Tatiana Orel
University of Ottawa, Ottawa, Ontario, Canada

Inge Alberts
University of Ottawa, Ottawa, Ontario, Canada

Mary Cavanagh
University of Ottawa, Ottawa, Ontario, Canada

INFORMATION MANAGEMENT PRACTICES AND METHODOLOGIES IN ARCHITECTING INFORMATION SYSTEMS

Abstract
This research uses content analysis to provide a comprehensive overview of current trends in Information Architecture (IA) for Information Management (IM). It clarifies the IA concept, its elements, design practices, and methodologies. Additionally, it explores the education, roles, and skillsets expected of information architects in today's job market. This research can be used to train IA stakeholders, define information architect responsibilities, standardize terminology, and develop best practices and standards for IA design. Ultimately, this work contributes to the evolving field of IA by reducing ambiguity and offering pedagogical insights for Library and Information Studies programs.

Introduction
Information Management (IM) faces challenges coping with the rapid expansion of data quantities and cannot effectively handle every stage of the information lifecycle. This ongoing challenge for both researchers and field professionals results in growing difficulties in adhering to compliance requirements and regulations. Information Architecture (IA) enables information accessibility, findability, management, and security in business environments since it involves creating and designing logical systems to facilitate efficient and effective IM. Furthermore, the establishment of IA, grounded in robust IM practices, is crucial for managing the influx of large volumes of digital information and automating recordkeeping tasks.

Information Architecture (IA) is a discipline studying how to make information accessible, findable, manageable, and securable in the context of enterprise information environments by modeling and designing logical systems for efficient and effective information management (ARMA International, n.d.). *Information Management (IM)* is the way organizations manage their information resources supported by information technology (Hjørland, 2021). Being widely used in the IM professional setting, IA is still an ambiguous concept without much scientific or professional consensus on its definition and elements (Almeida et al., 2020). It should be noted that there is also little consensus in the IA community on what can be included in the IA practices and methodologies (Almeida et al., 2020; Kotusev et al., 2022).

Since IA is a concept with multiple interpretations, there is no all-encompassing description of information architects' roles (Swope, 2019). The description of responsibilities is inconsistent both in academic and professional literature. It includes quite a broad statement that information

architects “translate abstractions to the behind-the-scenes structures that enable digital experience” (Steenson, 2017, p. 125). As a result, due to the lack of consensus about the essence of IA as a profession, it is not clear what constitutes IA “theory” and IA “practice”, including the concepts, topics, activities, knowledge, and skills (MacDonald, 2013; Swope, 2019).

In summary, IM practices applied in designing such information systems as IA for IM require further analysis and investigation to provide a comprehensive insight into the nature of the information architect profession.

Research Objectives

The purpose of the research was to provide an overview of the current trends in the field of IA for IM to support information professionals with a better understanding of its concepts, practices, and methodologies, as well the required knowledge and skills to architect information systems. Due to the scarcity of scientific literature on the concept and constituent parts of IA and a lack of generally accepted methodologies and practices for IA modeling, the objective of this research was to shed light on the way how information professionals understand IA for IM and how they design and use it. Furthermore, one of the research objectives was to determine the roles information architects play in the corporate landscape and to describe the education, roles, responsibilities, knowledge, and skills expected from the information architect in the current job market.

Thus, to investigate IM practices in architecting information systems to support effective IM, this research focused on examining the following questions:

1. What are information architecture and its elements?
2. What methodologies, methods and practices do information professionals currently utilize to develop information architecture for information management?
3. What education, roles, responsibilities, knowledge and skills are expected from the information architect in the current job market?

Methodology and Scope

Content analysis served as the research approach within the frameworks of qualitative and quantitative methodologies. The *qualitative approach* based on induction within the *conceptual framework* of Morville and Rosenfeld (2006) prevailed in the research process. Whereas the *quantitative approach* complemented the qualitative analysis in the description of findings to present some data sets in the form of frequency and percentage to highlight the most frequently occurring IA phenomena.

