Multi-class interest profile: applications in the intelligence process

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Abstract
Noting that accurate information needs overlay the entire intelligence cycle from planning to reporting, the authors propose a new concept to fine-tune the process of electronically gathering information. Since most tools are nondiscriminatory in information gathering, a new concept is needed to assist managers at all levels of the organization. The proposed multi-class interest profile (M-CLIP) provides the capability of expanding the representation of interests to reflect the assorted areas that make up a manager's information needs. The M-CLIP covers project, organizational, and industry class interest areas. Each area is customizable to make the search pertinent to the user while considering the need for both recall and precision. Supporting features, such as profile expansion, and fine-tuning are also considered.

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Introduction

> Facts should lead us to better decisions. Facts provide the basis for improved decision making as well as monitoring or measuring the performance of the decisions over time. The advent of business intelligence tools made it easier for us to access business facts that can help us make better decisions (Osterfelt, 2001, p. 1).
>
> Current practice in CI is characterized by manual information gathering – CI professionals tend to spend 80 percent of their time manually gathering data and only 20 percent of their time using tools to aid the gathering and analysis process (Nodine *et al.*, 2000, p. 7)

Theory in the intelligence process has its heritage in environmental scanning (Aguilar, 1967; Fahey and King, 1977; Fahey *et al.*, 1982; Hambrick 1982). But the topic has more recently been examined under the labels of business intelligence (Cleland and King, 1975; Pearce, 1976; Benjamin, 1979), and market[ing] intelligence (Guyton, 1962; Pinkerton, 1969; Chonko *et al.*, 1991).

The existence of market or business intelligence as a business activity has previously been examined by studies involving CEOs, executives, and other managers (Keegan, 1974; Fahey and King, 1977; Montgomery and Weinberg, 1979; Zinkhan and Gelb, 1985; Daft *et al.*, 1988; Prescott and Smith, 1987; Gelb *et al.*, 1991; Ghoshal and Westney, 1991; Cartwright *et al.*, 1995; Maltz and Kohli, 1996). Crucial to these findings is the demand for tools that allow for the increased efficacy of the manager when processing intelligence for decision making (McCann and Gomez-Mejia, 1992; Vedder *et al*, 1999; Kim *et al.*, 2000; Fuld, 2001).

There is a multitude of tools available for gathering marketing and competitive intelligence, and new tools are appearing at an increasing rate. Osterfelt (2001) noted that there is a marked difference between query tools and analytic applications; therefore, selecting the proper tool is very important. A report by Boureston (2000) discussed the status of many of these tools and the advantages and disadvantages of the various tools are examined. The problems, however, is that unless those tools are equipped with an adequate specification of the environmental variables that need to be monitored, their information gathering will be incomplete.

A great deal of research has been devoted to studying how to look for information, while seemingly overlooking the equally vital issue of what information to look for. In fact, a recent review of software marketed toward the online intelligence community clearly illustrates that the ability of most software to gather what information is clearly deficient (Fuld, 2001). The two basic activities that a CI professional is most concerned with include, first, providing on-demand historical snapshots of competitor statistics across multiple behavioral indicators and, second, detecting trends and shifts in trends for technology indicators (Nodine *et al.*, 1999). Vedder *et al.* (1999) reports the effectiveness of CI programs is rated as only fair to good among the CEOs and CIOs surveyed. This, he suggests, means there is room for improvement in the means that CI professionals do their job. The purpose of this paper is to propose a means of creating a profile of scanning interests that more completely expresses information

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needs, thus leading to more effective and efficient environmental scanning.

Background

As noted, there have been many attempts to address the problem of accurate environmental scanning and competitive intelligence gathering through the application of a wide range of tools. Profile-based tools, such as intelligent agents, push phase information access, and information filters, screen information through a profile of interests or preferences (Berghel, 1997). Often, these profiles are a set of topics or keywords that describe specific interests (Foltz and Dumais, 1992). The primary weakness of this filtering approach is its reliance on the completeness and accuracy of a one-dimensional or single-class profile. If that profile is insufficient in any way then the effectiveness of the filtering process is seriously impaired. For example, if the profile is incomplete or too narrow in scope, the filter will be unable to extract all of the pertinent information available and the investigator may remain unaware of many important facts. If, on the other hand, the profile is too broad or general, then the filtering process may, in fact, increase information overload by generating a flood of irrelevant information. In short, the filtering criterion specified within the profile is the pivotal element in determining the success or failure of any filtering system.

