts. This also includes the range of judgments where agreement is not verified, and the justifications and research for the differing views.

It should be emphasized that the descriptions here are intended only to give an idea of the kind of interface that is envisioned.

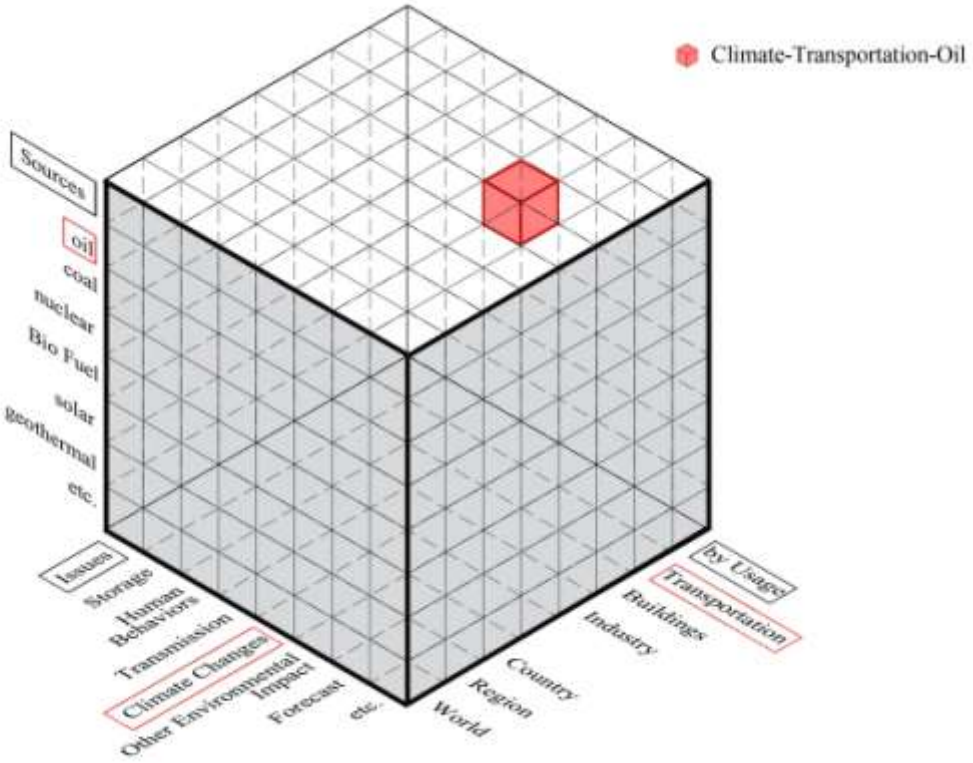
Front Page: The front page could be a graphic representation of a taxonomy or map of the issue for scanning; in this case, global energy elements. The front page might be a map of the global energy situation and future prospects arranged by energy usage, sources, storage, transmission,

6 In computer jargon, a "federation." One purpose of knowledge federation is to join together, organize, reconcile, and present the fragmented pieces or sources of information that pertain to a given subject. The word "federation" is used to distinguish this approach from integration. See "What Is Knowledge Federation?" at folk.uio.no/dino/KF/KF.pdf or Jack Park's page on the Artificial Intelligence Center Web site, at www.ai.sri.com/people/park.

forecasts, technology potentials, human behavior, major issues, and programs and models.

Another approach to the front page could be a three-dimensional table or cube (see Figure 1):

Figure 1. Cube Interface



The first axis could be sources such as oil, coal, nuclear, biofuels, solar, geothermal, and so on. The second axis could be uses or demand for the world, region, country, and categories such as transportation, buildings, and industry. The third axis could be issues such as storage, human behavior, transmission, climate change, other environmental impacts, and forecasts.

Elements of the Main Page: Each element on the front page would display a link to its own front page with subsets, and subsets of those, and so on. Ideally, these subsets could have their own overviews that could be an expert and non-expert wiki, an argument structure, or an issues map, and possibly ontologies[7] as a graphical interface (a solar ontology, transportation ontology, etc.). Next to the display of each item would be a column with options such as:

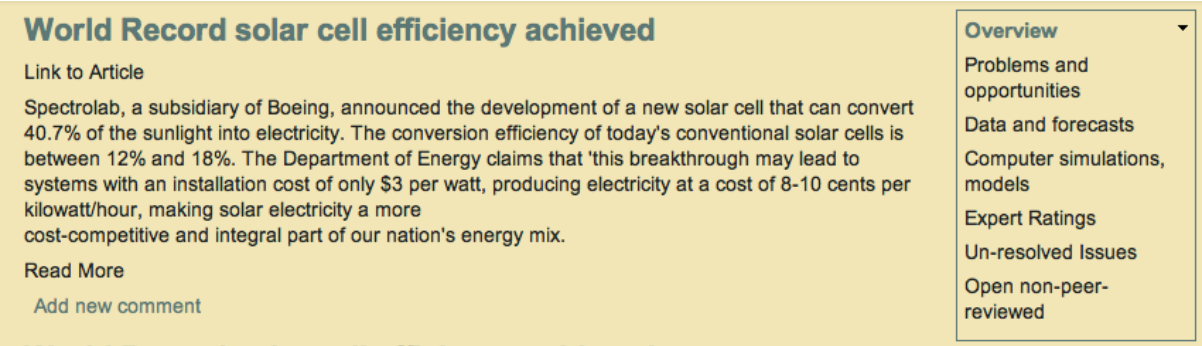
- Overview (GEN wiki, article, and/or argument structure)

7 On this point, one interviewee said: "An ontology, as an expression of attributes of a concept into logical language that a machine can interpret, would put machines to work for the system (saving great cost), but I don't think anything would happen short of a major recognition that 'ontological engineering' is a key enabler to help us bring machines into the fold to help resolve this "energy" challenge, and major funding going into developing solutions in that direction!"

- Links to specific problems and opportunities
- Data and forecasts
- Computer simulations, models, programs if available8
- Expert Ratings in wiki (via GEN using Real-Time Delphi)
- Unresolved Issues wiki—Range of Expert views (via GEN using Real-Time Delphi)
- Open non-peer-reviewed wiki (via PGEN)

Figure 2 provides an example of an information unit with these attributes in the column to the right:

Figure 2. Example of a Unit of Information, with Column of Choices about the Information



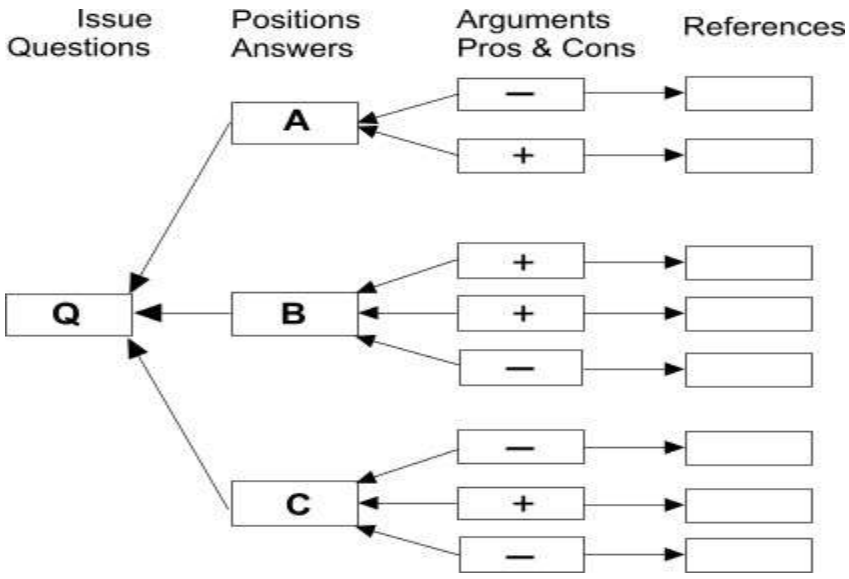
Members of GEN and PGEN plus a small staff would contribute to these attributes for each unit of information. Ideally, expert committees of ten people or so from GEN would review specific areas of information (using the Real-Time Delphi), giving numeric ratings as to authoritative quality and importance of the topic or information, along with comments. These can be put next to the information unit to show the status of expert consensus and commentary. In addition, a map of different views could be displayed. The ratings for the unit of information would appear when a person clicks on the side column's item "expert ratings," as shown above. Other attributes, such as related simulations, forecasts, etc., can also appear next to the information in the right column.

When there is no expert consensus (as defined by the numerical spread of ratings from the Real-Time Delphi of a GEN panel or by a display of different positions in argument software, as illustrated in Figure [3]), the range of views on the unresolved issues would be added under the attribute "Unresolved issues" or possibly as the overview of the issue. The general public could add to the open non-reviewed sections, much like the Wikipedia or a public version of a wiki argument.

8 Eventually, individuals could propose policies that could be tested at least to a first level to see initial impacts. To use such models or simulations, a participant would have to provide information about the policy under test, such as timing, cost, source of supply, and so on, together with ranges of uncertainty. With the participant's permission, the inputs and ranges could be discussed by GEN or PGEN discussion areas or added to a Real-Time Delphi so that judgments could be collected and organized.

One application developed nearly 20 years ago (CM/1) would present and organize overviews of the interrelationships of issues (or questions), the range of positions on each issue, arguments for and against each position, and references for the arguments. Figure 3 provides a simple diagram of the user interface for such a system that could be updated by GEN and GENIS staff to keep track of the evolving picture of many energy issues.

Figure 3. Argument-structured Information Overview of an Issue



Source: Peter and Trudy Johnson-Lenz, www.johnson-lenz.com based on early work on CM/1 by Jeff Conklin of CogNexus Institute

Using the structure above prevents repetitions such as can occur in blogs, structures the overview for decision makers better than a page or two of wiki text, and exposes assumptions and relationships more clearly than conventional databases do. Hence, where possible, overviews would be updated in structured argument software as well as overviews in wiki or text articles.

Those who need a much simpler system than GENIS could build their data base with just this argument structured software alone. The scanning inputs by an individual could be analyzed and entered into such a display system.

The GEIS knowledge base (KB) would contain as much energy knowledge as can be accumulated, either explicitly or in the form of pointers to external sources. Collaboration with national academies of sciences, national science teachers associations around the world, and other such organizations should be explored to review content, create mashups to fill gaps in the GEIS, and to contribute to specific language GENs.

In additional to conventional approaches to federated searches and mashups, services like Deep Web Technologies <see www.deepwebtech.com> could be used to create a federated search

portal so that single point searches of all data that is not visible via the usual search engines can be carried out. A topic map portal can also provide a federated search capability without the necessity of subscribing to the services of others.[9]

Key information from such sources as the International Energy Agency/OECD, the Energy Information Administration of the US Department of Energy, Google, www.worldwidescience.org[10] with its federated searches, and so on would be found, organized, and made available in this dynamic knowledge repository. This would contain not only articles but also organized data. It would contain or have pointers to:

- Qualitative data about all the classes of entities (experts, research institutions, communities, and other energy-related resources)
- Quantitative data, such as statistics by country, energy source, etc.
- The ability to mashup information from external data bases into consolidated output
- Special areas of the listed information, such as current issues and unresolved questions, containing "all" the information about that issue or question from a full range of perspectives—each issue or question will be a network of related and interacting knowledge structures; this body of knowledge can be displayed in a "dashboard" reflecting the current state of that knowledge and expert views on the issue's various aspects (definitions, trends, current status, etc.) (see the section entitled *How a Complex Issue Could be Tracked*)
- How users can set up "new items" alerts

These components would be linked, as much possible, to "Wikipedia-type" articles by both GEN and PGEN, in addition to the constantly changing more technical or specialized main content, and to areas for additional comments.

GEIS would also have an Application Programming Interface to run or link to computer simulation models and other related programs. Such programs might help a country, industry, or individual determine their carbon footprint or forecast energy supply and demand. Other applications could help non-experts make an informed decision, taking them through a programmed learning module. Many new energy-environmental analysis programs are appearing on the Web and would be linked to GEIS.

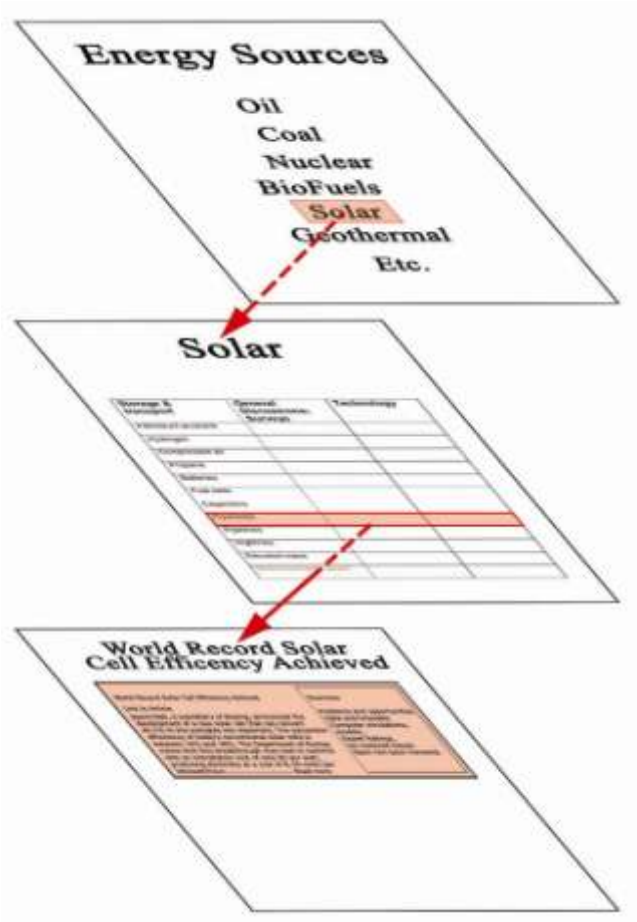
The MIT Center for Collective Intelligence would bring to GEIS "families of interconnected models that could serve to organize discussion, pointing to where the most important uncertainties are, and helping to determine the combined impact of many different assumptions from many separate conversations." Such simulation choices would be available on the right-hand column of information units as shown in Figure [2].

