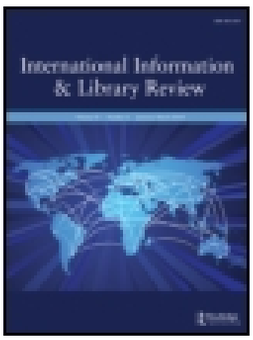

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Information Professionals in the Digital Age†

BLAISE CRONIN*

ABSTRACT

The strategic significance of information and intelligence management to socioeconomic growth is described. The implications in terms of human and structural intellectual capital development are considered. Demand- and supply-side analyses of the knowledge and skills required of information professionals in the digital age are provided.

NEW WORLD ORDER

The socioeconomic well-being of nations depends increasingly on their ability to access and exploit both indigenous and extra-territorial knowledge stocks. In the digital age, this ability is tightly linked to the quality of a nation's telecommunications infrastructure and the extent to which information processing and analysis skills have been diffused throughout the work-force. The prodigious growth of the Internet and World Wide Web (e.g. Hoffman *et al*., 1996)[1] highlights the importance of rapid capacity building in the information sector, especially for developing economies and regional trade blocs like MERCOSUL (Cronin, 1992; Morales, 1997).[2,3] The perceived importance of information management and knowledge networking to companies is reflected in the

† I am grateful to Rob Kling and Elisabeth Davenport for comments on an earlier draft. A version of this paper was presented at a Latin American Seminar, *Markets and New Trends for the Information Professional*, August 25–26, 1997, Brasilia, Brazil. The financial support of the Instituto Euvaldo Lodi in Brasilia is gratefully acknowledged.

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[1] Hoffman, D.L., Kalsbeek, W.D. & Novak, T.P. (1996) Internet and Web use in the U.S. *Communications of the ACM* **30**(12), pp. 36–46.

[2] Cronin, B. (1992) Information and market integration in Latin America. *Journal of Economic and Social Intelligence* **2**(3), pp. 233–243.

[3] Morales, E.C. (1997) Latin America and the Caribbean. *In* Courrier, Y. & Large, A. (Eds). *World Information Report 1997 / 98*. Paris: UNESCO, pp. 107–123.

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language used by the Society for Competitive Intelligence Professionals (SCIP) on its home page (http://www.scip.org/about.html):

> ''From fierce new competitors to changing technologies, the competitive environment is never the same from day to day... We all know that information is not enough any more. Managers need skilled professionals to turn a sea of data into actionable intelligence that will provide the company with a competitive edge''.

What applies at the enterprise level, applies also at the country level, especially when there are marked informational asymmetries between nations. In bidding for contracts, tracking competitors, in rescheduling debts with creditor banks or conducting negotiations with donor agencies or foreign direct investors, the cost of ignorance (''blind spots'') can be punitive. The ability of a nation (or region) to gather external intelligence and to make sense of its domestic environment is a critical success factor in building trade competitiveness in open markets (e.g. Cronin & Tudor-Silovic, 1990).[4]

A comparison of the relative absorption rates for different information technologies underscores the general point: the Web achieved mass market penetration (defined as 10 million customers) in 2 years, whereas the telephone took 38 years, the fax 22 years, and the personal computer 7 years to achieve similar levels of adoption. Although the Internet (but not Web) growth curve is beginning to slacken from exponential to logistic, predictions of a billion users by the year 2000 are still being made. There are, of course, enormous variations between countries, for example, in January 1996, there were more than 10 million hosts in the US compared with 77,000 in Brazil and 28 in Algeria. On a *per capita* basis, however, Finland has the highest level of Internet penetration of any nation. Connectedness is far from universal. In part, of course, this reflects the ''political dimensions of computing development'' (Kling, 1983).[5]

It is instructive to compare the advent of the Web in the late 20th century with the introduction of the printing press in the 15th century. As a *means* of cultural production, the Web is a potent and ubiquitous technology, but the ways in which it is being, and will be, used (*modes* of cultural production) are often unpredictable and less a function of technological capability than a consequence of prevailing social practices and value choices. This has potentially significant implications for information work-force planning and development. For one thing,

[4] Cronin, B. & Tudor-Silovic, N. (Eds) (1990) *The knowledge industries: levers of economic and social development in the 1990s*. London: Aslib.