Descriptions of current profiles are as a model or set of words that identify specific interests. In their current form, however, such profiles are often incomplete and unlikely to be sufficiently comprehensive to capture all of the issues that are significant to a corporate decision maker. Even highly individualized profiles tend to be single-dimensional unless extreme care is taken during profile construction. The restrictions related to using a single-class profile significantly limits the potential of any information filtering system to serve as a reliable information-gathering tool in the workplace.

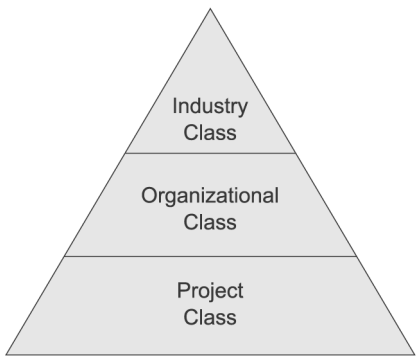
Because of the difficulty inherent in expressing a complete set of information needs in a single-class profile, a multiple-class profile must be considered. A multi-class interest profile (M-CLIP) provides the capability of expanding the representation of interests to reflect the assorted areas that make up an individual's information needs. Work by Stadnyk and Kass (1992) proposes the development of knowledge bases of description categories over which individual models of interests can be defined. The M-CLIP is an extension of this approach, and provides a framework based on the various types of information needs, each of which is made up of a set of attributes or keyword categories designed to insure that key items within each area are accounted for. By expanding the scope of the profile from a traditional one-dimensional or single-class representation to a multi-dimensional representation, the M-CLIP makes it possible for the filtering system to provide enhanced coverage and effectiveness, thereby leading to improvement in both competitive intelligence and knowledge management.

Design

The foundation of the M-CLIP is that the information needs of any corporation span several areas. The various components that make up these information needs vary from company to company and project to project. An analysis of information needs of corporate users requires consideration of the types of information required by different management levels. Organizations can be viewed as multi-level entities, as shown by Anthony's managerial pyramid model (Anthony, 1965). Each level represents a different level of control, and has different information needs.

By considering such information-intensive activities as project management, strategic planning, competitive analysis, and environmental analysis, and then recognizing a correlation between the information needs of those activities and the managerial levels described in the managerial pyramid, the primary components that make up the M-CLIP were derived (see Figure 1).

Figure 1
The M-CLIP components



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Project class

A project class consists of interest areas selected to accommodate the information needed to better manage projects that the corporation is currently undertaking. This includes both long-term activities, such as tracking the daily or weekly actions of a major competitor, as well as shorter-term specialized projects such as the investigation of a possible acquisition or alliance prospect. A variety of internal and external factors, and the awareness of these factors, can influence the success or failure of a project. Studies indicate that only around 20 percent of the projects undertaken are successfully completed owing to poor management, technical failure, and legislative or regulatory changes (Beidleman *et al.*, 1990).

The project component allows environmental scanning tools to be used to gather more effectively information relevant to ongoing projects. Information regarding project attributes such as market considerations, product differentiation, economic environment, and material costs are vital to project control. Considerations such as technical requirements and manpower capabilities must also be monitored. Increased access to pertinent information can help project managers to anticipate problems and act accordingly, thereby re-examining both the feasibility and the appropriateness of project objectives and planning assumptions on an ongoing basis. By being made aware of pertinent information as soon as it becomes available, project administrators can better identify and manage risks. Table I shows the interest areas that make up the project class.