[9] Jack Park of SRI, working with Topic Maps, adds: "In essence, we are talking about a socially crafted search engine that automatically maintains order in its records, very much like Mahalo (mahalo.com), which offers a fairly decent indication of what is possible."

[10] Gives references from 17 databases. British Library articles have to be purchased, hence this is not fully useful for real-time work, but it can be used to build the information system pending resolution of copyright issues.

Those who prefer not to use key word searches could click on the area of interest on the front page and then by quickly clicking through a hierarchical trail find the desired information. For example, after clicking on Energy Sources (both current and potential) and solar, the user would then see a two-dimensional matrix of buttons for solar options vs. their attributes such as definitions, current usage, forecasts, advantages, disadvantages, pending issues, and so on and could then further click through to get a specific item. (See Figure 4.)

Figure 4. Recursive Linked Interface



Where possible, graphic presentations will be used to show structure and flow within networks of energy-related elements.[11]

Another option of the user interface development to explore during Phase II is the possibility of a split screen approach: one view would show the Knowledge Base map with the logical "neighborhood" of the information and the other view would contain the requested output. The

[11] Where possible, pictures of the field of study would be included, where the picture/graphic might be considered the face of a cube, and the layers behind the face would mine specific topics behind each node. (Two examples of this family of graphics are found at www.visualknowledge.com/wikikey/A24181S6651504 and www.eia.doe.gov/emeu/aer/diagram1.html.)

user could click either on the map to move elsewhere (near or far) or on an output element to move to a more or less detailed view of that data, including the possibility of a user-defined or default dashboard display.

The conventional keyword search function would also be provided so the expert user wouldn't have to click through the whole system to find what is being sought but could instead go right to the selected term(s). The easy usability of the system will grow with each user's increasing familiarity with the structure of GEIS.

It should be noted that GEIS would contain "locations" for not only elemental entities and topics but also for problems or issues, so that, for example, "disposal of waste from nuclear plants" could have a node. An advantage of the interactive map approach is that this node can appear in the display "near" any number of different other points, such as nuclear power, dirty bombs, waste heat disposed of in fresh water near the nuclear plants, and freshwater depletions from use in cooling towers. Any location in the knowledge space could be the home of a wiki on that subject. Information units can also have buttons for users to add data, information, and comments, and to protest and explain why.

A nice feature to explore, but not required for the system, is a trace-back function that would show the user where the unit of information could have been found along different inquiry paths. For example, a list of such paths could be shown on, say, the upper left-hand corner of the unit, that, when clicked on, would allow the user to see other connections to that information.

Bringing GEIS and GEN Together to Produce GENIS

This section contains some examples to illustrate how the two systems could be merged.

How a Complex Issue Could Be Tracked

A user of GEIS could create a specific space of saved categories and update them regularly to find out the current status of, say, energy and greenhouse gas emissions issues. This password-protected user's private space could have a decision tree program. The user would have different decision trees for different possibilities that would be updated, including tradeoffs, legislation, and other factors that are relevant to each element in the decision trees. Another option could be the use of the argumentation software in Figure [3].

Complementing this could be a set of current data with projections of 10 and 25 years that would be continually updated in areas such as

- Energy needs by world, continent, and countries
- Power supply by each of the current major sources by world, continent, and country
- GHG emissions based on power supplied by each of the current major sources, displayed by world, continent, and country
- Alternative energy sources to meet the production needs by world, continent, and country

- Potential science and technology breakthroughs required to deliver adequate power to replace current environmentally damaging sources (what breakthroughs and probable year for the breakthrough)
- Potential methods to mitigate GHGs by cost estimate of research, infrastructure construction, and unit cost to consumers of power for all methods identified

Such structures for issues management could be made available to others. The GEN or PGEN member would draw on GEIS data and participate in discussion groups to update their information tracking. As patterns become significant, then they could be shared for consideration to be added to GEIS. It must be emphasized that GENIS itself will be ideologically neutral. It will provide only the infrastructure; others can use it to come to their own conclusions. It is not a normative system, but one that could be used by others to create normative positions. It can be thought of as a federation (collection) of all (known/knowable) world views from which social sensemaking is facilitated.

Public Variation—Individual Collective Intelligence System

The user would go to the GENIS Web site, decide what cells he or she wants for their personal dashboard, and then begin entering terms or using maps of energy ontologies and taxonomic maps to click through systematically to find the needed information. As references are selected, and then within the selected references, key text, graphs, or other media are selected, the user can store and display the results on the dashboard or other custom display system, such as the issue argument map shown in Figure [3]. Participating in PGEN discussion groups allows for feedback on this information so that an individual can return many times to his or her "space," deleting or editing some items or adding new ones. This could create an accumulative collective intelligence customized for and by that user. Such storage could be shared with others and added to the GEIS.

Another example of an environmental scanning or early warning system was developed for UNDP. One of the authors of this paper (Glenn) developed the basis for an environmental scanning data base with the staff of UNDP/African Futures during a training exercise. Nine domains were identified and a "template" was designed for organizing information about future developments that could be important to national plans. The interviews with key individuals, group judgment from panels of experts, scanning of on-line data bases, and reading periodicals, were selected as providing input. To be most useful, this material should be recorded in some standard form and analyzed.

The suggested domains for scanning are:

1. Conflict and Governance;
2. Science and Technology;
3. Agriculture and Food Security;
4. Natural Resources and Environment;
5. Energy;
6. Population, Education and Human Welfare;

7. Communications and Transportation;
8. Regional and International Economics; and
9. Social Cultural Issues.

Each staff member can be assigned responsibility for a domain or two. All staff can enter information in any domain, but assigned staff would be charged with oversight, quality control, and analysis of that domain.

In order to record key prospective developments and track their evolution, a "template" was derived that provides a series of questions about each future development of importance. This template consists of the following items:

1. Item: Identify the trend, event, or issue
2. Description: Describe the trend, event, or issue
3. Significance: What is the significance of this item for the future? (see Section 4)
4. Importance: Why is this item important for the future?
5. Consequences or Impacts: What are the future consequences or impacts of this item?
6. Status: What is the status of this item; e.g., early social movement, laboratory testing, sales volume, percent of the public involved, or other way to specify current status?
7. Actors: Who are the actors directly involved or affected (people, organizations, nations)?
8. Miscellaneous: What do you want to add that is not noted above?
9. Classification: In which domain does this event, trend or issue belong?
10. Source: Where did you obtain this information (i.e. journals, books, or other media)?
11. Location: Where is the source located?
12. Date: The day the information was entered
13. Scanner: Name and address of the person making the entry.

Using a template like this allows computer-generated reports of patterns to be produced. Each item (in computer terminology: "field") can be searched for certain key words of interest to the scanner. For example, one might search field number 5 for consequences using the world "health" and generate a report of all items with impacts on health that have been entered, or one might generate a report of all the entries under actors and then determine if any patterns exist. In this way, additional "weak signals" or new elements can be found within the pattern of previously identified issues, trends, or potential future events.

APPENDICES

Appendix A: Environmental Scanning System Effect on an Organization

Example of how an environmental scanning system could affect an organization—in this case a hypothetical situation of the Kuwait Oil Company (KOC):

Scenario: Heavy Crude and Microorganisms

Routine KOC scanning searches of the science literature turned up an article about a new microorganism that could live without oxygen and digest benzene.12

Here's a hypothetical story of how the discovery was made at KOC and how it affected strategy. A routine periodic search of the science and technology literature turned up reference to a biologic invention by an academic team lead by John Coates of Southern Illinois University. The group had apparently isolated strains of *Dechloromonas* that could digest benzene. The breakthrough was that their microorganisms were anaerobic, whereas previous petroleum digesting microorganisms, principally pseudomonas, were aerobic. In other words the new bacteria did not require oxygen to metabolize hydrocarbons into lighter materials including water and carbon dioxide.

In prior uses of microorganisms, aerobic bacteria were spread on the surface of the sea over oil spills to accomplish environmental cleanup. The new microorganisms functioned in a similar way but did not need oxygen. The strains of bacteria produced by the academic team were denoted RCB and JJ

In the original source the scanners discovered that:

> Strain RCB uses perchlorate as a surrogate for oxygen to break benzene into carbon dioxide. It can also use nitrate instead of oxygen. Strain JJ works only with nitrate. So both bacteria can get to work if nitrate is added as a nutrient.
>
> The inventiveness of Dechloromonas bodes well for finding other strains with decontaminating abilities. Bacteria, it seems, can evolve to capitalize on most conditions. Their swift proliferation throws up many new mutations, facilitating rapid adaptation.

The inventors' application was to industrial uses such as removing benzene from sediments or samples spiced with a mixture of unidentified organisms. They concentrated on benzene because it does not break down easily and is used as a solvent in industrial processes and products and is present in engine exhausts. Further, it poses a significant human health hazard. Treated with the new strains in the laboratory, the principal by-product was carbon dioxide.

The KOC scanners, on seeing this report, reasoned that residuals at well bottoms have air

12 See http://www.nature.com/nsu/010628/010628-14.html for background

available only at the surface and hence could not be treated with the available pseudomonas; if the new bacteria could digest the petroleum where there was no air, perhaps it could be mixed in some way with nitrates- which are abundant and may even exist naturally near the residual heavy oil- the digestion process might lower the viscosity of the heavy oil.

Presented to the manager of the KOC scanning process, and after KOC coordination with KPC, authorization was given for an intensified search. The patent literature was searched and it was found that no patents had yet been issued. On request by the manager, company chemists confirmed the insight of the scanners.

After consultation with KPC, a team was dispatched to Southern Illinois University where a technology transfer contract was negotiated. KOC initiated funding efforts within Kuwait that funded the further research into the use of the strains for lowering the viscosity of heavy oil, in return for which they were granted license-free use of any inventions flowing from the work. Patents would be jointly held and royalties would be divided between the company and the university, a fairly standard arrangement.

New strategy made use of the intriguing possibilities opened by the invention and KOC's partial ownership of it. First, wells that had been thought depleted were seen to be possibly usefu,l thus increasing the company's reserves. Second, the company saw the possibility of going into large-scale production of the microorganisms for sale to others. Third, licensing of the patents could bring a great return with little investment other than the research funding. The company's role was publicized and a great PR benefit was also realized.

Appendix B: Example of an Environmental Scanning Report

Example of an Internet scanning report on Environmental Security for the U.S. Army Environmental Policy Institute.
Note: All reports since 2002 are available at http://www.millennium-project.org/millennium/env-scanning.html

January 2009 Report

Note to Readers: Pages 1-15 comprise the summary and analysis of this report. Expanded details for some items are in the Appendix beginning on page 16.

Item 1. U.S. Policy Shift May Improve International Environmental Security

Appointments of environmental scientists to the new U.S. administration, presidential memoranda, and speeches all signal that the new White House will give special attention to environmental matters from energy security to international cooperation for addressing climate change. [See Appendix for more detail].

Military Implications:

As the military was called upon to play a key role in racial integration, it may be called upon to play a key role in the accelerated adoption of green technology in the U.S. and around the world. The Army Strategy for the Environment should be brought to the attention of President Obama, as military environmental security capabilities might receive more attention from the new U.S. Administration. International military-to-military environmental programs could receive higher profiles. Since climate change is a new top priority, the military should identify all its resources and programs for reducing GHGs and responding to effects of climate change, update information continuously, forecast how it may be called upon for both mitigation and adaptation, and perform a gap analysis in anticipation of future requests.

Sources: (additional sources in the Appendix)

Barack Obama makes history as he takes office with green agenda
http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=556&ArticleID=6040&l=en
SUBJECT: The Energy Independence and Security Act of 2007
http://www.whitehouse.gov/the_press_office/Presidential_Memorandum_fuel_economy/
SUBJECT: State of California Request for Waiver Under 42 U.S.C. 7543(b), the Clean Air Act
http://www.whitehouse.gov/the_press_office/Presidential_Memorandum_EPA_Waiver/
World-Class Environmental Scientists Take Leadership Positions on Obama's Team
http://blog.nature.org/2009/01/obamas-scienceteam
'Climate hope' in economic plans
http://news.bbc.co.uk/2/hi/science/nature/7851227.stm
Stepping on the gas
http://www.economist.com/daily/news/displaystory.cfm?story_id=13009620&fsrc=nwl

Item 2. Green Economy a Solution for Addressing the Global Economic Crises

Fiscal stimulus packages adopted around the world to help address the economic crises include important measures involving renewable energy and environmental issues. Energy and climate change themes also dominated the World Economic Forum 2009, highlighting that industries related to energy-efficiency are a growing jobs-creating sector. The report *Green Investing: Towards a Clean Energy Infrastructure*, launched at the Forum, states that clean energy investment should more than triple—to at least $515 billion a year between now and 2030—to prevent emissions reaching unsustainable levels. In the same spirit, UN Secretary-General Ban Ki-moon suggests creating a global Green New Deal. Such initiatives could be important also to reduce potential social unrest in developing countries that could experience a reversal of progress due to the global financial crisis. The crisis could reverse progress by cutting access to capital markets, income from trade and remittances, money from voluntary contributions for UN and other international development efforts, and increasing economic nationalism. As tensions

triggered by the economical crises already led to social unrest in several countries around the world, and climate change warnings increase, green economy policies should be implemented without delay as a comprehensive strategy to address both. [See also *Briefings on Environmental Security at NATO Conference* in April 2008 and other related items in previous environmental security reports.]