[5] Kling, R. (1983) Value conflicts in computing developments: developed and developing countries. *Telecommunications Policy*, March, pp. 12–34.

historical or linear projections of need and demand will not suffice. The social contexts in which information professionals work are in constant flux, as are the undergirding technical systems.

Norms and assumptions from an earlier age may not hold in digital environments: a new market space is evolving, based on the ''culturally universal, or commodity, properties of information'' (Schement & Curtis, 1994),[6] one in which a rich variety of professional tribes will joust for jurisdictional control and legitimacy (Abbott, 1983).[7] A concrete illustration of this is the proliferation of professional associations with an explicit interest in information systems, policies and technologies. The memberships of these associations, and their proliferating special interest groups (SIGs), reveal a striking variety of academic and career backgrounds, a testimony to the growing interdisciplinarity of information work. Old boundaries are dissolving and new partnerships evolving, as demarcation and regulation become increasingly anachronistic features of information praxis (Cronin & Davenport, 1988).[8]

ECOLOGIES OF KNOWLEDGE

To put it in simplistic terms, the information world was once dominated by librarians whose primary concern was the management of (essentially stable) book collections. Librarians have certainly not disappeared from the stage; indeed, it can be argued that librarianship is one of a select group of professions to have benefited from the informatization of society: ''. . . some occupations such as scientists, engineers, and librarians have found a niche in response to the fundamental need of the information society'' (Schement & Curtis, 1994).[9] The loci and foci of information work have, however, diversified. Today, information workers operate in every sector (for-profit, non-profit, voluntary) of society, and their charge is no longer just books, but a plethora of materials (multiple media and multimedia), many of which are dynamic and bibliographically unstable in character.

This dramatic multiplication of texts and contexts (both physical and virtual) which define spheres of information work has created a host of previously unimagined employment opportunities for individuals with

[6] Schement, J.R. & Curtis, T. (1994) *Tendencies and tensions of the information age: the production and distribution of information in the United States*. London: Transaction Publishers.

[7] Abbott, A. (1983) *The system of professions: an essay on the division of expert labor*. Chicago, IL: University of Chicago Press.

[8] Cronin, B. & Davenport, E. (1988). *Post-professionalism: transforming the information heartland*. London: Taylor Graham.

[9] Schement, J.R. & Curtis, T. (1994). *op. cit*.

academic and/or professional backgrounds in information science, computer science, information systems, electronic publishing, multimedia design and related fields. This is, however, a highly contested marketplace. Think of it as a two-dimensional space within which to locate information professionals: the vertical axis defines the degree of task specificity or generality, while the horizontal axis indicates the extent to which the focus is on artefacts (e.g. storage/transmission media) or semantics (i.e. meaning/significance) of the information content.

The pervasiveness of information-based activities in organizations of every kind makes a mockery of the idea of a self-contained, or homogeneous, group, called information professionals. A paradox of the information age is that the term ''information worker'' has so little denotative power. In many fields (e.g. medicine, pharmaceutic, law, engineering, investment banking), domain knowledge cannot be separated from instrumental knowledge—knowledge of information sources, processes and tools. A good illustration of the trend is the Genome Database, the result of a global collaboration among geneticists participating in the Human Genome Project. In short, the conduct of science has become co-extensive with information codification and exchange. Thus, the embeddedness of information tasks is a defining feature of the digital age. Another is the structural abundance of information (Goldfinger, 1995).[10] Combined, these two features have effectively broken the *de facto* monopoly on information work held by classically trained librarians and information scientists.