Organizational class

An organizational class includes such individualized areas as technical interests, investment issues, corporate news, industry information, etc. This includes both internal and external information at both the tactical and strategic levels that may have not been previously shared with all appropriate divisions of the organization. For example, a regional manager in Miami may be closely watching the actions of a new competitor, not realizing that the Denver office has maintained a complete file on the company since they began doing business in Colorado several years earlier under a slightly different name. Internal scanning, in conjunction with knowledge management tools, would help to reveal the availability of such information. By sharing this information, the Miami office could be proactive rather than reactive to the actions of the new competitor. By sharing such information, strategic planners may find that plans must be altered owing to the expansion of a formerly regional competitor. Table II shows the interest areas that comprise the organizational class.

Industry class

An industry class is intended to satisfy information needs that stem from the type of industry or organization performing the investigation. This class can target information related to the general external environment of the company. For instance, a corporation may want to keep a watchful eye on possible changes in competitive, economic, political, legal and regulatory, technological, and socio-cultural forces. This includes both the domestic and international marketplaces.

Because of its focus on external and long-range issues, this segment is particularly critical in the environmental scanning process. Information regarding key economic, social, and technological issues that affect the organization helps managers to allocate attention and resources correctly (McCann and Gomez-Mejia, 1992). In any industry there are certain key factors on which all firms depend for success, such as a widespread level of manufacturing technology, the availability of low-cost raw materials, the presence of protective regulation, or certain customer attitudes or characteristics. Changes in such key environmental variables may have the potential to dramatically alter the industry as a whole. Those firms that become aware of such changes early can get a head start on incorporating those changes and can consequently attain a major competitive advantage. Table III shows the interest areas that are contained in the industry class.

As indicated in Tables I-III, each of the components that make up the M-CLIP includes a set of suggested interest areas for which multiple keywords or concepts can be specified. Because no such list can realistically be exhaustive, each class is made extensible by including provisions for a set of user-defined categories for which additional interest areas can be specified.

Additional considerations

The goal of any information gathering system is high recall and precision. Recall is the percentage of available relevant documents that are collected by the system, while precision is the percentage of all the information gathered by the tool that is actually of use to the corporation (Cleverdon

Table I
Interest categories that make up the project class

Interest area	Description	Example
Project goals or objectives	Overall focus and goals of the project. Includes such factors as scope, time and cost parameters, environmental, technological, and operational constraints, milestones, and control considerations	Strengthen market share, upgrade infrastructure
Project basis or background	Premise or background information on which the project is based	Availability of faster processors, improved bandwidth
Technical requirements	The technical requirements associated with the project	Broadband, high speed networking hub, GigaPop, Bluetooth
Resource requirements	The number and skill level of personnel involved in the project or the project results; the cost of materials required as well as their availability	Price of P4, price of P3, release date of Tualatin, Itanium servers, Athlon
Market considerations	Progress of competition, product differentiation, economic environment	Internet cafes in California, southwest, western Canada
Project management priorities	Includes scheduling, cost control, quality control, scope management, contract management, resource management, and interface management	Access speed, faster PCs, wireless
Financial requirements	Factors that influence project financing or costs.	
Return-on-investment factors	Factors that could influence the projected return-on-investment	Increased patronage
User-added interest areas	Miscellaneous interests that do not fit neatly into other categories	

Table II
Interest categories that make up the organizational class

Interest area	Description	Example
Technological Interests	Technological or scientific areas that affect the organization	Microsoft Exchange mail server security, PC recession, wireless networks, Bluetooth
Financial/investments	Stocks or other portfolio items of interest	Decrease in technical stocks, .dot com failures, decrease in prime lending rate
Legal issues	Legal issues that impact the organization	RIAA
Corporate news	News that affects the corporation	Bandwidth sharing, 802.11b, wi-fi
Unexpected operating expenses	Increases in the cost of utilities, insurance, labor, materials, transportation	Public Utility Commission, utility rate hikes, NT underwriting costs
Personnel	Qualifications and training needs of personnel	Internet navigation, Internet research, peer-to-peer
Infrastructure	Infrastructure maintenance and improvements	End of free Web, high-speed Internet access
Professional affiliations	Professional or industry affiliations with which an organization should be involved	IEEE
Regulatory issues	Regulations issued by governmental or licensing bodies that directly affect an organization	Library filters
Political issues	Political issues that affect the organization	Online privacy legislation
User-defined categories	Miscellaneous interests that do not fit neatly into other categories	

