INFORMATION MANAGEMENT PRACTICES AND METHODOLOGIES IN ARCHITECTING INFORMATION SYSTEMS

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Abstract

The results of this research, with the application of content analysis, offer a comprehensive perspective on the contemporary trends in the domain of Information Architecture (IA) for Information Management (IM) and the information architect profession. It enhances the understanding of the IA concept and its elements as well as practices 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. The findings of this research can be implemented in training IA stakeholders at different levels, determining the responsibilities of an information architect, standardizing terminology, defining strategies to clarify users' needs and goals in alignment with IA best practices, and developing official standards complementing IA design. Besides, 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.

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List of Acronyms

AI – Artificial Intelligence

BASCS – Business Activity Structure Classification System

BM – Business Management

CA – Content Analysis

EA - Enterprise Architecture

EDRMS - Electronic Documents and Records Management Systems

GVT – Generic Valuation Tool

IA – Information Architecture

IG – Information Governance

IM – Information Management

ISIS – Integrated Semantic Information Services

IT – Information Technology

ML – Machine Learning

LAC – Library and Archives Canada

LIS - Library and Information Studies

RM – Records Management

UI – User Interface

UML – Unified Modeling Language

UX – User Experience

1 Introduction

1.1 Statement of the Problem

Information, along with people and money, is an asset of any organization, where it is used for informed decision-making, service providing, recording business activities, and generating revenues (Laney, 2018; Seiner, 2014). Organizations confront the growing requirements to adopt innovative approaches that allow navigating the complexities of today's information landscape and enable obtaining a profit from information assets. Thus, the organizations that can successfully use and implement information at their disposal have "an unprecedented competitive edge" (AIIM, 2022, slide 10). Laney (2018) emphasizes that information is versatile due to its contextuality and assists in attaining "insights, relationships, performance, and things" (p. 20), leading to direct or indirect monetization. Nevertheless, according to the Market Pulse survey (King, 2019), data volumes are growing at an average of 63 percent per month, with 12 percent of organizations reporting over 100 percent growth every month. At the same time, despite the exponential growth of data volumes, 97 percent of data is inaccessible (AIIM, 2022).

Brown and Toze (2017) also point out that due to information decentralization, where no single entity is the sole authority, less metadata are being created, leading to a significant decrease in information findability. Thus, increased data volumes with evolving forms of records and formats in different information ecologies pose risks of information brittleness and decentralization and require an effective approach to navigating overwhelming quantities of information. This avalanche of information is produced in the organizational setting where any business activity is underpinned by the information life cycle comprised of "the collection, production, processing, analysis, use and reuse, dissemination, protection, disposal and long-term retention of information" (Brown & Toze, 2017, p. 582). Records management struggles with the

exponential growth of data volumes and cannot adequately address all the phases of the information lifecycle, which leads to increasing challenges with compliance and regulations (Baan, 2013; Smallwood, 2014; Caron, 2021).

Records Management (RM) means "a field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use, and disposition of records, including the processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records" (ISO, 2016, p. 7). This term is synonymous to *recordkeeping* which indicates "the making and maintaining of complete, accurate, reliable evidence of business transactions" (State Records Authority of New South Wales, 2003, p. 5). Thus, recordkeeping realized through *recordkeeping systems*[1] is vital for organizations to have the information to support their business operations.

Information Management (IM) is a broader discipline encompassing an organization's entire spectrum of information, including records. Consequently, the complexity of IM, i.e., the way organizations manage their information resources supported by information technology (Hjørland, 2021), requires a new perspective through *Information Governance* (IG). IG is an emerging concept indicating an overall strategy bringing in alignment all organizational information through establishing "the authorities, supports, processes, capabilities, structures, and infrastructure to enable information to be a useful asset and reduced liability to an organization, based on that organization's specific business requirements and risk tolerance"

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[1] *Recordkeeping systems* are business information systems that are used for managing records over time and include people, policies, standards, procedures, tools, technology, education, and maintenance. The characteristics of efficient recordkeeping systems are reliability, integrity, compliance, comprehensiveness, fixity, and accessibility. Moreover, recordkeeping systems include the following functions: registration, classification, indexing, access and security, monitoring, tracking, disposal, storage, reporting, searching, retrieval, and rendering (ISO, 2016).

(ARMA International, n.d.). IG also promotes information-centered organizational culture (Smallwood, 2014, 2018; Brown & Toze, 2017; Caron, 2021; Desrochers, 2022) and relates to the activities and technologies employed to increase the information value while reducing possible risks and costs (Information Governance Initiative, 2014).

Brooks (2019) explores the evolution of the relationship between records management and IG and indicates that there are two major perspectives in the records management community. Some information experts believe records management is obsolete and is associated with the paper era; hence, IG is perceived as a new and distinctive concept of a broader scope offering wider opportunities for them. In contrast, the other representatives of the records management community are quite skeptical about the IG concept and perceive it as part of a rebranding exercise, where IG does not offer any particular novelty (Brooks, 2019).

Despite these controversial views, information professionals agree that IG is built on the fundamental principles of records management (Brooks, 2019). So, effective IG is based on the eight principles of RM: accountability, transparency, integrity, protection, compliance, availability, retention, and disposition (ARMA International, 2017).

ARMA International (2019, December 31) describes seven key areas necessary for the IG program implementation: steering committee, authorities, supports, processes, capabilities, structures, and infrastructure. *Information Architecture* (IA)[2], along with taxonomy and metadata, is assigned to the area of the structures as part of the information storage structure in IG. 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 (Wusteman, 2013). It

[2] The concept of Information Architecture as the focus of our research is described in detail in Chapter 2 *Literature Review*.

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).

Before proceeding to the detailed analysis of this concept, we note the expansive definition introduced by ARMA International (n.d.). It defines IA as 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 IM (ARMA International, n.d.).

Moreover, building IA based on good recordkeeping to automate recordkeeping tasks is essential to support effective IM and IG for organizations and to address the flow of large volumes of digital information (Alberts & Eby, 2019). Although information is a strategic resource, implementing digital solutions within the IG framework is still a challenge due to the inherently unstable nature of the information ecosystems, which are characterized by complexity and high velocity (Brown & Toze, 2017). For automated recordkeeping practices, IA proved to be helpful in achieving better results by providing a model of structured content and organized information (Thomas, 2018) with a professionally developed records management strategy facilitating the effective functioning of automated tools (NARA, 2014).

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, information management 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.

1.2 Research Objectives and Questions

The purpose of the research is 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 is 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 is 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 information management practices in architecting information systems to support effective IM within the framework of IG, this research focuses 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?

1.3 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. At the second phase, the results of these surveys were used 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.

2 Literature Review

This chapter is devoted to the literature review on the concept and elements of IA for IM and its current methodologies and practices. The nature of the information architect profession with its responsibilities, knowledge and skills will also be examined.

2.1 Information Architecture and Its Definition

IA is an ambiguous concept having multiple interpretations due to its interdisciplinary nature as it is widely used in information and library science, computer science, and web development (MacDonald, 2013; Wusteman, 2013; Swope, 2019).

The term IA was first coined by the architect Richard Saul Wurman in 1976 (Wurman, 1996) and indicated the practice of information organization to make it more comprehensible for a user and to clarify its structural complexity via visualization similar to designing buildings (Anderson et al., 2020). IA was introduced as a metaphor of structure, and as Lakoff and Johnson (2003) suggest, metaphor is a tool used by people to cognize the world at a more abstract level through familiar knowledge of direct physical and social experiences. Thus, IA as a metaphor

encompasses the complex concept that has undergone a significant transformation within a few decades and requires further examination.

In the late 1990s, Rosenfeld and Morville (1998; 2003) suggested using the library principles of taxonomy, metadata and controlled vocabulary to assist in information findability for websites' organization. Besides information organization and representation, IA, called 'little IA' by Dillon (2002), becomes part of the user experience, where findability together with multiple access to information is also affected by information-seeking behavior, interaction design, branding, search engine optimization, etc. (Jacob & Loehrlein, 2009).