Military Implications:
The Defense Advanced Research Projects Agency should explore how it could accelerate R&D for green technology and coordinate with related efforts of the national labs, National Science Foundation, and key technology firms to play its role in creating the future green technologies and fulfilling the military's potential requirements for technology transfer.

Sources:
Ban urges leaders at Davos to forge 'Green New Deal' to fight world recession
http://www.un.org/apps/news/story.asp?NewsID=29712&Cr=Ban&Cr1=Climate+change
World Economic Forum Report: US $515 Billion needed in Green Investments
http://www.investorideas.com/news/012909f.asp
World Economic Forum 2009, Davos
www.reuters.com/davos
World Economic Forum Explores Green Strategies for Recovery
http://www.ens-newswire.com/ens/jan2009/2009-01-29-02.asp
The other global warming
http://www.boston.com/bostonglobe/ideas/articles/2009/01/25/the_other_global_warming/

Item 3. European Energy Security Strategies

The recent natural gas crises caused by the Russia/Ukraine clash prompted Europe to address energy security more aggressively. The European Commission proposed a €3.5 billion (approx. $4.5 billion) program for new gas pipelines and electricity networks and offshore wind projects; earmarked €250 million (approx. $320 million) for the politically controversial Nabucco project (the outstanding balance to the estimated €8 billion (approx. $10.25 billion) to be covered by member states and private companies); and Germany is promoting the Nord Stream pipeline project. Europeans might also emulate the U.S. super-grid scheme to carry solar energy from the Sahara, geothermal energy from Iceland, hydropower from Scandinavia, and wind power from the North Sea. [See also *EU Renewable Energy Policy becomes Legally Binding* in December 2008 and other related items in previous environmental security reports.]

Military Implications:
Military stationed in EU member states should review their actions to coordinate with the EU energy policy and seek opportunities to apply the *Army Strategy for the Environment*.

Sources:
Worst-hit EU states get least in post-gas crisis plan
http://euobserver.com/9/27493/?rk=1
Merkel puts pressure on EU for Russian pipeline
http://euobserver.com/9/27497/?rk=1
As Europe Fiddles, U.S. May Take Lead on Climate Change
http://www.alternet.org/environment/119300/as_europe_fiddles%2C_u.s._may_take_lead_on_climate_change_/?page=2

Item 4. Global Plan to Address Freshwater Supplies Negotiated

In preparation for the 5th World Water Forum to be held in March 2009 in Istanbul, senior officials from more than 60 countries met in Rome, January 21-23, to negotiate a global plan of action for addressing issues of freshwater resources and improving water governance. Industrial and agricultural use, growing population, pollution of ground and underground reservoirs, and effects of climate change all reduce the amount of clean water available and threaten water security. The Rome meeting is expected to negotiate a Ministerial Statement to be adopted by the Ministerial Conference at the World Water Forum. [The outcomes of the meeting were not available at the time of this writing.] Meanwhile, addressing the meeting "Managing our Future Water Needs" held in Davos, UN Secretary-General Ban Ki-moon underlined, "The problem is that we have no coordinated global management authority in the UN system or the world at large. There is no overall responsibility, accountability or vision for how to address the related problems of climate change, agricultural stress and water technology." [See also *Unless Water Management Improves, Conflicts over Water Are Inevitable* in August 2006 and other related items in previous environmental security reports.]

Military Implications:

Since water tables are falling on all continents and 40% of the world gets their water from watersheds controlled by two or more countries, improving fresh water availability can reduce the potential for future conflicts. Water experts from the military should attend the Forum to offer knowledge and to find opportunities for collaboration to prevent water-related conflict. Experts should also report back on new strategies, concepts, and potential regulations to improve global water governance.

Sources:

Moving closer to a global plan of action for water
http://www.worldwatercouncil.org/index.php?id=2279
"Unique Insights to the World's Water Problems"
http://www.worldwatercouncil.org/fileadmin/wwc/News/WWC_News/Guest_view-magazine_ISO.pdf
5th World Water Forum
http://www.worldwaterforum5.org/
Davos, Switzerland, 29 January 2009 - Secretary-General's remarks at event entitled "Managing our Future Water Needs" [as prepared for delivery]
http://www.un.org/apps/sg/sgstats.asp?nid=3682

Item 5. The Woodrow Wilson International Center Opens Synthetic Biology Project

Genomic pioneer Craig Venter has said that we will write genetic code to create artificial biology, as we wrote computer code to create software. Synthetic biology holds great promise but also may create unintended consequences and a new weapons source for bioterrorists of the future. The Woodrow Wilson International Center for Scholars launched the Synthetic Biology Project in January within the Center's Foresight and Governance Project to "foster informed public and policy discourse concerning synthetic biology" by providing "independent, rigorous analysis that can inform critical decisions affecting the research, commercialization and use of

synthetic biology." Some experts estimate that by 2015 a fifth of the chemical industry could be dependent on synthetic biology. A Wilson Center panel exploring unresolved synthetic biology ethical questions remarked that, although threats related to synthetic biology are not different from those related to most sciences, regulations are lagging, opening the possibility for misuse. Hence, they suggested that the problem to be addressed is to get policy and commercial organizations to adopt ethical criteria, standards, and policies.

Military Implications:
Relevant military personnel working on biological and chemical safety issues should consider collaboration with such initiatives.

Sources:
Synthetic Biology: Is Ethics a Showstopper?
http://www.wilsoncenter.org/index.cfm?fuseaction=events.event&event_id=492968
Synthetic Biology Project
http://www.synbioproject.org/about/
WMD Detection Facility Opens in Singapore
http://gsn.nti.org/gsn/nw_20090121_2237.php

Item 6. Technological Advances with Environmental Security Implications

6.1 New Process Improves Water Desalination Efficiency

Yale University researchers have developed a new energy-saving forward osmosis technique for water purification. The method, which is claimed to require only 10% as much power as previous ones, uses a new formulation for the "draw solution" in the osmosis process. Oasys Water, Inc. has been formed to exploit the discovery.

Military Implications:
The military should follow this development as it is scaled up toward commercialization for eventual use in addressing water scarcity.

Sources:
A Low-Energy Water Purifier. A Yale spinoff hopes to solve the big problem with desalination
http://www.technologyreview.com/business/21934/?nlid=1636&a=f
Global Challenges in Energy and Water Supply: The Promise of Engineered Osmosis
http://pubs.acs.org/doi/full/10.1021/es800812m?prevSearch=McGinnis+osmosis&searchHistoryKey=

6.2 Another "Green" Concrete Announced

In a press release, Ekocrete, Inc. announced, "…the availability of a new 'green' concrete that uses 90% recycled and by-product materials without sacrificing strength or durability." The new product uses crushed recycled concrete for aggregate, plus fly ash waste from coal mills, and other industrial byproducts that provide nano-fibers for crack reduction and nano-particles for surface density to reduce water penetration. [See also *Environmentally Polluting Ash Turned into Concrete-like Structural Material* in November 2008 environmental security report.

Military Implications:
The military should investigate the possible use of this environmentally friendly product in military construction. However, the presence of nano materials in this product implies that a suitable risk assessment should be considered before it is used.

Sources:
Ekocrete Launches 'Green' Concrete That Uses 90% Recycled and By-Product Materials
http://www.nanowerk.com/news/newsid=8868.php
Information: info@ekocrete.com (Email address for obtaining more information.)

6.3 New Material Makes Biodegradable Plastic Bags

A research group led by Truong Phuoc Nghia at the Ho Chi Minh City University of Sciences has developed a nanocomposite plastic bag material that is less expensive than others, made from renewable sources, and is biodegradable in landfills. Its application may be somewhat limited by the facts that the resultant bags are reusable only if they do not come in contact with water, and that they rely on bacterial degradation for their low environmental impact.

Military Implications:
Considering the increased restrictions adopted by many countries, as well as the recycling issues, the military should follow this development for its applicability. [See Item *7.6 India to Enact Regulation Curbing Plastic Bags Use* in this report.] However, the presence of nano materials in this product implies that a suitable risk assessment should be considered before it is used.

Source:
Vietnamese scientists come up with natural plastic
http://www.thanhniennews.com/print.php?catid=4&newsid=45235

6.4 New Technique Provides Cheaper LEDs

A team at Cambridge University, led by Colin Humphrey, has developed a new production technique for gallium nitride LEDs that allows them to be grown on a silicon wafer and brings their price down to levels competitive with other types of light sources. [See *Light Emitting Diodes Offer Big Environmental Advantages* in December 2008 environmental security report.]

Military Implications:
Although commercial availability of this particular technique is expected to be up to five years off, the military should follow its development and be ready to exploit the less expensive products as the technology matures.

Source:
Cheap, super-efficient LED lights on the horizon
http://www.newscientist.com/article/dn16496-cheap-superefficient-led-lights-on-the-horizon.html?DCMP=OTC-rss&nsref=online-news

6.5 New Detection and Cleanup Techniques

6.5.1 New Techniques for Multi-nanowire Detection Arrays

A team from the Electrical Engineering Department at Pennsylvania State University has developed an improved, potential mass production technique for assembling detector nanowires into an array on a silicon chip, using an electric field. Once in place, with electrodes on top of them, the set of treated wires yields a portable and very sensitive detector for multiple toxins or pathogens. A nanowire detectably changes its conductivity when a target substance (say, a toxin) binds to the specific complementary coating on the wire. Harvard chemist Charles Lieber earlier devised a competing technique to line up nanowires using polymer bubbles, and Prof. Mark Reed at Yale attacked the problem using an etching process.

Military Implications:
The military should follow these lines of research, as they possibly lead to improved battlefield and environmental assessment devices and systems.

Sources:
Nanosensors Made Easy. A trick to assemble nanowires on silicon could lead to cheap, tiny sensing devices
http://www.technologyreview.com/computing/21974/?a=f
Practical Nanowire Devices. A way to align nanowires could lead to better sensors and flexible displays
http://www.technologyreview.com/computing/18802/?a=f
Easy-to-Make Nanosensors. Tiny electronics-based detectors could provide simple tests for cancer or bioterror agents
http://www.technologyreview.com/biomedicine/18127/

6.5.2 Manure Aids in Removing Hydrogen Sulfide from Biogas

SulfaMaster is a product combining manure and other ingredients to produce a filtering material that removes hydrogen sulfide, an acid rain- and corrosion-causing component, from biogas, a renewable energy source derived from the breakdown of animal waste. It is especially suitable for small biogas-producing operations that cannot afford large scrubbers. The developers are Gary Harman, professor of plant biology at the New York State Agricultural Experiment Station in Geneva, and Terry Spittler, a retired analytical chemist at Cornell.

Military Implications:
The military should investigate the use of this technology in community aid situations in countries where small biogas-producing operations could yield environmental benefits.

Source:
Cornell technology makes biogas greener
http://www.enn.com/top_stories/article/39043

6.5.3 New Deep Water Marine Sensors Being Developed

Prof. Hywel Morgan from the UK's University of Southampton's School of Electronics and Computer Science and Dr. Matt Mowlem at the National Oceanography Centre, Southampton, have performed initial testing of new technology marine sensors that are "capable of measuring harsh environments [and] can be deployed for months at a time", according to a University announcement. The four-year project's two goals are said to be "to develop lab-on-a-chip chemical and biochemical analyzers to detect nutrients and pollutants at the ultra-low concentrations found in the ocean, and to develop small chips to identify individual phytoplankton in the oceans". The researchers foresee applications wherever the condition of environmental water needs to be assessed.

Military Implications:
The military should follow this work as it proceeds to determine its usefulness in assessing the condition of water in battlefield monitoring and environmental management.

Source:
World's first deep-sea 'lab-on-a-chip' sensors proved to work
http://www.soton.ac.uk/mediacentre/news/2008/dec/08_233.shtml

Item 7. Updates on Previously Identified Issues

7.1 New Chemicals Considered for Toxic Lists

Health Canada and Environment Canada are recommending adding diethyl sulphate to the country's list of toxic substances. The compound is used in the production of fabric softeners, flocculants, pharmaceuticals, fragrances, and dyes. Various foreign jurisdictions, including the European Commission, consider it a possible carcinogen. The agencies also designated butane and isobutane for further assessment.

Concerns over the use of formaldehyde in pressed-wood products are getting increased attention. California issued new rules on these products, and the EPA published an Advance Notice of Proposed Rulemaking.