To investigate IM practices and methodologies in designing IA and to examine the trends of the information architect profession, the data collection consisted of three major phases involving content analysis. The first phase included the analysis of 11 surveys of information professionals administered online by means of SurveyMonkey. The results of these surveys were then used during a second phase as a ground for conducting 5 follow-up interviews guided by a list of open-ended questions reflecting key themes from the survey. The third phase involved the analysis of 50 job postings for information architects. The *data* were retrieved from the most recent job postings of the leading Web platforms, such as LinkedIn, Google Jobs, Monster, Quora and Indeed, dedicated to job search, professional networking and expert discussions.

Analysis of online surveys, follow-up interviews, and job postings for information architects was conducted manually and according to standard content analysis procedures identifying themes and key concepts in iterative rounds. The *constant comparison* approach (Glaser & Strauss, 1967; Boeije, 2002) to data analysis assisted in the refinement of emerging categories and relationships as well as in the comparison of new data or patterns with the old ones.

To support the data analysis, spreadsheets and a qualitative data analysis software tool NVivo, allowing to organize and analyze patterns of research data, were used. The data were analyzed qualitatively and quantitatively by means of the following techniques: tabulations, cross-tabulations, triangulation (the use of multiple datasets to address research inquiries), associations, interpretations, clustering, and counts of numbers and percentages. The summary of findings with the description of identified patterns and relationships among the findings were presented to answer the research questions and were visualized both in tabular and graphic forms.

Findings

This section is devoted to the description of the research results derived from the analysis of textual data in the online surveys, follow-up interviews, and job postings. The findings are organized into three themes that facilitate answering the research questions: (1) The concept of IA and its elements; (2) Methodologies, methods and practices to develop IA for IM; and (3) Education, roles, responsibilities, knowledge and skills of the information architect.

The Concept of IA and Its Elements

The data related to the IA concept were organized in line with the aspects reflected in the IA definitions and discussed by Almeida et al. (2020) and Morville and Rosenfeld (2006) (see Figure 1).

Based on the data analysis from the surveys and follow-up interviews, the concept of IA is described from the *structural* perspective indicating the granularity and interconnectedness of information pieces that can be reflected in hierarchical, sequential and matrix forms.

IA can also be represented from the *organizational* perspective focusing on categorizing information into certain groups by means of metadata, taxonomies, semantic representations, and collections of terms. IA is a practice of providing an information structure to organize and protect information resources where technology, information management and records management principles are holistically blended to ensure information stability and quality.

Moreover, IA's definitions sometimes include aspects emphasizing the *orientation* perspective, where the bottom-up approach to the IA's activities is described. The bottom-up approach means that IA is primarily an inductive process incorporating various elements into an IA design. Since there is no theory to guide the activities of IA designers, the top-down approach is not observed, but some shifts to a top-down orientation may occur. In this regard, IA is defined as a framework for analyzing a context where an information resource evolves and for understanding an organization from the perspective of ordering its information resources. Such a framework includes identifying how information resources fit with the organization, what their purpose is, how they are used, retrieved and stored. Another bottom-up orientation perspective includes an accumulation of widely used terms facilitating the management of information resources.

From the Information Technology (IT) viewpoint, IA is understood as a *tool* for digital environments and specified as a set of hardware and software tools assisting the alignment of

content with business solutions so that IA could address the hardware requirements, networking configurations, and security restrictions. From the business viewpoint, IA is defined as a tool providing the ability to retrieve the required content by the right person involved in a business process so that the desired business outcomes are achieved.