From the 2010s, 'big IA' (Dillon, 2002), has become pervasive in its organizing and labeling functions not only to navigate websites in a digital environment but to facilitate user experience interaction in cross-channel systems, e.g., augmented realities or machine learning, which are more expansive than a website topology (Resmini & Rosati, 2011; Anderson et al., 2020). Thus, IA involves "identifying and developing detailed content models that ensure designers can architect experiences persisting across any and all channels, including ones that may not yet exist" (Anderson et al., 2020, p. 4).

Morville and Rosenfeld (2006) provide four aspects of IA:

> 1. The structural design of shared information environments. 2. The combination of organization, labeling, search, and navigation systems within websites and intranets. 3. The art and science of shaping information products and experiences to support usability and findability. 4. An emerging discipline and community of practice focused on bringing the principles of design and architecture to the digital landscape. (p. 3)

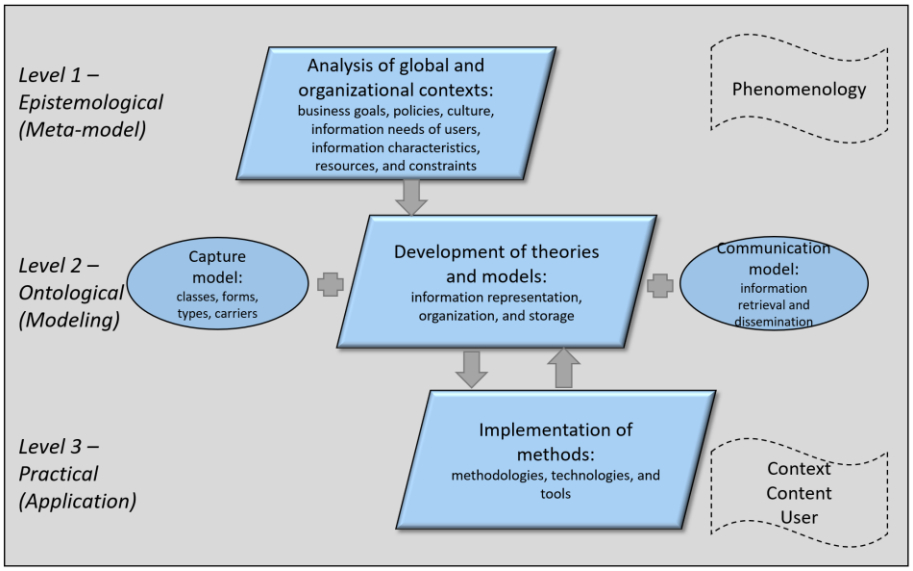
The authors propose that the four aspects of IA are realized within three principles: context, content, and users.[3] In this conceptualization of IA, structuring relates to information granularity and how its pieces are interrelated; organizing is about categorizing information into certain groups; labeling refers to naming information categories and their interconnection through the navigation system; searching is associated with the findability of information. Among art and science disciplines can be usability engineering based on computer science and ethnography. Usability engineering relates to human-computer interaction and user-friendly interfaces allowing a user to successfully accomplish a task, e.g., to retrieve the required information. Ethnography explores cultural phenomena from the perspective of the subject of the study by immersing oneself in the community being researched to analyze users' needs and information-seeking behavior (Jayathilaka, 2021). Its methods can be applied to various organizational analyses for IA design and include the examination of people, their activities, environment and cultures. Moreover, Rascão (2016) significantly expands the interdisciplinarity of IA to include such disciplines as software engineering, organizational psychology, sociology and anthropology, information science, cognitive science, industrial and graphic design, computer science, and education.

Developing the ideas of Morville and Rosenfeld (2006) about the three principles of IA (context, content and users)[4], Rascão (2016) offers a generic model of IA applicable to any information environment (see Figure 1).

[3] These principles will be used as a conceptual framework for this research with their detailed description in Chapter 3 *Conceptual Framework*.
[4] See Chapter 3 *Conceptual Framework*.

Figure 1. *Generic Model of Information Architecture*

(adapted from Rascão, 2016, p. 74)



The most abstract *Level 1* represents a meta-model of epistemology that encompasses analysis of global and organizational contexts, e.g., business goals, policies, culture, information needs of users, constraints, information characteristics, and resources. This theoretical level provides the foundation for information environment modeling. *Level 2* relates to modeling and is considered ontological or scientific as it is involved in developing theories and models based on the epistemological discoveries from Level 1. The methods of content organization with the consideration of all parties and their roles are determined there. At this level, the author also introduces the *Capture Model* based on information typology that can be expressed through classes, forms, types, or support/carrier. The content treatment in this model can be realized through three modules: information representation, organization, and storage. Level 2 can also have the *Communication Model*, which means information retrieval and dissemination for different stakeholders. Finally, *Level 3* is practical or operational and relates to the

implementation of the methods of content organization and representation via methodologies, techniques, technologies, and tools for the IA design.

Rascão (2016) analyzes the IA concept encompassing the epistemological, ontological and practical aspects through the prism of phenomenology, i.e., inspecting various types of experience from the first-person perspective where subjectivism is an important characteristic of the relationship between the subject and the world. Phenomenology plays a significant role in the analysis of organizational contexts where personal experiences and views affect the conclusions and implications made during the participation with all the stakeholders (Wendt, 2014). It follows then that IA models and their implementation can be impacted by individuals' subjective perceptions which thus require a more mindful and reflective attitude from the information architect.

Almeida et al. (2020) also investigate the advances in the IA concept in the most prominent academic journals and offer five main topics or aspects reflected in the IA definitions in the scope of the Library and Information Studies (LIS) literature: blueprint, structure, coverage, orientation, and theory. From these topics, they extracte relevant aspects characterizing IA in the LIS context.

Blueprints relate to a metaphorical representation of an architectural plan introduced by Wurman (1996). *Structure* is considered the backbone of IA and part of knowledge organization (Hjørland, 2012). *Coverage* indicates an information space, e.g., web environments, Internet, Intranet, organized via IA in a corporation (Jacob & Loehrlein, 2009). *Orientation* concerns the top-down and bottom-up approaches the IA's activities should implement. Finally, *theory* based on comprehensive empirical evidence, which is currently missing for IA, should provide a

sufficient foundation for IA professionals to avoid redundancy when they have to start from scratch in each project (Dillon, 2002).

To encompass the four aspects of IA by Morville and Rosenfeld (2006), the IA for IM definition provided by Evernden and Evernden (2003) seems the most appropriate: “Information architecture is a foundation discipline describing the theory, principles, guidelines, standards conventions and factors for managing information as a resource” (p. 24). ARMA International (n.d.) offers a similar but more specific context where IA for IM is “the art and science of making information usable, findable, manageable, and securable. This is accomplished by applying information science to enterprise information environments to model and design logical systems for organizing, labeling, navigating, and searching information.” Almeida et al. (2020) broaden the scope of ARMA International (n.d.) and define IA for IM as a meta-discipline related to the development, implementation, and maintenance of digital information ecologies. Alberts and Eby (2019) specify IA for IM as a semantic and conceptual model applied to the consistent and controlled description of any type of information produced in an organization.

To conclude, the concept of IA coined by Wurman in 1976 (Wurman, 1996) has undergone a significant reconceptualization over the past decades and can be interpreted in various ways. However, despite the lack of transparency in defining IA for IM and establishing its theoretical background, there has been progress in the development of methodologies and practices for IA that will be described in the next chapter.

2.2 Methodologies, Methods and Practices for IA to Support IM and IG

The leading methodologies and practices applied to architecting information systems will be discussed with the consequent focus on those that can be understood as compliant with an IG perspective.

The major methodologies and practices for IA to support IM originate from the approaches widely applied in records management. One of the best practices for records management recommended by AIIM (Weis, 2012) is the functional analysis as a top-down approach.

The extensive guidelines on the classification schemes development for records management based on the functional approach are presented in such standards as ISO 15489-1 (ISO, 2016), DoD 5015.02-STD (Department of Defense, 2007, April 25), and MoReq2010® (2010).