An investigation by CDC is underway to determine if antimony in fire-resistant clothing is posing a health risk. The issue was triggered by complaints in the Boca Raton FL Fire Dept.

The European Parliament voted to prohibit around 22 substances used in pesticides due to their potential health hazards. Two separate bills address the issue: one banning the very hazardous substances from pesticides and another considering use reduction of all pesticides. Three transborder geographical regions within the EU—rather than countries—can rule on the use of specific products, while countries can ban a product because of specific environment or agricultural circumstances. [See also *New Hazardous Substances to be Banned* in October 2008 and other related items in previous environmental security reports.]

Military Implications:

In anticipation of potential future restrictions, as well as for obvious health reasons, if not already done so, the military should maintain a comprehensive database with all compounds and substances believed to present health and/or environmental hazards and considered for regulations, regions/countries where those apply, and possible implications for the military.

Sources: (additional sources in the Appendix)

Backgrounder on Batch 4 of the Chemicals Management Plan
http://www.chemicalsubstanceschimiques.gc.ca/challenge-defi/batch-lot-4/background-information_e.html
Formaldehyde Emissions from Pressed Wood Products
http://www.epa.gov/opptintr/chemtest/formaldehyde/index.htm
Ailing Boca Raton firefighters blame chemical in pants
http://www.palmbeachpost.com/localnews/content/local_news/epaper/2009/01/10/a1a_boca_pants_0111.html
Toxic pesticides banned in Europe
http://euobserver.com/9/27399/?rk=1

7.2 New Jersey Ports Pushing for Toxic Diesels Ban

The New Jersey Port Authority is considering imposing a ban of some kind on polluting diesel trucks at the ports of Newark and Elizabeth, perhaps similar to the one already set up in Southern California. [See Item 1 above and *Aviation and Shipping should be Subject to Emissions Cuts* in September 2008 environmental security report.]

Military Implications:

Military logistics planners should continue their preparations for the worldwide spread of restrictions of this kind. Additional domestic bans are becoming more likely as a result of the federal policy proposal to allow increased state-level imposition of anti-pollution measures.

Source:
N.J. pushing for restrictions on diesel trucks at ports
http://www.northjersey.com/environment/NJ_pushing_for_restrictions_on_diesel_trucks_at_ports.html

7.3 Chemical and Biosecurity Issues

Reportedly, the al-Qaeda cell that shut down operations in the Tizi Ouzou province in Algeria after an accident might have been developing chemical and biological weapons. Last year, it was reported that allegedly up to 100 potential terrorists had attempted to enter postgraduate programs in Britain to gain access to laboratories. Experts and security organs repeatedly warn that the security measures to stop eventual development and use of such weapons by terrorist groups are insufficient and inadequate.

Six-legged Soldiers: Using Insects as Weapons of War by Jeffrey A Lockwood warns about the possibility of terrorists developing an insect-based weapon and conducting a biological attack more easily than a chemical or nuclear strike. He therefore urges governments to create an effective "pest management infrastructure" able to detect insects carrying a deadly disease.

Countries with inadequate safety standards for pharmaceutical and food production combined with insufficient import verification mechanisms open a new avenue for terrorist activity. In an increasingly globalized world with greater access to S&T knowledge and software, international standards, information-sharing agreements, common ground for cooperation with the local authorities, improved inspections and testing systems, and stronger and more comprehensive import safety regulations (especially for pharmaceutical and food production) are needed. [See also *Better International Controls Needed to Prevent Bioterrorism* in July 2006, *Call for Reinforcements to Chemical Safety* in September 2006, and other items on this theme in previous environmental security reports.]

Military Implications:
The military and its relevant contractors should consider collaborating in the establishment of international safety standards and procedures, as well as anticipating potential regulations in the planning of future R&D in these areas. Meanwhile, research on detection and countermeasures should increase.

Sources:
http://gsn.nti.org/gsn/nw_20090121_4538.php
Experts Debate Threat of Nuclear, Biological Terrorism
http://gsn.nti.org/gsn/nw_20090113_7105.php
Al-Qaeda cell killed by Black Death 'was developing biological weapons'
http://www.telegraph.co.uk/news/worldnews/africaandindianocean/algeria/4294664/Al-Qaeda-cell-killed-by-Black-Death-was-developing-biological-weapons.html
Bioterrorists Could Employ Insects, Expert Warns
http://gsn.nti.org/gsn/nw_20090106_5074.php
Book Review: Six-Legged Soldiers: Using Insects as Weapons of War
http://www.sciencenews.org/view/generic/id/39506/title/Book_Review_Six-Legged_Soldiers_Using_Insects_as_Weapons_of_War_by_Jeffrey_A._Lockwood_
Drug Safety Watchdog Sees Al-Qaeda Risk to U.S. Food, Drug Imports
http://gsn.nti.org/gsn/nw_20090129_3617.php

7.4 Arctic Security and Sovereignty Debate Continues

Delegates to a NATO meeting held in Iceland discussed the security implications of Arctic thawing and the potential need for a NATO military presence in the region. In view of the arguments among powerful nations over sovereignty and resources, NATO Secretary-General Jaap de Hoop Scheffer noted, "It should be a military presence that is not overdone, and there is a need for political cooperation and economic cooperation." The U.S. Arctic policy was published January 9, 2009. [See also *EU Arctic Policy Guidelines* in November 2008, *Arctic Needs New International Regulations* in September 2008 and other related items in previous environmental security reports.]

Military Implications:

[Similar to previous on the same issue] Negotiations for clear international regulations concerning the Arctic region are necessary. The potential for new military roles in the region increases for both national security and protection of the ecosystems. Relevant military personnel should cooperate with their counterparts in other countries and international organizations for developing adequate strategies, regulations, and enforcement procedures.

Sources:

NATO chief wants military in Arctic as it thaws
http://www.msnbc.msn.com/id/28907448/
Defence warns of climate conflict
http://www.smh.com.au/news/environment/global-warming/defence-warns-of-climate-conflict/2009/01/06/1231004021036.html
National Security Presidential Directive and Homeland Security Presidential Directive NSPD-66/HSPD-25, January 9, 2009
http://www.fas.org/irp/offdocs/nspd/nspd-66.htm
New policy emphasizes U.S. interests in Northwest Passage
http://www.thestar.com/news/canada/article/569679
Who Owns Rights to Melting Arctic?
http://www.businessweek.com/bwdaily/dnflash/content/jan2009/db20090127_954391.htm

7.5 Greenhouse Gas Observing Satellite Could Help Enforcing Environmental Regulations

Japanese Greenhouse Gases Observing Satellite "IBUKI" (meaning "breath") is the world's first satellite dedicated to monitoring greenhouse gas emissions. It circles the earth every 100 minutes and monitors the levels of CO_2 and methane at 56,000 observation points. The data should help the global effort to understand and combat global warming. [See also *Increased Use of Space Technology for Monitoring Environmental Events* in September 2008 and other related items in previous environmental security reports.]

Military Implications:

[Same as previous on similar issues] Further developing an integrating environmental monitoring capability to provide informed data to the public, and policy- and decision-makers, would considerably improve the assessment of potential environmental impacts of different actions, facilitate enforcement of international treaties worldwide, and mitigate environmental and social consequences.

Source:

Greenhouse gases Observing SATellite "IBUKI" (GOSAT)
http://www.jaxa.jp/projects/sat/gosat/index_e.html

7.6 India to Enact Regulation Curbing Plastic Bags Use

India's regulation to curb plastic bags gets increased enforcement by the decision of the city of Delhi to outlaw the, "use, storage and sale", of all polyethylene bags, and apply severe penalties for non-compliance. The law is effective immediately, and applies to customers and retailers alike, but the first target is manufacturers, to restrict availability. India thus joins other countries that have introduced similar regulations. [See also *Restrictions on Plastic Bags Expanding* in January 2008 and other related items in previous environmental security reports.]

Military Implications:

[Same as previous on this theme] The military should review its usage of plastic bags (especially the thinnest varieties) and plan for their eventual replacement. This would apply primarily to commissaries and PXs, but could extend to convenience uses for other functions.

Sources:

Heavy baggage. India's urban environment
http://www.economist.com/world/asia/displaystory.cfm?story_id=13041382
In India, plastic bag use is a capital offence
http://www.theage.com.au/world/in-india-plastic-bag-use-is-a-capital-offence-20090117-7jl4.html

7.7 Climate Change

7.7.1 Scientific Evidence and Natural Disasters

According to the Center for Research on Epidemiology of Disasters, in 2008 there were 321 disasters, below the 398 annual average for 2000–2007. Nevertheless, the 235,816 people killed, and the $181 billion in economic losses were considerably higher then the yearly average for the same period. About 211 million people were affected, with the highest number of deaths in Asia, mainly due to Cyclone Nargis and the Sichuan earthquake. The largest numbers of disasters were recorded in China—26, the Philippines—20, U.S.—19, Indonesia—16, and Vietnam and India—10 each.

A NASA study based on five years of data shows that for every 1^{o}C (1.8^{o}F) increase in average ocean surface temperature, there is a 45% increase in the frequency of the very high clouds associated with severe storms and rainfall. Senior Research Scientist Hartmut Aumann notes that at the present rate of global warming of 0.13^{o}C (0.23 ^{o}F) per decade, the frequency of severe storms could increase by 6% per decade.

7.7.2 Food and Water Security

Half the world's population might face food crises by 2100, warns a team of scientists from Stanford University's Program on Food Security and the Environment. The main cause is a combination of climate change and water shortage, reducing crop yields in the tropical and subtropical regions (between about 35° north latitude and 35° south latitude) where the world's fastest-growing and poorest populations are. They suggest rethinking the whole agricultural system in view of the new environmental and demographic trends.

The number of hungry people increased by 40 million in 2008, said FAO, but $30 billion a year investment in infrastructure and agricultural production could eliminate the root causes of hunger by 2025. This represents only 8% of the support to agriculture by OECD countries. In sub-Saharan Africa only 4% of the arable land is irrigated (compared to 38% in Asia), and only 3% of renewable water reserves are used.

Before the high level meeting, "Food Security for All," held in Madrid, January 26-27, the ETC Group released a *Communiqué* on global governance of food and agriculture. It suggests that the four main agencies (FAO, CGIAR, IFAD, WFP) should coordinate and work together along with smaller more specialized organizations from the developing countries.

The UK created a new Food and Environment Research Agency (FERA) by merging several Defra agencies and thus better integrating food and environmental security research and policy.

Indonesia's rice production was very good in 2008, but inefficient implementation of land reforms and improvement of economic conditions of farmers led to numerous conflicts.

Two-thirds of the Tibetan plateau glaciers might be gone by 2050 if the current temperatures rise continues, note scientists. Water shortages would affect 2 billion people in China, India, Pakistan, Bangladesh, and Bhutan.

In Africa, by 2020, water shortages might affect 250 million people, and agricultural productivity could decline 50%. These points were stated at the two-day meeting organized by the UN Office for the Coordination of Humanitarian Affairs (OCHA) and the African Union (AU), aimed at developing a continent-wide policy framework to protect pastoralists in Africa.

7.7.3 Migration

The Australian Defense Force report *Climate Change, The Environment, Resources And Conflict*, warns of possible conflict in the South Pacific triggered by increased illegal immigration and fishing and potential failed states, as a consequence of climate change and rising sea levels.

In an address to the UN Security Council, UN High Commissioner for Refugees António Guterres warned of new forms of displacement, with natural disasters on the rise due to climate change. He explained the interrelationship between climate change, extreme deprivation, and conflict, and how they can exacerbate each other as causes of displacement.

7.7.4 Melting Glaciers and Sea Ice

The University of Zurich's World Glacier Monitoring Service published the latest data showing that alpine glaciers from the Andes to Alaska and across the Alps shrank twice as fast as a decade ago, losing on average 0.7 meters of thickness in 2007—the most recent data available. The experts warn that most glaciers will disappear by mid-century.

Synthesis and Assessment Product 1.2: Past Climate Variability and Change in the Arctic and at High Latitudes is a comprehensive synthesis of science literature about the Arctic, integrating research on the past 65 million years of climate change, with contributions from 37 scientists from several countries. The conclusions show that faster warming at the Arctic than other places in the Northern Hemisphere is expected to continue, with all its consequences—sea-ice retreat, rising sea levels, increased erosion, etc. Additionally, human activity might induce changes that would exceed documented natural variability and trigger serious transformations.

Despite earlier beliefs, all of Antarctica seems to be warming, reported climatologists in the article "Warming of the Antarctic ice-sheet surface since the 1957 International Geophysical Year" published in the journal Nature. The conclusions resulted from combining satellite observations over the entire continent with data from land weather stations for the past 50 years. Warming of the continent's western side has been twice as rapid as the East Antarctica.

7.7.5 Rising Sea Levels

Research published by European scientists in *Climate Dynamics* shows that the next century might be 3°C warmer, and the ocean level could rise between 0.9 and 1.3 meters. Similarly, models by the U.S. National Oceanic and Atmospheric Administration Earth Systems Research Laboratory show that sea levels would be 1.3 to 3.2 feet higher from thermal expansion of ocean water alone, if CO_2 increase would cap at 600 parts per million, but twice as much if CO_2 peaks at 1,000 parts per million. The models also showed that even if warming stopped, climate change effects might last until 3000.

