A Global Information Marketplace for Emergency Management

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Abstract

This paper proposes the establishment of a global information marketplace for emergency management to facilitate exchanges of information among autonomous providers and users. It begins by summarizing the global drivers of the information society and the need to adapt to the new order. Then, a conceptual model of a virtual emergency information market is presented. This is followed by an explanation of the functionality that could be provided by such an infrastructure. The last section discusses opportunities and challenges associated with implementing this proposal.

1. Introduction

The "Information Revolution" is changing the way we live, how we work and do business, how we educate our children, study and do research, train ourselves, and how we are entertained (G7, 1995). Key attributes of the "Information Society" include: an accelerating rate of change, increasingly complex technology, networks as key organizational structures, an overabundance of information, global-scale connectivity, and increasingly complex issues (Simard, 2000); for emergency management, we may add increasing values at risk. These changes are expected to reshape the world on a scale equal to the agricultural and industrial revolutions (Toffler, 1980); they will also profoundly reshape emergency management.

In the knowledge-based economy, adding value will be less dependant on processing atoms and more dependant on processing bits (Negroponte, 1995). The ability to create and use new knowledge is seen as the only sustainable competitive advantage (Davenport and Prusak, 1998). However, knowledge must be managed as an asset to be accessible, it must be shared before it can be used, and it must be used to complete the value chain. Creating and managing knowledge are primarily the purview of emergency management organizations. The purpose of an information marketplace would be to facilitate sharing and using knowledge, thereby leveraging its value.

There are many barriers to sharing emergency information, including: diversity and fragmentation of autonomous providers, inadequate systems to enable users to integrate and process information, an enormous volume of information that must be searched, accessibility, in terms of media, format, location, and technology, and the cost of production and acquisition. A global emergency management information marketplace would substantially reduce these

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barriers to benefit the global emergency management community and, more importantly, to mitigate the economic, social, and environmental impacts of disasters.

2. Information Market Concepts

Emergency information spans a broad spectrum of subjects, perspectives, and applications as well as many spatial, temporal, and process scales. Meeting these diverse needs will be challenging. One way to describe the global exchange of emergency information is with a business model involving a marketplace comprising three sectors: providers, users, and information brokers (Fig. 1) The purpose of the market is to enable, support, and facilitate the exchange of emergency data, information, and knowledge among providers and users. Market is used here only in the sense of information transactions irrespective of the exchange of money.

Fig. 1 A Business Model
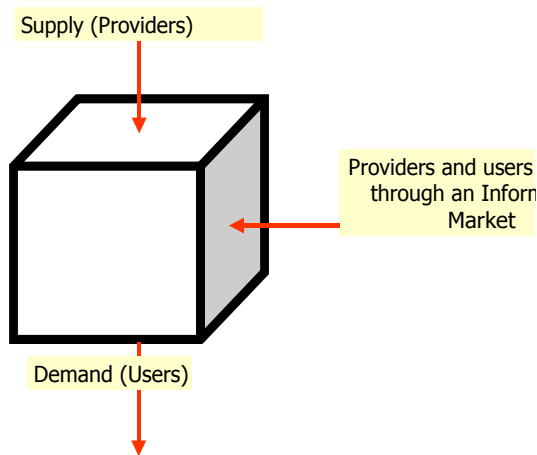
Providers create and disseminate information. The amount and nature of the available information is controlled by provider mandates, roles, and capacities. They may provide repository services or links to repositories, facilitate search and retrieval, convert media and format to that needed by users, and disseminate information – at no cost, at market value, or something in between. Providers can be grouped into four organizational categories with broadly differing mandates, processes, and societal roles: academia, public sector, private sector, and non-governmental organizations (Fig. 2).