The functional analysis is "grouping of all processes undertaken to achieve a specific, strategic goal of an organization, which uncovers relationships between functions, processes and transactions which have implication for managing records" (ISO, 2008, clause 3.2). The functional analysis assists in creating a classification scheme based on the identification of functions, sub-functions, activities and/or processes supporting the functions. The identified activities and processes determine record categories. Further, a classification scheme can be based on organizational divisions and departments derived from the organization chart (Weis, 2012).

An example of the macro-appraisal and functional analyses outlined in the Appraisal Methodology for the Library and Archives Canada (LAC) is presented by Cook (2001). Macro-appraisal focuses on the functions of an organization (Couture, 2005). The guidelines for macro-appraisal are not prescriptive but instead provide a template for appraisal research and include the methodological steps to make adequate records appraisal decisions within the LAC context (Cook, 2001).

Moreover, Library and Archives Canada (2017) offers the Generic Valuation Tool (GVT) designed for IM specialists employed for the government of Canada and used for determining information resources of business value and retention specifications. This tool is based on the

superseded Business Activity Structure Classification System (BASCS), using “the structure of the functional sequencing of activities composing a business process or business function to structure the records classification system’s sequence of block, primary, and secondary file titles” (Sabourin, 2001, p. 143). The BASCS was also foundational for the Government Activity Thesaurus (Portail Quebec, 2022) and assisted in the effective research on the website of the Quebec administration. It provides several thousand terms covering the main domains of government activity and exhibited in hierarchical relationships.

The State Archives and Records of Australia (n.d.) also offers a methodology for appraising records retention and disposal based on the functional analysis of the organization’s responsibilities, context and requirements. Thus, functional analysis permeates the records appraisal practices at their various stages in the life cycle. However, this methodology only applies to the appraisal of records based on the functional context in which records are created and does not include the appraisal of records’ content.

To address the gap of missing record’s content appraisal, the sequential analysis as a bottom-up approach is used to map “a business process in a linear and/or chronological sequence which reveals the dependent relationships between the constituent transactions” (ISO, 2008, clause 3.4). In this regard, micro-appraisal analysis emphasizes the information value of a record from the perspective of its content or format (Couture, 2005). The methodologies for the functional and sequential analyses for IM are presented in three technical reports: ISO/TR 21946 (ISO, 2018), ISO/TR 26122 (ISO, 2008), ISO/TR 18128 (ISO, 2014) that provide the best practices in analyzing business context, business activities, work processes, and risk.

For example, ISO/TR 26122 (ISO, 2008), based on the Australian Standard AS 5090-2003 (AS, 2003), describes both functional and sequential analyses and is implemented for IA design

in an open government initiative in Canada (Léveillé & Timms, 2015). Conducting the functional analysis of an open government initiative encompasses the context analysis of an organization, including its mandate and regulatory aspects, namely, the governing body and its jurisdiction. Subsequently, the objectives of an open government initiative are also delineated, which leads to transparency and accountability when government information is disclosed. A sequential analysis examines how tasks are executed, shedding light on the prerequisites for creating records at the transaction level. It also delves into the roles, responsibilities, and interdependencies among related processes (for instance, situations where the output of one process serves as input for another). Factoring in the roles of the participants in this analysis aids in defining the specific sequence of such steps as providing guidance, approval or authorization, performing evaluation or audit, etc. Determining these roles facilitates classifying records generated during a business process and identifying the individuals accountable for them (Léveillé & Timms, 2015).

In this regard, Léveillé and Timms (2015) introduce three stages of an open government business process: initiation, identification and distribution, and promotion and evaluation. As outcomes of business processes, generated information objects "must be considered both for their purpose as evidence supporting the workflow as well as for their value as attributes of accountability in relation to the open government initiative" (Léveillé and Timms, 2015, p. 170).

In addition, the DIRKS methodology (State Records Authority of New South Wales, 2003; ISO, 2016) helps develop the recordkeeping systems with adequate recordkeeping functionality based on the business information systems that are utilized to manage evidence of the organization's activities. DIRKS consists of eight steps that are not required to be implemented in a linear way: 1) preliminary investigation of organization's characteristics; 2) analysis of

business activity; 3) identification of recordkeeping requirements; 4) assessment of existing systems; 5) identification of strategies for recordkeeping; 6) design of a recordkeeping system; 7) implementation of a recordkeeping system; 8) post-implementation review. The DIRKS methodology is a framework for recordkeeping that addresses all kinds of records but does not provide much focus on electronic information; as a result, it is not widely implemented these days.

Based on the functional and sequential analyses, a classification scheme to facilitate an IA design to support IM and IG can be developed (Alberts et al., 2010; Weis, 2012). The functional approach can be used to derive a controlled vocabulary and a metadata model for an organization (Alberts et al., 2010). A metadata model is a set of descriptions that can be used for IM, for example, accessibility, addressee, aggregation, date, digital signature, format, mandate, source, etc. Weis (2012) recommends the Dublin Core (n.d.) as a metadata standard designed to describe any type of information and support data exchange across various information systems. The principal standards for taxonomies and controlled vocabulary design and maintenance are ISO 25964-1 (ISO, 2011) and ANSI/NISO Z39.19 (ANSI/NISO, 2010).

However, the challenges associated with the function-based approach in the digital context remain as it does not finally consider the user's needs (Orr, 2005; Foscarini, 2009). Although functional classification is a valuable method, "organization-based records managers as well as end-users encounter difficulties when creating and dealing with such classification systems" (Alberts et al., 2010, p. 366). Alberts et al. (2010) attempt to reconcile the organizational perspective as an intellectual abstraction with the end-user perspective as a practical tool to design IA for IM. They propose that "combining a functional description of an organization at a high level of abstraction with process-level descriptions at lower levels of granularity provides

the most useful contextual description of document creation" (Alberts et al., 2010, p. 379). They also refine and enrich the theoretical concepts of business functions, activities and processes as well as their interconnectedness with a theory of "action types" (Bedny et al., 2000).

Mas and Marleau (2009) propose a Faceted Classification Model based on Ranganathan's facet theory (1967) to support business information organization where digital documents are standardized, leading to transparency of IM throughout the document's life cycle in line with compliance to legal and policy requirements. A hierarchical structure of descriptive categories associated with organization's functions and activities is the core of these facet classification practices. However, they emphasize the necessity of a novel methodology to use the faceted classification inspired by the methods based on facet theory, library sciences and record management through document analysis from the administrative and operational perspectives. Also, methods for designing content facets through the perspective of the top-down approach are necessary, which might lead to unified and predefined facets. Mas et al. (2011) succeed in the enhancement of traditional classification schemes with the proposed original faceted classification in a decentralized, digital work environment with the involvement and feedback of their potential users.

As a further examination of the Faceted Classification Model (Mas & Marleau, 2009), Alberts et al. (2010) introduce the Integrated Semantic Information Services (ISIS) framework encompassing both the process and function views on actions linked by facets and business rules determining business functions of action, the role performing the action, and the inputs and outputs necessary to perform the action. ISIS comprises three components. The first component is the ISIS framework which conceptually determines a business-oriented classification system. Furthermore, it becomes an ISIS model when it is designed for a specific organization. The

second component is the GenISIS methodology that encompasses various types of analyses to produce an ISIS framework: functional decomposition and process mapping. Finally, the ISIS software suite with a trained classifier provides automation for the business rules based on the ISIS model.

