

# Classification Schemes of Information Science: Twenty-Eight Scholars Map the Field

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**The field of Information Science is constantly changing. Therefore, information scientists are required to regularly review—and if necessary—redefine its fundamental building blocks. This article is one of a group of four articles, which resulted from a Critical Delphi study conducted in 2003–2005 (Zins, 2007a, 2007b, 2007c). The study, “Knowledge Map of Information Science,” was aimed at exploring the foundations of information science. The international panel was composed of 57 leading scholars from 16 countries who represent nearly all the major subfields and important aspects of the field. This particular article documents 28 classification schemes of Information Science that were compiled by leading scholars in the academic community. This unique collection of 28 classification schemes portrays and documents the profile of contemporary Information Science at the beginning of the 21st century.**

## Context

The field of Information Science (IS) is constantly changing. Therefore, information scientists are required to regularly review—and if necessary—redefine its fundamental building blocks. This article is part of a group of four articles, which resulted from a Critical Delphi study conducted in 2003–2005. The study, Knowledge Map of Information Science, explores the theoretical foundations of information science. It maps the conceptual approaches for defining data, information, and knowledge (Zins, 2007b), as well as the major conceptions of Information Science (Zins, 2007a). It portrays the profile of contemporary Information Science by documenting 28 classification schemes compiled by leading scholars over the course of the study, which are presented here; and culminates in developing a scientifically based and theoretically grounded knowledge map (Zins, 2007c).

Formulating a knowledge map—which is equivalent here to a subject classification scheme—means to set the boundaries of the field and define its main parts. This article is

focused on exploring how leading scholars and practitioners in the academic milieu map the field. This exploration is an important step on the road to understanding the essence of contemporary information science and to ground the mapping of the field on empirical data.

## Knowledge Mapping

Knowledge mapping plays an essential role in the construction, learning, and dissemination of knowledge (Zins, 2004). How do information scientists structure the field of Information Science? The literature provides thousands of knowledge maps; not all of them are comprehensive and systematic. In fact, most of them are partial, incomplete, and inconsistent. Knowledge maps of the field can be found in library classification schemes (e.g., Library of Congress Classification [LCC], Dewey Decimal Classification [DDC], and Universal Decimal Classification [UDC]), classification schemes in bibliographic resources, information services and databases (e.g., Information Science Abstract [ISA] and Library and Information Science Abstract [LISA]), thesauri (e.g., *ASIS Thesaurus of Information Science and Librarianship*; Milstead, 1998), conferences' programs (e.g., American Society for Information Science and Technology [ASIST] Annual Meeting), course syllabi, introductory texts, and encyclopedia entries. Nearly every book on information science explicitly or implicitly presents a knowledge map of the relevant body of knowledge in its table of contents.

Still the structuring has to be systematic. Formulating a systematic knowledge map should be based on a systematic conception of the field. Formulating a systematic conception of Information Science should be grounded on systematic conceptions of the constitutive concepts data, information, and knowledge (see Zins, 2007b). This article documents 28 classification schemes that portray the diversified aspects of the field. All of them are based on reflective thinking.

## Methodology

The scientific methodology is Critical Delphi. Critical Delphi is a qualitative research methodology aimed at facilitating critical and moderated discussions among experts

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(the panel). The international and intercultural panel is composed of 57 participants from 16 countries. The panel is unique and exceptional; it is comprised of leading scholars who represent nearly all the major subfields and important aspects of the field (see Appendix A). The indirect discussions were anonymous and were conducted in three successive rounds of structured questionnaires. The first questionnaire contained 24 detailed and open-ended questions covering 16 pages. The second questionnaire contained 18 questions in 16 pages. The third questionnaire contained 13 questions in 28 pages (see relevant excerpts from the three questionnaires in Appendix B). The return rates were relatively high: 57 scholars (100%) returned the first round, 39 (68.4%) returned the second round, and 39 (68.4%) returned the third round. Forty-three panelists (75.4%) participated in two rounds (i.e., R1 and either R2 or R3), and 35 panelists (61.4%) participated in all three rounds. In addition, each participant received his or her responses that I initially intended to cite in future publications. The responses were sent to each panel member with relevant critical reflections. Forty-seven (82.4%) participants responded and approved their responses. Twenty-three of them, which is 48.9% (23 out of 47), and 40.3% of the entire panel (23 out of 57) revised their original responses. Therefore,

one can say that actually the critical process (the study) was composed of four rounds.

### *Formulating the Schemes*

To be specific, the process of formulating the schemes was exhaustive (see Appendix B). It consisted of three steps. First, in the second round each panel member was asked to compile a knowledge map of the field, or rather a classification scheme, which represented his or her conception of Information Science. Next, in the third round, the investigator presented the panel's schemes, and each participant was asked to comment on the various schemes, select the one that best represented his or her position, and revise the scheme that he or she had developed in the second round. Finally, the investigator sent personal letters to the authors of the schemes. Each letter included the panel's relevant reflections, and if applicable, critical comments. Once again, each author was asked to revise his or her scheme.

### *The Panel's Schemes*

Twenty-eight panel members contributed their schemes and reflections, which follow:

Aldo de Albuquerque Barreto

#### **1. Information Production and Organization**

- 1.1 Information Nature, qualities & value
- 1.2 Production of stocks of information
- 1.3 Information management & control
- 1.4 Technologies & practices of information

#### **2. Information Distribution**

- 2.1 Users & information communities
- 2.2 Communication of information
- 2.3 Information sources
- 2.4 Channels of information & its flow

#### **3. Information consumption and use**

- 3.1 Information availability & access
- 3.2 Information Uses & Applications
- 3.3 Cognition Aspects of Information
- 3.4 Assimilation of information
- 3.5 The production of knowledge

#### **4. History, Philosophy, Legal, Ethics, and Ancillary Aspects of Information**

- 4.1 Legal Structure of Information (e.g., Copyright)
- 4.2 Ethics of Information
- 4.3 Policy & Politics
- 4.4 Globalization aspects
- 4.5 History, Philosophy, Environment

*“Reflections. In my view, information science is a set of flows, processes and actions that starts in a generator’s (author’s) mind and ends in a space where users (receptors) appropriates that information to be knowledge. As it is a dynamic model I cannot see it in a static table where headers do not match the whole idea.” [1] (Aldo Barreto)*

<p><b>1. Foundations of IS</b></p> <p>1.1 History of IS</p> <p>1.2 History of Librarianship</p> <p>1.3 Archival Science</p> <p>1.4 History of knowledge Formats: Manuscripts, Print &amp; digital</p> <p>1.5 IS Epistemology</p> <p><b>2. Methodology</b></p> <p>2.1 Quantitative &amp; qualitative research</p> <p>2.2 Bibliometrics, Informatics</p> <p>2.3 Bibliology</p> <p>2.4 Domain Analysis</p> <p>2.5 Webometrics</p> <p><b>3. Information/Learning Society</b></p> <p>3.1 Social &amp; cultural aspects in the information society</p> <p>3.2 Sociology of Knowledge</p> <p>3.3 Social Communication</p> <p>3.4 Scientific Communication</p> <p>3.5 E-learning</p> <p>3.6 Information Literacy</p> <p>3.7 IS Education</p> <p>3.8 Lifelong Learning</p> <p><b>4. Information Technology</b></p> <p>4.1 Communication &amp; Computer networks.</p> <p>4.2 Document Delivery Systems</p> <p>4.3 Structure of Computerized Systems</p> <p>4.4 Programming languages</p> <p>4.5 Multimedia</p> <p>4.6 Information retrieval Systems</p> <p>4.7 Systems Analysis</p> <p>4.8 Artificial Intelligence</p> <p>4.9 Human Computer Interaction</p> <p>4.10 Information Architecture</p> <p>4.11 digital security systems</p> <p>4.12 websites construction</p> <p>4.13 Net works technologies</p> <p>4.14 Knowledge Representation</p> <p>4.15 search tools</p>	<p><b>5. Data organization &amp; Retrieval</b></p> <p>5.1 Classification Schemes</p> <p>5.2 Metadata</p> <p>5.3 Indexing</p> <p>5.4 Abstracting</p> <p>5.5 Knowledge organization</p> <p>5.6 Taxonomies</p> <p>5.7 Thesauri</p> <p>5.8 Ontology</p> <p>5.9 Vocabulary Control</p> <p>5.10 Online Searching techniques</p> <p>5.11 Reference work</p> <p>5.12 The semantic web</p> <p><b>6. Information industry Economic &amp; Management</b></p> <p>6.1 Competitive Intelligence</p> <p>6.2 Databases</p> <p>6.3 Digital Libraries</p> <p>6.4 Electronic publishing</p> <p>6.5 Information Industry Market</p> <p>6.6 Information Management</p> <p>6.7 Information Manipulation</p> <p>6.8 Knowledge Management</p> <p>6.9 Information centers &amp; Libraries management.</p> <p>6.10 Collection management</p> <p>6.11 Electronic comers</p> <p><b>7. Information Ethic and Law</b></p> <p>7.1 Copyright</p> <p>7.2 Digital Security</p> <p>7.3 Digital divide</p> <p>7.4 Censorship</p> <p>7.5 Internet crime</p> <p>7.6 Free Access to Information</p> <p>7.7 Information Policies</p>	<p><b>8. User studies</b></p> <p>8.1 Human Information Behavior</p> <p>8.2 Information seeking Behavior</p> <p>8.3 Information Needs</p> <p>8.4 Reference interview</p> <p>8.5 User- information scientist-interaction</p> <p><b>9. Diffusion studies</b></p> <p>9.1 Information Dissemination</p> <p>9.2 Communication Theory</p> <p>9.3 Message Theory</p> <p>9.4 Information centres &amp; Libraries</p> <p><b>10. Social information Science</b></p> <p>10.1 Information needs of Different cultures</p> <p>10.2 Information Education, Power &amp; ethics</p> <p>10.3 Social information Banks</p> <p>10.4 Social information sections in school &amp; public Libraries</p> <p>10.5 Self help sources-printed Electronic</p> <p>10.6 The social information scientist</p> <p>10.7 Community Information.</p> <p>10.8 Information diffusion in multi cultural societies</p> <p>10.9 Health information centres</p>
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[2] (Shifra Baruchson–Arbib)

<p><b>1. People</b></p> <p><b>1.1 By group:</b>          Community          Culture          Domain          User group</p> <p><b>1.2 By individual:</b>          Researcher          User</p> <p><b>2. Object of Study</b></p> <p><b>2.1 By element:</b>          Data          Information          Knowledge          Message</p> <p><b>2.2 By conceptual foundation:</b>          Epistemology          History          Philosophy          Practice(s)          Theory</p> <p><b>2.3 By purpose:</b>          Communication          Creation          Discipline area          Dissemination          Evaluation          Management          Organization          Representation          Retrieval          Search          Storage</p>	<p><b>2.4 By methodology:</b>          Qualitative          Quantitative</p> <p><b>3. Systems</b></p> <p><b>3.1 By cultural factor:</b>          Economic aspects          Education          Ethical aspects          Legal aspects          Professions          Societal aspects</p> <p><b>3.2 By technology:</b>          Electronic          Manual          Mechanical</p> <p><b>4. Space</b>          [by Universal Decimal Classification]</p> <p><b>5. Time</b>          [by Universal Decimal Classification]</p>
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*“Rationale. It’s interesting that no one has produced a faceted (analytico-synthetic) system, so I’ve provided the basis for one... The fundamental facets are People, Object of Study, Systems, Space, and Time. These are subdivided into sub-facets and foci at a general level. It would need further conceptual development for sub-facets and foci, and a synthetic notation that would allow both inter- and intra-facet synthesis. The Universal Decimal Classification has been chosen for subdividing Space and Time because it is more highly developed in those areas than other general systems. Like other faceted systems, it is hospitable by nature and therefore potentially comprehensive. It is adequate and systematic. It is based on the most recent theoretical research in classification. It allows complex statements to be made using inter- and intra-facet synthesis (e.g., “qualitative historical research on information organization in 19th century France compared to 14th century China” or “quantitative research on information practice by user groups in electronic systems for specific discipline areas”). [3] (Clare Beghtol.)*