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Table III
Interest categories that make up the industry class

Interest area	Description	Example
Customer base and marketplace	The group or type of customer that the organization serves	Internet savvy, coffee drinkers, Playstation
Industry	The industry type and major products that the organization produces	Internet café, Web café, cyber cafe
Socioeconomic and demographic	Socioeconomic factors that affect demand for the organization's products	Target neighborhoods
Competition and corporate environment	Industries that produce the same or substitute products	Cybarea, Swish, EasyEverything
Manpower and resources	Availability of qualified personnel and organizational resources	
Technological	Technological factors that affect the organization's performance and success	Playstation, PC pricing trends, bandwidth
Geopolitical	Geopolitical factors that affect the organization's markets and expansion	
Governmental	Regulations and trade barriers that affect an organization's markets such as import/export laws, taxation issues, business law, patent and trademark law	Tauzin-Dingell Bill, Financial Services Modernization Act
User-defined categories	Miscellaneous interests that do not fit neatly into other categories	

et al., 1966). One of the dangers inherent in any system that relies on expanded interest profile is that it will consequently lead to the collection of more extraneous information, thus decreasing precision.

While the multi-class design of the M-CLIP makes for a greatly expanded profile, improvements in both recall and precision can be attained by further expanding the profile in order to make it as comprehensive as possible and then by assessing the profile and removing any keywords or concepts that result in unwanted material passing through the filter. Expansion of the M-CLIP is necessary to account for synonymy, i.e., the wide variety of terms that can be used to describe the same topic. Synonymy makes it difficult for a profile builder to select the exact words or phrases that will result in the most successful filtering of information, because different individuals often select different keywords to describe the same concept (Furnas *et al.*, 1987). Synonymy can be managed by supplementing the M-CLIP with additional features such as specialized templates and a profile-expansion mechanism.

Specialized templates

The purpose of specialized templates is to provide guidance to the user during the profile generation process. The multi-class interest profile provides a degree of guidance for the user in profile creation because the very structure of the M-CLIP forces the user to consider those areas contained within each class. However, additional guidance can be provided with the inclusion of domain-specific templates to help insure a more comprehensive profile. This requires the development of a knowledge-base of sample profiles, or specialized templates, that serves as a listing of suggested keywords for the user in that particular domain during the profile generation phase.

The creation of specialized templates is made easier if a common vocabulary can be established for the domain. Ontologies are especially useful for this task. An ontology provides a specification of a shared conceptualization to be used for formulating knowledge-level theories about a domain (Domingue and Motta, 1999; Guarino, 1997). If a specific domain or domains can be identified and selected for the knowledge-gathering process, then a common ontology can be defined to map vocabularies of specified terms with generally accepted definitions (Gruber, 1991).

> Ontologies inform the system user of the vocabulary that is available for interacting with the system and about the domain and the meaning that the system ascribes to terms in that vocabulary" (Farquhar *et al.,* 1997).
>
> Tools like the Ontolingua Server can be used to assist in the construction of ontologies (Farquhar *et al.*, 1997).

Profile expansion

The purpose of profile expansion is to deal with the problem of synonymy, as discussed previously. Useful for expanding acronyms as well as providing less common industry or career phrases, the synonym feature helps to expand the profile and make it more