Further, the boundary lines which historically demarcated different kinds of information work are blurring, as are the theoretical orientations and skill sets deployed by information professionals. The US Bureau of Labor Statistics in its 1997 *Occupational Outlook Handbook* (http://stats.bls.gov/oco/ocoo68.htm) notes that computer scientists and systems analysts will be among the faster growing occupations through the year 2005, while employment of librarians is expected to grow more slowly than average for all occupations over the same time frame. However, the report also notes that there will be opportunities for librarians *outside traditional settings:*

> ''Nontraditional library settings include information brokers, private corporations and consulting forms. Many companies are turning to librarians because of their excellent research and organizational skills, and knowledge of library automation systems. Librarians can review the vast amount of information that is available and

[10] Goldfinger, C. (1995) Financial markets as information markets: preliminary exploration. *In* Mayere, A. (Ed.). *Economie de l'information: colloque internationale*. Villeurbanne: ENSSIB, pp. 258–270.

analyze, evaluate, and organize it according to a company's specific needs. Librarians are also moving into organizations to set up information on the Internet. Librarians working in these settings are often classified as systems analysts, database specialists and trainers, managers, and researchers''.

A monolithic species (librarian) has splintered into an array of both generic and niche information specialists (e.g. Paez-Urdaneta, 1992; Cronin, 1993).[11,12] To quote Davenport (1997):[13] ''As biological ecologies thrive on species diversity, information ecologies thrive on information diversity''. Although he was talking primarily about the need to go beyond ''machine-engineering'' approaches to information management in organizations, the implications for the traditional library and information science (LIS) profession are clear. Ecological perspectives (Van House & Sutton, 1996)[14] and narrative approaches (Czarniawska, 1997)[15] call for a greater emphasis on, and sensitivity to, context and behavior. This is not the world of traditional systems analysis or special librarianship. New skills and a new mind-set are required. Today's information professionals are actively engaged in the development and management of organizations' structural and human information capital—capturing, formalizing, codifying, sharing and leveraging intellectual assets to enhance overall organizational performance (Stewart, 1997).[16]

MEDIATION, DISINTERMEDIATION, REINTERMEDIATION

With the Internet, services which once necessitated a broker or intermediary can now be provided directly to the ultimate consumer (e.g. Gellman, 1996).[17] New software (and successive upgrades) can, for example, be distributed electronically by suppliers to their customers without employing a network of wholesalers, retailers, dealerships or sales teams. Most of the operations and activities associated with retail banking can also be handled interactively via the Web, and there is no

[11] Paez-Urdaneta, I. (1992) To experience a connection: in search of a new information professional for Latin America. *In* FID Special Interest Group on Roles, Careers and Development of the Modern Information Professional (DFID/MIP). *State of the modern information professional 1992–1993. An international view of the state of the information professional and information profession in 1992–1993*. The Hague: International Federation for Information and Documentation, pp. 33–53.

[12] Cronin, B. (1993) Profissionalizacao ou proletarizacao da atividade informacional? *Revista da Escola de Biblioteconomia da UFMG* **22**(1), pp. 38–65.

[13] Davenport, T.H. (1997) *Information ecology: mastering the information and knowledge environment*. Oxford: Oxford University Press.

[14] Van House, N. & Sutton, S.A. (1996) The panda syndrome: an ecology of LIS education. *Journal of Education for Library and Information Science* **37**(2), pp. 131–147.

[15] Czarniawaska, B. (1997) *Narrating the organization: dramas of institutional identity*. Chicago, IL: University of Chicago Press.

[16] Stewart, T.A. (1997) *Intellectual capital: the new wealth of organizations*. New York, NY: Doubleday.