- 1. Foundations of Information & Library Science**
  - 1.1 Information Science Epistemology
  - 1.2 Information Theory
  - 1.3 Cognition Theory
  - 1.4 Semantics
  
- 2. Knowledge Organization**
  - 2.1 Theoretical foundations
    - 2.1.1 Knowledge Representation
    - 2.1.2 Categorization & Classification
    - 2.1.3 Classification Theory
    - 2.1.4 Subject Analysis
    - 2.1.5 Indexing
  - 2.2 Tools for Knowledge Organization and Library Science
    - 2.2.1 Classification Systems
    - 2.2.2 Ontologies
    - 2.2.3 Thesauri
    - 2.2.4 Vocabulary Control
    - 2.2.5 Information Processing
    - 2.2.6 Information Retrieval
    - 2.2.7 Information Science Technology
    - 2.2.8 Online searching
    - 2.2.9 Search Engines
  
- 3. Measuring & Evaluation**
  - 3.1 Information Quality Evaluation
  - 3.2 Bibliometrics
  - 3.3 Informetrics
  - 3.4 Webometrics
  
- 4. Social aspects**
  - 4.1 Information use and user
  - 4.2 Readership Studies
  - 4.3 Scientific Communication
  - 4.4 Research Evaluation

***“Rationale and structure.*** *The scheme is divided into four sections:*

*1) Foundations. This section relates to Information Science as well as Library Science, since Information Science has its own foundations in the concept of “information” that needs reference to a cognitive system or a knowing subject. “Information” starts when signs are in connection with an interpreter. Similarly, Library Science relates to theories of mediating human knowledge and elaborating methodologies in order to connect external memories (books and documents) with human cognitive ability.*

*2) Knowledge Organization. This section is the core of the scheme. It has two subsections, without hierarchical structure. One subsection is concerned with theoretical foundations and methodological problems, the other subsection concerns the tools created in the field of Information and Library Science in order to organize the knowledge.*

*3) Measuring and Evaluation. This section accommodates the procedures elaborated to measure the realization and the use of bibliographical entities, electronic resources in the WEB, and to evaluate them.*

*4) Social aspects. This section is concerned with the social side of the Knowledge Organization: research strategies of the users, characteristics of the scientific communication, and so on.” [4] (Maria Teresa Biagetti)*

<p><b>1. Concepts</b></p> <p>1.1 Abstracting</p> <p>1.2 Artificial intelligence</p> <p>1.3 Categorization &amp; classification</p> <p>1.4 Classification theory</p> <p>1.5 Cognition</p> <p>1.6 Communication</p> <p>1.7 Competitive Intelligence</p> <p>1.8 Digital preservation</p> <p>1.9 Digital security</p> <p>1.10 Human information behavior</p> <p>1.11 Information Architecture</p> <p>1.12 Information ethics</p> <p>1.13 Information Science Epistemology</p> <p>1.14 Informetrics</p> <p>1.15 Library Science</p> <p>1.16 Memetics</p> <p>1.17 Message theory</p> <p>1.18 Ontology</p> <p>1.19 Operations Research</p> <p>1.20 Philosophy of Information science</p> <p>1.21 Semiotics, Social, legal, &amp; ethical aspects of information</p> <p>1.22 Taxonomies</p> <p><b>2. History</b></p> <p>2.1 Foundations of information science</p> <p>2.2 History of information science</p> <p>2.3 Indexing</p> <p><b>3. Information System development</b></p> <p>3.1 Domain Analysis</p> <p>3.2 Evaluation</p> <p>3.3 Information need Evaluation</p> <p>3.4 Knowledge representation</p> <p>3.5 Knowledge structures Organization of Information</p> <p>3.6 Readership studies</p> <p>3.7 Subject analysis</p> <p>3.8 Systems analysis</p> <p>3.9 Thesauri</p> <p>3.10 Vocabulary control</p> <p>3.11 Estimation of Info Tech projects</p> <p>3.12 Sizing of Software</p> <p><b>4. Information Processing</b></p> <p>4.1 High-Density Book Storage Systems</p> <p>4.2 Information manipulation</p> <p>4.3 Information processing</p> <p>4.4 Information retrieval</p>	<p>4.5 Information storing</p> <p>4.6 Information structures</p> <p>4.7 Information use and user</p> <p>4.8 Knowledge management</p> <p>4.9 Metadata</p> <p>4.10 Online searching</p> <p>4.11 Publishing</p> <p>4.12 Scientific Communication</p> <p><b>5. Information System Implementation</b></p> <p>5.1 Data bases</p> <p>5.2 Information dissemination,</p> <p><b>6. Quality assurance of Information</b></p> <p>6.1 Information Quality</p> <p>6.2 Information Science Education</p> <p>6.3 Research evaluation</p> <p>6.4 Testing of Software</p> <p>6.5 Quality assurance of Software</p> <p><b>7. Applications</b></p> <p>7.1 Access systems</p> <p>7.2 Archival Science</p> <p>7.3 Aviation informatics</p> <p>7.4 Bibliometrics</p> <p>7.5 Community Informatics</p> <p>7.6 Diffusion of info studies</p> <p>7.7 Digital libraries</p> <p>7.8 Distributed networked environments</p> <p>7.9 Document Delivery Systems</p> <p>7.10 Economics of information</p> <p>7.11 Electronic Information Industry</p> <p>7.12 E-journals</p> <p>7.13 E-learning</p> <p>7.14 Health/Biomedical Informatics</p> <p>7.15 Information industry</p> <p>7.16 Information technology</p> <p>7.17 Internet</p> <p>7.18 Labor in information systems</p> <p>7.19 Music-information-retrieval</p> <p>7.20 Philosophy of Librarianship</p> <p>7.21 Public Information Policies</p> <p>7.22 Social information/Social Informatics</p> <p>7.23 Information in traditional &amp; User</p> <p>7.24 Web</p> <p>7.25 Webometrics</p> <p><b>8. Information project management</b></p> <p>8.1 Information management</p> <p>8.2 Management</p>
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[5] (Manfred Bundschuh)

<p><b>1. Thematic information</b> Biomedical information, Copyright, e-government, Economic information, Ethical aspects of information, Health &amp; safety information, Legal information, Media information, Social information</p> <p><b>2. Methodology</b> Knowledge representation, Organization of Information, Publishing, Search methods, Social Informatics, Standards, Team work, Terminology, Translation, methods, User needs, User satisfaction, Working group</p> <p><b>3. Training</b> Information skills, Professional competences, Training courses, e-learning</p>
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[6] (Paola Capitani)

Rafael Capurro

<p><b>1. Foundations of Information Science*</b></p> <p>1.1 Philosophy of Information 1.2 The Concept of Information (Information Theory) 1.3 The Concept of Media (Media Theory) 1.4 The Concept of Message (Message Theory) 1.5 The Concept of Sign (Semiotics) 1.6 The Concept of Communication (Communication Theory) 1.7 Second-Order Cybernetics 1.8 System Theory 1.9 Cognition Theory (Social Epistemology) 1.10 Interpretation Theory (Hermeneutics)</p> <p><b>2. History of Information Science</b></p> <p><b>3. History of Media</b></p> <p><b>4. Information Societies</b></p> <p>4.1 Information Cultures 4.2 Information Behavior 4.3 Information Needs 4.4 Social Informatics 4.5 Scientific Communication</p> <p><b>5. Information Systems</b></p> <p>5.1 Information Architecture 5.2 Information Design 5.3 Multimedia Systems 5.4 Image Retrieval 5.5 Sound Retrieval 5.6 Mobile Computing 5.7 Ubiquitous Computing 5.8 Distributed Networks 5.9 Information Retrieval 5.10 System Analysis 5.11 System Evaluation 5.12 Library Systems 5.13 Public Media Repositories 5.14 Streaming Media 5.15 Mass Media 5.16 Archival Systems 5.17 Document Delivery Systems 5.18 Evaluation of Information Systems 5.19 Search Engines</p>	<p><b>6. Subject Analysis</b></p> <p>6.1 Domain Analysis 6.2 Taxonomy Theory 6.3 Ontologies</p> <p><b>7. Content Management</b></p> <p>7.1 Knowledge Organization 7.2 Community Informatics 7.3 Competitive Intelligence 7.4 Computer mediated communication</p> <p><b>8. Information Measurement</b></p> <p>8.1 Informetrics 8.2 Bibliometrics 8.3 Webometrics 8.4 Scientometrics 8.5 Indicators for Research Evaluation</p> <p><b>9. Economics of Information</b></p> <p>9.1 Information Industry 9.2 Information &amp; Media Products 9.3 E-Economy 9.4 Labor and Information</p> <p><b>10. Information Ethics, Media Ethics</b></p> <p>10.1 Theories of Information Ethics 10.2 Ethical Dilemmas in Information Society 10.3 Codes of Practice 10.4 Intercultural Information Ethics</p> <p><b>11. Legal Aspects</b></p> <p>11.1 Copyright 11.2 Censorship 11.3 Access</p> <p><b>12. Information Policies</b></p> <p>12.1 E-Government 12.2 E-Democracy</p> <p><b>13. Education and Training</b></p> <p>13.1 E-Learning 13.2 Information Science Education 13.3 User Education 13.4 Continuing professional education 13.5 Corporate Universities 13.6 Consultancy 13.7 Coaching</p>
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*“Delimitations. Note that the order of this scheme does not imply any kind of practical or didactic order and importance.” [7] (Rafael Capurro)*

Thomas A. Childers

**Group 1:**

Abstracting, Indexing, Knowledge representation, Metadata, Semiotics

**Group 2:**

Bibliometrics, Information diffusion, Human information behavior, Media use & users, Information need, Information use & users

**Group 3:**

Competitive Intelligence, Information dissemination, Information retrieval, Online searching, Knowledge management

**Group 4:**

Copyright, Publishing

**Group 5:**

Information systems analysis, Database creation, Human-computer interaction, Artificial intelligence

**Group 6:**

Information storage, Information structures, Information technology, Digital libraries, Distributed networked environments, Informatics

**Group 7:**

Document Delivery Systems, Information industry, Information management, Information processing

**Group 8:**

Economics of information, Information ethics, information policy

**Group 9:**

Management of Information Organizations, Operations Research, Evaluation of information systems

**Group 10:**

Information theory, Library Science

[8] (Thomas A. Childers)

Charles H. Davis

1. **Abstracting** (subsuming extracting)
2. **Classification and categorization** (subsuming ontology, taxonomy, domain analysis and similar terms)
3. **Indexing** (subsuming other terms implying in-depth content analysis)
4. **Cognition** (subsuming artificial intelligence and the like)
5. **Communication**
6. **Database management**
7. **Document delivery**
8. **Education & training**
9. **Ethics**
10. **Evaluation**
11. **History & foundations**
12. **Information theory**
13. **Legal aspects**
14. **Library science**
15. **Operations research**
16. **Publishing**
17. **Semiotics**
18. **Web & Internet studies**