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complete by supplementing the user's keyword selections. Profile expansion can be accomplished through various techniques, including query expansion, ontologies, or thesaurus programs. Hancock-Beaulieu and Walker (1992), Robertson (1990), Ekmekcioglu *et al.* (1992), and Guarino (1997) all investigate query expansion from an information retrieval perspective. Ontologies can also be used to expand or even refine a profile. The ontology can be used to supplement the words that were included in the profile, or to replace the specified words with a more domain-specific term. Thesaurus programs are also an option that should be considered in profile expansion. Jones (1993), Lee *et al.* (1994) and McMath *et al.* (1989) explore the use of thesaurus data models in retrieval systems. A relational thesaurus identifies sets of lexical relations that exist between word pairs, while a statistical thesaurus is constructed by analyzing the co-occurrence of different terms in the collection of documents or Web pages being searched. Thus, words that appear frequently in the same context will appear together in the thesaurus so that the profile can be intelligently expanded. An excellent discussion of various approaches to thesaurus construction can be found in Crouch and Yang (1992). Each of these approaches provides a viable alternative for profile expansion, and any of them can be adapted to serve as a profile expansion mechanism.

For example, a user may include the term FireWire in their project class, but may overlook the technical designation IEEE 1394. The profile-expansion feature must be capable of supplementing provided terms (FireWire) with one or more expansion terms (IEEE 1394 or even USB). Thus, a profile-expansion feature can provide synonyms or alternatives for each keyword. After expansion occurs, the user must have the option of reviewing the additional terms and removing those that are deemed unnecessary or irrelevant.

Profile fine-tuning

Although profile expansion helps to increase recall, it can lead to a decrease in precision. Increasing the size of the profile will almost inevitably lead to an increase in the number of documents returned, but not all of those documents will be relevant. Some of the original interests in the profile may have been poor selections. Further, other interests may become obsolete as the user's interests evolve. Frisse and Cousins (1989) note that there is often an abrupt change in the desirability of information topics, and information that once seemed essential may suddenly become redundant. The adaptive mechanism can counter that problem by insuring that only optimal interest areas are represented in the M-CLIP. When user interests change, the system must be able to notice that change and, further, it must be capable of adapting in response to that change (Sheth, 1994).

One method of adapting in response to user needs is based on an analysis of user behavior patterns of which users are not aware (Fischer and Stevens, 1991). Based on these usage patterns the system can assist in modification of the profile to maintain its accuracy. This concept has its basis in Anderson's (1990) discourse on the rational analysis of human memory, which recognizes that past usage patterns help to predict future usage. In order to determine which portions of the profile are responsible for irrelevant material, user feedback must be used. Relevance feedback allows users to assess the relevance of filtered material to their information needs. Incremental feedback is a form of relevance feedback especially applicable to information filtering, because judgments are made on a case-by-case basis rather than all at once (Allen, 1996). When the user evaluates and rates the documents or Web pages returned by the filtering system, that rating can be associated with the specific interests that led to the selection of that material. By maintaining a cumulative average rating for every term or concept in the profile, the M-CLIP can track profile performance. The system can be designed to monitor the ratings and automatically reduce the relative weight of suspect terms, automatically remove those terms, or periodically request user consideration of suspect terms for possible removal.

An alternative to relevance feedback is implicit feedback, as described in Oard and Kim (1998), Kim *et al.* (2000) and Balabanovic (1998). Implicit feedback can be inferred from user behavior without any additional work on the part of the user. Regardless of the approach selected, an adaptive feature should be used in conjunction with the M-CLIP.

Practical implications

The M-CLIP allows the calibration of information-gathering techniques to a specific organization or type of corporate user. By encompassing a wide spectrum of corporate interests, the M-CLIP provides the means to access a greater percentage of

relevant online information, enhancing knowledge management efforts. The multiple classes that comprise the M-CLIP provide a set of customizable components. This allows each user to retrieve the type of information that best suits the nature of decision at hand. For example, one user may be interested in the overall picture of an industry, while another is interested only in the legal issues that the company may face, while still another needs to know what promotional campaign a competitor is about to launch.

This customization can take place on a variety of levels. If users are individually responsible for constructing their own profiles, then the organization can develop component templates and make them available to users to provide suggested interest areas. If, instead, the organization prefers to supply standardized profiles to users, then entire profile components can be pre-built and customized to target a particular specialization, situation, project, or the overall organization. Once created, these components are available throughout the organization with minimal modifications. This makes it possible to create a complete profile by integrating a set of pre-constructed components. This helps to insure that individuals in key positions throughout the firm are performing the type of information acquisition necessary for optimal decision making.