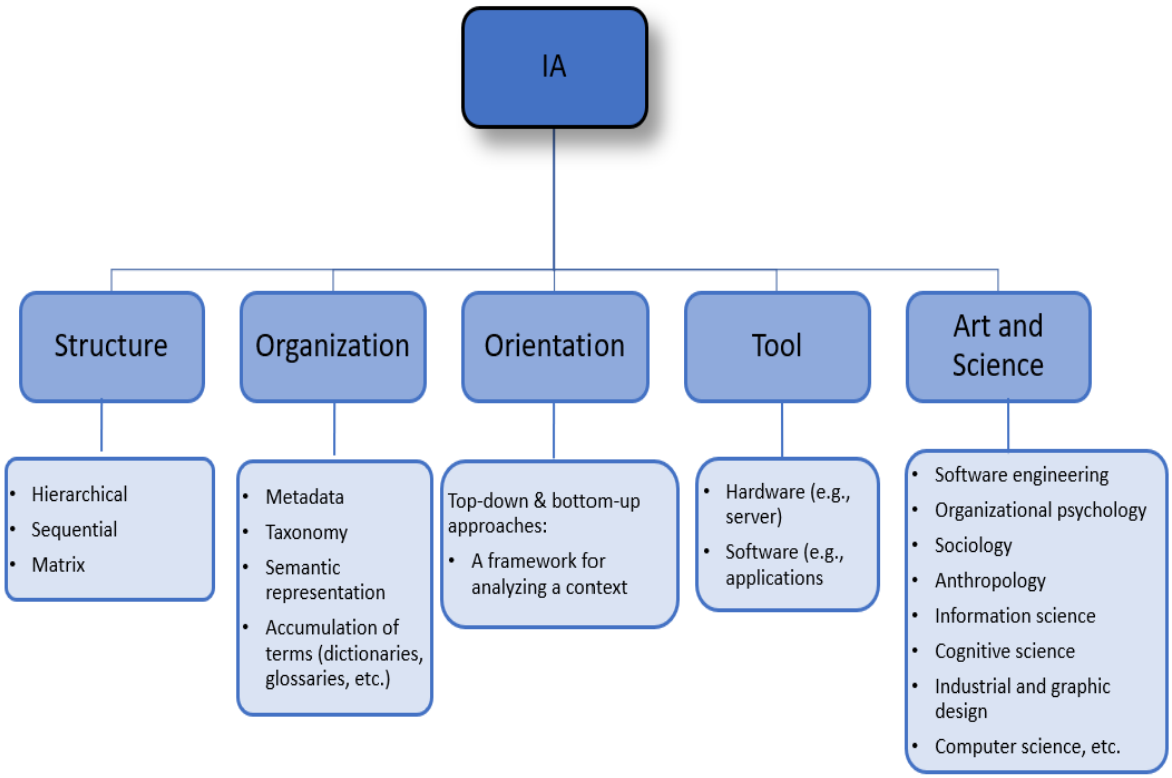

Figure 1. The concept of IA based on the aspects discussed by Almeida et al. (2020) and Morville and Rosenfeld (2006) and supported by the data

Also, IA is viewed as both an *art* and a *science*, requiring a blend of creativity and analytical rigor to create solutions that are useful, feasible, and valuable. The "art" of IA lies in understanding user needs and behaviors, crafting intuitive and engaging information experiences, and considering the aesthetics of information presentation. The "science" of IA involves applying structured methodologies, taxonomies, and ontologies to organize information logically and consistently, ensuring findability and usability. This multidisciplinary field draws upon domains such as software engineering for technical implementation, organizational psychology and sociology for understanding user behavior, anthropology for cultural considerations, information science for theoretical frameworks, cognitive science for insights into human information processing, and industrial and graphic design for visual aesthetics. By integrating these diverse perspectives, IA can effectively bridge the gap between information and users.

The IA elements are classified from the perspectives of Information Management (IM), Business Management (BM), and Information Technology (IT). The most frequent IA elements in the IM domain are taxonomy, metadata, UX design, and security and access management. In the BM and IT domains the most widely spread IA elements are business processes and workflows as well as hardware and software.

Methodologies, Methods and Practices to Develop IA for IM

Numerous methodologies, methods and practices to develop IA for IM were discovered in the dataset based on online surveys and follow-up interviews. The most frequent methodologies and practices are business analysis, context analysis, metadata schema development, and content analysis (see Table 1).

Table 1. The list and frequency of the methodologies, methods and practices to develop IA for IM retrieved from the survey data

Methodologies, Methods and Practices To Develop IA for IM	**Terminology Synonyms**	**Relevant Concepts**	**Number of Occurrences In the Survey Data**
Business analysis	• Analysis of business processes and inputs and outputs of information • Process mapping • Business process mapping • Business process modelling • Process modeling	• Six Sigma approach • Information flow analysis • Critical path analysis • Functional analysis and functional model development • Sprint-based approach	18
Context analysis	• Analysis of users' needs and expectations	• Questionnaires • Forms • Templates • Interviews • Semi-structured interviews	13
Metadata schema development	• Metadata modeling • Metadata identification	• Semantic metadata representation	7
Content analysis	• Content description of classifications • Content review		4
Education and constant validation with stakeholders	-	-	2
Taxonomy modeling	-	-	1
Properties and security model	-	-	1
UI mock-ups	• Working demos	-	1

The most widely used tools to design IA for IM belong to the class of relationship matrices and entity-relationship diagrams where conceptual data diagrams and business process maps are the

most frequent IA instruments. Knowledge graphs can be considered a rare but innovative instrument having strong potential in designing IA. In addition, the tools belonging to the classes of entity, attribute and association definitions, catalogs and glossaries, as well as information standards, rules and guidelines, are also widely implemented in architecting information systems.