[9] (Charles H. Davis)



<b>1. Event</b>	4.9 Operations research
1.1 Subject Analysis (e.g. weather, medical diagnostics, market fluctuations, etc.)	4.10 Programization of Information
<b>2. Acquisition</b>	4.11 Philosophy of computers
2.1 Sensor systems (Optics, Radar, and Hearing aids could also be included under processing)	4.12 Webmetrics
2.2 Classification, Categorization (of events)	4.13 Abstracting
2.3 Indexing (of events; examples: clouds, storms, crime, etc)	4.14 Electronic information industry
2.4 Access system	<b>5. Utilization</b>
<b>3. Transmission</b>	5.1 Artificial intelligence
3.1 Electronics	5.2 Cognition
3.2 Cable	5.3 E learning
3.3 Wireless telephony	5.4 Human Information Behavior
3.4 Electronic information industry	5.5 Information ethics
3.5 transmission	5.6 Information management
3.6 Distributed Networks	5.7 Information need
<b>4. Processing</b>	5.8 Information use & user
4.1 Bibliometrics	5.9 Aviation Informatics
4.2 Data bases	5.10 Social, legal, ethical aspects of information
4.3 Digital libraries	<b>6. Transfer (communication)</b>
4.4 Domain analysis	6.1 Computer related communication
4.4 High density book storage systems	6.2 Librarianship
4.5 Information manipulation	6.3 Document delivery system
4.6 Information Processing	6.4 E Journals
4.7 Information storage	6.5 Metalibrarianship
4.8 Information structures	6.6 Scientific communication
	6.7 Readership studies
	6.8 Social, legal, ethical aspects of information
	6.9 Archival science
	6.10 Community informatics

*“Rationale. The rationale of the model is based on three basic premises. First, all organisms are data, information, knowledge systems. They could not deal with the external world without them. Second, information is a state of consciousness (i.e., awareness). Thus, information is a cognitive/affective process and the products of that process (Miller, 1978). The focus is on the product and management of these processes (Drucker, 2001). Third, technology augments the human capacities and the products there from. (Englebart, 1962).*

*Based on these premises, ontology of human organisms can provide a map of the various relationships between an event (i.e., state of the world), the sensory mechanism that receive energy from the outside world, the movement (transmission) of these sensory impulses (transmission) to the brain (processors). The knowledge component of the augmented data information knowledge (ADIK) systems has reference to the formulation of judgment (i.e., decision/action) (Newell, 1972) that follows the processing of data-information. Decision incorporates an application of understanding, analysis, synthesis and evaluation (Bloom, 1956), the products of these processes are transferred (i.e., communicated) to others (e.g., cells, person, social entities) responding to various states of an event. The main role of the ADIK system is to respond to various states of the event world.*

*Information science establishes the law and principles that govern the relationships in the analysis, design, and evaluation of ADIK systems and wherein the basic premise, namely, such systems augment human processes, prevails (Debons et al., 1988).” [10] (Anthony Debons)*

**1. General**

Economics of information, Foundations of IS, History of IS, Information ethics, Information management, Information Quality Management, IS Education, IS Epistemology, Information systems, Information technology, Social, legal, & ethical aspects of information

**2. Information Generation Process**

Databases, Information Architecture, Information structures, Informetrics, Organization of Information, Philosophy of Information science, Thesauri,

**3. Information Processing, Storing & Communication Processes**

Abstracting, Artificial intelligence, Categorization & classification, Communication, Indexing, Information processing, Information storing, Taxonomies

**4. Information Use Process**

Bibliometrics, Cognition, Decision making, Information dissemination, Information retrieval, Information use & user, Knowledge management, Problem Solving, Social information/Social Informatics, Subject analysis, Webometrics

*“Rationale. The scheme represents the conception of information science as the science of information society (focusing on information systems); it studies the information and its five basic sub-processes – generation, processing, communication, storage and use - in order to optimize them. These processes are related to information as immaterial product and are representing the information cycle (within a research system). It is similar to the well known product cycle (within an economic system) with its three basic processes: production, distribution, and consumption. This is a managerial and pragmatic approach (Dragulanescu, 1999)” [11] (Nicolae Dragulanescu)*

**Actors**

People, institutions, professional organizations, research groups, funding agencies, and so on.

**Practices**

The activities that actors engage in when they use, categorize, mobilize, share, store, information

**Methods**

*The moments or strategies that actors use when they engage in the above practices (some of which are already known and well-understood in science and elsewhere, and others of which will arise through the emerging practices and technologies)*

**Technologies**

*The reified objects that actors utilize in carrying out their activities (including, but not limited to, digital hardware, computer software, and so on)*

*Inscriptions: all kinds of representations that mediate among actors – e.g., references, citations, digital libraries, web pages (and any similar medium that may emerge).*

*“Rationale. The rationale behind my proposal derives from the lessons learned in the last few decades by the students of science studies, especially what has come to be known as “actor-network theory.” Science, according to this view, is the outcome or performance of a heterogeneous set of actors, which are linked together in networks. A major premise of this view is that actors are not only human beings, but also non-humans such as, among others, technologies, documents, inscriptions, money, power, information, and so on. My separation of actors, inscriptions, and technologies in the following map should therefore be understood as a simplification.” [12] (Hamid Ekbia)*

<p><b>1. Foundations of IS</b></p> <p>1.1 Classification theory</p> <p>1.2 Cognition science</p> <p>1.3 Communication theory</p> <p>1.4 Foundations &amp; history of IS</p> <p>1.5 IS epistemology</p> <p>1.6 Library science</p> <p>1.7 Philosophy of information</p> <p>1.8 Museology</p> <p>1.9 Archive science</p> <p><b>2. Technology</b></p> <p>2.1 Buildings &amp; equipment</p> <p>2.2 Multimedia</p> <p>2.3 Internet, intranets, extranets</p> <p>2.4 “High tech”</p> <p>2.5 ICT</p> <p>2.6 Information processing tools</p> <p>2.6.1 Classification schemes</p> <p>2.6.2 Structured vocabularies</p> <p>2.6.3 Metadata &amp; schema</p> <p>2.6.4 Information &amp; data models</p> <p>2.7 Information workers</p> <p><b>3. Activities</b></p> <p>3.1 Systems analysis &amp; design</p> <p>3.1.1 Information (&amp; knowledge) architecture</p> <p>3.1.2 Information (&amp; knowledge) audit</p> <p>3.1.3 Website design</p> <p>3.1.4 Typology &amp; graphic design</p> <p>3.1.5 Standardisation</p> <p>3.2 Knowledge management</p> <p>3.3 Information management</p> <p>3.3.1 Library management</p> <p>3.3.2 Records &amp; archives management</p> <p>3.3.3 Document management</p> <p>3.4 Museum documentation</p> <p>3.5 Information processing</p> <p>3.5.1 Information analysis</p> <p>3.5.2 Writing and journalism</p> <p>3.5.3 Collection management</p> <p>3.5.4 Indexing</p> <p>3.5.5 Abstracting</p> <p>3.5.6 Cataloguing</p> <p>3.5.7 Classification &amp; categorisation</p> <p>3.5.8 Information storage</p> <p>3.5.9 Information curation</p> <p>3.5.10 Information retrieval</p> <p>3.5.11 Information dissemination</p>	<p><b>4. Metrics, Evaluation &amp; Research</b></p> <p>4.1 Evaluation of information systems</p> <p>4.2 Evaluation of retrieval</p> <p>4.3 User needs studies</p> <p>4.4 Usability studies</p> <p>4.5 Diffusion studies, SNA</p> <p>4.6 Economics of information</p> <p>4.7 Evaluation of information quality</p> <p>4.8 Biblio-, Infor-, Sciento-metrics</p> <p>4.9 Webometrics</p> <p>4.10 Research methods</p> <p>4.11 Evaluation of research</p> <p><b>5. Information use &amp; users</b></p> <p>5.1 Information needs &amp; use</p> <p>5.2 User typologies</p> <p>5.3 Information behaviour</p> <p>5.4 Group psychology</p> <p>5.5 Information usability</p> <p>5.6 Info &amp; IT literacy</p> <p><b>6. Supporting disciplines</b></p> <p>6.1 Management</p> <p>6.1.1 Strategy &amp; planning</p> <p>6.1.2 Financial management</p> <p>6.1.3 Human resource mgmt</p> <p>6.1.4 Facilities management</p> <p>6.1.5 Operations research</p> <p>6.1.6 Decision support systems</p> <p>6.1.7 Management information</p> <p>6.2 Mathematics &amp; logic</p> <p>6.2.1 Bayesian probability</p> <p>6.2.2 Vector space analysis</p> <p>6.2.3 Information theory</p> <p>6.2.4 Bradford-Zipf analysis</p> <p>6.3 Linguistics &amp; logic</p> <p>6.3.1 NLP</p> <p>6.3.2 Computational linguistics</p> <p>6.3.3 Semiotics</p> <p>6.3.4 Semantics</p> <p>6.3.5 Speech recognition</p> <p>6.4 Artificial intelligence</p> <p>6.5 Psychology</p> <p>6.6 Information politics</p> <p>6.7 Communication</p>	<p><b>7. Application areas</b></p> <p>7.1 Information industry</p> <p>7.1.2 Electronic Publishing</p> <p>7.1.3 Libraries</p> <p>7.1.4 Digital libraries</p> <p>7.1.5 Primary Information Services</p> <p>7.1.6 Secondary Information Services</p> <p>7.1.7 Tertiary Information services</p> <p>7.1.8 Intellectual capital</p> <p>7.1.9 Business intelligence</p> <p>7.1.10 Geospatial Systems (GIS)</p> <p>7.1.11 Patent analysis</p> <p>7.1.12 Market research</p> <p>7.2 Discipline-oriented systems</p> <p>7.2.1 Chemical informatics</p> <p>7.2.2 Medical informatics</p> <p>7.2.3 Music information retrieval</p> <p>7.3. Function-oriented systems</p> <p>7.3.1 Marketing</p> <p>7.3.2 Finance &amp; accounting</p> <p>7.3.3 Educational systems</p> <p>7.3.4 Health informatics</p> <p>7.3.5 Legal information systems</p> <p>7.3.6 e-Government</p> <p>7.3.7 Citizen’s information systems</p> <p>7.4. Media-based</p> <p>7.4.1 Text-based systems</p> <p>7.4.2 Pattern recognition</p> <p>7.4.3 Content-Based Image Retrieval</p> <p>7.4.4 Video systems</p> <p>7.4.5 Audio systems</p> <p>7.4.6 World Wide Web</p> <p>7.4.7 Portals and gateways</p> <p><b>8. Legal, Ethical &amp; Social issues</b></p> <p>8.1 Intellectual property</p> <p>8.2 Information ethics</p> <p>8.3 Freedom of Information</p> <p>8.4 Data privacy, Censorship</p> <p>8.5 National information policy</p> <p>8.6 Social exclusion</p> <p>8.7 Third World problems</p> <p><b>9. IS Education</b></p> <p>9.1 Training</p> <p>9.2 e-Learning</p>
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[13] (Alan Gilchrist)

Information Phenomena at the various systems levels:

**1. Information at the quantum level**

Information processing subsystems: input transducer; internal transducer; channel and net; decoder; associator; memory; decider; encoder; output transducer

**2. Information at the cellular level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**3. Information at the organ level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**4. Information at the organism level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**5. Information at the group level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**6. Information at the organization level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**7. Information at the society level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**8. Information at the supra-national level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

**9. Information at the cosmological level**

Information processing subsystems: input transducer; internal transducer; channel & net; decoder; associator; memory; decider; encoder; output transducer

*“Rationale and structure. The general systems levels and components stated above are adapted from J. G. Miller’s brilliant synthesis of general systems theory (1995), but with the addition of a quantum level and a cosmological level. Each level has an associated subsystem level that processes information (other complementary subsystems at the different levels process matter and energy). The information processing subsystems for each level are these: input transducer; internal transducer; channel and net; decoder; associator; memory; decider; encoder; output transducer.*

***Quantum level.** Information at the quantum level relates to the properties of very small, sub-atomic particles that function not according to most prevailing notions of classical physics (which are based on classical or Newtonian models of three dimensions of space and one of time), but according to n-dimensional models of space-time. Quantum models generally portray very small particles as having the capability of moving backward or forward through linear time, being in two positions simultaneously, and possibly traveling or communicating at super-luminous speed (faster than the speed of light). When quanta collectively form patterns, quantum coherence can occur and can stimulate such things as neural microtubule receptors, and thus neural functioning and cognition (See Penrose, 1994).”*

[14] (Glynn Harmon)

<p><b>1. Information Science Research</b></p> <p>1.1 Concepts, definitions, theories, methodologies &amp; applications</p> <p>1.2 Properties, needs, quality, and value of information</p> <p>1.3 Statistics, measurement (Bibliometrics, citation analysis, scientometrics, informetrics)</p> <p>1.4 Information retrieval research (Searching techniques (Boolean, fuzzy, natural language), the search process, precision/relevance, ranking/recall, searching models, query formulation, inverted files, updating, database structures)</p> <p>1.5 User behaviour &amp; uses of information systems (Searcher tactics, information overload, user surveys, usability studies)</p> <p>1.6 Human-computer interface (Human factors, ergonomics, design issues)</p> <p>1.7 Communication (Editing, writing, linguistics, <i>Internet authoring &amp; design principles</i>)</p> <p>1.8 Operations research/mathematics (Modeling, Boolean logic, coding, systems analysis, algorithms, compression)</p> <p>1.9 History of information science, biographies</p> <p>1.10 Information genres</p> <p><b>2. Knowledge Organization</b></p> <p>2.1 Thesauri, authority lists (Taxonomies, ontologies, semantic networks, nomenclatures, terminologies, vocabularies)</p> <p>2.2 Cataloging &amp; classification (Tagging, metatags, Dublin Core, DOIs, OPACs, MARC, AACR2, topic maps, cataloging processes &amp; theories)</p> <p>2.3 Abstracting, indexing, reviewing Automatic indexing &amp; abstracting</p> <p>2.4 Standards &amp; protocols (NISO, Z39.5, XML, SGML, HTML, Open Archives Initiative (OAI), Encoded Archival Description (EAD), Open URL, portable document format (PDF))</p> <p><b>3. The Information Professions</b></p> <p>3.1 Information professionals (Intermediaries, searchers, reference librarians, information brokers, translators, educators, librarians and librarianship, mentoring, career outlook, future of the profession professional ethics, skills &amp; competencies)</p> <p>3.2 Organizations &amp; societies</p> <p><b>4. Societal Issues</b></p> <p>4.1 Information ethics, plagiarism, credibility</p> <p>4.2 Information literacy, lifelong learning</p> <p>4.3 The Information Society (Universal access &amp; accessibility, technological &amp; socioeconomic impacts of information, technology forecasts, information flows, futures scenarios, preservation)</p>	<p><b>5. The Information Industry</b></p> <p>5.1 Information &amp; knowledge management (Knowledge transfer in organizations, business strategies)</p> <p>5.2 Markets &amp; players (Vendor profiles &amp; interviews, trends)</p> <p>5.3 Economics &amp; pricing (Business models, value chain)</p> <p>5.4 Marketing, e-commerce</p> <p><b>6. Publishing &amp; Distribution</b></p> <p>6.1 Print</p> <p>6.2 Electronic (E-journals, e-books)</p> <p>6.3 Secondary publishing (Abstracting &amp; indexing services, directories)</p> <p>6.4 Scholarly communication (Peer review process, future of journals, dissertations, grey literature)</p> <p><b>7. Information Technologies</b></p> <p>7.1 Internet (World Wide Web, Invisible Web, Deep Web, search engines, browsers, hypermedia, Listservs, bulletin boards, portals, gateways, directories, pathfinders)</p> <p>7.2 Intranets (private), Web conferencing</p> <p>7.3 Software (Programming languages, operating systems, platforms)</p> <p>7.4 Hardware</p> <p>7.5 Multimedia</p> <p>7.6 Document management (Imaging, scanning, text retrieval, digitization, records management, bookmarking, hypertext systems, preservation technologies, digitization, linking &amp; electronic cross referencing, storage, digital rights management)</p> <p>7.7 AI, expert systems, intelligent agents, (Cybernetics, visualization and mapping, data mining, pattern and character recognition, Search agents and robots)</p> <p>7.8 Telecommunications (Networks, wireless &amp; satellite information delivery, Palm Pilots &amp; other PDAs, LANs &amp; WANs)</p> <p>7.9 Security, access control, authentication, encryption (Digital watermarking)</p> <p>7.10 Other</p> <p><b>8. Electronic Information Systems &amp; Services</b></p> <p>8.1 Information searching &amp; retrieval systems &amp; services (Bibliographic, numeric, &amp; image databases; descriptions of online services)</p> <p>8.2 Customized information systems, alerting, current awareness</p> <p>8.3 Document delivery systems &amp; services (Interlibrary loan, resource sharing)</p> <p>8.4 Geographic information systems</p>	<p><b>9. Subject-Specific Sources and Applications</b></p> <p>9.1 Physical sciences (Chemistry, physics, engineering, earth sciences, computer science, energy, mathematics)</p> <p>9.2 Life sciences (Medicine, biosciences, agriculture, environment)</p> <p>9.3 Social sciences, humanities, history, linguistics</p> <p>9.4 Business (Management, economics, companies)</p> <p>9.5 Law, political science, government Patents &amp; trademarks, intellectual property, case law)</p> <p>9.6 News</p> <p>9.7 Education, library &amp; information science, ready reference</p> <p>9.8 Other/multidisciplinary (Biography &amp; genealogy databases, encyclopedias, databases of theses &amp; dissertations)</p> <p>9.9 Countries &amp; geographic areas</p> <p><b>10. Libraries &amp; Library Services</b></p> <p>10.1 Library descriptions &amp; types: Special, government, academic, &amp; public libraries, archives, museums, State &amp; National libraries, depository libraries</p> <p>10.2 Library services</p> <p>10.3 Library automation &amp; operations</p> <p>10.4 Library consortia &amp; networks, coalitions, cooperatives</p> <p>10.5 Digital &amp; virtual libraries, hybrid libraries</p> <p>10.6 Education &amp; training (Distance learning, continuing education, bibliographic instruction library schools, courses &amp; curricula)</p> <p>10.7 Library Management, Planning &amp; Personnel</p> <p>10.8 Library facilities</p> <p><b>11. Government &amp; Legal Information &amp; Issues</b></p> <p>11.1 Intellectual property protection (Copyright issues &amp; implications, fair use, trademarks, patent law)</p> <p>11.2 Legislation, laws, &amp; regulations (except copyright)</p> <p>11.3 Contracts &amp; licensing</p> <p>11.4 Liability issues (Filtering, censorship, privacy)</p> <p>11.5 Sources of public information</p> <p>11.6 Information policies &amp; studies (Security, encryption, privacy, freedom of information, censoring, national &amp; other information policies)</p> <p>11.7 Systems &amp; infrastructure (Technology transfer)</p>
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<p><b>1. Conceptions</b></p> <p>1.1 Artificial Intelligence  1.2 Categorization &amp; Classification  1.3 Classification theory  1.4 Cognition  1.5 Communication  1.6 Copyright  1.7 Domain analysis  1.8 Information ethics  1.9 Information science epistemology  1.10 Information structures  1.11 Information theory  1.12 Knowledge organization  1.13 Knowledge representation  1.14 Knowledge structures  1.15 Memetics  1.16 Message theory  1.17 Metadata  1.18 Ontology  1.19 Organization of information  1.20 Scientific communication  1.21 Social, legal &amp; ethics aspects  1.22 Subject analysis  1.23 Systems analysis</p> <p><b>2. Disciplines</b></p> <p>2.1 Archival Science  2.2 Economics of Information  2.3 Human information behavior  2.4 Information architecture  2.5 Information retrieval  2.6 Knowledge management  2.7 Librarianship  2.8 Library Science  2.9 Metalibrarianship  2.10 Operations research  2.11 Philosophy of computation  2.12 Philosophy of information  2.13 Philosophy of information science  2.14 Philosophy of librarianship  2.15 Semiotics</p>	<p><b>3. Research &amp; Evaluation</b></p> <p>3.1 Bibliometrics  3.2 Computer-mediated communication  3.3 Diffusion studies  3.4 Evaluation  3.5 Evaluation of information Systems  3.6 Information quality evaluation  3.7 Readership studies  3.8 Research evaluation  3.9 Webometrics</p> <p><b>4. Education &amp; History</b></p> <p>4.1 Education &amp; training  4.2 E-learning  4.3 Information science education  4.4 Foundations of information science  4.5 History of information science</p> <p><b>5. Resources</b></p> <p>5.1 Access systems  5.2 Databases  5.3 Internet  5.4 Online searching  5.5 Web</p> <p><b>6. Environments/Cultures/Contents</b></p> <p>6.1 Chemical Documentation  6.2 Educational information  6.3 Health/Biomedical informatics  6.4 Labor in information systems  6.5 Music information retrieval  6.6 Social information/social informatics  6.7 Information in traditional &amp; transitional societies  6.8 Technological information  6.9 Aviation Informatics  6.10 Community Informatics  6.11 Public information policies</p>	<p><b>7. Organizations</b></p> <p>7.1 Electronic information industry  7.2 Information industry  7.3 Publishing</p> <p><b>8. Technologies</b></p> <p>8.1 Digital libraries  8.2 Digital security  8.3 Distributed networked environments  8.4 Document delivery systems  8.5 E-journals  8.6 High-density book storage systems  8.7 Information processing  8.8 Information storing</p> <p><b>9. Operations &amp; Processes</b></p> <p>9.1 Abstracting  9.2 Classification schemes  9.3 Classification systems  9.4 Competitive Intelligence  9.5 Digital preservation  9.6 Indexing  9.7 Information dissemination  9.8 Information management  9.9 Information manipulation  9.10 Informetrics  9.11 Management  9.12 Taxonomies  9.13 Thesauri  9.14 Vocabulary control</p> <p><b>10. Users</b></p> <p>10.1 Information need  10.2 Information use  10.3 User</p>
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[16] (Ken Herold)