Fig. 2 The Provider Face
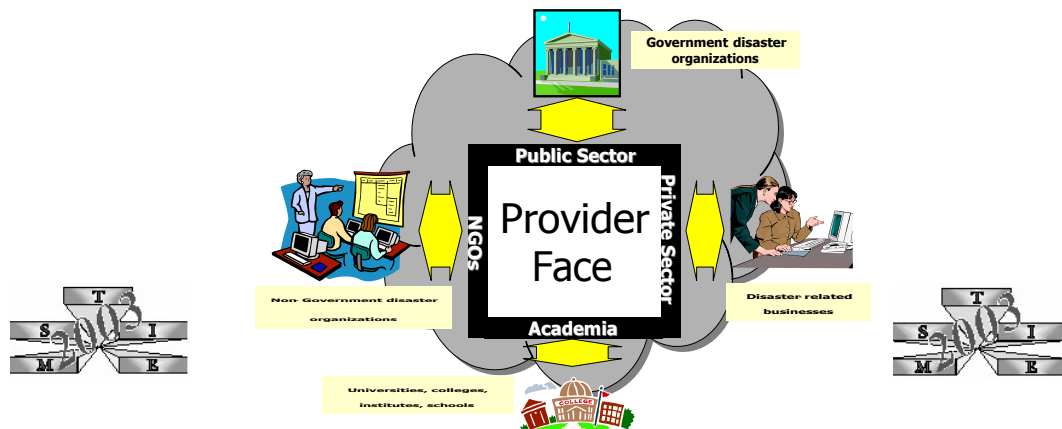
Every emergency management organization distributes and/or provides some access to it's information holdings. Dissemination ranges from traditional distribution of published documents via mail to digital access of electronic documents. It also ranges from disseminating only official reports to allowing interactive access to databases. Despite a willingness on the part of providers to make their information available, there are a number of barriers to sharing information, including: resources, technological capacity, knowledge, management, and institutional issues.

Users acquire information and apply it to addressing issues or solving problems. However, they often have difficulty in finding what they need, filtering relevant content, and applying it to their situation. In a digital environment, a browser and search engine are used to find and download information. User communities can be classified into four groups, based on the nature of their information needs: practitioners, general public, policy makers, and business (Fig. 3). Although information can yield high valued to users, its' relatively abundance and often limited ability to pay, results in a price of information that may be less than its cost.

Fig. 3 The User Face
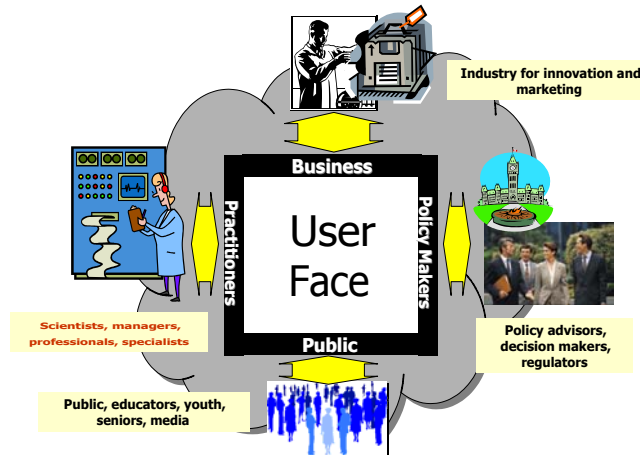
Users are faced with a cacophony of providers and information. The primary challenge is to discover who has what information related to their needs. Then there is the issue of terminology, complicated by an international context. If the user chooses a different key word than an author, a match to relevant material cannot be found. There are several barriers to acquiring and using emergency information, including: technological capacity, searching, limited accessibility, language, retrieval, cost, and quality assurance.

Information Facilitators, such as the Global Disaster Information Network (GDIN), ReliefWeb, the Emergency Preparedness Information Exchange (EPIX) and the Federal Emergency

Management Agency (FEMA) act as intermediaries between providers and users. Libraries have performed an information broker function for more than two millennia. They provide repositories for and access to published knowledge, along with classification systems and thesauri to organize and index knowledge.