While this discussion of the M-CLIP assumes a text retrieval information-gathering approach, the basic idea behind the M-CLIP, i.e. multiple segments that reflect the spectrum of information needs, can be incorporated into other types of information-gathering systems. For example, the M-CLIP can be integrated into systems that utilize context information, keyword proximity, or other types of semantic matching when evaluating information. A simplified example demonstrates the application of the M-CLIP to latent semantic indexing (LSI) as it is described by Foltz and Dumais (1992).

LSI calculates associations among terms and documents with the assumption that there is an underlying structure in the pattern of word usage across documents. A description of terms, documents, and user queries based on the underlying semantic structure is used for representing and retrieving information. User interests can be described in a document profile made up of documents that the user has previously rated as useful (Foltz and Dumais, 1992).

By incorporating the concepts behind the M-CLIP, the initial document profile created by the user can be enhanced to become a multi-class document profile. A multi-class document profile is a set of abstracts developed by the user describing project-level interests, organization-level interests, and industry-level interests. These abstracts can be incorporated into the user's document profile and assigned the highest possible rating. In this way, the LSI filtering system can be "trained" to retain documents that best reflect the user's interests as specified in the multi-class document profile.

Conclusion

The multi-class interest profile can be easily implemented using any object-oriented tool as a plug-in or enhancement to an existing information-delivery system for the express purpose of providing competitive information. The separation of content and design allows the concept of multiple classes of scanning interests to be implemented in a variety of ways, and it can be utilized in intelligent filters, profile-based push software, bandwidth managers, search engines, and intelligent agents. Regardless of the manner in which the M-CLIP is used, the enhanced profile will improve the performance of any profile-based information-gathering tool by allowing it to gather more relevant information, while at the same time being more discriminating. The M-CLIP allows CI professionals to spend more of their time gathering information electronically rather than manually, while making the information gathered more accurate and reliable. This will allow them to assist management efforts by providing analyst and decision makers with a more complete set of information, making it possible for them to assess issues in an efficient, accurate, and timely manner.

References

Aguilar, F.J. (1967), *Scanning the Business Environment*, Macmillan, New York, NY.

Allen, J. (1996), "Incremental relevance feedback for information filtering", in *Proceedings of the Nineteenth Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, Zurich, August, pp. 270-8.

Anderson, J.R. (1990), *The Adaptive Character of Thought*, Lawrence Erlbaum Associates, Hillsdale, NJ.

Anthony, R. (1965), *Planning and Control Systems: A Framework for Analysis*, Harvard University Press, Boston, MA.

Balabanovic, M. (1998), "An interface for learning multi-topic user profiles from implicit feedback", in *Proceedings of the AAAI Workshop on Recommender Systems*, Madison, WI, July, pp. 7-11.

Beidleman, C., Fletcher, D. and Veshosky, D. (1990), "On allocating risk: the essence of project finance", *Sloan Management Review*, Spring, No. 1, pp. 47-55.

Benjamin, W.A. (1979), "Management of business information", *Industrial Marketing Management*, Vol. 8, pp. 51-6.

Berghel, H. (1997), "Cyberspace 2000: dealing with information overload", *Communications of the ACM*, Vol. 40, pp. 19-24.

Boureston, J. (2000), "Using 'intelligent search agents' for CI", *Competitive Intelligence Magazine*, Vol. 3 No. 1, January-March, pp. 32-6.

Cartwright, D.L., Boughton, P.D. and Miller, S.W. (1995), "Competitive intelligence systems: relationships to strategic orientation and perceived usefulness", *Journal of Managerial Issues*, Vol. 7 No. 4, pp. 420-34.

Chonko, L.B., Tanner, J.F. and Smith, E.R. (1991), "Selling and sales management in action: the sales force's role in international marketing research and marketing information systems", *Journal of Personal Selling & Sales Management*, Vol. 11 No. 1, pp. 69-70.

Cleland D. and King W. (1975), "Competitive business intelligence systems", *Business Horizons*, Vol. 19 No. 6, p. 19.