<p><b>1. Disciplines &amp; Sub-disciplines</b></p> <p>1.1 Archival Science  1.2 Bibliography  1.3 Bibliometrics  1.4 Informetrics  1.5 Information management  1.6 Librarianship/Library Science  1.7 Museology</p> <p><b>2. Related fields</b></p> <p>2.1 Cognition  2.2 Economics of information (Information management)  2.3 Information theory  2.4 Knowledge management  2.5 Semantics  2.6 Semiotics  2.7 Literature studies  2.8 Sociology of science /sociology of knowledge  2.9 Science studies  2.8 Systems analysis</p> <p><b>3. Knowledge Organization</b></p> <p>3.1 Abstracting  3.2 Categorization &amp; classification  3.3 Classification systems  3.4 Concepts  3.5 Disciplines  3.6 Domain Analysis  3.7 Genres  3.8 Indexing  3.9 Information Architecture/Information structures  3.10 Knowledge  3.11 Knowledge Organizing Systems  3.12 Knowledge production, dissemination &amp; consumption  3.13 Knowledge representation  3.14 Literatures (primary, secondary, tertiary etc)</p>	<p>3.15 Metadata  3.16 Ontology  3.17 Organization of Information  3.18 Paradigms  3.19 Semantics &amp; semantic relations  3.20 Semantic tools dictionaries, thesauri, classification schemes, ontologies etc)  3.21 Subject analysis  3.22 Subject access points  3.23 Taxonomies  3.24 Thesauri  3.25 Vocabulary control  3.26 Words</p> <p><b>4. Domains</b></p> <p>4.1 Chemical Documentation  4.2 Culture  4.3 Health/Biomedical Informatics  4.4 Geographical information  4.5 Medical information  4.6 Social science Information  4.7 Arts &amp; humanities information  4.8 Legal information  4.9 Music-information-retrieval  4.10 Scientific Communication  4.11 Technological information</p> <p><b>5. Meta-issues</b></p> <p>5.1 Foundations of IS  5.2 History of IS  5.3 IS Education  5.4 IS Epistemology  5.5 Philosophy of information  5.6 Philosophy of IS  5.7 Philosophy of Librarianship</p>	<p><b>6. Processes, entities &amp; Institutions in Information Work</b></p> <p>6.1 Communication  6.2 Computer mediated communication  6.3 Databases  6.4 Archives, libraries, Museums  6.5 Digital libraries  6.6 Digital preservation  6.7 Distributed networked environments  6.8 Documents  6.9 Document Delivery Systems  6.10 E-journals  6.11 Evaluation of information systems  6.12 Full-text databases  6.13 Information dissemination  6.14 Information ethics  6.15 Information need  6.16 Information processing  6.17 Information Quality Evaluation  6.18 Information retrieval  6.19 Information sources  6.20 Information storing  6.21 Information use &amp; user  6.22 Internet  6.23 Online searching  6.24 Public Information Policies  6.25 Publishing  6.26 Readership studies  6.27 Reference work  6.28 Reference works  6.29 Research evaluation  6.30 Social information/Social Informatics  6.31 Information in traditional &amp; transitional societies  6.32 Social legal &amp; ethical aspects of information  6.33 Subjects (e.g. Bradfords law)  6.34 User  6.35 Web  6.36 Webometrics</p>
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*“Delimitations. A research into such issues is an ongoing process. My scheme, which reflects my theoretical orientation, will be expanded and revised in future research publications.” [17] (Birger Hjørland)*

<p><b>1. Foundations of IS</b>  1.1 Philosophy of Information  1.2 Information Theory  1.3 IS Epistemology  1.4 Philosophy of Computation  1.5 Information Ethics  1.6 Metalibrarianship  1.7 Library Science  1.8 Semiotics</p> <p><b>2. History of IS</b></p> <p><b>3. Information/Learning Society</b>  3.1 Information Cultures  3.2 Sociology of Knowledge  3.3 Social Communication  3.4 Scientific Communication</p> <p><b>4. Information Systems</b>  4.1 Information Architecture  4.2 Information Design  4.3 Information Storing  4.4 Access Systems  4.5 Document Delivery Systems  4.6 High-Density Book Storage Systems  4.7 Distributed Networked Environments  4.8 Systems Analysis  4.9 Evaluation of Information Systems</p> <p><b>5. Information technology</b>  5.1 Technological Information  5.2 Information Processing  5.3 Knowledge representation  5.4 Human Computer Interaction  5.5 Computer Mediated Communication  5.6 Artificial Intelligence  5.7 Ontologies  5.8 Databases  5.9 Internet  5.10 Community Informatics</p>	<p><b>6. Knowledge organization</b>  6.1 Categorization &amp; Classification  6.2 Taxonomies  6.3 Classification Systems  6.4 Classification Schemes  6.5 Retrieval Languages  6.6 Subject Analysis  6.7 Vocabulary Control  6.8 Indexing  6.9 Thesauri  6.10 Abstracting  6.11 Metadata  6.12 Librarianship Standards</p> <p><b>7. Information industry</b>  7.1 Digital Libraries  7.2 Competitive Intelligence  7.3 Knowledge Management  7.4 Information Management  7.5 Content Management  7.6 Economics of Information  7.7 Information Manipulation  7.8 Information Quality Evaluation  7.9 Readership Studies  7.10 E-journals  7.11 Operations Research</p> <p><b>8. Information retrieval</b>  8.1 Electronic Information Sources  8.2 Online Searching  8.3 Music-Information-Retrieval</p> <p><b>9. Quantitative analysis in IS</b>  9.1 Bibliometrics  9.2 Informetrics  9.3 Webometrics  9.4 Domain Analysis</p>	<p><b>10. Diffusion studies</b>  10.1 Information Dissemination  10.2 Communication Theory  10.3 Message Theory  10.4 Memetics</p> <p><b>11. Public Information Policies</b>  11.1 Free Access to information (Intellectual Freedom)  11.2 Copyright  11.3 Digital Security  11.4 Publishing</p> <p><b>12. User studies</b>  12.1 Human Information Behavior  12.2 Information Needs  12.3 Information Seeking  12.4 Knowledge Structures</p> <p><b>13. Information Literacy &amp; Education</b>  13.1 IS Education  13.2 Information Literacy  13.3 Computer Literacy  13.4 Educational Information  13.5 E-learning  13.6 Lifelong Learning</p> <p><b>14. Applied Information Science</b>  14.1 Librarianship  14.2 Bioinformatics  14.3 Chemical Documentation  14.4 Health/Biomedical Informatics  14.5 Legal Informatics  14.6 Aviation Informatics</p>
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[18] (Michal Lorenz)



Ia McIlwaine

<p><b>Group 1:</b> History of information science Foundations of information science Philosophy of information science</p> <p><b>Group 2: Information science epistemology</b> Artificial intelligence Information structures Information technology Information theory Informetrics Knowledge structures Ontologies</p> <p><b>Group 3: Librarianship</b> Philosophy of librarianship Public information policies Publishing</p> <p><b>Group 4: Information retrieval</b> Databases Categorization and classification Classification systems Subject analysis Indexing Metadata Thesauri Abstracting Vocabulary control Online searching</p>	<p><b>Group 5: Management</b> Evaluation of information systems Information management</p> <p><b>Group 6: Communication</b> Cognition Human information behavior Information dissemination Readership studies</p> <p><b>Group 7: Copyright</b></p> <p><b>Group 8: Digital preservation &amp; conservation</b></p> <p><b>Group 9: Archival Science</b></p>
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[19] (Ia McIlwaine)

<p><b>1. Meta-IS</b></p> <p>1.1 Disciplines &amp; professions</p> <p>1.1.1 Archival Science</p> <p>1.1.2 Library Science (or Librarianship)</p> <p>1.1.3 Documentation</p> <p>1.1.4 Labor in information systems</p> <p>1.1.5 IS Education</p> <p>1.2 Foundations of IS</p> <p>1.3 Information theory</p> <p>1.4 Classification theory</p> <p>1.5 Information ethics</p> <p>1.6 Philosophy of information</p> <p>1.7 IS Epistemology</p> <p>1.8 Philosophy of Computation</p> <p>1.9 Philosophy of IS</p> <p>1.10 Philosophy of Librarianship</p> <p>1.11 History of IS</p> <p><b>2. Primary Information Forms</b></p> <p>2.1 Data</p> <p>2.2 Documents</p> <p>2.3 Images</p> <p>2.4 Tacit knowledge</p> <p>2.5 Formal knowledge</p> <p>2.6 Formal information</p> <p>2.7 Informal information</p> <p>2.8 Indigenous knowledge</p> <p>2.9 Stories</p> <p>2.10 Genres</p> <p><b>3. Information Processing</b></p> <p>3.1 Contents representation</p> <p>3.1.1 Abstracting</p> <p>3.1.2 Indexing</p> <p>3.1.3 Domain Analysis</p> <p>3.1.4 Information structures</p> <p>3.2 Knowledge organization</p> <p>3.2.1 Knowledge representation</p> <p>3.2.2 Knowledge structures</p> <p>3.2.3 Categorization &amp; classification</p> <p>3.3 Organization of information</p> <p>3.3.1 Subject analysis</p> <p>3.4 Information Architecture</p> <p>3.5 Representation tools</p> <p>3.5.1 Classification schemes &amp; systems</p> <p>3.5.2 Ontologies</p> <p>3.5.3 Taxonomies</p> <p>3.5.4 Thesauri</p> <p>3.5.5 Vocabulary control</p> <p>3.5.6 Metadata</p> <p>3.6 Information storage</p> <p>3.7 Information retrieval (IR)</p>	<p>3.8 Online searching</p> <p>3.9 Information dissemination</p> <p>3.10 Information visualization</p> <p>3.11 Information Quality Evaluation</p> <p>3.12 Information consolidation</p> <p><b>4. Systems &amp; Products</b></p> <p>4.1 Information generation systems (e.g. blogs, Wiki, publishing)</p> <p>4.2 Information storage &amp; retrieval systems</p> <p>4.3 Documents management systems</p> <p>4.4 Access systems</p> <p>4.4.1 Web based products</p> <p>4.5 Document Delivery Systems</p> <p>4.6 Digital libraries</p> <p>4.7 Databases</p> <p>4.8 E-journals &amp; books</p> <p>4.9 Evaluation of information systems</p> <p><b>5. Information &amp; Communication Technologies</b></p> <p>5.1 Analog technologies</p> <p>5.2 Digital technologies</p> <p>5.2.1 Internet technologies</p> <p>5.2.2 Distributed networked environments</p> <p>5.2.3 Digital preservation</p> <p>5.2.4 Digital security</p> <p>5.3 Media integration</p> <p>5.4 Mobile information technologies</p> <p><b>6. Human Information Behavior</b></p> <p>6.1 Information users</p> <p>6.2 Information uses</p> <p>6.3 Information needs</p> <p>6.4 Information seeking</p> <p>6.5 Information production</p> <p>6.6 Information utilization</p> <p>6.7 Computer-mediated communication</p> <p>6.8 Information support to learning</p> <p>6.8.1 By type of learning / learner</p> <p>6.8.2 E-learning</p> <p>6.9 Readership studies</p> <p>6.10 Diffusion studies</p>	<p><b>7. Societal Dimensions</b></p> <p>7.1 Social Informatics</p> <p>7.1.1 In traditional &amp; transitional societies</p> <p>7.1.2 In technology intensive societies</p> <p>7.2 Community Informatics</p> <p>7.3 Information industries</p> <p>7.3 Electronic Information Industry</p> <p>7.3.2 Publishing</p> <p>7.3.3 Media industries (Newspapers, radio, TV)</p> <p>7.4 Industry applications of IS</p> <p>7.4.1 Aviation informatics,</p> <p>7.4.2 Chemical Documentation</p> <p>7.4.3 Health/Biomedical Informatics</p> <p>7.4.4 Educational information</p> <p>7.4.5 Scientific information</p> <p>7.4.6 Technological information</p> <p>7.4.7 Bio-informatics</p> <p>7.5 Knowledge management</p> <p>7.6 Information management</p> <p>7.7 Competitive Intelligence</p> <p>7.8 Research evaluation</p> <p>7.9 Information policy</p> <p>7.9.1 Public Information Policies</p> <p>7.9.2 Corporate information policies</p> <p>7.10 Economics of information</p> <p>7.11 Information Law</p> <p>7.11.1 Copyright</p> <p>7.11.2 Intellectual property rights</p> <p>7.11.3 Data protection</p> <p>7.11.4 Privacy</p> <p>7.11.5 Freedom of information</p> <p>7.11.6 Information access rights</p> <p>7.12 Measurements of information</p> <p>7.12.1 Bibliometrics</p> <p>7.12.2 Informetrics</p> <p>7.12.3 Webometrics</p> <p>7.12.4 Scientometrics</p> <p><b>8. Related Disciplines &amp; Tools</b></p> <p>8.1 Artificial intelligence</p> <p>8.2 Cognitive sciences</p> <p>8.3 Communication</p> <p>8.4 Evaluation</p> <p>8.5 Management</p> <p>8.6 Operations Research</p> <p>8.7 Semiotics</p> <p>8.8 Systems analysis</p>
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[20] (Michel Menou)