[17] Gellman, R. (1996) Disintermediation and the Internet. *Government Information Quarterly*, **13**(1), pp. 1–8.

in-principle reason, for example, why the entire house buying process cannot be conducted without some of the established intermediaries being eliminated from the chain. Bypass can thus translate into reduced operating costs for the manufacturer/service provider, which, in theory, should mean more competitive prices for the consumer/client. Books can be ordered via the Web from a virtual store with a virtual inventory, but one with a very real ability to satisfy almost any request. No longer is it necessary to go to a local outlet in an effort to find what one wants from a necessarily constrained inventory. For at least some businesses/services, and for some clients, the Web affords a more immediate (and possibly more satisfying) form of consumption—one that is sedentary and impersonal.

As far as the library and information services sector is concerned, we should be careful not to fall into the trap of confusing changing modes of production/distribution with changes in the overall value chain, a point made cogently by Peters (1996):[18] ''First of all, it is important not to mistake the distribution-chain for the value-chain. We believe that networks and networked information are creatively destroying the former, and that they are creatively re-organizing (''re-engineering'' is an even better term) the latter. CNI (Coalition for Networked Information) believes that ''re-intermediation'' of actors (some old, many new) around different functions (again, some old, many new) is a more likely scenario for the value chain than is disintermediation.'' The implications for librarians are thus clear: identify emerging roles and opportunities as, for example, Web publishers (Stover, 1996)[19] in a reconfigured value chain where professional skills and expertise can be brought into play in such a way as to create fresh career opportunities (Homan, 1996; Rosenthal and Spiegelbaum, 1996; Tate and Alexander, 1996).[20–22]

According to a survey by the National Commission on Libraries and Information Science (NCIS), approximately 45% of public libraries in the US have some connection to the Internet: the projected figure for

[18] Peters, P.E. (1996) Cost centers and measures in the networked information value-chain. *In* Butler, M.A. & Kingma, B.R. (Eds). *The economics of information in the networked environment*. Washington, DC: Association of Research Libraries, pp. 137–142.

[19] Stover, M. (1996) The librarian as publisher: a World Wide Web publishing project. *Computers in Libraries* **16**(9), pp. 40–43.

[20] Homan, M.J. (1996) Disintermediation and education. *Bulletin of the Medical Library Association* **84**, pp. 589–590.

[21] Rosenthal, M. & Spiegelman, M. (1996) Evaluating use of the Internet among academic reference librarians. *Internet Reference Services Quarterly* **1**(1), pp. 53–63.

[22] Tate, M. & Alexander, J. (1996) Teaching critical evaluation skills for World Wide Web resources. *Computers in Libraries* **16**(10), pp. 49–52 and 54–55.

1997 is 76% (Bertot *et al*., 1996).[23] Access is not, however, equally distributed (whether in terms of geography, ethnicity or socioeconomic status), nor may patrons always use Internet services directly. Nonetheless, the penetration of the Internet into public libraries is increasing at a significant rate, and will be boosted by the creation of the Gates Library Foundation. Established in June 1997 by Bill Gates, founder and Chief Executive Officer of Microsoft, the Foundation will provide $400 million in cash and software to support Internet access to public libraries in low-income communities throughout North America.

The uncertainty which the library and information science profession occasionally feels about its future has its mirror image in the uncertainties the general public feels about the place of the traditional library in the new information world order, as this telling quotation from the Benton Foundation (1996)[24] study clearly indicates: ''Americans continue to have a love affair with their libraries, but they have difficulty figuring out where libraries fit in the new digital world. And many Americans would just as soon turn their local libraries into museums and recruit retirees to staff them. Libraries are thus at a crossroads, for they must adjust their traditional values and services to the digital age.'' The questions that need to be addressed are, what kinds of adjustments will be necessitated, and what will be the implications for professional practice?