According to a report by the State Oceanic Administration, the sea level along China's coastal areas has risen about 2.6 millimeter per year in the past 30 years, 0.8 millimeter higher than the world's average, and might rise 0.13 meter in the next three decades.

Tens of thousands of people were displaced in the Pacific islands as a consequence of climate change effects. Coastal residents of Fiji were instructed to move to higher ground to avoid storms and flooding.

7.7.6 Post-Kyoto Negotiations

The EU proposes that richer countries cut greenhouse gas emissions by 30% by 2020, and that developing countries (except the poorest) cut emissions to 15%-30% below "business as usual" levels. The proposal suggests setting up a carbon market for richer countries by 2015 and that poorer countries be included five years later. The proposal will be submitted for member states' approval at a summit in March. An important shortfall is the lack of budget.

The McKinsey report *Pathways to a low carbon economy* addresses the feasibility and conditions to keep global warming within the 2°C limit. The report finds that it is possible to reduce GHG emissions "to stay on track until 2030" but immediate action and a strong policy framework are needed. Any delay might result in missing the 2°C limit.

At the World Economic Forum, BP Chief Executive Tony Hayward said that the world should establish a price for carbon emissions.

Delegates attending the Ministerial Conference on Transport held January 14-16, 2009, in Tokyo, called on the International Maritime Organization and International Civil Aviation Organization to prepare by the end of the year "a package of appropriate mechanisms for reducing emissions," from the aviation and shipping sectors.

Military Implications:

[Same as previous on similar issues] The military should identify all its resources and programs for reducing GHGs and responding to effects of climate change, update information continuously, forecast how it might be called upon for both mitigation and adaptation, and to perform a gap analysis in anticipation of future requests. International discourse over climate change increases the rate of emergence of international policies trying to tackle the causes and develop strategies to mitigate climate change effects.

Sources: (see a more expanded list in the Appendix)

CRED Disaster Figures. Deaths and economic losses jump in 2008
http://www.unisdr.org/eng/media-room/press-release/2009/pr-2009-01-disaster-figures-2008.pdf
NASA Study Links Severe Storm Increases, Global Warming
http://www.jpl.nasa.gov/news/news.cfm?release=2008-242
Global crisis talks move to Davos
http://news.bbc.co.uk/2/hi/business/davos/7830633.stm

H(a)LF a Loaf: Finally, in Madrid, a High-Level Forum considers Governance
http://www.etcgroup.org/en/materials/publications.html?pub_id=715
Half of world's population could face climate-induced food crisis by 2100
http://uwnews.org/article.asp?articleID=46272
UK creates Food and Environment Research Agency
http://www.defra.gov.uk/news/2009/090114a.htm
AFRICA: Pastoralists grapple with climate change
http://www.irinnews.org/Report.aspx?ReportId=82614
Defence warns of climate conflict
http://www.smh.com.au/news/environment/global-warming/defence-warns-of-climate-conflict/2009/01/06/1231004021036.html
University of Zurich's World Glacier Monitoring Service
http://www.geo.unizh.ch/wgms/index.html
Many glaciers will disappear by middle of century and add to rising sea levels, expert warns
http://www.guardian.co.uk/environment/2009/jan/19/glacier-rising-sea-levels
All Antarctica seems to be warming, report says
http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/01/22/MN8015E0U9.DTL
Sea level rise of 1 meter within 100 years
http://www.physorg.com/news150645386.html
Tens of thousands abandon flooded Pacific villages
http://www.alertnet.org/thenews/newsdesk/SYD379288.htm
Climate change: Commission sets out proposals for global pact on climate change at Copenhagen
http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/141&format=HTML&aged=0&language=EN&guiLanguage=en
BP's Hayward Says World Needs A Carbon Price
http://planetark.org/wen/51403
Ministerial Conference on Transport Calls on IMO and ICAO to Pursue Work on Reducing GHG Emissions
http://www.mlit.go.jp/kokusai/MEET/index_en.html

7.8 Nanotechnology Safety Issues

Detailed descriptions of the following nanotechnology issues are in the Appendix

- companies under pressure to make public the presence of nanomaterials in their products, and their policies for dealing with these possibly hazardous substances. (more)
- high aspect ratio (much longer than wide) nanoparticles (HARN), such as nanowires and carbon nanotubes, may pose the same health risks as asbestos fibers. (more)
- quantum dots (QDs) may be toxic to cells under acidic or alkaline conditions (more)
- Nanotech Conference & Expo 2009 May 3-7, 2009 at the George R. Brown Convention Center, in Houston, Texas (more)
- Nanotech Europe 2009 will take place 28-30 September 2009, in Berlin (more)
- nano tech 2009 International Nanotechnology Exhibition & Conference in Tokyo 18-20 February 2009 (more)
- observatoryNANO consortium will hold a dissemination event in London at the BERR conference center in London on 19 March 2009. (more)
- report on Ethical Evaluations of Nanotechnology (more)
- *nano* Magazine issue 10 features energy and environment (more)

Military Implications:
[Same as previous on this issue] Military personnel concerned with nanotech issues should contribute their views to these activities. Also, relevant military personnel should review the information generated by such activities to improve military and contractor practices, as well as to assist and cooperate with the organizations working on those issues for enriching their studies.

Sources:
Increase Expected in Shareholder Resolutions Urging Disclosure of Nanomaterials, Policies -- The Bureau of National Affairs' Daily Environment Report (1/15/2009)
http://news.bna.com/deln/DELNWB/split_display.adp?fedfid=11312763&vname=dennotallissues&fn=11312763&jd=A0B7U4H4J7&split=0 (subscription required)
An outline scoping study to determine whether high aspect ratio nanoparticles (HARN) should raise the same concerns as do asbestos fibres
http://randd.defra.gov.uk/Document.aspx?Document=CB0406_7760_FRP.pdf
Quantum dots may be toxic to cells, environment under certain conditions
http://www.nanowerk.com/news/newsid=9059.php
Nanotech Conference & Expo 2009: http://www.nanotechexpo.jp/en/index.html
observatoryNANO consortium http://www.nano.org.uk/events/ionevents.htm
Ethical Evaluations of Nanotechnology
http://www.nanotechproject.org/news/archive/ethical_evaluations_nanotechnology/

Item 8. Reports Suggested for Review

8.1 State of the World 2009

State of the World 2009: Into a Warming World by Worldwatch Institute is a comprehensive analysis of potential evolution of climate change by the end of the century and of the urgent actions and policies that need to be taken now. It is "intended to inject new inspiration and energy into national and international climate negotiations." It examines the technologies that would be the most efficient for reducing greenhouse gas emissions; policies and strategies to address climate change; ideas for saving biodiversity; and security implications of climate change. It also includes a climate change reference guide and glossary.

Military Implications:
The report is a source of information on the implications of climate change, including security and adaptation, and thus aids planning improvement, resource prioritization, and preparedness.

Source:
State of the World 2009: Into a Warming World
http://www.worldwatch.org/node/5658

8.2 New 2009 Terminology on Disaster Risk Reduction

United Nations International Strategy for Disaster Reduction (UNISDR) released an extensively upgraded terminology to help international common understanding and application of disaster risk reduction concepts. It also includes new concepts that are not in widespread use but are of growing professional relevance.

Military Implications:
Given the increasingly international nature of relief efforts, using a common "language" is important. The "guide" should be widely distributed to relevant military personnel.

Source:
UNISDR Terminology on Disaster Risk Reduction (2009)
http://www.unisdr.org/eng/library/lib-terminology-eng.htm

APPENDIX

Reference Details

This Appendix contains expanded background information on some items.

Item 1. U.S. Policy Shift May Improve International Environmental Security

Some bold actions considered by the new U.S. administration in its first week in office, include:

- implement the Energy Independence and Security Act that requires increasing car fuel efficiency standards starting with model year 2011 for reaching at least 35 miles per gallon by 2020 for cars and light trucks
- instruct the Environmental Protection Agency to allow California and other States willing to adopt stricter emissions standards for new motor vehicles (California's law requires reducing vehicles' emissions by 30% by 2016; so far, 13 other states and the District of Columbia want to follow California's standards, representing about 40% of the U.S. car market)
- double capacity for alternative sources of energy like wind, solar, and biofuels over the next 3 years
- build a smart electricity super-grid to transport renewable energy from the West to the rest of the country
- allocate funds for weatherizing public and private buildings, and appoint a special envoy for climate change. There are also signals for tougher environmental standards, the adoption of a cap-and-trade system for CO_2 emissions, and America's participation in the international efforts to negotiate a post-Kyoto Protocol on climate change
- appoint a climate change special envoy (Todd Stern) for international negotiation of actions and accords to address climate change causes and effects

Sources: (a more comprehensive list)
SUBJECT: The Energy Independence and Security Act of 2007
http://www.whitehouse.gov/the_press_office/Presidential_Memorandum_fuel_economy/
SUBJECT: State of California Request for Waiver Under 42 U.S.C. 7543(b), the Clean Air Act
http://www.whitehouse.gov/the_press_office/Presidential_Memorandum_EPA_Waiver/
As Europe Fiddles, U.S. May Take Lead on Climate Change
http://www.alternet.org/environment/119300/as_europe_fiddles%2C_u.s._may_take_lead_on_climate_change_/
California's green light
http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=13031009&subjectID=348924&fsrc=nwl
Clinton Climate Change Envoy Vows "Dramatic Diplomacy"

http://planetark.org/wen/51349
'Climate hope' in economic plans
http://news.bbc.co.uk/2/hi/science/nature/7851227.stm
Stepping on the gas
http://www.economist.com/daily/news/displaystory.cfm?story_id=13009620&fsrc=nwl
Barack Obama promises to lead world on climate change
http://www.telegraph.co.uk/news/worldnews/northamerica/usa/barackobama/4349132/Barack-Obama-promises-to-lead-world-on-climate-change.html
Obama's Inaugural Address Shows Concern for the Planet
http://www.ens-newswire.com/ens/jan2009/2009-01-20-01.asp
Obama: Oil dependence, climate change endanger security
http://www.reuters.com/article/reutersComService_2_MOLT/idUSTRE50P4AN20090126
A Strong Signal on Global Warming
http://roomfordebate.blogs.nytimes.com/2009/01/26/a-strong-signal-on-global-warming/?8dpc
President Obama to lawmakers: 'Can't afford delays' on economic rescue plan
http://www.nydailynews.com/news/politics/2009/01/26/2009-01-26_president_obama_to_lawmakers_cant_afford.html
U.S. Should Adopt California Car Rules: Schwarzenegger
http://planetark.org/wen/51371
As Europe Fiddles, U.S. May Take Lead on Climate Change
http://www.alternet.org/environment/119300/as_europe_fiddles%2C_u.s._may_take_lead_on_climate_change_/
'Climate hope' in economic plans
http://news.bbc.co.uk/2/hi/science/nature/7851227.stm
World Economic Forum 2009, Davos
www.reuters.com/davos

Item 7. Updates on Previously Identified Issues

7.1 New Chemicals Considered for Toxic Lists

Sources: (a more comprehensive list)
Backgrounder on Batch 4 of the Chemicals Management Plan
http://www.chemicalsubstanceschimiques.gc.ca/challenge-defi/batch-lot-4/background-information_e.html
Ottawa suggests adding chemical to toxic list
http://www.theglobeandmail.com/servlet/story/RTGAM.20090124.wtoxic24/BNStory/National/
Comments Sought On Formaldehyde in Wood Products
http://members.sej.org/sej/tipsheet.php?rssID=2417&viewt=tipsheet
Formaldehyde Emissions from Pressed Wood Products
http://www.epa.gov/opptintr/chemtest/formaldehyde/index.htm
Formaldehyde. Hazard Recognition
http://www.osha.gov/SLTC/formaldehyde/recognition.html
Toxicological Risks of Selected Flame-Retardant Chemicals
http://www.nap.edu/catalog.php?record_id=9841

Ailing Boca Raton firefighters blame chemical in pants
http://www.palmbeachpost.com/localnews/content/local_news/epaper/2009/01/10/a1a_boca_pants_0111.html
Antimony & compounds fact sheet (Australia)
http://www.npi.gov.au/database/substance-info/profiles/10.html
EU Assembly Votes To Ban Toxic Pesticides
http://planetark.org/wen/51205
Toxic pesticides banned in Europe
http://euobserver.com/9/27399/?rk=1

7.7 Climate Change

Sources: (a more expanded list)