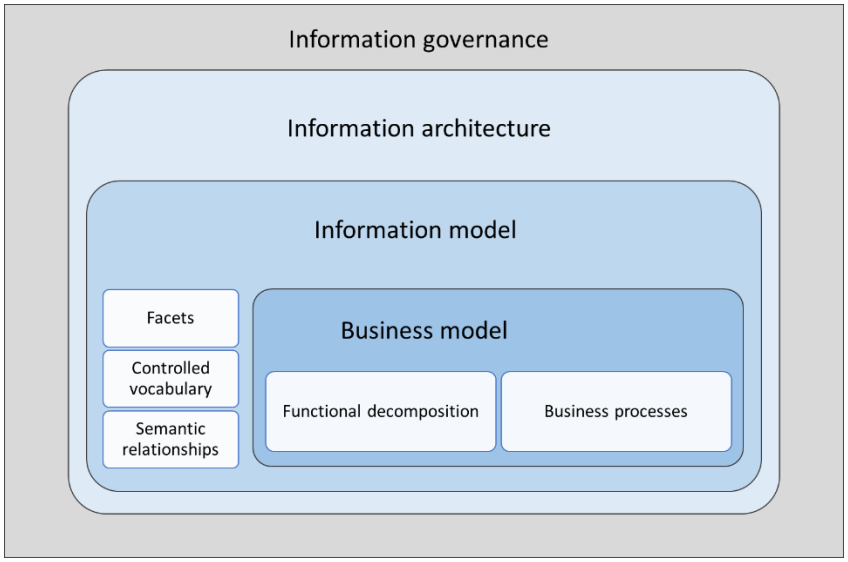
Alberts (2020) points out that the archival appraisal of records from a compliance perspective is insufficient and should also include business analysis, strategic planning, and performance evaluation. Consequently, the author introduces an IG methodology to investigate the principles of information value identification at the time of information creation within business processes. The methodology consists of four steps: "1) needs and organizational capacity analysis; 2) functional analysis; 3) representation and description of business processes; 4) information architecture development" (Alberts, 2020, p. 1). The innovation of this approach is the business process analysis that is the core of the consistent IA development. The business process analysis aims to identify the received or produced information, i.e., input or output, as part of business activities. In the course of this analysis, a series of interviews among various stakeholders belonging to different hierarchical levels of the organization is conducted where the analyst's attention is focused on the activities that generate valuable for the organization information, i.e., information assets leading to "direct" or "indirect" monetization (Laney, 2017, p. 68).

Moreover, at the stage of IA development, in compliance with the IG perspective, Alberts and Eby (2019) offer an IA model (see Figure 2). This IA model includes functional decomposition and business processes as a source of deriving business facets (or metadata), controlled vocabulary in each facet, and semantic relationships between the facets (Mas & Marleau, 2009; Alberts et al., 2010; Alberts, 2020). As a result, IA allows to transparently

associate an information resource with its context by applying the semantically relevant facets of metadata derived from the business analysis.

Figure 2. *Information Architecture Model*

(Alberts, 2020, p. 9)



AIIM (n.d.) also emphasizes that business process mapping, which is tightly interrelated with content produced by an organization, is a necessary step in IA design to automate content-intensive processes. AIIM (n.d.) recommends the following: 1) mapping the ongoing processes and documenting the intersections of content with the process; 2) improving the process by dividing serial processes into parallel steps; 3) repurposing the content by supporting templates providing employees with the opportunity to quickly collect documents rather than dealing with redundant rewriting of the same documents; 4) automating the processes wherever possible by utilizing systems integration.

Thus, business process modeling and mapping are essential methods in IA development. In this regard, Paille (2022) suggests some methods to collect information about a business process: existing process documentation, workshops, interviews, observation, brainstorming,

testing/confirming the way how a process works with stakeholders and iterating if gathered information is irrelevant or incomplete. Then business process maps depicting the output that generates value for an organization are thoroughly recorded. In contrast to the functional approach (ISO, 2008) and macro-appraisal principles (Cook, 2001) emphasizing the social value of the end-of-life document, this operational perspective significantly enhances them.

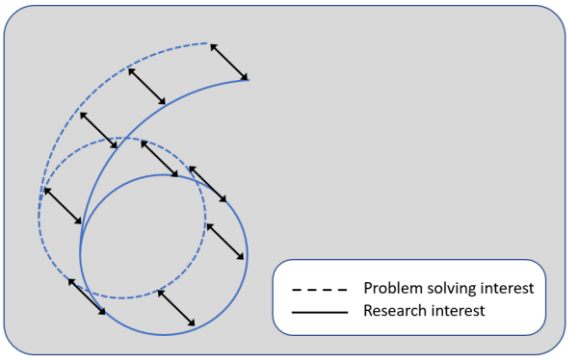
Evans et al. (2014) present an example of IA for IM development within data-driven research environments. The authors elaborate on the recordkeeping informatics approach, which means "refiguring our thinking, systems, processes and practices as we confront ever-increasing convergence, chaos and complexity" (Upward et al., 2013, p. 37) and apply it to tackling recordkeeping challenges encompassing the technological, organizational and societal complexity and offer a set of strategies to address them.

Their ideas are grounded in the works of Upward et al. (2011), who modeled the recordkeeping single mind approach based upon four basic dimensions of an information processing continuum: creation, capture, organization, and pluralization. Within this information processing continuum, the four recordkeeping continua were arranged: transactionality, identity, evidentiality, and recordkeeping containers. Upward et al. (2011) also suggest two building blocks for recordkeeping informatics, continuum thinking and metadata, which should be combined with three facets of analysis: organizational culture, business process analysis, and archival access. This analysis aims "to identify forces shaping information and communication systems in the given context and assess capacities and constraints for recordkeeping within them" (Evans et al., 2014, p. 209) so that IA for complex information ecologies can be developed.

As a result, Evans et al. (2014) offer an interventionist action research approach, which is a methodology for recordkeeping informatics inquiry based on McKay and Marshall's notion of a dual agenda (2001). This dual imperative consists of the practical cycles, solving problems and including interventions, and the research cycles followed by the reflective analysis of the practice effects (see Figure 3). The two-way arrows indicate the theoretically informed interventions in the problem space leading to data generation for the research agenda where the practitioners and researchers are actively engaged. This action research approach is a qualitative interpretivist inquiry based on a comprehensive understanding of the problem and context with the consideration of credibility, transferability, dependability, and confirmability (McKay and Marshall, 2001).

Figure 3. *The Interconnected Cycles of Research and Practical Problem-Solving*

(McKay & Marshall, 2001)



Among the most outstanding challenges in the development of sustainable and scalable IA is preserving endurance in technological and business transformations. Evans et al. (2014) try to address those challenges with the assistance of the recordkeeping informatics approach and the interventionist action research approach based on the data curation continuum (Treloar, 2008, p. 6) and the data management of the Australian Research Data Commons (Laurie et al., 2012, p. 69).

Kotusev et al. (2022) research the main IA instruments used in the organizational environment of Australia. Their empirical study concludes that these instruments are diverse and inconsistent in the analyzed organizations and do not comply with the TOGAF-based architecture practices (TOGAF, 2018). They provide a list with the description of major classes of instruments for IA presented in the literature. They are relationship matrices (e.g., entity-to-system, entity-to-function, etc.); entity-relationship diagrams with various modeling notations and abstraction levels; entity, attribute and association definitions, catalogs, dictionaries and glossaries; information standards, rules and guidelines; IA principles; and entity lifecycle models (e.g., state transition and event sequence diagrams).

Nonetheless, in their empirical research, Kotusev et al. (2022) identify only 12 distinct instruments used for IA in IM, thoroughly investigate their features, properties and relationships, and provide their comparison. They are conceptual data models, enterprise data portfolios, guidelines, information management capability models, inventories, landscape diagrams, logical data models, master data maps, policies, principles, solution overviews and designs, and target states. Thus, the researchers observe IA not as a comprehensive plan for information but as a metaphorical umbrella term encompassing a set of loosely related instruments and practices facilitating IM.

To conclude, all the described methodologies and practices in creating IA for IM offer strategic solutions to creating complex information environments in the distributed information universe of digital records. However, they could benefit from multidisciplinary refinement and development to address the recordkeeping challenges within a diverse range of organizational and community contexts.

2.3 The Profession of Information Architect

This section aims to investigate the profession of information architect to understand the trends in the nature of work. Thus, to address the lack of consistent description of the information architect profession, Swope (2019) surveyed 35 IA professionals to identify what their roles and activities are, what education they have, where they learn new skills, and how to become an information architect. As a result, the author determined the following common IA tasks: content analysis, content development and coaching support, content or information modeling, content reuse design and implementation, metadata analysis and design, and taxonomy development. Moreover, Swope (2019) also identified a list of non-IA tasks common among information architects: content creation, content development coaching and support, template creation, tools administration and development, transformational development and maintenance, and training delivery.