Information facilitators may simply provide links, in the form of a portal (Fig. 4). Portals are gateways to an information space defined by a domain, such as emergency management. Portals access content from many providers and may provide some content and synthesis themselves. Portals add value by providing search capability across multiple sites, organizing information, promoting standards, security, content management, tools for processing content, and quality control.

**Fig. 4 A Portal to the Emergency
Information Space**
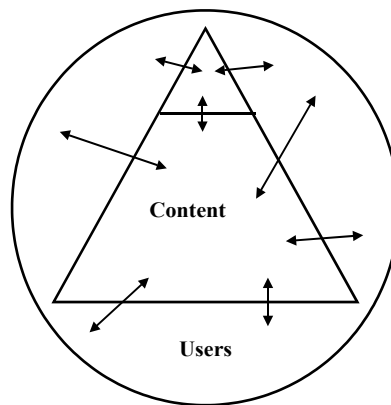
Information facilitators may also add value by providing repository services, publishing and reformatting services, search and retrieval services, manage financial transactions, and interpretive services. Facilitators also face barriers to information exchanges, including: resources to support international initiatives, multiple standards and types of information, legal issues, different languages and terminology, and costs of processing and managing information transactions.

Providers focus on organizational mandates; users on individual needs. There is a clear need for a service to facilitate the exchange of information among providers and users. Because the bulk of the added value accrues to users, however, it is critical that resource requirements and effort be minimized for providers.

3. Functionality

Anyone with a computer connected to the Internet and World-Wide Web can currently access and retrieve information from anyone else that is also connected. The role of a global emergency information market would be to add sufficient value to currently available information so that it becomes the portal of choice for a critical mass of providers and users.

A global emergency information marketplace could provide a number of services to support the global emergency management community.

- Information retrieval – support Web-based information search and retrieval
- Accessing data – support Web-based global database search and access
- Synthesis and expertise – create value-added information products and reports
- Supporting interaction – support networking among communities of interest
- Promoting dissemination – assist providers with communication and cataloguing
- User assistance – help users with searching, reformatting, and interpretation.

Most Web sites organize their information in only one dimension (e.g., organizational function, subject, events). These are essentially the same as one-dimensional physical library card catalogues based on author or title. You need some clue or background in what you are looking for (such as who is responsible for what in an organization) before you can find what you want by browsing. This leads to a lot of user frustration and ad hoc success (or failure).
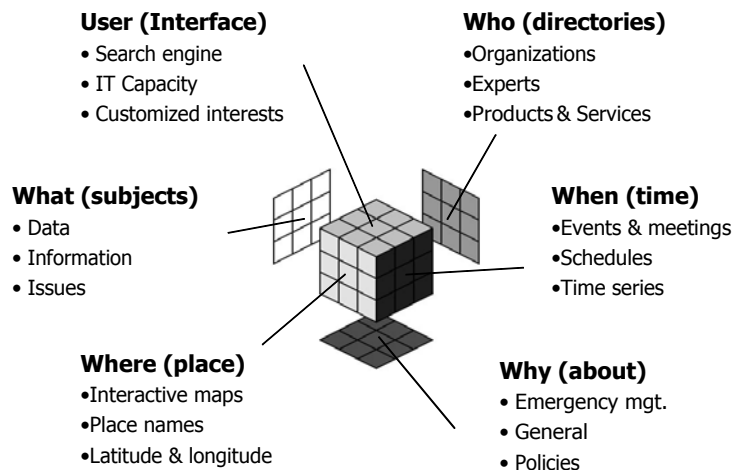
Alternatively, many sites include a search engine based on key words or whole text searches. This can be viewed as a free-form organizational structure with an unlimited number of dimensions. If you know something about what you are looking for, it is far more efficient to go to it directly. Of course, success here depends on knowing the exact keyword used by the organizer to classify the information – another significant source of uncertainty.