DIGITAL LIBRARIES

Rather than devote time to crafting definitions or typologies of information professionals (e.g. systems analysts, Webmasters, programmers, information resource managers, competitor intelligence analysts, records managers), it may be more instructive to explore the changing nature of information work by using, for example, digital libraries (DLs), a vogue, if deliquescent, construct, as a site in which to examine shifting social processes (e.g. the dialectic of mediation, disintermediation, reintermediation) and the kinds of interdisciplinary collaboration which seem likely to drive the design of next generation, human-centered information systems.

In a sense, the digital library functions as a zone of convergence where librarians, computer scientists, electrical engineers, cognitive scientists, cultural anthropologists, organizational theorists and sundry others are forging a *lingua franca* for better understanding the nature of

[23] Bertot, J.C. *et al*. (1996) *The 1996 National Survey of Public Libraries and the Internet: progress and issues*. Washington, DC: NCLIS. Available at: http://www.nclis.gov

[24] Benton Foundation (1996) *Buildings, books, and bytes: libraries and communities in the digital age*. Available at: http://www.benton.org/buildings.html

distributed information systems and knowledge access. As such, the digital library may be a useful lens through which to apprehend some of the defining contours of tomorrow's information landscape. This does not mean that the gradual creation of digital/hybrid libraries will necessarily translate into large-scale employment opportunities for information professionals, but some of the LIS world's traditional strengths (e.g. organization, classification/labelling, validation, archiving) will be central to DL developers' ability to create distributed information and communication spaces.

The first wave of DL development projects funded by the National Science Foundation (NSF) in the US is concluding, and a planning framework for follow-on initiatives has recently been instituted. It is probable that the primarily engineering focus of the Digital Library Initiative (DLI), established 3 years ago by the NSF, will be expanded to included social and behavioral dimensions of DL use. At the June 1997 Santa Fe Planning Workshop (http://www.si.umich.edu/SantaFe/report.html), three central issues were identified around which it was deemed important to frame future DL-related research: systems-centered issues; collection-centered issues; user-centered issues.

Given the complexity of the systems engineering challenges associated with building large-scale digital libraries, it is quite understandable that early efforts (in the US and elsewhere) should have been technically-focused. The major design challenges include: (i) transparent searching across distributed repositories; (ii) federating/mapping together similar objects from different collections; (iii) creating deep semantic interoperability; and (iv) automatic indexing of dynamic collections comprising fluid concepts (Schatz & Cheng, 1996).[25] These, of course, are not exclusively engineering issues: the development of indexing and classification schema is a core LIS competency.

Successful DL design will require sustained partnerships between a variety of professional groups and the forging of new interpretative communities. Fig. 1 provides a schematic for analysing the issues (technical, content-related, usability, social) and related research foci. Digital library design is not an end-in-itself: DLs are created to support the needs of specific user communities, and their design should thus be grounded in knowledge of contexts, cultures and end-user requirements. Early DL design experiences have highlighted the need for deeper understanding of behavior and cognition, and of the ways which individuals use/misuse/abuse information systems. In addition, there is

[25] Schatz, B. & Chen, H. (1996) Building large-scale digital libraries. *IEEE Computer* **29**(5), pp. 22–26.

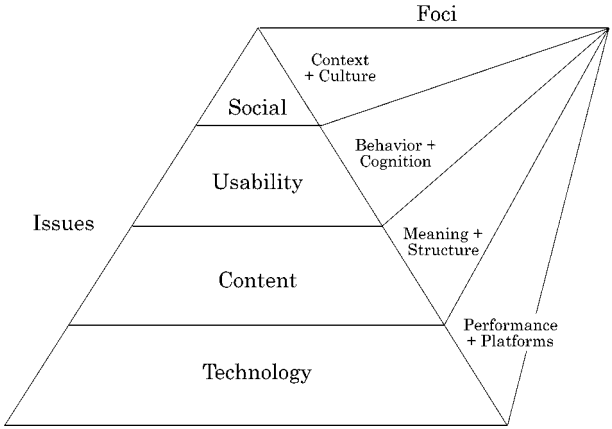

FIGURE 1. Digital library design issues and research foci.

a complex raft of issues relating to the economics of networked-information access and the sociopolitical implications of ubiquitous computing (e.g. tariffication, privacy, security, censorship, ethics, archiving), which invite systematic investigation.