According to Morville and Rosenfeld (2014, January 24), an information architect should have knowledge about "business goals and context, content and service, and user needs and behaviour; and then work with colleagues to transform this balanced understanding of the information ecology into the design of organization, labeling, and navigation systems that provide a solid but flexible foundation for the user experience" (para. 15). The authors propose the definition of information architect based on their four aspects of IA: 1. Structural design; 2. Organization, labeling, search and navigation systems; 3. The art and science of shaping information products and experiences; 4) An emerging discipline and community of practice[5].

[5] For more information, see Chapter 2.1 *Information Architecture and Its Definition*.

These four pillars are realized within three principles or elements: context, content and users[6] (Morville & Rosenfeld, 2006).

From an educational perspective, Haller (2013) emphasizes the gap between formal education and real-life learning about IA. For example, Tucker (2021) describes an online course development aimed to create experiences for students where they can engage with critical concepts of IA, acquire new professional skill sets and tools for IA and evolve in their professional identities. Wusteman (2013) also presents a teaching module for LIS where students have an opportunity to experience a website development project from the perspective of the information architect. However, MacDonald (2013) points out that due to the interdisciplinarity of the IA, it is challenging to teach and learn it within an organized approach and states that practical experience is the best way to learn IA.

To sum up, the literature on the information architect profession is somewhat scarce to reflect the rapidly evolving field of IA. The most significant body of research addresses the introduction of IA concepts into an educational setting to train information architects. The study by Swope (2019) is the most relevant to our research. However, it presents a view of experts who have already gained a long-term experience and expertise in the IA field and in this way, represent a particular professional niche. Our goal is to determine the job market requirements for IA candidates and potentially to detect the changes in the expected responsibilities, knowledge and skills required for the information architect.

[6] For more information, see chapter 3 *Conceptual Framework*.

2.4 Literature Review Conclusion

This literature review determines multiple knowledge gaps in identifying formal characteristics of IA for IM, showing some fuzziness and obscurity in its definition. For instance, the four aspects of IA that include the elements of the structural design, the combination of organization, labeling and search, the art and science of shaping information and an emerging discipline of IA practice in the digital context (Morville & Rosenfeld, 2006) as well as the five topics of blueprint, structure, coverage, orientation, and theory in the LIS literature (Almeida et al., 2020) indicate the enormous scale of the IA domain. Besides, it should be taken into account that the lack of a central theoretical foundation for IA leads to inconsistencies in methodologies and practices and restricts the development of a comprehensive methodology.

The methodologies and practices for IA to support IM and IG are mostly based on the analysis methods for IM that encompass the most recommended functional and sequential analyses (ISO, 2008; Weis, 2012), which still do not address the challenges of the digital context. However, there are some attempts to compensate for these deficiencies by enhancing them with the Faceted Classification Model (Mas & Marleau, 2009), the Integrated Semantic Information Services framework (Alberts et al., 2010), the IG methodology (Alberts, 2020; Alberts & Eby, 2019), the DIRKS methodology (State Records Authority of New South Wales, 2003; ISO, 2016), the AIIM methodology (AIIM, n.d.), the recordkeeping informatics approach (Upward et al., 2013), and the interventionist action research approach (Evans et al., 2014). Moreover, Kotusev et al. (2022) identify and compare 12 IA tools used for IA in IM in the Australian context, where IA is viewed as not a well-structured entity but a set of loosely related tools and practices in IM.

The literature review of the information architect job also indicates that this profession includes multiple lacunas reflecting its ambiguity and fuzziness (Swope, 2019; Haller, 2013; MacDonald, 2013). Nonetheless, the primary scope of the IA tasks identified by Swope (2019) is content analysis, content development and coaching support, content or information modeling, content reuse design and implementation, metadata analysis and design, and taxonomy development.

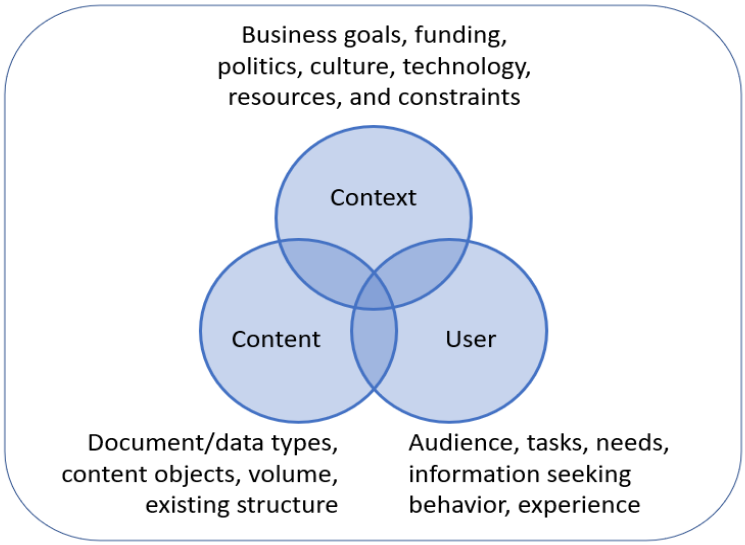
To conclude, our research may be helpful in outlining the borders of IA for IM and in elaborating on the methodologies and practices in architecting information systems. Moreover, this study and its findings will be useful in identifying the major activities associated with the IA profession, which can be further useful for preparing LIS specialists in the competitive job market.

3 Conceptual Framework

Information systems are dynamic and adaptive entities that always exist in unique information ecologies containing complex dependencies. The coding scheme is organized within the *conceptual framework* of Morville and Rosenfeld (2006), who propose the model for performing effective IA design consisting of three elements: context, content, and users (see Figure 4). Figure 4 illustrates the interconnectedness of context, content and users within the complexity of an information environment. Although the model (Morville & Rosenfeld, 2006) was designed for Web sites and intranet, it can be extended to other dynamic information systems with emerging qualities where information needs to be flowing within numerous information ecologies of departments, business units, organizations, and states. The three elements – context, content and users – that are crucial for performing IA design will be explained in detail in this chapter.

Figure 4. *Three Circles of Information Architecture*

(Morville & Rosenfeld, 2006, p. 41)



Context is comprised of the following subelements: business goals, policies, resources, budget, technology, culture, and constraints. A business *goal* is "an end result that an organization is expected to achieve over a one- to ten-year period" (Pride et al., 2014, p. 168) and includes an *objective* as a specific statement to be accomplished within a shorter period of time. Goals and objectives can include such factors as sales, company growth, costs, customer satisfaction, employee morale, ethical sourcing, environmental stewardship, community involvement, etc. (Pride et al., 2014). Business *policies* encompass the areas that underpin decision making for employees in an organization (Management Study Guide, n.d.). *Resources* relate to money, materials, staff, and other assets of an organization. *Budget* includes income, expenditures, or both over a certain period of time (Pride et al., 2014). *Technology* is defined as an application of information technology as part of a business operation (Sumo Logic, n.d.). According to the Management Study Guide (n.d.), there are four levels of *culture* in business: national, business, industry, and organization. *National culture* consists of common values,

thoughts, beliefs and traditions shared by the people of a country. *Business culture* involves common values, thoughts, beliefs and traditions of employers and employees and significantly impacts business ethics. *Industry culture* includes common values, thoughts, beliefs and traditions that impact how a specific industry conducts its business. Finally, *organizational culture* has common values, thoughts, beliefs and traditions that influence how employees conduct their organizational functions. All cultural levels are tightly interwoven and carry significant complexity in global organizations (Management Study Guide, n.d.). Finally, business *constraints* are limiting conditions impacted by existing business contracts, procurement policies and business rules (IBM, 2021).

Thus, an information architect should understand the business context, including its specific features, current state, and future transformations as well as consider its politics and legal issues involved, which is tacit knowledge that needs to be elicited from stakeholders. Consequently, IA should reflect the uniqueness of its context and be in alignment with a mission, vision, values, strategy, and culture of an organization (Morville & Rosenfeld, 2006).

Content encompasses *documents*, *data*, *content objects* (e.g., documents, people, processes, and organizations), *document volume*, and *existing structure*. It may contain such facet structure as ownership, format, structure, metadata, and dynamism of content generation and turnover, leading to customization of IA.