Cleverdon, C., Mills, J. and Keen, M. (1966), "Factors determining the performance of indexing systems", ASLIB Cranfield Project.

Crouch, C. and Yang, B. (1992), "Experiments in automatic statistical thesaurus construction", in *Proceedings of the Fifteenth Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, June, pp. 77-88.

Daft, R., Sormunen, J. and Parks, D. (1988), "Chief executive scanning, environmental characteristics, and company performance: an evaluative study", *Strategic Management Journal*, Vol. 9 No. 2, pp. 123-39.

Domingue, J. and Motta, E. (1999), "A knowledge-based news server supporting ontology-driven story enrichment and knowledge retrieval", in Fensel, D. and Studer, R. (Eds), *Proceedings of the 11th European Workshop on Knowledge Acquisition, Modeling, and Management (EKAW 1999)*, Springer-Verlag, pp. 103-20.

Ekmekcioglu, F.C., Robertson, A.M. and Willett, P. (1992), "Effectiveness of query expansion in ranked-output document retrieval systems", *Journal of Information Science*, Vol. 18 No. 2, pp. 139-47.

Farquhar, A., Fikes, R. and Rice, J. (1997), "The Ontolingua Server: a tool for collaborative ontology construction", *International Journal of Human-Computer Studies*, Vol. 46 No. 6, pp. 707-28.

Fahey, L. and King, W. (1977), "Environmental scanning for corporate planning", *Business Horizons*, Vol. 20 No. 4, pp. 61-71.

Fahey, L., King, W. and Narayanan, V.K. (1982), "Environmental scanning and forecasting in strategic planning – the state of the art", *Long Range Planning*, Vol. 14 No. 1, pp. 32-9.

Fischer, G. and Stevens, C. (1991). "Information access in complex, poorly structured information spaces", *Human Factors in Computing Systems: Reaching through Technology (CHI '91 Conference Proceedings)*, New Orleans, LA, April, pp. 63-70.

Foltz, P. and Dumais, S. (1992), "Personalized information delivery: an analysis of information-filtering methods", *Communications of the ACM*, Vol. 35, pp. 51-60.

Frisse, M.E. and Cousins, S.B. (1989), "Information retrieval from hypertext: update on the Dynamic Medical Handbook Project", *Hypertext '89 Proceedings, ACM SIGCHI Bulletin*, ACM/SIGCHI, New York, NY, pp. 199-212.

Fuld, L. (2001), "Intelligence software: reality or still virtual reality?", *Competitive Intelligence Magazine*, March-April, Vol. 4 No. 2, pp. 22-7.

Furnas, G., Landauer, T., Gomez, L.M. and Dumais, S. (1987), "The vocabulary problem in human-system communication", *Communications of the ACM*, Vol. 30, pp 964-71.

Gelb, B.D., Saxton, M.J., Zinkhan. G.M. and Albers, N.D. (1991), "Competitive intelligence: insights from executives", *Business Horizons*, Vol. 34 No. 1, pp. 43-7.

Ghoshal, S. and Wesney, D.E. (1991), "Organizing competitor analysis systems", *Strategic Management Journal*, Vol. 12 No. 1, pp. 1-15.

Gruber, T. (1991), "The role of common ontology in achieving sharable, reusable knowledge bases", in Allen, J.A., Fikes, R., and Sandewall, E. (Eds), *Principles of Knowledge Representation and Reasoning*, Morgan Kaufmann, San Franciso, CA, pp. 601-2.

Guarino, N. (1997), "Semantic matching: formal ontological distinctions for information organization, extraction, and integration", in Pazienza, M.T. (Ed.), *Information Extraction: A Multidisciplinary Approach to an Emerging Information Technology*, Springer Verlag, Rome, pp. 139-70.

Guyton, W.J. (1962), "A guide to gathering marketing intelligence", *Industrial Marketing*, March, pp. 84-8.

Hambrick, D.C. (1982), "Environmental scanning and organizational strategy", *Sloan Management Review*, Vol. 3 No. 2, pp. 159-74.