The emergence of DLs, more specifically virtual digital libraries (VDLs), raises the question of whether, and to what extent, traditional intermediary functions will disappear, be replicated or be transformed. Davenport and Procter (1997)[26] have recently used genre analysis to explore consultation and collaboration issues from both the librarian's and user's perspective in a networked reference environment. The two historical prerequisites of professional information practice, in a physicalist world, have been (i) personal knowledge of collections and users, and (ii) active agency (i.e. facilitation, intervention, mediation, brokering). But what happens in a virtual world where collections are distributed on remote servers and intelligent agents or ''knowbots'' are programmed to carry out searches for end-users? The development of interactive recommender systems, such as PHOAKS (Terveen *et al*., 1997)[27] and Referral Web (Kautz *et al*., 1997),[28] which enable users to visualize and search social networks, might seem to threaten the traditional role of the reference librarians or information intermediary.

[26] Davenport, E. & Procter, R. (1997) The situated intermediary: remote advice giving in a distributed reference environment. *In* Williams, M.E. (Ed.) *Proceedings of the National Online Meeting, New York, May, 1997*, Medford, NJ: Learned Information, pp. 115–123.

[27] Terveen, L. *et al*. (1997) PHOAKS: a system for sharing recommendations. *Communications of the ACM* **40**(3), pp. 59–62.

[28] Kautz, H., Selman, B. & Shah, M. (1997) Referral Web: combining social networks and collaborative filtering. *Communications of the ACM* **40**(3), pp. 63–65.

However, a more plausible scenario is that some information professionals will be engaged in both the design and management of such software systems and also adding extra value through interpretation, evaluation and synthesis of automatically generated output. They will exhibit and facilitate ''digital literacy'' (Glister, 1997).[29]

WORLD WIDE WEB

The World Wide Web, a major creator of new jobs, constitutes a second site within which to speculate on future directions for the information profession. It would be naive to assume that the growth of the Web and the correlative growth of both networked electronic enquiry services (e.g. Gleadhill, 1997),[30] search engines (e.g. Lycos, Yahoo!) and smart software agents (e.g. Firefly) herald the demise of the information intermediary. In fact, it is precisely because the Web is so large, fast-growing, unstructured and heterogeneous that demand for quality control, content evaluation and ''reasoned, reflective judgment'' (Stoll, 1995, p. 32)[31] is increasing. (It is estimated that the average lifetime of a Web object is 45 days (see the June 1997 Santa Barbara Workshop on Human Dimensions of Knowledge Networking—http://alexandria.sdc.ucsb.edu/NSF/index.html)). The information profession, skilled in collection development and evaluation, is well positioned to play a role in creating and maintaining top-quality sites for the discriminating user.

Faced with a mass of electronic resources, users will want to know the reasons for including/excluding materials on a given Web page (i.e. what are the bases of cognitive authority?). They will need to know who validated/approved the material and what its effective ''shelf life'' will be (date stamping, in effect). They will seek sites which are collocative, well designed and easy to navigate. They will also want sustainable, reliable access to significant electronic resources (e.g. peer-reviewed electronic journals), a role which major research libraries, in particular, have historically fulfilled (Harter & Kim, 1996).[32] Already, a number of major publishers are developing high-grade Web sites to bring authoritative content to scientists (e.g. Gibson, 1997).[33] Professional associa-

[29] Glister, P. (1997) *Digital literacy*. New York: Wiley.

[30] Gleadhill, D. (1997) Electronic enquiry desk: does the Nerd have the answer? *Library Technology* **2**(2), pp. 35–36.

[31] Stoll, C. (1995) *Silicon snake oil: second thoughts on the information highway*. New York: Anchor.