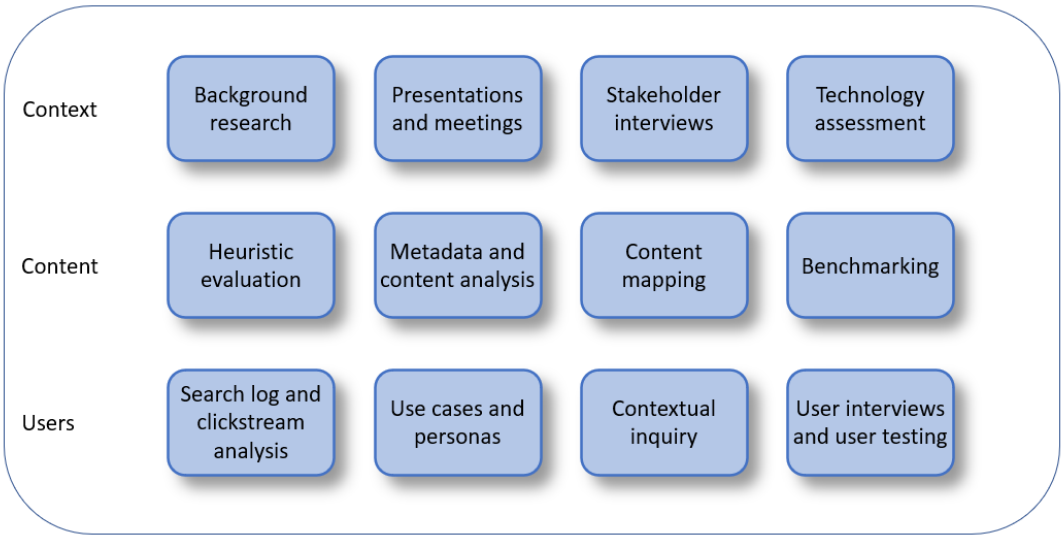
And ***users*** include such subelements as an *audience*, *tasks*, *needs*, *information-seeking behavior* (patterns of usage), and *experience*. Customer preferences and behaviors in the real world can be transferred into various information ecologies and reflected in IA, serving different users and purposes.

Morville and Rosenfeld (2006) indicate that the three elements of IA can be used as a model to conduct research and provide an overview of relevant methodologies and practices (see Figure 5). They also admit that this list is not exhaustive. The authors emphasize that IA design is valuable when it is user-centered "as it moves the pendulum away from executive-centered design" (Morville & Rosenfeld, 2006, p. 283).

3.1 Methods and Tools for IA Design within the Conceptual Framework of Context, Content and Users

Morville and Rosenfeld (2006) introduce current methods and tools for IA design within the conceptual framework of context, content and users. Thus, in the ***context***, *background research* encompasses the investigation of the organization's mission, vision, goals, business plan, politics, budget, intended audiences, management structure, culture, technical infrastructure, users' tasks and type of content to be created and managed as well as past challenges and success.

Figure 5. *Methods and Tools for IA Design*
(Morville & Rosenfeld, 2006, p. 282)



Introductory presentations are intended to raise awareness about the project, identify potential issues, establish a rapport with the involved teams, and negotiate major milestones and deliverables. *Research meetings* are also initiated at this stage to support the background research and include a strategy team meeting, content management meeting, and information technology meeting. The *strategy team meeting* is arranged to define high-level goals, mission, vision, intended audience, content, and functionality. This meeting can also be useful to determine possible obstacles and the timeframes for results. The *content management meeting* involves the participants who deal with the content and content management process and encompasses the formal and informal policies related to content inclusion, a content management system and its elements that may contain controlled vocabularies and attributes to manage content, the types of content and its users, the purpose of the content, the format of the content, the planned future content or services, the provenance of the content as well as the legal issues impacting the content management process. The *information technology meeting* involves the system administrators and software developers who can share about the existing and planned technical infrastructure and provide their expertise if it can support an integration with a new IA.

Stakeholder interviews can provide important insight into the business context and their assessment of the current information environment. These interviews may include the vision of stakeholders on how IA can be a competitive advantage, how they use the current information system and the challenges they are facing, the critical success factors for the new information system, and the top priorities for the IA design.

Technology assessment is helpful in understanding what is available, what is in process and who can help. It also can include the analysis of gaps between business goals, user needs and the limitations of the current technology infrastructure (Morville & Rosenfeld, 2006).

To analyze the ***content***, Morville and Rosenfeld (2006) recommend a *heuristic evaluation* before examining background data to avoid bias. The heuristic evaluation as a top-down approach may incorporate a critique of the existing information system and its IA from the perspectives of various experts, for example, an information architect, a usability engineer, and an interaction designer. The purpose of the heuristic evaluation is to determine the most significant issues with IA and find the opportunities for improvement. The principles of the heuristic evaluation can include the analysis of how information is accessed, how taxonomy is supplemented, how the information system is used, of what language is used, etc.

Metadata and content analysis is a part of the bottom-up approach to IA that encompasses the examination of existing records to identify the discrepancies related to the top-down visions of the organization and the bottom-up reality. Metadata and content analysis can be conducted in the form of an informal survey to investigate the scope and nature of content or a formal audit to facilitate a detailed understanding of the content organization. The initial step of this analysis is *gathering content* in the form of a diverse sample of each type of records, including the ones that are widely spread and that are unique but content rich. Such a content sample can include the following dimensions: format, document type, source, subject, existing architecture, intended audience, document length, dynamism, language, etc. The next step is *analyzing content* essential in the IA design to identify the patterns and relationships of the content objects, for example, structural metadata, descriptive metadata, and administrative metadata. Some metadata can be predefined; nonetheless, it is crucial to notice the emerging patterns and relationships of content objects.

Content mapping is a bridge between the heuristic evaluation and content analysis that conceptually visualizes the existing information environment. Content mapping is an instrument

for understanding the structure, organization, and location of existing records to obtain some insights for improved IA. Content mapping may include such categories as content sources, content models, content types, content templates, etc.

Benchmarking is identifying the reference points for comparative measurements or judgments about the IA features and their improvements.

Within the realm of ***users***, it is essential to develop a user-centered or user-sensitive design of IA, considering the complexity of users' needs, priorities, mental models, and information-seeking behaviors. *Search-log and clickstream analysis* is an approach for tracking and analyzing queries in search engines. The examination of these queries can provide important information about the words and phrases users apply to develop controlled vocabularies. Moreover, it can be helpful in determining popular queries that retrieve zero or hundreds of results. The clickstream analysis consists of tracking a navigation path of users through a website.

Use cases and personas relate to gathering information about users through various organizational departments and to selecting representative samples of users based on surveys, focus groups, interviews and ethnographic studies to develop categorial profiles of participants. In this method, the focus can be on the most valuable content objects for users, the information system elements they find useful or need improvement, etc.

Contextual inquiry is a valuable research tool that involves watching users work and observing them doing their everyday tasks in the organization to provide insight into the improvement of IA design so that the users can be more productive.

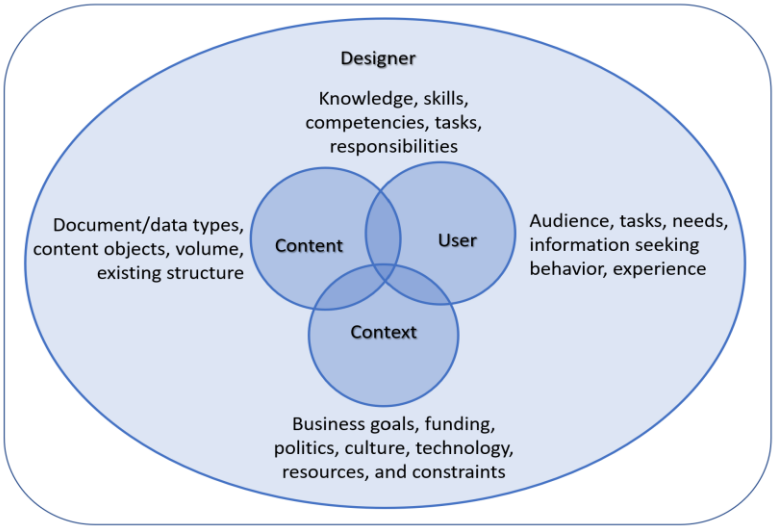
Finally, *user interviews and user testing* are face-to-face research sessions, including only one participant. The multimethod approach, a combination of an interview with either card sorting or user testing, is recommended (Morville & Rosenfeld, 2006).