Hancock-Beaulieu, M. and Walker, S. (1992), "An evaluation of automatic query expansion in an online library catalogue", *Journal of Documentation*, December, Vol. 48 No. 4, pp. 406-21.

Jones, S. (1993), "A thesaurus data model for an intelligent retrieval system", *Journal of Information Science*, Vol. 19 No. 3, pp. 167-78.

Kim, J., Oard, D.W. and Romanik, K. (2000), "Using implicit feedback for user modeling in Internet and intranet searching", *Technical Report, College of Library and Information*

Services, University of Maryland, College Park, MD.

Keegan, W.J. (1974), "Multinational scanning: a study of the information sources utilized by headquarters executives in multinational companies", *Administrative Science Quarterly*, Vol. 19 No. 3, pp. 411-21.

Lee, J., Kim, M.H. and Lee, Y.J. (1994), "Ranking documents in thesaurus-based Boolean retrieval systems", *Information Processing and Management*, Vol. 30 No. 1, pp. 79-91.

McCann, J. and Gomez-Mejia, L. (1992), "Going 'online' in the environmental scanning process", *IEEE Transactions on Engineering Management*, Vol. 39 No. 4, pp. 394-9.

McMath, C., Tamaru, R. and Rada, R. (1989), "A graphical thesaurus-based information retrieval system", *International Journal of Man-Machine Studies*, Vol. 31 No. 2, pp. 121-47.

Maltz, E. and Kohli, A. (1996), "Marketing intelligence dissemination across functional boundaries", *Journal of Marketing Research*, Vol. 33 No. 1, pp. 47-61.

Montgomery, D.B. and Weinberg, C.B. (1979), "Toward strategic intelligence systems", *Journal of Marketing*, Vol. 43 No. 4, pp. 41-52.

Nodine, M., Fowler, J., Ksiezyk, T., Perry, B., Taylor, M. and Unruh, A. (2000), "Active information gathering in InfoSleuth", *International Journal of Cooperative Information Systems*, Vol. 9 Nos 1/2, pp. 3-28.

Nodine, M., Fowler, J. and Perry, B. (1999), "An overview of active information gathering in InfoSleuth", in *Proceedings of the International Symposium on Cooperative Database Systems for Advanced Applications CODAS '99*, Wollongong, March 27-28.

Oard, D. and Kim, J. (1998), "Implicit feedback for recommender systems", in *Proceedings of the AAAI Workshop on Recommender Systems*, July, Madison, WI, pp. 81-3.

Osterfelt, S. (2001), "The facts ... and nothing but the facts!", *DM Review*, August, pp. 1-6.

Pearce, F.T. (1976), "Business intelligence systems: the need, development and integration", *Industrial Marketing Management*, Vol. 5 Nos 2/3, p. 115.

Pinkerton, A. (1969), "How to develop a marketing intelligence system" (five articles), *Industrial Marketing*, Vol. 5 Nos 4/8.

Prescott, J.E. and Smith, D.C. (1987), "A project-based approach to competitive analysis", *Strategic Management Journal*, Vol. 8 No. 5, pp. 411-23.

Robertson, S.E. (1990), "On term selection for query expansion", *Journal of Documentation*, December, Vol. 46 No. 4, pp. 359-64.

Sheth, B.D. (1994), "A learning approach to personalized information filtering", Master's thesis, Massachusetts Institute of Technology, Cambridge, MA.

Stadnyk, I. and Kass, R. (1992), "Modeling users' interests in information filters", *Communications of the ACM*, Vol. 35, No. 12, pp. 49-50.

Vedder, R.G., Vanecek, M.T., Guynes, C.S. and Cappel, J.J. (1999), "CEO and CIO perspectives on competitive intelligence", *Communications of the ACM*, Vol. 42 No. 8, pp. 108-16.

Zinkhan, G.M. and Gelb, B.D. (1985), "Competitive intelligence practices of industrial marketers", *Industrial Marketing Management*, Vol. 14 No. 4, pp. 269-75.