The most frequently noted final products and services of IA design are conceptual data model diagrams, taxonomies, data dictionaries, controlled vocabularies, information inventories, policies, best practices, infographics and AI with knowledge graphs and machine learning models.

Education, Roles, Responsibilities, Knowledge and Skills of the Information Architect

The educational prerequisites for an information architect are notably diverse, including both arts and science, with a predominant preference for the technical background of a prospective job applicant. The data indicate that information architects can function as an IA and sometimes as an Enterprise Architecture (EA) expert as well as a mediator between stakeholders, IT departments and EA experts. Their roles can include the facilitation of the User Interface (UI) and User Experience (UX) design and the creation of conceptual and logical information models.

The expected knowledge, competencies and responsibilities of an information architect correspond to the IA elements (see Figure 2).

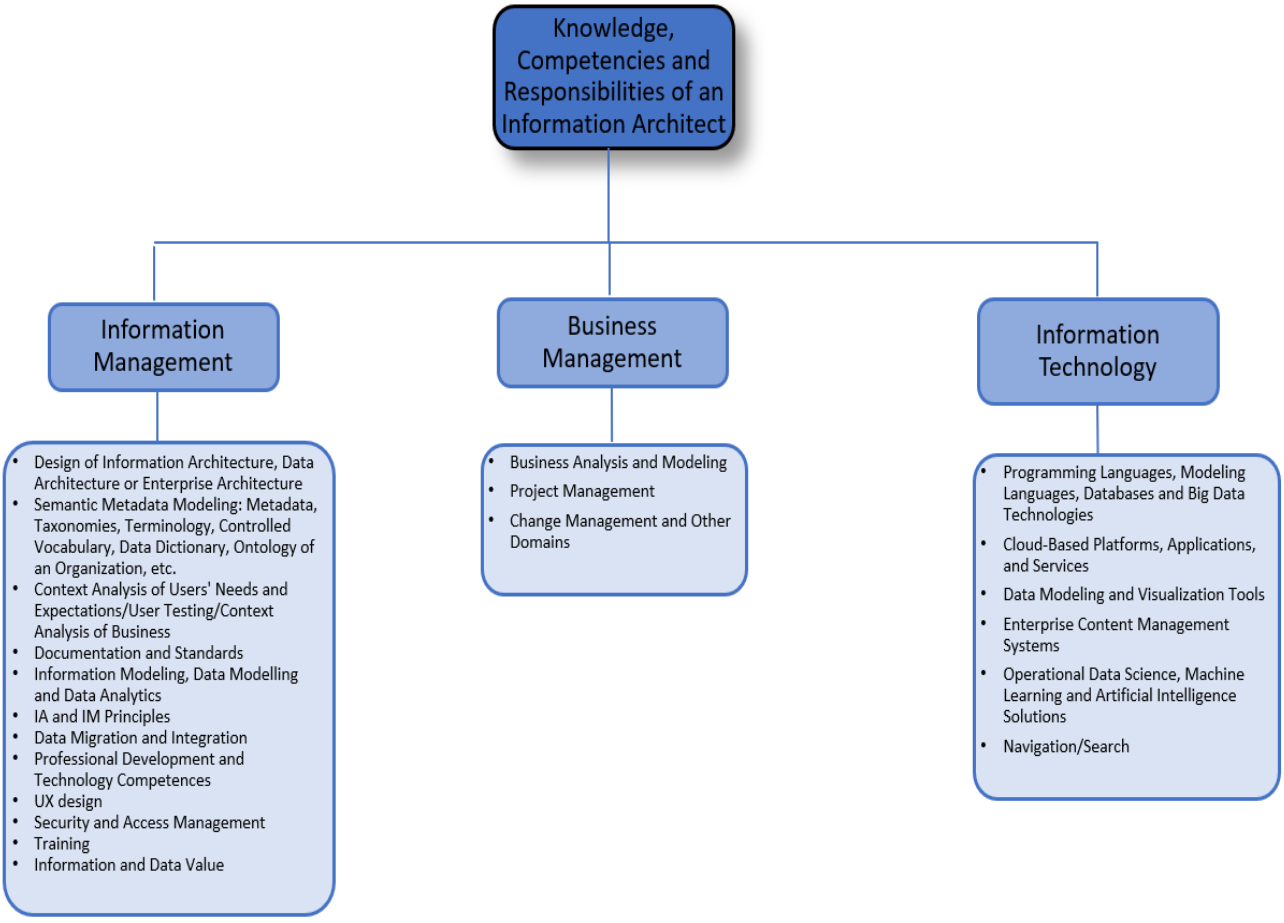

Figure 2. Knowledge, competencies and responsibilities of an information architect

From the IM perspective, the most frequently required professional expertise and responsibilities include the design of information architecture, data architecture or enterprise architecture; semantic metadata modeling: metadata, taxonomies, terminology, controlled vocabulary, data dictionary, ontology of an organization, etc.; context analysis of users' needs and expectations/user testing/context analysis of business, etc. From the BM perspective, expertise in business analysis and modeling as well as project management are in high demand. From the IT perspective, the required competences involve knowledge of programming languages, modeling languages, databases and big data technologies; cloud-based platforms, applications, and services; and data modeling and visualization tools. Finally, a successful information architect is expected to have a numerous list of soft skills and personal qualities, for example, written and verbal communication; research, analysis and problem solving; collaboration and teamwork; and leadership.

Conclusion

The results of this research offer valuable insights into the contemporary trends in the domain of IA for IM and the information architect profession. The study enhances the understanding of the IA concept and its elements as well as practices, methods and methodologies of IA design for IM. It also provides insights into education, roles, knowledge and skills expected from information architects in the current job market.