<p><b>1. Information studies</b>  1.1 Theories &amp; methodologies of IS  1.2 Statistical analysis  1.3 Information Retrieval  1.4 User studies</p> <p><b>2. Organization of Information</b>  2.1 Indexing &amp; abstracting  2.2 Cataloging &amp; Classification  2.3 Meta data</p> <p><b>3. Information &amp; society</b>  3.1 Information acquisition  3.2 Continuing education  3.3 Communities</p> <p><b>4. The Information Market</b>  4.1 Publishers  4.2 Consumers  4.3 Publication media  4.4 marketing &amp; advertising</p>	<p><b>5. Information Technology</b>  5.1 Online databases  5.2 Artificial intelligence  5.3 Hardware &amp; software  5.4 Programming languages  5.5 Internet technologies  5.6 Data mining</p> <p><b>6. Information professionals &amp; services</b>  6.1 Libraries &amp; librarians  6.2 Digital libraries  6.3 OPACs  6.4 Information brokers  6.5 Professional schools  6.6 Trade publications  6.7 Professional associations</p> <p><b>7. Legislations</b>  7.1 Copyright laws  7.2 Free speech  7.3 Court decisions  7.4 Digital forensics  7.5 Law enforcement</p>
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*“Reflections. The seven theme areas represent my understanding of how IS encompasses different areas of scholarships, professional activities, and technologies.” [21] (Haidar Moukdad.)*

<p><b>Group 1</b>  1.1 Identification, 1.2 Behavior, 1.3 Characteristics, 1.4 Environmental context, 1.5 Use, 1.6 Management (includes description), 1.7 Impact, 1.8 Study methods (includes education, research, philosophy, information futures).</p> <p><b>Group 2</b>  2.1 Assessment and evaluation, 2.2 Control (includes storage, preservation, metadata etc), 2.3 Transmission, 2.4 Utilisation (includes information management aspects of comprehension, intake and retention by both practitioners &amp; users, and also manipulation &amp; processing)</p> <p><b>Group 3</b>  3.1 Tools, 3.2 Processes, 3.3 Systems, 3.4 Architectures.</p> <p><b>Group 4</b>  4.1 Every form that can be identified in the data – information – knowledge – message continuum</p> <p><b>Group 5</b>  5.1 All possible instantiations of each form - electronic data, electronic interactive, human &amp; machine mediated, hardcopy forms etc.</p>
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[22] (Dennis Nicholson)

<p><b>Group 1: Structural or Basic Disciplines</b></p> <ul style="list-style-type: none"> <li>1.1 Domain analysis</li> <li>1.2 Foundations of Information Science</li> <li>1.3 Information Science Education &amp; training (including E-learning)</li> <li>1.4 Information Science Epistemology</li> <li>1.5 Inter &amp; transdisciplinarity studies</li> <li>1.6 Information Theory</li> <li>1.7 Philosophy of Information Science</li> <li>1.8 History of Information Science</li> <li>1.9 Bibliometrics, Informetrics, Webometrics/Netometrics (methodologies)</li> </ul> <p><b>Group 2: Instrumental Disciplines</b></p> <ul style="list-style-type: none"> <li>2.1 Information architecture</li> <li>2.2 Knowledge organization (or information representation)</li> <li>2.3 Abstracting</li> <li>2.4 Cataloguing</li> <li>2.5 Classification (classification schemes, classification systems, classification theory)</li> <li>2.6 Taxonomy</li> <li>2.7 Thesauri</li> <li>2.8 Vocabulary control</li> <li>2.9 Information processing</li> <li>2.10 Information storing</li> <li>2.11 Information structures</li> <li>2.12 Metadata</li> <li>2.13 Ontology</li> <li>2.14 Subject analysis</li> <li>2.15 Automatic processing of language</li> </ul> <p><b>Group 3: Management Disciplines</b></p> <ul style="list-style-type: none"> <li>3.1 Competitive intelligence</li> <li>3.2 Economics of information</li> <li>3.3 Information dissemination (information products and services: bibliographies, catalogs, publishing)</li> <li>3.4 Information management</li> <li>3.5 Information quality evaluation</li> <li>3.6 Knowledge management</li> <li>3.7 Marketing Information</li> </ul>	<p><b>Group 4: Technological Disciplines</b></p> <ul style="list-style-type: none"> <li>4.1 Computer mediating communication</li> <li>4.2 Databases</li> <li>4.3 Data Mining</li> <li>4.4 Digital/Virtual libraries</li> <li>4.5 Digital preservation</li> <li>4.6 Digital security</li> <li>4.7 Document delivery systems</li> <li>4.8 E-journals</li> <li>4.9 Information Networks</li> <li>4.10 Information Systems (access system, evaluation for information systems, system analysis)</li> <li>4.11 Information retrieval systems (on line search)</li> <li>4.12 Information technology</li> <li>4.13 Internet/Web technologies</li> </ul> <p><b>Group 5: Socio – Cultural disciplines</b></p> <ul style="list-style-type: none"> <li>5.1 E-Learning</li> <li>5.2 Information ethics</li> <li>5.3 Information need &amp; use</li> <li>5.4 User Studies</li> <li>5.5 Scientific communication</li> <li>5.6 Social information/Information in traditional &amp; transitional societies (division by culture, e.g. Africa), legal, &amp; ethical aspects of information</li> <li>5.7 Information policy (copyright, intellectual property rights, privacy etc.)</li> <li>5.8 Public information policies</li> <li>5.9 Information Literacy</li> <li>5.10 Digital inclusion</li> </ul> <p><b>Group 6: Information Applications</b></p> <ul style="list-style-type: none"> <li>6.1 Scientific information (all fields of knowledge)</li> <li>6.2 Technological information</li> <li>6.3 Industrial information</li> <li>6.4 Information in Art</li> <li>6.4 Archives information</li> <li>6.5 Library information</li> <li>6.6 Museums information</li> </ul>
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[23] (Lena Vania Pinherio)

Maria Pinto

<p><b>1. Epistemological</b> Archival Science, Classification Theory, Information Science Theory (Foundations, History, Epistemology, Education, Philosophy), Librarianship.</p> <p><b>2. Systemic</b> Information Systems, Information Management, Knowledge Management, Information Policies, Systems Analysis.</p> <p><b>3. Cognitive</b> Domain Analysis, Abstracting, Indexing, Classifications (Ontology, Taxonomies, Thesauri), Databases, Metadata.</p> <p><b>4. Psychological</b> Economics of Information, Evaluation of Information Systems, Human information Behaviour, Information Quality.</p> <p><b>5. Communicative</b> Communication, Copyright, Information Dissemination, Information retrieval, Message Theory.</p> <p><b>6. Technological</b> Artificial Intelligence, Digital Security, Digital Libraries, Information Industry, Internet, Publishing, Web.</p>
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*“Reflections. It is almost impossible to elaborate an Information Science tree with clearly defined branches, because Information Science, as many others fields, does not have a tree structure, but rather a network structure. Therefore, dependencies and overlapping are an essential constituent of this multi-paradigmatic domain.” [24] (Maria Pinto)*

Richard Smiraglia

<p><b>1. Information (UF ‘Information Science’)</b></p> <ul style="list-style-type: none"><li>1.1 Information use &amp; user<ul style="list-style-type: none"><li>1.1.1 Memetics</li><li>1.1.2 Social informatics</li></ul></li><li>1.2 Information need<ul style="list-style-type: none"><li>1.2.1 Applied informatics</li></ul></li><li>1.3 Information architecture<ul style="list-style-type: none"><li>1.3.1 Information structures</li></ul></li><li>1.4 Philosophy of information<ul style="list-style-type: none"><li>1.4.1 Ontology</li><li>1.4.2 Epistemology</li></ul></li><li>1.5 Information policy<ul style="list-style-type: none"><li>1.5.1 Ethics</li></ul></li><li>1.6 Information theory</li></ul>	<p><b>2. Knowledge organization</b></p> <ul style="list-style-type: none"><li>2.1 Knowledge representation</li><li>2.2 Metadata</li><li>2.3 Knowledge structures</li><li>2.4 Ontology: classification</li><li>2.5 Taxonomy: epistemology</li></ul> <p><b>3. Information retrieval (i.e. message)</b></p> <ul style="list-style-type: none"><li>3.1 Information processing</li><li>3.2 Document delivery</li></ul> <p><b>4. Information management</b></p> <ul style="list-style-type: none"><li>4.1 Competitive intelligence</li><li>4.3 Information dissemination<ul style="list-style-type: none"><li>4.3.1 Economics of information</li><li>4.3.2 Publishing</li><li>4.3.3 Librarianship</li></ul></li><li>4.4 Information industry<ul style="list-style-type: none"><li>4.4.1 Information technology</li></ul></li></ul>
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[25] (Richard Smiraglia)