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2008 disasters in numbers
http://www.unisdr.org/eng/media-room/facts-sheets/2008-disasters-in-numbers-ISDR-CRED.pdf
Natural Disasters Cost China $110 Billion In 2008
http://planetark.org/wen/51334
NASA Study Links Severe Storm Increases, Global Warming
http://www.jpl.nasa.gov/news/news.cfm?release=2008-242
NASA study links severe storm increases, global warming
http://www.pasadenastarnews.com/ci_11539060
Ban urges greater efforts to feed world's hungry amid ongoing recession
http://www.un.org/apps/news/story.asp?NewsID=29681&Cr=food+crisis&Cr1=
Global crisis talks move to Davos
http://news.bbc.co.uk/2/hi/business/davos/7830633.stm
UN Chief Warns More Could Go Hungry In Crisis Year
http://planetark.org/wen/51374
UN urges release of billions for world food crisis
http://www.washingtonpost.com/wp-dyn/content/article/2009/01/26/AR2009012600602.html
H(a)LF a Loaf: Finally, in Madrid, a High-Level Forum considers Governance
http://www.etcgroup.org/en/materials/publications.html?pub_id=715
Historical Warnings of Future Food Insecurity with Unprecedented Seasonal Heat
http://fsi.stanford.edu/publications/historical_warnings_of_future_food_insecurity_with_unprecedented_seasonal_heat/
http://iis-db.stanford.edu/pubs/22374/battisti_naylor_2009.pdf (the article)
Unprecedented heat will trigger global food crisis
http://www.theglobeandmail.com/servlet/story/RTGAM.20090108.wclimate0108/BNStory/International/home
Half of world's population could face climate-induced food crisis by 2100
http://uwnews.org/article.asp?articleID=46272
Half Of World's Population Could Face Climate-induced Food Crisis By 2100
http://www.sciencedaily.com/releases/2009/01/090108144745.htm
Billions face food shortages, study warns
http://www.enn.com/agriculture/article/39038

Record purchase enabled UN to feed hungry, boost southern African economies
http://www.un.org/apps/news/story.asp?NewsID=29649&Cr=wfp&Cr1=
UK creates Food and Environment Research Agency
http://www.defra.gov.uk/news/2009/090114a.htm
Food and Environmental Security moves one step nearer, says CLA
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"Warming of the Antarctic ice-sheet surface since the 1957 International Geophysical Year"
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Transport can help propel world to greener future
http://www.reuters.com/article/environmentNews/idUSTRE50E3CW20090115
World Economic Forum Annual Meeting 2009 "Shaping the Post-Crisis World", Davos-Klosters, Switzerland, 28 January - 1 February, 2009
http://www.weforum.org/en/events/AnnualMeeting2009/index.htm

7.8 Nanotechnology Safety Issues

7.8.1 Corporations under Stockholder Pressure for Nanotech Disclosure

According to a story in Meridian Nanotechnology and Development News, a number of companies are coming under pressure from stockholder resolutions to make public the presence of nanomaterials in their products, and their policies for dealing with these possibly hazardous substances.

Military Implications:

Military concerned with nano risk assessment of contractor materiel should be on the alert for instances of this popular movement, and be prepared to take advantage of any subsequent disclosures.

Sources:

Increase Expected in Shareholder Resolutions Urging Disclosure of Nanomaterials, Policies --

The Bureau of National Affairs' Daily Environment Report (1/15/2009)
http://news.bna.com/deln/DELNWB/split_display.adp?fedfid=11312763&vname=dennotallissues&fn=11312763&jd=A0B7U4H4J7&split=0 (subscription required)

7.8.2 High Aspect Ratio Nanoparticles May Pose Asbestos-like Risks

A consortium of UK scientists, led by the Institute of Occupational Medicine, Edinburgh, has published a report discussing whether high aspect ratio (much longer than wide) nanoparticles (HARN), such as nanowires and carbon nanotubes, may pose the same health risks as asbestos fibers. The report concluded that there is enough evidence to suggest that HARN, which have the same physical characteristics as asbestos, are likely to induce similar pathology. The report presents a set of prioritized recommendations for future research.
Similar concerns have caused France's High Council of Public Health (HCSP) to recommend that workers in contact with carbon nanotubes receive the greatest protection under French law. Further, a new paper from Chinese researchers systematically reviews most of the experimental results on the variety of factors affecting carbon nanotubes' cytotoxicity.

Military Implications:

Military personnel concerned with nano risk assessment should follow this and subsequent research, and take its results into consideration in their evaluations of nanomaterials.

Sources:

UK report: http://randd.defra.gov.uk/Document.aspx?Document=CB0406_7760_FRP.pdf
News story on Chinese report: http://www.eurekalert.org/pub_releases/2008-12/sicp-soc122208.php
Chinese paper:
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News story on UK report: http://www.nanowerk.com/news/newsid=8996.php
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French action:
http://translate.google.com/translate?hl=en&sl=fr&u=http://fr.news.yahoo.com/2/20090121/thl-nanotubes-de-carbone-le-haut-conseil-96993ab.html&sa=X&oi=translate&resnum=1&ct=result&prev=/search%3Fq%3Dhttp://fr.news.yahoo.com/2/20090121/thl-nanotubes-de-carbone-le-haut-conseil-96993ab.html%26hl%3Den%26safe%3Doff%26client%3Dfirefox-a%26rls%3Dorg.mozilla:en-US:official%26hs%3Dukj

7.8.3 Possible Environmental Hazard from Quantum Dots

According to an item in Nanowerk, "New research is showing that quantum dots (QDs) may be toxic to cells under acidic or alkaline conditions." It appears that the metallic shells of these semiconductor nanocrystals, increasingly used in electronic systems, may decompose under non-neutral pH conditions, (e.g. during weathering) releasing toxic zinc or cadmium.

Military Implications:

Health and environmental risk assessment personnel should review military and contractor use of

these components to evaluate possible hazards.

Sources:
Quantum Dot Weathering Results in Microbial Toxicity
http://pubs.acs.org/doi/abs/10.1021/es8023385
Quantum dots may be toxic to cells, environment under certain conditions
http://www.nanowerk.com/news/newsid=9059.php

7.8.4 Nanotech Conferences to Be Held in Houston, May 2009, and Berlin, September 2009

The Nano Science and Technology Institute (NSTI) will hold the Nanotech Conference & Expo 2009 May 3-7, 2009 at the George R. Brown Convention Center, in Houston, Texas, with more than 5000 attendees and more than 1000 presentations, including policy issues. The meeting will be co-located with the Clean Technology Conference & Expo 2009. Nanotech Europe 2009 will take place 28-30 September 2009.

Sources:
NSTI Announcement: http://www.nanowerk.com/news/newsid=8815.php
Houston Nanotech Conference: www.nsti.org/Nanotech2009/expo
Clean Technology Conference: www.csievents.org/Cleantech2009
Berlin Nanotech Conference: http://www.nanotech.net/content/home

7.8.5 Nanotechnology Conference to Be Held in Tokyo 18-20 February 2009

The nano tech 2009 International Nanotechnology Exhibition & Conference will be held in Tokyo 18-20 February 2009. It will include several presentations on nanotech and the environment.

Source:
Conf. site: http://www.nanotechexpo.jp/en/index.html

7.8.6 UK Dissemination Event for the observatoryNANO Project in London, March 2009

The observatoryNANO consortium will hold a dissemination event in London at the BERR conference center in London on 19 March 2009. According to the announcement, it, "…will provide an overview of the work performed within the first year of the project and … a better insight into how nanotechnology is evolving,…[including] the potential environment, health and safety issues. It also provides a platform for individuals to become involved in future engagement processes and have their opinions included in reports and analyses presented to EU policy makers."

Military Implications:
Appropriate military personnel should consider attending this event to gather information on nanotech developments and policies in the European theater.

Sources:
'Shaping European Nanotechnology – the role of observatoryNANO'
http://www.nano.org.uk/events/ionevents.htm 19 March 2009: BERR Conference Centre, London, UK

7.8.7 New Report on Ethical Evaluations of Nanotechnology

The Wilson International Center's/Pew Trust's Project on Emerging Nanotechnologies has

issued a new report on Ethical Evaluations of Nanotechnology that strives to, "…address social and ethical issues … [and] both the substantial potential risks of nanotechnology and its possible significant contributions to our well-being and environmental sustainability," and, "emphasizes ways in which such topics intersect with governmental functions and responsibilities, including science and technology policy, as well as research funding, regulation and work on public engagement", according to a Project announcement.

Source:
Report: http://www.nanotechproject.org/news/archive/ethical_evaluations_nanotechnology/

7.8.8 *nano* Magazine to Feature Energy and Environment

Issue 10 of *nano*, with the theme Energy and Environment, will be available for download from 1 February 2009. It will also provide comment and features on nanotechnology for: environmental benefit and nanotech for clean water, land remediation, and construction, http://www.nanomagazine.co.uk

Appendix C: Abridged Notes on Environmental Scanning

From original by National Long-Term Perspectives Studies
Methodological Working Paper Series MES/93/003
African Futures May 1993

Introduction

The business of studying and forming opinions about the future is a complicated task...which does not have an all-purpose tool....attempts to glimpse at future possibilities...has led to the development of various tools...one is Environmental Scanning...a relatively new phenomenon...to plan the future; to increase their effectiveness; to increase their bottom line or profitability and, in the case of the military, to win a war or maintain strategic advantages over the perceived enemy...termed differently by different organizations...the process is aimed at identifying emerging issues; obtaining most current factual materials and information available on subjects of interest; and considering the implication of the issues on the institution (Grell, 1992). Rather than just being another "planning technique for information gathering, it is a systemic process of strategic learning about organization circumstances" (Spies, 1991). This learning process, according to Spies (1991), aims at providing an understanding with respect to:

a) the nature of change (what is happening)
b) the reasons for change (why it is happening)
c) the processes producing and supporting change
d) the relations between processes
e) the main actors and their objectives
f) the consequences of change for the organization.

In his classic article on scanning, Aguilar (1967) has identified two types of viewing and two types of search: undirected viewing, conditioned viewing, informal search and formal search. Based on this, Renfro et al. (1983 B) classified scanning into four specific aspects which determine the kind of scanning used by institutions. These four aspects are:

a) selecting information to scan
b) searching or screening for information resources
c) identifying criteria by which to search
d) determining special action for the scanning results.

As identified by Renfro et al. (1983 B), the different kinds of scanning are passive, active and directed scanning...As defined by Spies (1991), undirected viewing is a general exposure to information where the scanner/person does not have any specific purpose in mind...conditioned viewing, however, involves directed exposure without active search. Informal search, described as a "relatively limited and unstructured effort to obtain information for a specific purpose" (Spies 1991), corresponds with active scanning. In this mode, information resources which are

being scanned are specifically selected and not left to chance. Formal search or Directed Scanning involves a deliberate active scanning of existing resources. This scanning approach usually follows well established plans and procedures.

Objectives and purpose...according to Spies (1991), the purposes of environmental scanning are:

a) understanding the context in which the organization has to operate
b) adapting to a rapidly changing environment
c) creating a more desirable operating environment in the future
d) improving judgment regarding management's action potential (what aspects of the future cannot be changed and what aspects can be changed and how).

Environmental scanning...is approached in different ways...a generic process...creation of a scanning committee; the definition of its operations, the scanning procedures and methodologies. Subsequently, the focus and the taxonomy of the scan should be defined. Then the list of information resources to scan must be established.

The scanning committee...must be interdisciplinary...where possible, heads of the different divisions... between twelve and fifteen...serve as an advisory group...usually no authorization to act on the issues. As a group, the committee is expected to define its modality of operations, the procedures and methodologies. The committee should meet at regular intervals. Individual members are assigned day-to-day tasks. The committee usually elects a coordinator or chairman.

Focus & Taxonomy of the Scan...threats or opportunities...attention to technological innovations, social change and developments, economic developments and legislative and regulatory developments... information resources to scan...major newspapers, journals, trade publications, professional journals, magazines, resident and outside experts, outside resources such as electronic mails, other institutions and national agencies. Other materials such as underground and fringe publications can also be very useful.

Procedures...regular meetings...members report emerging issues in their designated areas... background report on emerging issues...should be prepared...background research materials should be provided to the committee members...discussed, assessed and evaluated with regard to their importance to the institution. Impacts assessment can be done using futures wheel. Implementing a futures wheel is a structured process which allows the impacts and possible consequences of new developments to be assessed and addressed.

In addition, each issue can be evaluated using a probability impact chart in order to establish the priority of issues. This process involves each member of the committee estimating the probability that the issue will materialize fully within the time frame of the interested future, and the probable impact of the issue or event on the organization. The resulting matrix can then be summarized based on the objective of the evaluation. Likewise, cross-impacts analysis or structural analysis can be used in ranking or prioritizing the issues or consequences.

QUEST - An example of Environmental Scanning

The Quick Environmental Scanning Technique, is a scanning procedure designed to assist executives and planners to keep abreast of change and its implications for the organizational strategies and policies. The procedure permits administrators and top executives to share their views and to develop a shared understanding of high priority issues, future options and eventualities which have implications to the institution. QUEST produces a) a broad and comprehensive analysis of the external environment and b) analysis and assessment of the institution's capacity and strategic options for dealing with the external environment. In doing this, the organization can clarify its underlying purpose in relation to environmental changes and also encourage strategic thinking and an understanding of the dynamics of change. The QUEST procedure involves four stages. These are: a) preparation, b) environmental scanning workshop, c) intermediate analysis and report, d) strategic options workshop and follow-up.

Preparation: Preparation for the QUEST involves four specific tasks. These tasks are definition of the strategic issue, selection of participants (usually between twelve and fifteen members), preparation of a notebook which contains information on the major environmental trends and events which are pertinent to the institution, and selection of suitable distraction-free sites for the QUEST workshop. Usually an off-premises site is recommended.

Environmental Scanning Workshop: Following the preparation phase, an all-day workshop is organized to discuss the strategic environment in which the institution operates. The workshop begins with a definition and discussion of the mission, purposes, and objectives of the institution in order to increase the relevance of the deliberations. After the discussion of the strategic context, an open-ended discussion of the critical events and trends in the external environment which could have significant impacts on the institution takes place. During this meeting, time is also devoted to analyzing the cross-impacts of these issues on each other and on the institution's strategic strengths.