3.2 Enhancement of the Conceptual Framework

Morville and Rosenfeld (2006) admit that it is an oversimplified construct, and *technology* can probably have its own circle or IA element. However, they did not include this aspect for the reason that technology is the focus of attention anyway, and we second this perspective. Nonetheless, we believe the fourth IA element – ***designer*** – should be added to the IA model to enrich it and allow us to focus on the profession of information architect which includes knowledge, skills, competencies, tasks, and responsibilities of this job (see Figure 6). Figure 6 displays the element of designer encompassing context, content and user from the perspective of the actor, who utilizes multiple methodologies and practices to analyze them.

Figure 6. *Four Elements of IA*

(adapted from Morville & Rosenfeld, 2006, p. 41)



To conclude, the three elements of IA design: context, content and user (Morville & Rosenfeld, 2006) can be enhanced by the fourth aspect of designer to describe the required knowledge, skills and tasks of an information architect required to develop information systems. Moreover, the methods and tools presented in Figure 5 (Morville & Rosenfeld, 2006, p. 282) impacted our data analysis, which is discussed in detail in Chapter 4.

4 Methodology

In this chapter, the research design, ethics approval, data sampling, participation recruitment, data collection, data analysis, research quality and the limitations of the study are discussed.

4.1 Research Design

Content analysis (CA) is a research method (White & Marsh, 2006; Armann-Keown & Patterson, 2020) or a research technique (Krippendorff, 2004; Hsieh & Shannon, 2005) employed in this research study. CA has its origin in mass communication and journalism and is widely used in Library and Information Science (LIS) (Wildemuth, 2017; White & Marsh, 2006). In LIS, CA has been used to analyze various types of data: journal articles, open-ended interview transcripts, reference interviews, job advertisements, websites, blogs, and social media (Armann-Keown & Patterson, 2020).

Krippendorff (2004) defines CA as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 18). According to Neuendorf (2017), CA is "the systematic objective, quantitative analysis of message characteristics" (p. 1) that is comprised of human-coded analyses and computer-aided text analysis.

This research was predominantly conducted within the framework of the qualitative approach, supported by quantitative analysis through the implementation of descriptive statistics (Byrne, 2007; Given, 2008; Wildemuth, 2017). The perspective of mixed method research, involving the application of both qualitative and quantitative research methods in the LIS discipline, is gaining prominence and support (Granikov et al., 2020; Ullah & Ameen, 2018; Chu, 2015; Ma, 2012; Fidel, 2008). White and Marsh (2006) state that CA can include qualitative, quantitative or mixed research and consists of multiple analytical strategies aimed at producing findings associated with a certain context. Krippendorff (2004) points out that the dichotomy of the quantitative/qualitative distinction is not justifiable as both analyses are tightly intertwined and include "the explicitness and objectivity of scientific data processing on the one side and the appropriateness of the procedures used relative to a chosen context on the other" (p. 87). Ma (2012) also emphasizes the need for combining qualitative and quantitative approaches in LIS due to its mix of objectivism and subjectivism of information and information-related phenomena that can be understood by the implementation of large-scale data analyses together with a detailed description of community practice.

Moreover, Wildemuth (2017) points out that most steps in the qualitative CA overlap with the traditional quantitative analysis. The major steps include preparing the data, determining the unit of analysis, developing categories and a coding scheme, testing a coding scheme on a text sample, coding all the text, assessing the coding consistency, and drawing conclusions from the coded data (Wildemuth, 2017). The units of analysis for CA usually consist of lexical units (e.g., words, sentences, and paragraphs) that are analyzed through qualitative approaches, such as open coding, complemented by quantitative methods, such as frequency and percentage (Chu, 2015). Therefore, the integration of analytic and hermeneutic methods enhances a more advanced

comprehension of information-related phenomena and "amplifies the richness and complexity of the research findings" (Fidel, 2008, p. 266).

The qualitative approach prevailing in the research process was based on deduction and induction within the conceptual framework of Morville and Rosenfeld (2006)[7]. The naturalistic perspective of qualitative CA (White & Marsh, 2006) assisted in the identification of text themes that were used to categorize the purposive sampling to inform the research questions; consequently, a coding scheme was developed in the process of iterative reading. Although the coding was subjective, it was improved by the credibility and confirmability techniques[8]. The data were described and interpreted to answer the research questions with the usage of NVivo as a software tool for annotation.

A quantitative approach was employed to complement the qualitative analysis in the description of results and findings to summarize and describe the main features of the data. Information extracted from the data based on descriptive statistics (Byrne, 2007; Wildemuth, 2017) encompassed the median experience of the research participants, ordinal variables related to their formal and informal education, including percentage descriptions, and frequency distributions of relevant IA phenomena to gain insights into the characteristics of the data, identify patterns, and make comparisons. Thus, these data allowed us to identify general trends and tendencies prevailing in the domain of IA for IM, which enhanced the descriptive representation of this field and its current state in the job market. Moreover, descriptive statistics provided insights into the central and peripheral IA practices, methods and methodologies, as well as job requirements for information architects. Thus, these findings can be implemented in

[7] See Chapter 3. *Conceptual Framework*
[8] Credibility and confirmability techniques are described in detail in Chapter 4.6 *Research Quality*.

the curricula of LIS programs and assist in identifying the most prominent topics of this complex discipline to prepare information professionals for the current job market.

Nonetheless, it should be emphasized that such a process of data interpretation remains subjective and based on the knowledge and experience of the researcher, so it is unlikely that similar results can be reproduced. Consequently, the statistical representations of frequency distributions should be considered relative and used for understanding general tendencies only.

Although NVivo has a feature for determining word frequency, it was ineffective for our purposes as the frequency of the terms used to answer the research questions was significantly lower than the words of general language. Thus, Excel and Word features were used to describe the statistical results.

In LIS research, multiple techniques are used to generate, analyze and describe the research findings qualitatively and quantitatively, namely, tabulations, cross-tabulations, triangulation, associations, interpretations, clustering, and counts of numbers and percentages, and, if need be, connection of text concepts to develop grounded theory (White & Marsh, 2006). In this research, tabulations, data and methodological triangulations, associations, interpretations, clustering, counts of numbers and percentages were used as research techniques[9].

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[9] *Tabulation* involves the presentation of research data in the form of tables to facilitate comparison, analysis and interpretation. *Triangulation* is the approach for using multiple perspectives to interpret meaning and verify the repeatability of results (Wildemuth, 2017). According to Denzin (1978), there are four types of triangulation: 1) *data triangulation* (incorporating several sources of data); 2) *investigator triangulation* (integrating data collected by several investigators); 3) *methodological triangulation* (collecting data via various methods); and 4) *theory triangulation* (merging data collected from multiple theoretical perspectives). *Associations* include identifying patterns and relationships between variables (e.g., topics) in a dataset. *Interpretation* involves analyzing and explaining the meaning of research data to understand complex phenomena and subjective experiences and to provide new insights and hypotheses that can inform further research. *Clustering* relates to grouping together similar or related items or observations in a dataset based on their characteristics or attributes. *Counts of numbers* refer to the absolute number of occurrences or observations for a particular variable or category, whereas *percentages* relate to the proportion of occurrences or observations out of the total number of observations or respondents (White & Marsh, 2006; Wildemuth, 2017).

To conclude, CA is a systematic and rigorous approach to analyzing various kinds of documents obtained or generated for research. It is a justified method for this study design. Within the mixed mode of the qualitative and quantitative approaches, it should be emphasized that qualitative analysis played the leading role in our interpretative investigation and naturalistic inquiry backed up by descriptive statistics. Moreover, an expansive range of analytical techniques were utilized to generate and describe our findings.