<p><b>1. Organization of Information &amp; Knowledge</b></p> <p>1.1 Abstracting  1.2 Categorization &amp; classification  1.3 Classification schemes &amp; systems  1.4 Classification theory  1.5 Indexing  1.6 Information Architecture  1.7 Information processing  1.8 Information structures  1.9 Knowledge representation  1.10 Knowledge structures  1.11 Metadata  1.12 Ontology  1.13 Organization of Information  1.14 Subject analysis  1.15 Systems analysis  1.16 Taxonomies  1.17 Thesauri  1.18 Vocabulary control</p> <p><b>2. Retrieval and use of Information &amp; Knowledge</b></p> <p>2.1 Access systems  2.2 Artificial intelligence  2.3 Domain Analysis  2.4 E-learning  2.5 Evaluation of information systems  2.6 Information dissemination  2.7 Information manipulation  2.8 Information needs  2.9 Information Quality Evaluation  2.10 Information retrieval  2.11 Online searching  2.12 Readership studies</p> <p><b>3. Understanding users of information &amp; knowledge</b></p> <p>3.1 Bibliometrics  3.2 Cognition  3.3 Communication  3.4 Community Informatics  3.5 Competitive Intelligence  3.6 Computer-mediated communication  3.7 Diffusion studies  3.8 Human information behavior  3.9 Information use &amp; user  3.10 Informetrics  3.11 Scientific Communication  3.12 Semiotics  3.13 Social information/Social Informatics  3.14 User Webometrics</p>	<p><b>4. Storage of information &amp; knowledge</b></p> <p>4.1 Archives  4.2 Copyright  4.3 Digital preservation  4.4 Digital security  4.5 Distributed networked environments  4.6 Document Delivery Systems  4.7 Information storage  4.8 Preservation</p> <p><b>5. Information content &amp; publishing</b></p> <p>5.1 Databases  5.2 Digital libraries  5.3 Economics of information  5.4 Electronic Information Industry  5.5 E-journals  5.6 Information industry  5.7 Publishing</p> <p><b>6. History &amp; philosophy of IS</b></p> <p>6.1 Foundations of information science  6.2 History of information science  6.3 Information ethics  6.4 Information Science Education  6.5 Information Science Epistemology  6.6 Information technology  6.7 Information theory  6.8 Philosophy of Computation  6.9 Philosophy of information  6.10 Philosophy of Information science  6.11 Philosophy of Librarianship  6.12 Public Information Policies  6.13 Message theory  6.14 Research evaluation  6.15 Information in traditional &amp; transitional Societies  6.16 Social, legal, &amp; ethical aspects of information</p> <p><b>7. Managing information Organizations</b></p> <p>7.1 Information management  7.2 Knowledge management  7.3 Knowledge organizations  7.4 Librarianship  7.5 Library Science  7.6 Management  7.7 Operations Research</p>
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[26] (Carol Tenopir)

Joanne Twining

Cultural, social, ethical, legal, economic, methodological, political, philosophical, theoretical, & technological processes & aspects of:

**1. Education** for Library Information Science

**2. Metalibrarianship**

- 2.1 Foundations, History, Theory, Philosophy of:
- 2.2 Information Science
- 2.3 Knowledge
- 2.4 Librarianship
- 2.5 Library Science

**3. Human Aspects**

- 3.1 Cognition
- 3.2 Communication
- 3.3 Transfer
- 3.4 Education
- 3.5 Training
- 3.6 Uses
- 3.7 Behaviors

**4. Information**

- 4.1 Architecture & Design
- 4.2 Documentation & Publishing
- 4.3 Preservation & Archiving
- 4.4 Organization & Representation
- 4.5 Abstracting & Indexing
- 4.6 Categorization & classification
- 4.7 Storage & Retrieval
- 4.8 Management
- 4.9 Systems & Networks

**5. Knowledge**

- 5.1 Architecture & Design
- 5.2 Documentation & Publishing
- 5.3 Preservation & Archiving
- 5.4 Organization & Representation
- 5.5 Abstracting & Indexing
- 5.6 Categorization & classification
- 5.7 Storage & Retrieval
- 5.8 Management
- 5.9 Systems & Networks

**6. Research & evaluation**

- 6.1 Bibliometrics
- 6.2 Informatics
- 6.3 Informetrics

[27] (Joanne Twining)

Irene Wormell

**1. Information Analysis**

Quantitative analysis of information, Citation analysis, Informetrics, Bibliometrics, Webometrics, Subject & domain analysis, Publication analysis, Trend analysis, Innovation studies, (Databases), Diffusion studies, Information dissemination, Information manipulation, Research evaluation, Scientific Communication.

**2. Knowledge Organization**

Abstracting, Access systems, Categorization & classification, Classification schemes, Classification systems, Classification theory, Domain Analysis, Indexing, Knowledge representation, Knowledge structures, Information structures, Ontology, Organization of Information, , Subject analysis, Systems analysis, Taxonomies, Thesauri, Vocabulary control.

[28] (Irene Wormell)

## Discussion and Conclusion

### *Anthropological Document*

Twenty-eight scholars compiled classification schemes. This unique collection portrays and documents the profile of contemporary Information Science at the beginning of the 21st century.

*Delimitations.* It is expected that a systematic mapping should be adequate, comprehensive, and systematic (see Appendix B, Item 4 for definitions of the foregoing terms.). This means that it is assumed that each scheme should adequately and coherently represent the conception of the field, as it is understood by the contributor. Meaning, it is assumed that every one of the 28 schemes demonstrates a distinct conception of IS. For example, if one asserts that IS explores all the aspects of the data, information, knowledge, message (D-I-K-M) phenomena, I would expect his or her scheme to include all the aspects of the D-I-K-M phenomena. Each scheme should be up-to-date and comprehensive; that is, it should represent all the key characteristics of the field (at least in the eye of the contributor). Additionally, each scheme should be systematic; namely, all the categories at each level are mutually exclusive (i.e., without overlaps) and collectively exhaustive (i.e., cover all the various aspects of the field). Many of the 28 schemes are adequate, comprehensive, and systematic, and are based on solid theoretical and philosophical foundations. However, a few are incomplete, inconsistent, and logically faulty. For this reason, the study is focused on an overall analysis, rather than on evaluating the accuracy, adequacy, comprehensiveness, and coherency of the panel's diversified definitions.

*Types of classifications.* The collection is composed of different types of classification schemes. For the benefit of readers who are not familiar with the terminology, let us specify the various types. Note that the various types are not mutually exclusive. Most of the schemes are taxonomies; namely, they are grounded on empirical data (e.g., schemes [8], and [9]). A few are typologies; namely, they are based on conceptual analysis of the constitutive concepts (e.g., scheme [3], and [12]). Scheme [10] is a two-level hierarchical classification. The first level is a six-category typology. The second level of each category is taxonomy. Most of the schemes are subject classification schemes designed for practical purposes, for example, scheme [15] was designed by Donald Hawkins, the editor of *ISA*. A few classifications are "ontologies"; namely, they are meant to divide the relevant phenomenon into its key attributes, characteristics, or facets. Clare Beghtol's faceted classification (see scheme [3]) is an ontology.

*Six conceptions.* In a previous study, I (Zins, 2007a) formulated six conceptions, or models, of Information Science. These models were identified and formulated based on analysis of 50 definitions of Information Science. The six models are *the hi-tech model* (Information Science is the study of the mediating aspects of D-I-K-M phenomena as they

are implemented in the hi-tech domain.); *the technology model*, (Information Science is the study of the mediating aspects of D-I-K-M phenomena as they are implemented in the technological domain in general, namely, all types of technologies.); *the culture model* (Information Science is the study of the mediating aspects of D-I-K-M phenomena as they are implemented in the cultural domain.); *the human world model* (Information Science is the study of all the aspects of D-I-K-M phenomena as they are implemented in the human realm.); *the living world model* (Information Science is the study of all the aspects of D-I-K-M phenomena as they are implemented in the living world, human and nonhuman.); and *the living & physical worlds* (Information Science is the study of all the aspects of D-I-K-M phenomena as they are implemented in all types of biological organisms, human and nonhuman, and all types of physical objects).

*The mainstream information sciences.* The six models imply six different bodies of knowledge. Consequently, they establish six different fields of knowledge; all carry the same name, *Information Science*, and all are represented by the panel. However, the vast majority of the panel adopts the culture model. Evidently, the culture model represents the mainstream of contemporary Information Science.

This conclusion gets additional and unequivocal substantiation while analyzing the panel 28 classification scheme. Twenty-six schemes reflect the culture model. These are schemes [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [15], [16], [17], [18], [19], [20], [21], [23], [24], [25], [26], [27], and [28]. One scheme, [14] represents the living & physical worlds model. One scheme, [22], is too general, and can represent any model.

*Knowledge Science.* I have suggested changing the name of the field from *Information Science* to *Knowledge Science* (Zins, 2006). This study substantiates the suggestion. More than 20 schemes include the concept "knowledge" as a main category or a subcategory of the field.

*Conclusions.* To summarize, based on the panel diversified schemes it is evident that the culture model represents the mainstream of contemporary Information Science, which means that Information Science is the study of the mediating aspects of D-I-K-M phenomena—*mutatis mutandis*—as they are implemented in the cultural (i.e., social) domain. Apparently, the suggestion to change the focus of the field—as well as its name—from information to knowledge is supported by a growing number of scholars.

### **A Concluding Remark**

This study documents 28 schemes of Information Science. This might help the reader to achieve better understanding of the issues and the considerations involved in establishing a solid, systematic, and comprehensive conception and knowledge map of the field; however, by no means does it replace the personal quest to ground one's positions on solid theoretical foundations.



## Acknowledgments

I would like to thank the Israel Science Foundation for a research grant that made the study possible (2003–2005). However, what made the difference were my 57 colleagues who participated in this exhausting and time-consuming study as panel members. Their invaluable contributions have made this study important, and I am truly grateful. Special thanks go to Prof. Anthony Debons and Prof. Glynn Harmon for their deep reflections throughout the study. The study was conducted at Bar-Ilan University in Israel.

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## Appendix A

### The Panel

**Dr. Hanne Albrechtsen**, Institute of Knowledge Sharing, Copenhagen, Denmark; **Prof. Elsa Barber**, University of Buenos Aires, Argentina; **Prof. Aldo de Albuquerque Barreto**, Brazilian Institute for Information in Science and Technology, Brazil; **Prof. Shifra Baruchson-Arbib**, Bar Ilan University, Ramat-Gan, Israel; **Prof. Clare Beghtol**, University of Toronto, Canada; **Prof. Maria Teresa Biagetti**, University of Rome 1, Italy; **Prof. Michael Buckland**, University of California, Berkeley, CA; **Mr. Manfred Bundschuh**, University of Applied Sciences, Cologne, Germany; **Dr. Quentin L. Burrell**, Isle of Man International Business School, Isle of Man; **Dr. Paola Capitani**, Working Group Semantic Web, Italy; **Prof. Rafael Capurro**, University of Applied Sciences, Stuttgart, Germany; **Prof. Thomas A. Childers**, Drexel University, Philadelphia, PA; **Prof. Charles H. Davis**, Indiana University; **Prof. Anthony Debons**, University of Pittsburgh, Pittsburgh, PA; **Prof. Gordana Dodig-Crnkovic**, Mälardalen University, Västerås/Eskilstuna, Sweden; **Prof. Henri Dou**, University of Aix-Marseille III, France; **Prof. Nicolae Dragulanescu**, Polytechnics University of Bucharest, Romania; **Prof. Carl Drott**, Drexel University, Philadelphia, PA; **Prof. Luciana Duranti**, University of British Columbia, Canada; **Prof. Hamid Ekbia**, University of Redlands, Redlands, CA; **Prof. Charles Ess**, Drury University, Springfield, MO; **Prof. Raya Fidel**, University of Washington, Seattle, WA; **Prof. Thomas J. Froehlich**, Kent State University, Kent, OH; **Mr. Alan Gilchrist**, Cura Consortium and TFPL, London, UK; **Dr. H.M. Gladney**, HMG Consulting, McDonald, PA; **Prof. Glynn Harmon**, University of Texas at Austin, Austin, TX; **Dr. Donald Hawkins**, Information Today, Medford, NJ; **Prof. Caroline Haythornthwaite**, University of Illinois at Urbana Champaign, Urbana, IL; **Mr. Ken Herold**, Hamilton College, Clinton, NY; **Prof. William Hersh**, Oregon Health & Science University, Portland, OR; **Prof. Birger Hjørland**, Royal School of Library and Information Science, Copenhagen, Denmark; **Ms. Sarah Holmes**,\* the Publishing Project, USA; **Prof. Ian Johnson**,\* the Robert Gordon University, Aberdeen, UK; **Prof. Wallace Koehler**, Valdosta State University, Valdosta, GA; **Prof. Donald Kraft**, Louisiana State University, Baton Rouge, LO; **Prof. Yves François Le Coadic**, National Technical University, Lyon, France; **Dr. Jo Link-Pezet**, Urfist, and University of Social Sciences, France; **Mr. Michal Lorenz**, Masaryk University in Brno, Czech Republic; **Prof. Ia McIlwaine**, University College, London, UK; **Prof. Michel J. Menou**, Knowledge and ICT management consultant, France; **Prof. Haidar Moukdad**, Dalhousie University, Halifax, Nova Scotia, Canada; **Mr. Dennis Nicholson**, Strathclyde University, UK; **Prof. Charles Oppenheim**, Loughborough University, Leicestershire, UK; **Prof. Lena Vania Pinheiro**, Brazilian Institute for Information in Science and Technology, Brazil; **Prof. Maria Pinto**, University of Granada, Spain; **Prof. Roberto Poli**, University of Trento, Italy; **Prof. Ronald Rousseau**, KHBO, and University of Antwerp, Belgium; **Dr. Silvia Schenkolewski-Kroll**, Bar Ilan University, Ramat-Gan, Israel; **Mr. Scott Seaman**,\* University of Colorado, Boulder, CO; **Prof. Richard Smiraglia**, Long Island University, Brookville, NY; **Prof. Paul Sturges**, Loughborough University, Leicestershire, UK; **Prof. Carol Tenopir**, University of Tennessee, Knoxville, TN; **Dr. Joanne Twining**, Intertwining.org, a virtual information consultancy, USA; **Prof. Anna da Soledade Vieira**, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil; **Dr. Julian Warner**, Queen's University of Belfast, UK; **Prof. Irene Wormell**, Swedish School of Library and Information Science in Borås, Sweden; **Prof. Yishan Wu**, Institute of Scientific and Technical Information of China (ISTIC), Beijing, China