The proposed global emergency information marketplace can be visualized as a cube, with each face representing one view, or window into the space (Fig.5). The six dimensions represents a substantial increase in browsing flexibility over one-dimensional lists. It can be likened to having a book with chapter headings in which you have some idea of what is in that chapter. Those who learn best through books will feel most comfortable with this approach; particularly when coupled with a keyword search engine (the index at the back of the book). Actually, a virtual information space can have any number of views, but the image of a cube is readily understandable by everyone. When someone "enters" the space through the portal, they may do so through any "window," depending on the type of information they are searching for.

Although the six views could be organized around services, these are not the way that users are likely to search for content, nor is it easy to understand the types of content that are to be found underneath. A better approach would be to structure the *external* windows around ways in which users are likely to look for content. The familiar "five Ws" (Who, What, When, Where, and Why) are useful in this respect. They are not only easy to remember, but also they relate to fundamentally different ways of organizing information. Adding a user interface (or a "How"

Fig. 5 Information Market-Functionality

User (Interface)
• Search engine
• IT Capacity
• Customized interests

Who (directories)
•Organizations
•Experts
•Products & Services

What (subjects)
• Data
• Information
• Issues

When (time)
•Events & meetings
•Schedules
•Time series

Where (place)
•Interactive maps
•Place names
•Latitude & longitude

Why (about)
• Emergency mgt.
• General
• Policies

for technical information) for the sixth face completes the external view of how the virtual information market would appear to users.

Internally, content would be structured very differently. Content would be stored only once with metadata relating to each external view. Three views or content dimensions (time, space, and subject) are shown in Fig. 6. A user might be interested in a subject, when an event occurred, or the place to which it applies. Conversely, this is also a "no wrong door" approach in that no matter how a user enters the information space, they can quickly find what they are looking for. A multi-dimensional organizational structure allows users to link to related information that has been classified differently. For example, a user starts by finding a "named" natural disaster, then switches to a map of the affected area, followed by a time series of the event's evolution, followed by a link to an expert in the field, and finally, a publication on the subject.

Figure 6 also shows that it is not necessary (it is also infeasible) to populate the entire information space to achieve functionality. Rather, only existing information that is readily accessible need be included at the start. Finally, most information would be relevant to only a subset of external views. For example, the strength of construction materials in terms of earthquake resistance has no space or time attributes.

Fig. 6 Populating the Information Space

What
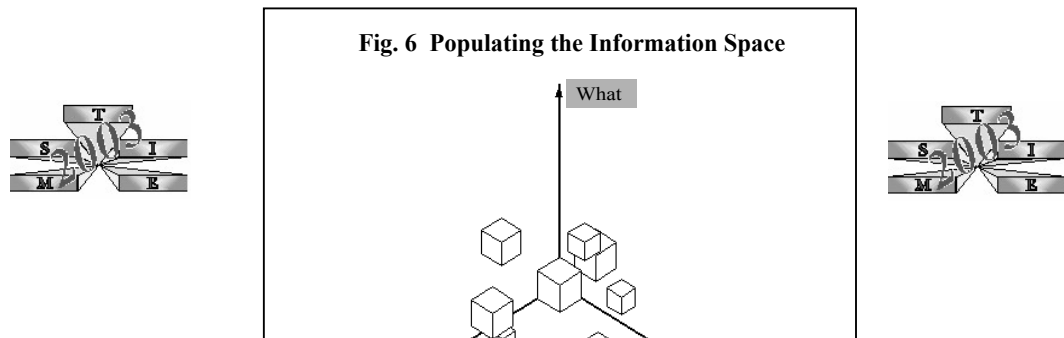
4. Discussion

This section discusses the benefits of a global emergency information market, factors that will enhance the chances of success, and challenges that will have to be overcome with associated risk management strategies.

Benefits

Developing and implementing a global emergency information marketplace in cyberspace would yield a number of benefits to providers, users, and emergency management. More importantly, it would also reduce the human, economic, and ecological impacts of natural disasters.

Providers

- Broadening the reach of emergency information would increase the visibility, influence, use, and impact, of information disseminated by providers.
- Providers would be seen as active, serious, competent, and knowledgeable global players, thereby increasing business opportunities.
- Increasing awareness of information availability would encourage partnerships, synergy, and leveraging resources to reduce duplication and redundancy.