[32] Harter, S.P. & Kim, H.J. (1996) Accessing electronic journals and other e-publications: an empirical study. *College & Research Libraries* **57**, pp. 440–456.

[33] Gibson, P. (1997) Top-quality sites for serious scientists: publishers are bringing authoritative scientific content to the Web. *Information Today* **14**(3), pp. 50–51.

tions, trade organizations, information utilities and libraries will also emerge as prominent meta site developers, as consumer demand for transparency in virtual markets grows. One of the best examples of a meta site for a particular community of practice is Medical Matrix (http://www.medmatrix.org/index.asp), which offers ''ranked, peer-reviewed, annotated, updated clinical medical resources''. Many others are coming on stream.

Long before the emergence of intelligent agents and customized news services (e.g. Watson, 1997),[34] the threat of displacement had been the subject of discussion in the professional LIS literature. With the advent of commercial online services in the 1970s, the specter of bypass (i.e. users doing their own searching) was first raised, causing some commentators to take an extremely pessimistic position on the future of LIS practitioners (e.g. Lewis, 1977).[35] This was followed by fears that expert systems technology (e.g., Grateful Med) would be used to displace human intermediaries, but, again, the worst case scenario did not materialize. A more likely trend is the gradual transformation of the information professional from searcher to coach/trainer/counsellor/mentor, working closely with information providers (primary and secondary) and ultimate users to create more effective delivery systems. That said, the Web will also stimulate fresh career opportunities: for instance in the area of competitive intelligence, as businesses, large and small, migrate to, and seek to exploit, virtual environments (e.g. Cronin *et al*., 1994; Cronin & McKim, 1996).[36,37] In this context, the importance of the Internet (and Web) has been acknowledged explicitly by the Office of Special Investigations of the US General Accounting Office (1997):[38]

> ''For the investigator, there may be significant advantages to accessing sources on-line rather than using a library or another information medium. The Internet provides enormous resource potential for investigators in a timely and cost-effective manner and is often more up-to-date than its paper counterparts''.

However, the drift to a predominantly electronic environment has broad implications for the tasks performed by information specialists and the skills sets entailed thereby. Traditional approaches to user needs

[34] Watson, D. (1997) Is this software after your job? *Library Association Record* **99**(7), pp. 363–365.

[35] Lewis, D.A. (1977) There won't be an information profession in 2000. *In* Raffin, M.R. & Passmore, R. (Eds). *The information worker: identity, image and potential*. London: Aslib, 38–49.

[36] Cronin, B. *et al*. (1994) The Internet and competitive intelligence: a survey of current practice. *International Journal of Information Management* **14**(3), pp. 204–222.

[37] Cronin, B. & McKim, G. (1996) Markets, competition, and intelligence on the World Wide Web. *Competitive Intelligence Review* **7**(1), pp. 45–51.

[38] Office of Special Investigations, United States General Accounting Office. *Investigators' guide to sources of information*. Washington, DC: GAO, 1997.

analysis will not suffice. Intimate knowledge of communities of practice and prevailing discourse will become essential, and that will require immersion in the target community. The penchant for generalizations (e.g. engineers don't read) and universal solutions (e.g., global classification schema) will be replaced by grounded knowledge of local practice and the creation of community-based knowledge representation schemata. There will be much closer collaboration between information specialists and domain experts than is usually the case. In some respects, the idea of the academic librarian/subject specialist will be revitalized by developments in electronic information management.

CONCLUSIONS

This paper has taken a demand-side perspective. There are, however, important supply-side issues to be addressed. These relate to the design and delivery of appropriate educational structures, curricula and programs. However, there is no one all-purpose/cross-cultural recipe: what works in Bloomington may not work in Brasilia. Already in Latin America, there exists a variety of educational solutions, ranging from the UNESCO-supported graduate program in information studies at Universidad Simon Bolivar in Venezuela to the diploma in information science offered through the Centro de Informacion Cientifica y Humanistica (CICH) at the Universidad Nacional Autonoma de Mexico (UNAM). However, novel approaches may in some cases be more appropriate than established delivery models (e.g. degree programs) and conventional institution building (e.g. creating academic departments).