\*An observer (i.e., those panel members who did not strictly meet the criteria for the panel selection and terms of participation).

## Appendix B

### *Excerpts From the Three Questionnaires on Developing Subject Classification Schemes*

Knowledge Map of Information Science:  
Issues, Principles, Implications  
(Second Round, April 15, 2004)

#### *2: Information Science Major Subfields and Key Concepts*

**Question 2.1** In this three-part assignment you will (a) list the most basic concepts, (b) list the major subfields, and (c) set a systematic classification of the field.

**A. List the (100) most basic IS concepts: Please check the following list (which was provided by the panel), erase duplications, add missing concepts, and if necessary rephrase the terminology. The list must be coherent with your conception of IS. Thanks. Your list:**

Abstracting, Access systems, Archival science, Artificial intelligence, Aviation informatics, Bibliometrics, Categorization and classification, Chemical documentation, Classification schemes, Classification systems, Classification theory, Cognition, Communication, Community informatics, Competitive intelligence, Computer-mediated communication, Copyright, Databases, Diffusion studies, Digital libraries, Digital preservation, Digital security, Distributed networked environments, Document delivery systems, Domain analysis, Economics of information, Education and training, Educational information, Electronic information industry, E-journals, E-learning, Evaluation, Evaluation of information systems, Foundations of information science, Health/biomedical informatics, High-density book storage systems, History of information science, Human information behavior, Indexing, Information architecture, Information dissemination, Information ethics, Information industry, Information management, Information manipulation, Information need, Information processing, Information quality evaluation, Information retrieval, Information science education, Information science Epistemology, Information storing, Information structures, Information technology, Information theory, Information use and user, Informetrics, Internet, Knowledge management, Knowledge organization, Knowledge representation, Knowledge structures librarianship, Library science, Labor in information systems, Management, Memetics, Message theory, Metadata, Metalibrarianship, Music information retrieval, Online searching, Ontology, Operations research, Organization of information, Philosophy of computation, Philosophy of information, Philosophy of information science, Philosophy of librarianship, Public information policies, Publishing, readership studies, Research evaluation, Scientific communication, Semiotics, Social information/social Informatics, Information in traditional and transitional societies (division by culture, e.g., Africa), Social, legal, and ethical aspects of information, Subject analysis, Systems analysis, Taxonomies, Technological information, Thesauri, User, Vocabulary control, Web, Webometrics.

**B. List the major subfields of IS: Copy your answer to A, erase duplications, add missing subfields, and if necessary rephrase the terminology. The list must be coherent with your conception of IS. [Note that if you prefer, you can skip B and move directly from A to C.] Your list:**

**C. Organize the major subfields of IS in a systematic order. Please copy your answer to B, erase duplications, add missing subfields, and rephrase the terminology (if necessary). Note that the result must be coherent with your conception of IS. Thanks. Your systematic list:**

Knowledge Map of Information Science: Issues, Principles, Implications  
(Third Round, October 8, 2004)

#### *4: Classification Schemes of Information Science*

**Requirements.** Each scheme is required to meet the following necessary requirements:

- (1) **Adequacy.** Each scheme should adequately and coherently represent the conception of the field, as it is understood by the contributor. It is assumed that every one of the 29 schemes demonstrates a distinct conception of IS. For example, if you claim that IS explores **all** the aspects of D, I, K, or M, I would expect your scheme to include **all** the aspects of D, I, K, or M.
- (2) **Comprehensiveness.** Each scheme should be up-to-date and comprehensive, that is, represent all the key characteristics of the field (at least in the eye of the contributor).
- (3) **Systematic.** Each scheme should be systematic; that is, all the categories at each level are mutually exclusive (i.e., without overlaps) and collectively exhaustive (i.e., cover all the various aspects of the field).

#### **Question 4.1**

1. Please revise your **preferred** scheme or formulate a **new** scheme. Please make sure that your scheme (a) adequately represents your conception of the field, (b) is comprehensive, and (c) is systematic. Thanks.
2. Please explain the rationale of your scheme. Thanks.

#### **Answer 4.1**

1. Copy your revised/new classification scheme here:
2. Formulate the rationale here:

**Question 4.2** If you have any comment or critical reflections, please let me know.

Note that I will send you (upon request) the panel's feedback regarding your scheme, so you will be able to revise it before the final report. Thanks.

#### **Answer 4.2**

**Scheme 4<sup>1</sup>**

<p>NT Internet          UF Web          NT Music-information-retrieval          NT Online searching          NT Labor in information systems</p> <p><b>4. Information Science</b>          NT Information science, Foundations of          NT information science, History of          NT Information Science Education          NT Informetrics            NT Bibliometrics            NT Webometrics            NT Scientific Communication              NT Domain Analysis</p> <p><b>5. Knowledge organization</b>          NT Knowledge representation            UF Subject analysis          NT Metadata            NT Abstracting            NT Indexing            [NT Cataloging]          NT Knowledge structures          NT Ontology            [?] Classification              UF Categorization and classification                NT Classification systems                NT Classification schemes          NT Epistemology          NT Taxonomies          NT Thesauri            UF Vocabulary control</p> <p><b>6. Management</b>          RT Knowledge management          UF Competitive Intelligence          RT Information dissemination            NT Publishing            NT Copyright            NT Librarianship              NT Metalibrarianship</p> <p><b>7. Philosophy</b>          NT Ontology          NT Semiotics          NT Epistemology          Applications: Computation, Librarianship, Information</p>	<p><b>1. Informatics</b>          NT Aviation informatics          NT Community Informatics          NT Health/Biomedical Informatics          NT Memetics          NT Social information/Social Informatics</p> <p><b>2. Information</b>          RT Communication            NT communication, Computer-mediated          RT Message theory          NT Human information behavior            RT Cognition          NT Information Architecture          NT Information dissemination            NT Publishing            NT Copyright            NT Librarianship              NT Metalibrarianship          NT Economics of information          NT Information ethics          NT Information industry          NT Information management            NT Information Quality Evaluation          NT Information need          NT Information Policies          NT Information storing          NT Information structures          NT Information technology          NT Information theory          NT Information use and user            UF User            NT Information in traditional and transitional societies              NT Social, legal and ethical aspects of information          NT Technological information</p> <p><b>3. Information retrieval</b>          NT Information processing            NT Artificial intelligence            NT Information manipulation            UF Programming            NT Access systems            NT Databases            NT Systems analysis              NT Operations Research          NT Distributed networked environments            NT Document Delivery Systems            NT Evaluation          NT Evaluation of information systems</p>
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**Researcher’s comments:** The author of the scheme noted that this is a thesaurus rather than a classification scheme. We are looking forward to see how you will turn your thesaurus into a classification scheme. Please elaborate section 7 (Philosophy). Thanks.

<sup>1</sup>The scheme was compiled by Richard Smiraglia, who replaced it with scheme [25] above.

## Scheme 11<sup>2</sup>

1. **Information and knowledge representation and organization systems and theory**  
including categorization and classification systems, thesauri, subject analysis and vocabulary control, abstracting and indexing, knowledge structures and representation, metadata, etc
2. **Evaluation methods and theories**  
including evaluation of information systems, of research, of access systems, in general and of all subcategories etc.
3. **Foundations of knowledge and information science**  
including history, philosophy, theory, epistemology, in general and of all subcategories, etc.
4. **Human information and knowledge behavior and theory**  
including communication, creation, dissemination, management, manipulation, research, search and retrieval, use, users, etc
5. **Information and knowledge professions and theory**  
Including archival science, library science, etc.
6. **Social, legal and ethical theory and practices of all of the above**

## Scheme 12<sup>3</sup>

Information Phenomena at the various systems levels:

1. **Cellular level**, e.g., Bioinformatics
2. **Organ level** e.g., medical or nursing informatics
3. **Organism level** e.g., cognitive science, biodiversity informatics, individual users
4. **Group level** e.g., social informatics
5. **Organization level**, e.g., management information systems
6. **Community level**, e.g., community health information systems (CHINs)
7. **Society level**, e.g., national defense information network
8. **Supranational level**, e.g., global news network
9. **Cosmological level**, e.g., NASA lunar information system

Each level would have associated input, internal processing, memory, output, etc.

**Researcher's comments:** An information system is a human artifact, which contains knowledge on the organism. What does information science explore? Is it the organism, or is it the human artifacts (i.e., the information system), which includes information on the organism? Logically, there are three options:

- (1) IS explores the object/organism. If this is the case, then "Information Science" is a generic name, which includes, for example, astronomy (at the cosmological level), and biology (at the cellular, organ, and organism levels).
  - (2) IS explores human artifacts (i.e., information systems). If this is the case, then "Information Science" is a generic name, which includes, for example, the *NASA lunar information system* (at the cosmological level), and Bioinformatics (at the cellular, organ, and organism levels).
  - (3) Information science explores both, the object/organism and the information system. If this is the case, than "Information Science" is a generic name, which includes biology as well as Bioinformatics and medical information.
- These are three different conceptions, which lead to three different information sciences. It seems that you follow the broadest (third) conception. If this is the case then you can further structure your scheme by dividing each level into two sub-categories: organism domain vs. information system domain.

<sup>2</sup>The scheme was compiled by Clare Beghtol, who replaced it with scheme [3] above.

<sup>3</sup>The scheme was compiled by Glynn Harmon, who replaced it with scheme [14] above.