Intermediate Analysis and Report: Following the all-day workshop, the results are summarized in a written report. The brief report is presented in two sections with the first part dealing with the institution's mission, purposes, objectives, and stakeholders, and the second part presenting alternative scenarios describing the external environments which the institution may face in the interested future.

Strategic Options Workshop and Follow-up: The final QUEST step is to hold a strategy meeting, usually for about half a day, to discuss the report and the strategic options open to the organization. The strategic options are evaluated, keeping in mind the expected external environment and examining them for consistency with the strengths and weaknesses of the institution. The QUEST is not used to set strategic policies. However, it provides the organization with a series of precise strategic issues which have to be studied in detail before decisions are made.

In doing QUEST or any other active environmental scanning various tools can be used to solicit emerging issues which are of importance to the organization. Questionnaires, Delphi, SWOT

analysis, stakeholder analysis, futures wheels, probability charts, assumption testing, structural analysis, cross impacts analysis, and scenario planning are among the various procedures which can be used.

Issues Analysis as an Extension of Environmental Scanning - The OPIN Program as an Example.

As a process of learning and discovery of critical events and trends in the environment, environmental scanning can easily be extended into analysis of issues, including policy alternatives and their potential implications. The OPIN program, Ohio Policy Issues Network, is an environmental scanning network, the purpose of which is to contribute to the improvement of government and quality of life in the state of Ohio in the United States.

The OPIN program, an environmental scanning process, was augmented by issues analysis because it was discovered that simply identifying relevant issues leads only to recycled discussions and not to continuing contribution. The OPIN program uses environmental scanning as the principal method for anticipating unforeseen emerging issues and trends that the members of the network believe can have significant impacts. Issues analysis was added to provide opportunity for participants to remain involved in the search for solutions. The issues analysis uses environmental scanning as a first step.

A properly implemented issues analysis is more or less a condensed futures study because it involves going through most, if not all, the steps of futures research.

In the OPIN program, scanning the environment to identify emerging issues is a collaborative effort by the members of the network. Extra effort is made by the team to find current factual materials on the emerging issues and specific fields of interest. In addition to these, the network tries to identify the newness or emerging features of the emerging trends and issues; also the scanners consider the implications of the issues to the organizations which they are considering. To guide their analysis of issues several questions were developed. These issues analysis questions guide the discussions during the scanning process. These same questions can be adapted for use in other settings such as addressing an internal corporate or national problem and developing strategies. These questions are:

* What is new about the issue?
* What specific facts are known that substantiate this emerging issue?
* What further information, if any, is needed to support or confirm this issue?
* How is this issue relevant to local leaders, state officials, and governors?
* How can local leaders, governors, and other policy makers influence this issue?
* Who are the other actors this issue will affect?
* What other levels of government will this issue impact?
* What policy options can we propose and what comments do we have about them?

The OPIN program is a practical example of an environmental scanning process. The program follows the basic steps of the scanning process, however, with the addition of issues analysis. Environmental scanning can be adapted to any situation where there is a need for the organization to have a good knowledge about the environment. The implementation of an

environmental scanning process may vary among institutions; however, its primary objective as a learning process about the environment in order to strategically take advantage of external developments does not. As a tool for exploring how an organization should respond strategically to likely future events, it provides strategic planners the capabilities to plan in a more process-oriented environment which cannot easily be understood with predictive and forecasting processes.

Organizing an Environmental Scanning Function for NLTPS

In organizing a scanning function for NLTPS, determination of the issues and developments to scan for is a major problem which has to be addressed. Granted that the unit of study in an NLTPS is a nation, rather than an organization, the focus of the scan for an entity of any size must still take on multiple perspectives. Not only will developments within the nation have to be scanned, emerging issues from the region and the world at large must also be examined. That is, for the purpose of the NLTPS or strategic planning for a nation, multiple perspectives must be adopted. This involves scanning the internal and external environments of the nation.

Spies (1991) specifies the environment of an organization in terms of an hierarchy of influence and control and in terms of multiple perspectives. These he represented with two figures that are in annex III of that paper. However, for a nation, the key elements of the system and trend areas must be completely defined in order to determine the scanning focus. In general, system elements for a nation may contain the following: capital, infrastructure, materials, knowledge, people, energy, customs, laws, processes, and constituents, while the trend areas may include demography, international factors, environment, technology, values and attitudes, knowledge/information, religion, culture, work and workers, agriculture, life-styles, industry and business, institutions, economy, natural resources and family. The above list is not exhaustive,, but it is a starting point.

Given the extensiveness of what an active scanning process will involve for a nation, African Futures has decided at the regional project level to assist the NLTPS process in scanning the regional and international environment. The scanning function will utilize the regional team members as well as other key individuals in strategic positions around the world. Also the regional project is entering into an agreement with the United Nations Millennium feasibility studies project to assist in scanning global forecasts and trends.

As a support service to the National NLTPS process, African Futures will be scanning the region and international environment for developments in the following nine broad domains. They are: conflict and governance, science and technology, agriculture and food security, natural resource and environment, population, education and human welfare, communication and transportation, regional and international economics, social and cultural issues. Each domain will be handled by a member of the regional team.

In scanning the environment, what is important are new trends, emerging issues, ruptures and breakthroughs. The idea is to scan resources for what is new and for developments in the different domains. The scanner is charged with the following: identify the new trend, issue or

event, describe it, find its significance, its importance, its consequences or impacts for the future, its status of development, the actors involved, the source of the information and the location. It is important that there should be a formal procedure for recording the outputs of the scanning process. The name of the scanner must be included in each scanning report. A computer software such as database management program or hypertext can be used to store the results of the scanning exercise. Using computers for this process will allow extensive flexibility in the retrieval and subsequent usage of the system. The regional project office will be encouraging information sharing between national teams and also between the national teams and itself.

Environmental Scanning in the NLTPS process

As envisioned in the project document and in the methodological approach, the NLTPS process, in many ways, is an extension of the strategic planning process. As such, it is a learning process, since it is now recognized, in many circles, that planning is learning. It is a learning process about the past, the present and the future. To learn about the past, since it has already occurred or passed, one can turn to the history books, and in areas where existing books are not adequate one can always employ social science methods to explore and find out what happened. In studying the present, research methods can also be employed. However, learning about the future - which has not occurred - is an extremely complicated and difficult task. One approach which has gained ground, as more and more institutions anticipate the future, is environmental scanning. The NLTPS which is both a futures studies and strategic planning exercise will be employing this process.

As indicated in the African Futures publication, A Methodological Guide to the NLTPS Process, the NLTPS process is envisioned to go through five phases. These phases are: Issue Identification, Preparing the Base of Study, Constructing Scenarios, Designing Alternative Strategies, and a Strategic Agenda and an Action Plan. The issue identification phase is expected to be used to define the purpose of the NLTPS, national aspirations and long-term goals as well as the scope of the study. The phase for preparing the base of the study is to be used for studying the past and the present, analyzing the actors, their roles and strategies, and also to study the most important dynamics in society. The scenarios phase is expected to be used to construct scenarios while the strategies phase is expected to be used to construct broad strategies and policy options. The strategic agenda phase is left for each government to design their action plan and programs for achieving the desired future.

Unlike established institutions with extensive resources and personnel, NLTPS has only a two-year life expectancy and four to five core team members. Given this special situation, the NLTPS process, in doing their environmental scanning, will have to, in addition to the national core team, employ the assistance of outside resources and experts.

Specifically, an environmental scanning committee with fifteen members should be formed at the outset. Four of the members should be the national core team members. The remaining eleven positions should be filled with outside experts and visionaries in different fields. In selecting outside assistants for the scanning process, efforts must be made to utilize existing resources such as the universities, ministry of planning, non-governmental organizations (NGOs)

and the members of the multidisciplinary working groups of the NLTPS. The committee should be chaired by a member of the National Core Team. At the beginning, the committee should meet at least once a month and thereafter meet on a bimonthly basis.

Before the first meeting, the national core team should prepare the terms of reference for the committee, determine the phases in which they will be called upon to provide their services, and in general decide how to make use of the committee during the study process. During this preparation, a brief note on the purpose and objectives of setting up the team should be elaborated, so that it can be distributed during the first meeting. Also the members should be sensitized to the NLTPS processes, and they should be alerted to the contributions which are expected of the team. The team will be scouting internal and external sources of information for emerging issues which will have implications for the nation. During the first meeting of the committee, the focus of the scan must be defined, as well as the sources of information to scan, how the results of the scan will be discussed and elaborated, how the meetings will be organized and the frequency of the meetings. It is also necessary to decide on the day-to-day assignments of each committee member, for example what areas each committee member will be responsible for and what sources of information the members must scan and report on to the scanning committee. In many instances, the committee will need a clerk to assist the chair. It is also necessary to decide on how the reports of the scanning will be written. At this point, it should be noted that for the committee to be effective their decisions have to be completely democratic. The preferred voting method is secret balloting. This is necessary to avoid continued discussions on issues when there is already a consensus, and to reduce the likelihood of a group dominating the proceedings.

Conclusion

...The need for directed active scanning arises mostly due to the dramatic pace at which society is changing today. Scanning, particularly external environmental scanning, is even more important for Africa because of the impacts of the changes in the world on the continent.

To do a credible NLTPS, which demands a 25 to 30 year horizon, it is compulsory that we must scan for all the likely developments within this time frame which would have significant impacts on African nations collectively or individually. Let us examine two examples of likely developments. In the field of bio-technology, scientists in the United States are currently experimenting with the development of genetically engineered cocoa trees which will have all the utilities of traditional cocoa trees (Anderson 1989). The only difference and major problem for Africa is that this cocoa will be able to grow in the United States. Could one imagine the consequences of Africa having to compete with U.S. farmers in the world cocoa market? This is the type of significant event that could have major effects on the opportunities facing cocoa-exporting nations in the developing world and can only be discovered by actively scanning the environment.

Today many of the developed nations are moving from the industrial age into the information society and some are even talking about the impending revolution at the molecular level. These revolutions, and others which are sure to come, will certainly affect the way humans, whether in the developed or developing world, live their daily lives. How will this affect your nation?

Which of the technologies are likely to come on-board soon, that is, within the interested future of 25 years for the NLTPS project?

Discovering changes (critical trends, emerging issues), whether in technology, agriculture or human culture and learning about the effects of these changes on the nation, organization or institution is the sole objective and purpose of environmental scanning. In this regard, it is a process or technique which an NLTPS cannot do without.

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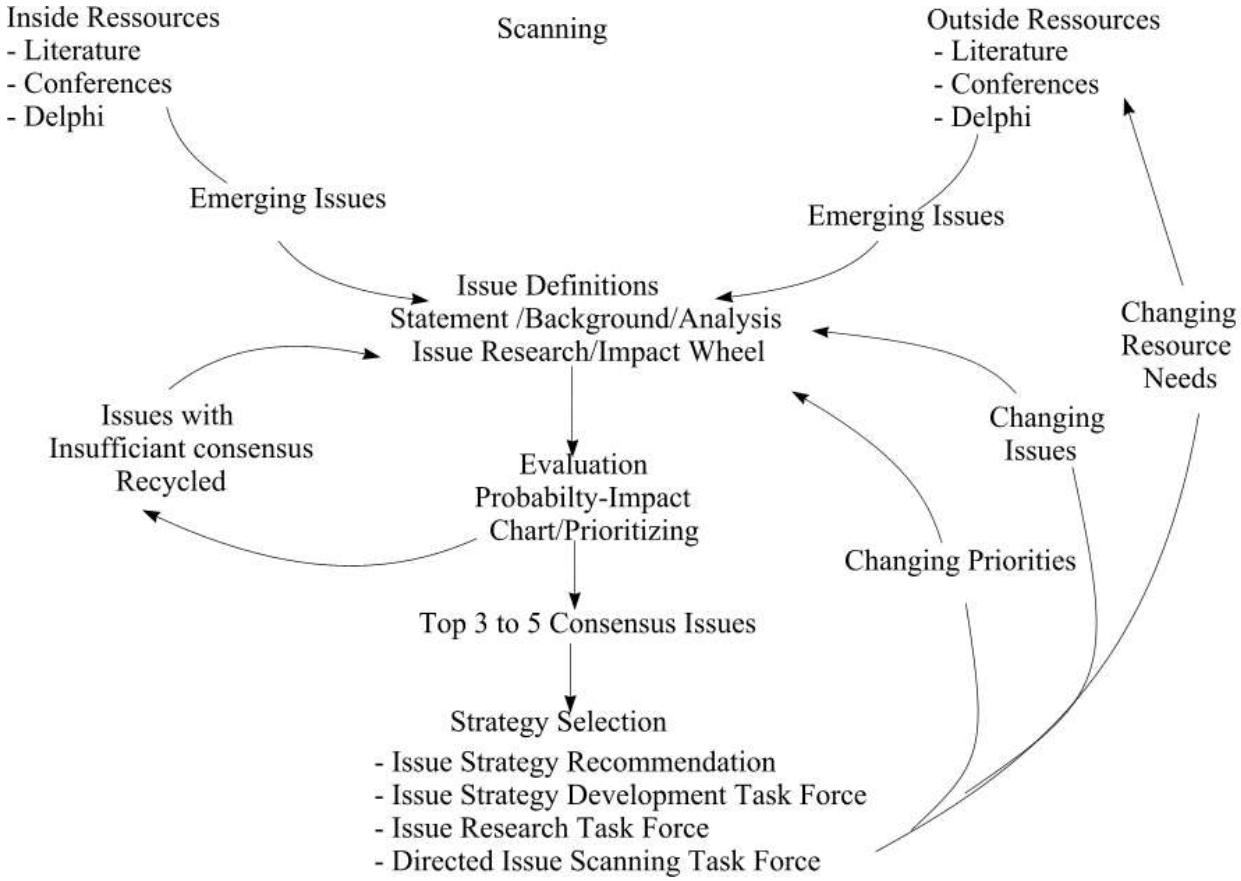
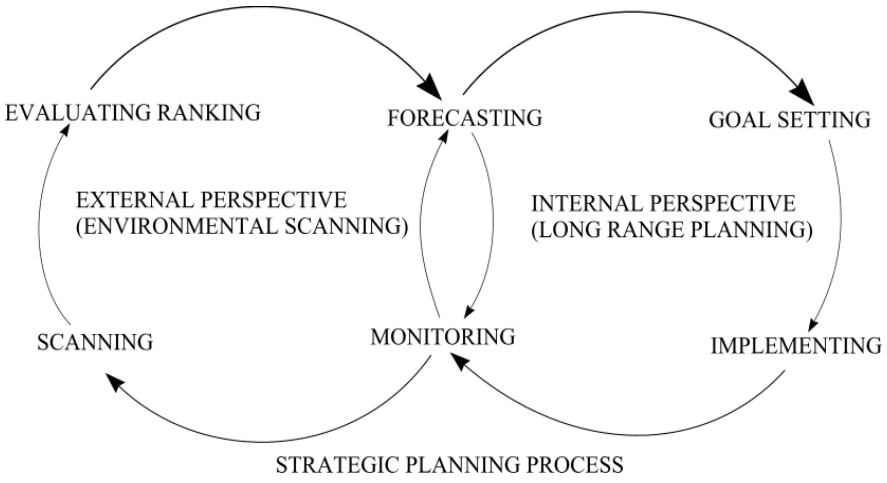
Appendix D: Issues Management Process Flow Diagram and Relationship with the Strategic Planning Process