This research contributes to enhancing the evolving domain of IA for IM, reducing the ambiguity surrounding its elements and methodologies, and offering pedagogical insights for organizing Library and Information Studies programs and training prospective stakeholders. This study can be beneficial for further investigation of several research areas. First, valuable support, currently absent in IA design, could come from leveraging pre-existing ontologies in certain knowledge domains to provide a foundation for structuring and organizing information. Utilizing advancements in terminology science, particularly cognitive terminology science, could be advantageous in incorporating existing ontologies into IA design. Second, the theoretical advancement of the IA domain holds the potential to unify frequently disjointed methods and practices into a comprehensive and logically organized framework. Finally, additional research is needed to explore the integration of artificial intelligence into the processes of architecting information systems.

References

Almeida, M.B., Felipe, E.R., & Barcelos, R. (2020). Toward a document-centered ontological theory for information architecture in corporations. *Journal of the Association for Information Science and Technology*, 71(11), 1308–1326. https://doi.org/10.1002/asi.24337

ARMA International. (n.d.). *Information Architecture*. https://www.arma.org/page/Information_Architecture

Boeije, H. (2002). A purposeful approach to the constant comparison method in the analysis of qualitative interviews. *Quality & Quantity, 36,* 391–409.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine Press.

Hjørland, B. (2021). Information management. *Encyclopedia of Knowledge Organization*. https://www.isko.org/cyclo/information

Kotusev, S., Kurnia, S., & Dilnutt, R. (2022). The concept of information architecture in the context of enterprise architecture. *Aslib Journal of Information Management*, 74(3), 432–457. https://doi.org/10.1108/AJIM-05-2021-0130

MacDonald, C.M. (2013). Learning and teaching information architecture: The current state of IA education. *Bulletin of the American Society for Information Science and Technology*, 40(1), 28–35. https://doi.org/10.1002/bult.2013.1720400109

Morville, P., & Rosenfeld, L. (2006). *Information architecture for the world-wide-web: Designing large scale web-sites* (3rd ed.). Sebastopol, CA: O'Reilly Media.

Steenson, M.W. (2017). *Architectural intelligence: How designers, tinkerers, and architects created the digital landscape.* The MIT Press.

Swope, A. (2019). Information architects: what they do and how to become one. *Communication Design Quarterly Review*, 6(3), 32–43. https://doi.org/10.1145/3309578.3309582