A model which might be replicated in some Latin American countries is that offered by the Department of Information Studies at the University of Sheffield in the UK and the Centro do Informacao Tecnica para a Industria (CITI) of the Instituto National de Engenharia e Tecnologia Industrial (INETI) in Portugal, who contracted with the European Community to provide training to information service specialists from the Less Favored Regions of the European Union (Owens *et al*., 1997).[39] In other cases, collaborative distance education and distributed learning models may ultimately be the best way of reaching target markets in countries (e.g. Brazil, Chile, Argentina, Mexico) or regions (e.g. Southern Cone) where geography and mobility are barriers to uptake (Cronin 1997).[40]

[39] Owens, I. *et al*. (1997) Training information service specialists in the less-favored regions of the European Union (TRAIN-ISS): the diploma/MSc programme at the University of Sheffield. *Education for Information* **15**(1), pp. 17–25.

[40] Cronin, B. (1997) *Structural dynamics of the distributed learning marketspace*, Paper presented at an international seminar organized by the Center for Library and Information Research of the National Autonomous University of Mexico, UNAM, Mexico DF, August 11–15, 1997.

Nor is there consensus on nomenclature. The rubrics ''information science'', ''information systems'', ''computer and information science'', ''information management'', ''information studies'', ''information technology'', ''computer science'', ''informatics'', ''information and communication studies'', ''social informatics'', ''information resources management'' and many others compete for dominance. The variety of information occupations is increasingly reflected in the pluralism of education and training programs. Major US schools, such as those at the universities of Berkeley, Illinois, Indiana, Michigan, Pittsburgh and Syracuse, though variously labelled, have eclectic faculties whose interdisciplinarity allows them to bring a variety of perspectives to bear on information issues and phenomena. Interdisciplinarity is the common denominator of leading-edge programs. The following extract from the promotional literature of Indiana University's School of Library and Information Science (http://www.slis.indiana.edu/Degrees/mis/mis-ltr.html) is illustrative of the thinking which drives the principal change agents in this sector:

> ''We bring fresh insights to bear on information design, access, and policy issues by looking at information and information technologies in diverse human contexts. We seek to understand the behaviors, cognitive factors, human contexts, social practices, media, and tools which foster and hinder effective information use. We focus on information and technologies in human contexts. Our program emphasizes the analysis and design of information and systems. We place a strong emphasis on the social and behavioral dimensions of information technology. Our program appeals to students who are interested in careers in information management, systems analysis and design, online searching and information brokerage, competitive intelligence and research analysis, network management, and database development and marketing''.

In summary, successful educational programs geared to the realities of the digital age will be characterized by, *inter alia*, the following four attributes: (i) catholicity, (ii) critical mass, (iii) coherence and (iv) synergy seeking. They will be inclusive and tolerant of diverse perspectives, promoting interaction between disciplines and sub-fields in an effort to create discourse richness, experimentation and innovation. These ''broad church'' (Cronin, 1992)[41] programs will typically be research-driven and market-connected. They will grapple with ''the idea of information'' (Schement & Curtis, 1994)[42] rather than define themselves in terms of

[41] Cronin, B. (1992) Information science in the international arena: an educator's perspective. *Aslib Proceedings* **44**(4), pp. 195–202.

[42] Schement, J.R. & Curtis, T. (1994). *op. cit.*

specific career tracks (e.g. systems analysts) or institutions (e.g. libraries), though not at the expense of providing their students with a highly marketable mix of technical skills and competencies. The cost of setting up and maintaining such programs (or converting/re-engineering existing programs) will be considerable, but clearly justifiable in the light of the longer-term social benefits.