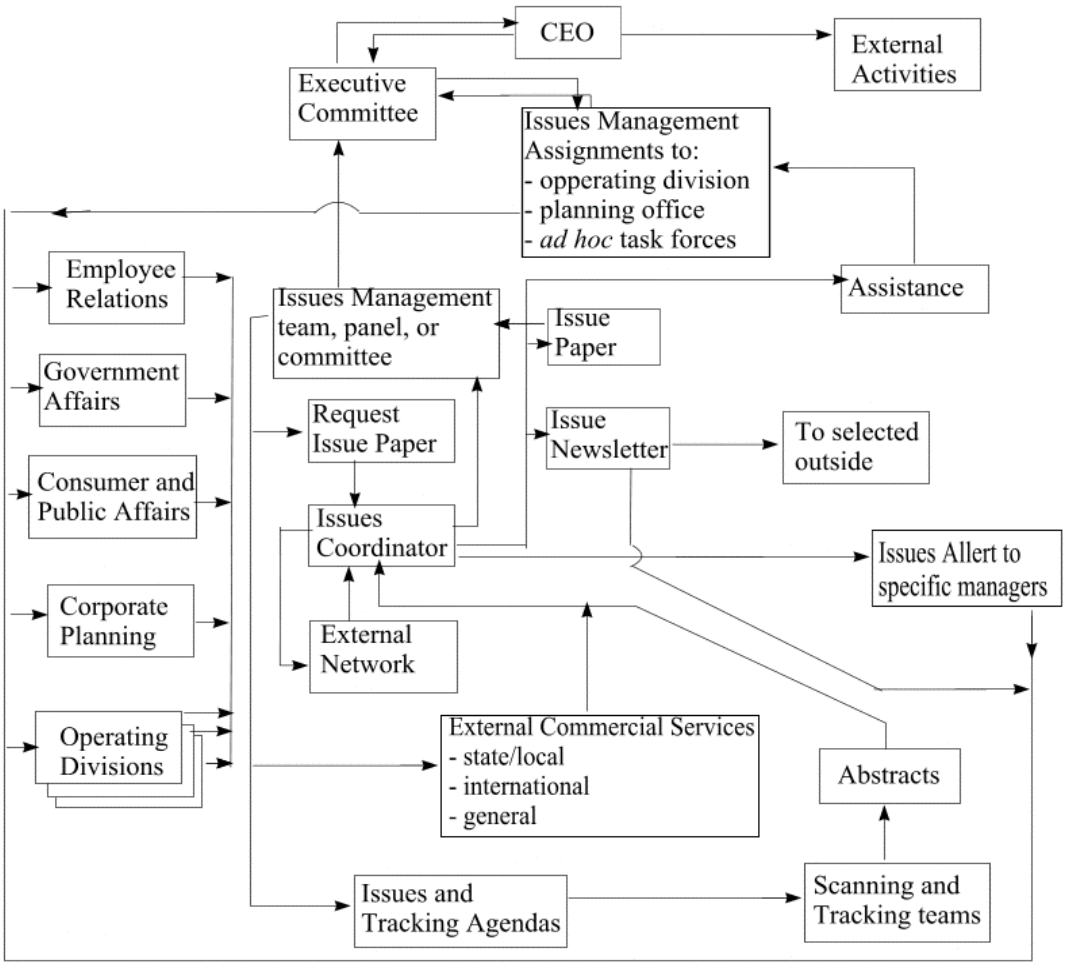
The following diagram illustrates how scanning, both inside and outside a nation, provides information to the strategic planning process. The diagram illustrates that this should not be a static, linear process but one that is dynamic. For a detailed explanation of this process, see *Issues Management in Strategic Planning* by William L. Renfro published by Quorum Books, Westport, Connecticut, USA in 1993, from which the following chart is reprinted with permission of the author:



The following diagram, also from Renfro, illustrates the relationship between environmental scanning and long-range planning that defines the strategic planning process:



The following diagram (reprinted from the author referenced below) will be helpful for national teams to develop their own process:



Environmental scanning and issues management are approaches to help large organizations and nations manage their future. To work, they must be embedded in a network reaching throughout the nation. The location, participation, authority, and path to effective impact are implicit in the organizational process outline above and are fully explored in *Issues Management* by Joseph F. Coates and the Staff of Coates & Jarratt published by Lamond, Mt. Airy, Maryland, in 1986.

Appendix E: Summary Matrix: Issues Management Techniques and Evaluation Factors

The charts on two pages, also reprinted from *Issues Management* with permission from the author, list and evaluate many of the techniques used in environmental scanning and issues management. Many of these techniques are included in the Futures Research and Studies Methodology series of which this is a part. All the techniques below are concisely explained in *Issues Management.*

CODES:

H	High
0-2 (years)	Near Term
S	Some, Short
M	Medium
2-5 (years)	Mid-Term
M	Many
L	Low, Long
5-50 (years)	Long-Term
F	Few
NA	No Applications
UNK	Unknown

Evaluation Factors	Relevance to IM	Importance to IM	Labor Cost	Expertise to Use	Services Available	Use in Startup	Use in steady state	Transferability to new users	Understandable to management	Doable by management	Validity
Techniques Networking	*H*	*H*	*H*	*L*	*S*	*M*	*H L*	*H*	*H*	*M*	*H*
Precursor Events Bellwethers	*M*	*M*	*H*	*H*	*S*	*L*	*M*	*M*	*M*	*L*	*L-H*
Media Analysis (Col. Inch Counting)	*M*	*M*	*M*	*H*	*F*	*L*	*M*	*H*	*M*	*L*	*L-H*
Polls/Surveys	*M*	*M*	*H*	*H*	*M*	*L*	*M*	*H*	*M*	*L*	*L-H*
Executive Jury	*H*	*H*	*L*	*L*	*NA*	*H*	*H*	*H*	*H*	*H*	*L-H*
Expert Panel	*M*	*H*	*H*	*H*	*M*	*L*	*L*	*M*	*H*	*H*	*L-H*
Scanning & Monitoring	*H*	*H*	*M-H*	*M*	*S*	*H*	*H*	*H*	*M*	*L*	*M-H*
Content Analysis	*M*	*M*	*H*	*M*	*F*	*L*	*M*	*L*	*L*	*L*	*M-H*
Legislative Tracking	*H*	*M*	*H*	*M*	*S*	*L*	*H*	*L*	*M*	*L*	*M-H*
Delphi	*L*	*L*	*M*	*H*	*M*	*L*	*L*	*M*	*L*	*L*	*L-M*
Conversational Delphi	*H*	*M*	*M*	*H*	*S*	*L*	*L*	*L*	*H*	*L*	*H*
Consensor	*M*	*L*	*L*	*L*	*NA*	*L*	*L*	*H*	*M-H*	*H*	*H*
Cross-Impact	*H*	*M*	*L-H*	*H*	*S*	*M*	*M*	*M*	*M=H*	*M*	*M-H*
Decision Support Systems	*H*	*M*	*M*	*L-M*	*F*	*L*	*M*	*M*	*M-H*	*M*	*M-H*
Computer Assisted Techniques	*H*	*M*	*M-H*	*M*	*M*	*L*	*H*	*L*	*L-M*	*L*	*M-H*
Small group Process	*H*	*H*	*L*	*H*	*M*	*H*	*H*	*L*	*H*	*H*	*M-H*
Scenario Building	*M*	*M*	*H*	*H*	*M*	*L*	*M*	*L*	*L-H*	*L*	*L-H*
Trend Extrapolation	*M*	*H*	*H*	*H*	*S*	*M*	*H*	*L*	*L-H*	*L*	*L-H*
Technological Forecasting	*L*	*L*	*H*	*H*	*S*	*L*	*L*	*L*	*L-H*	*L*	*L-H*
Decision Analysis	*L*	*L*	-	*H*	*F*	*NA*	*NA*	*L*	*L*	*L*	*L-H*
Factor Analysis	*L*	*L*	-	*H*	*M*	*NA*	*NA*	*L*	*L*	*L*	*M-H*
Sensitivity Analysis	*L*	*L*	-	*H*	*M*	*NA*	*NA*	*L*	*L*	*L*	*M-H*
Trigger Event Identification	*M*	*M*	-	*H*	*F*	*L*	*M*	*L*	*L-H*	*L*	*L-H*
Key Player Analysis	*M*	*M*	*M*	*H*	*F*	*H*	*H*	*L*	*M-H*	*M*	*M-H*
Correlation/Regression	*L*	*L*	-	*H*	*M*	*NA*	*NA*	*L*	*L*	*L*	*L-H*

Evaluation Factors	Scope of Use in industry	Start up Time	Data base Requirements	Interpersonal Skills Reqd.	Usable in Advisory Framework	Understandable to Advisors	Time Horizon	Capital Cost	Application to Strategic planning	Use of Computers
Techniques Networking	M	L	L	H	H	H	0-5*	L	M	L
Precursor Events Bellwethers	M	L	H	L	M	M	0-5*	L	M-H	M
Media Analysis (Col. Inch Counting)	M	S	M	L	M	M	0-2	L	L-M	H
Polls/Surveys	M	S	M	L	M	M	0-2	L	L-H	H
Executive Jury	M	S	L	H	H	H	0-5*	L	L-H	HL
Expert Panel	S	S	L	H	H	H	0-5*	L	L-H	L
Scanning & Monitoring	S	S	M	M	M	M	0-5*	L	L-H	M-H
Content Analysis	F	L	M	L	L	L	0-5*	L	L-H	H
Legislative Tracking	M	L	H	L	L	M	0-5*	L	L-H	M-H
Delphi	F	S	L	L	H	M	0-5*	L	M-H	M-H
Conversational Delphi	F	S	L	H	H	H	0-5*	L	M-H	L
Consensor	F	S	L	H	H	H	0-5*	L	L-H	H
Cross-Impact	F	S	L-H	H	L	L	0-5*	L	M-H	L-H
Decision Support Systems	F	L	M-H	L	L	M	0-5*	M	L-H	H
Computer Assisted Techniques	M	L	M-H	L	M	M	0-5*	M-H	L-H	H
Small group Process	M	S	L	H	H	H	0-5*	L	L-H	L-M
Scenario Building	S	L	M-H	H	L-M	M	0-5*	L-H	M-H	L-H
Trend Extrapolation	M	L	M-H	M	L	M	0-5*	L	M-H	M-H
Technological Forecasting	M	L	M-H	L	L	M	0-5*	L	M-H	M-H
Decision Analysis	UNK	UNK	UNK	L	NA	M	0-5*	L	M-H	H
Factor Analysis	UNK	UNK	UNK	L	NA	M	UNK	L	M-H	H
Sensitivity Analysis	UNK	UNK	UNK	L	NA	M	UNK	L	M-H	H
Trigger Event Identification	UNK	UNK	UNK	M	M	L	0-5*	L	L	L
Key Player Analysis	UNK	UNK	UNK	M	M	L	0-5*	L	L-M	L
Correlation/Regression	UNK	UNK	UNK	L	L	M	UNK	L	M-H	HG