Users

- Establishing a single gateway to global emergency information would facilitate users' ability to readily access information from multiple providers.
- Adopting common terminologies and thesauri would enable users to find and filter relevant information much more efficiently than is currently possible.
- Fostering and promoting common interoperability and metadata standards would make it easier for users to integrate information from multiple providers.

Emergency Management

- Making information more readily available when, where, and as needed.
- Lowering the cost of producing, providing, and using disaster information.
- Leveraging the efforts of existing disaster information and relief networks.
- Supporting more timely and better co-coordinated disaster response.
- Creating synergy to enable the production of new kinds of information.
- Increasing public awareness of how to plan for and respond to disasters.

Success Factors

A number of factors enhance the likelihood that a global emergency information marketplace could be successfully developed and implemented in cyberspace.

- A substantial number of agency and international sites already exist, indicating both a willingness to provide information as well as a need for it.
- An enormous amount of information is readily available to anyone with a computer connected to the Internet.
- The value of the totality of all emergency information currently available via the World-Wide Web is beyond calculation.
- Connectivity through the Internet and World-Wide Web greatly facilitates the dissemination and accessibility of information at very low cost and effort.
- A fundamental property of digital documents is that after the first copy is produced, reproduction and distribution costs are virtually zero.

Challenges

Developing and implementing a global emergency information market is an ambitious and complex undertaking. Many obstacles will have to be overcome if it is to succeed. Yet, sufficient commitment by a critical mass of stakeholders, can overcome these obstacles.

The single greatest obstacle will be to secure adequate resources. An initiative of this magnitude will require a critical mass of full-time, dedicated staff and funding to succeed. Financing would be sought from international donor organizations and potential sponsoring agencies. A firm commitment for adequate resources would be secured before beginning substantive work.

Operating an ongoing service will require a permanent staff to manage content and the IT infrastructure, as well as grow the network. It will be necessary to secure permanent sources of stable funding. Once a global-scale prototype network is operational, precise cost estimates for implementing and maintaining it would be developed. Leveraging the success of the prototype would facilitate securing adequate permanent funding.

It is essential that information and knowledge be retained as close to the source as possible to maintain relevancy and provider buy-in. A robust and secure distributed global-scale infrastructure will be needed to share and protect content. Surveys would be used to estimate capacity requirements. The infrastructure would be based on robust, mature off-the-shelf technology. It would include adequate security, appropriate redundancy, and systematic maintenance.

Language is a daunting barrier to international communication. No language or even set of languages could suffice as standards. The difficulty with translation on a large scale is that it remains essentially a costly, time-consuming human activity. Regional nodes would mitigate language barriers through existing relations among related languages. Selected document titles and key words would be translated into searchable languages. Artificial intelligence could be used to roughly translate documents.

Providers decide what, how much, and in what media and format they disseminate information. Agreeing on a set of interoperability, metadata, and service standards among providers and users will be a significant challenge. Internet and World-Wide Web protocols would be used to connect providers and users. A set of open standards would be selected to which content from most providers could be easily transformed.

Although leading-edge Internet users can exchange information at gigabyte rates, most users remain connected through a pair of twisted copper wires. Most users are, and will continue to be, limited to relatively low technology. Approaches that work satisfactorily with limited bandwidth and computer capacity would be used. A flexible infrastructure should allow providers and users with different capacities and capabilities to exchange information at different levels.

5. Conclusions

The information revolution provides the technology to access vast quantities of emergency management information at the speed of light. It also provides the enormous power of a global network when and where a user needs it. Conversely, it is difficult to find the precise information needed for a particular situation in the morass of what is available. As the pace of change accelerates, issues become more complex, and the consequence of decisions increases, it will become increasingly advantageous for emergency organizations to participate in a global information marketplace. As a cyberspace version of the agora of ancient Greece, this would provide a virtual place for providers and users to exchange information to the benefit of all emergency management organizations around the world.

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