4.2 Ethics Approval

Any research involving humans requires respect for human dignity and must be conducted "in a manner that is sensitive to the inherent worth of all human beings and the respect and consideration that they are due" (Canadian Institutes of Health Research et al., 2018, p. 6). Thus, this research was reviewed and approved by the University of Ottawa Research Ethics Board, which operates in accordance with the Tri-Council Policy Statement (Canadian Institutes of Health Research, 2018) and other laws and regulations guiding the design, ethical conduct and ethics review process of research involving humans. This research included two data collection methods with human participants: online surveys and follow-up interviews. The ethics approval for this research was granted by the Office of Research Ethics and Integrity at the University of Ottawa on February 8, 2023, for one year (see Appendix A: Ethics Certificate 2023). By the end of June 2023, data collection for the thesis research was complete.

4.3 Sampling and Recruitment

Sampling involves "a manageable subset of units that is statistically or conceptually representative of the set of all possible units, the population or universe of interest" (Krippendorff, 2004, p. 84). Information can convey a message in the form of text, audio, video,

image, map, sign, symbol or Web format consisting of blocks for sampling, collecting, and analysis and reporting. These blocks can be the sampling units (any of the elements selected from a population) that are the foundation for the data collection units (units for measuring variables) and units of analysis (the basis for reporting analyses). The sampling and data collection units are determined by pragmatism; however, the units of analysis are defined by the research question or hypothesis (White & Marsh, 2006).

A nonprobability strategy, i.e., a non-random way of participants' selection, was employed in sampling units. This, in tandem with the coding scheme, provided an effective foundation for CA aimed "to understand the meaning embodied in a wide variety of texts" (Wildemuth, 2017, p. 315). The research included purposive sampling that is grounded on selecting particular people or documents from the population of interest based on specific features (Wildemuth, 2017). The purposive samples provide rich information relevant to the investigated phenomenon (Vasileiou et al., 2018). Indeed, van Rijnsoever (2017) demonstrates the greater efficiency of purposive sampling in comparison with random sampling in the qualitative approach. In our case, purposive sampling consisted of gathering data from experts specializing in IA for IM and job postings, containing the words 'Information Architect' to be able to answer the research questions of the thesis.

Moreover, snowball sampling (Wildemuth, 2017), i.e., asking for suggestions for additional people involved in architecting information systems, was also applied due to an insufficient number of recruited participants for the human population at the initial stage of the investigation. Purposive and snowball sampling based on the nonprobability strategy proved to be effective in investigating the research topic with the relevant research questions.

Thus, for the purpose of triangulation and to ensure trustworthiness, this thesis research consisted of two populations. The first population was information architects working for organizations practicing information management. The criteria for recruitment were expertise in IA for IM and participation in projects involving the development of information systems.

Initially, the recruitment of participants was planned to be conducted in an organization practicing information management based on the preliminary agreement (see Appendix B: Agreement Email). Upon receiving permission from the CEO, the recruitment letter (see Appendix C: Recruitment Invitation Email) was sent to potential participants to contribute to this research. In the recruitment letter, prospective participants were invited to take part in the 20-minute online survey (see Appendix D: Online Survey), the direct link to which was provided in the email. The expectation was to obtain the survey responses from 6 to 15 participants; however, the researcher succeeded in recruiting only 5 respondents at this stage.

The survey respondents who expressed their interest in participating were then invited to the follow-up interviews (approximately 30-45 minutes) guided by a list of open-ended questions reflecting key themes from the survey and addressing the research questions to elaborate on details relevant to IA for IM (see Appendix E: Follow-up Interview Guide). The follow-up interviews were conducted virtually over Zoom or MSN Teams (depending on the participant's preference) at a time convenient for the participants. All 5 survey respondents expressed interest in participating in the follow-up interview, and 5 follow-up interviews were conducted.

Due to a low response rate, other initiatives were taken to recruit more participants. The invitation to participate in a follow-up interview was deleted both in the recruitment invitation email and in the online survey to reduce the possible pressure of time commitment among

prospective participants so that their participation would be restricted to the survey contribution only.

The respondents who agreed to participate in the follow-up interview were then asked to share the invitation to research participation through their professional networks. As a result, 10 additional individuals were contacted. The researcher also sent out a recruitment invitation to representatives of the Information Architecture Conference 2023 (IAC 2023), Association of Records Managers and Administrators of the National Capital Region Ottawa (ARMA NCR), and the Association for Intelligent Information Management (AIIM). Moreover, using the professional social network LinkedIn, the investigator posted a participant recruitment invitation in their professional account and in the public group "Information Architecture Community by World Information Architecture Association" (11,645 members), resulting in 261 post impressions, i.e., the total number of exposures to one's content. Consequently, six more surveys were completed.

The first dataset comprised 11 online surveys and 5 follow-up interviews.

A low response rate can be explained by research fatigue, "a state of psychological and emotional exhaustion both towards and as a result of research participation" (Ashley, 2021, p. 271) widely discussed in the scholarly literature (Patel et al., 2020; Ashley, 2021; Clark, 2008). Too many research requests or a lack of observing direct changes after the participation may be the reasons for potential respondents to experience research fatigue (Patel et al., 2020).

The second dataset consisted of text retrieved from the most recent job postings of the leading Web platforms, such as LinkedIn, Indeed, Google Jobs, Monster and Quora, dedicated to job search, professional networking, and expert discussions. These job postings described the

major skills, knowledge, competencies, tasks and responsibilities required from information architects at the current professional market.

In summary, the research utilized a nonprobabilistic strategy for both purposive and snowball sampling.

4.4 Data Collection

To investigate what IA and its elements are, to examine the practices and methodologies adopted by information architects as well as to discover the skills and competences required for these experts, the following three types of data were collected for this study: survey data, follow-up interview data, and textual document (i.e., job posting) data. As a consequence, 21 sources of data were collected and coded as shown in Table 1 (see also Appendix H: List of Sources and Source Codes).

Table 1. *List of Sources and Source Codes*

Type of Source	Source Code
Interview 1	S01
Interview 2	S02
Interview 3	S03
Interview 4	S04
Interview 5	S05
Survey 1	S06
Survey 2	S07
Survey 3	S08
Survey 4	S09
Survey 5	S10
Survey 6	S11
Survey 7	S12
Survey 8	S13
Survey 9	S14
Survey 10	S15
Survey 11	S16
Job Postings - LinkedIn	S17
Job Postings – Quora	S18
Job Postings – Indeed	S19

Type of Source	Source Code
Job Postings - Monster	S20
Job Postings – Google Jobs	S21

Initially, 65 job postings were found; after duplicates were deleted, a sample of 50 job postings was compiled (see Appendix I: List of Job Postings with Source Codes and URL). An embedded URL leads to a job posting; however, it should be noted that the links and content may have changed since collection.

In sum, 66 sources of data comprised 11 online surveys, 5 follow-up interviews and 50 job postings retrieved from 5 platforms for job search and expert discussions.

4.4.1 Data Collection Methods

The data collection involving humans consisted of two sources of data from online surveys and follow-up interviews. The data collection without humans included the textual document data from online job postings.

4.4.1.1 Online Surveys

The survey as a research instrument requires a thoughtful design influencing the response validity (Wildemuth, 2017). The survey for this research consisted of 11 open-ended and 3 closed-ended questions where the specificity of questions is thoroughly considered not to distort the production of an appropriate response or to lead to confusion (Peterson, 2000; Czaja & Blair, 2005). Open-ended questions with some examples prompted were designed to provide direction and assist respondents in comprehending the stated questions (Wildemuth, 2017). Closed-ended questions with a selected number of predetermined response categories were also crafted to collect data on the formal and informal training of respondents and their years of experience in designing IA for quantitative analysis of the professional background of an information architect.

The questions were categorized within our conceptual framework [10]: content, context, users, and designers. As a result, they were organized into four categories to answer the research questions in this thesis: content-related questions, context- and content-related questions, user-related questions, and designer-related questions (see Appendix D: Online Survey). Some questions were classified as relating to both content and context because the answers of the respondents might contain a different focus, depending on their perspective. For example, some methodologies and practices in IA for IM may relate to context and content simultaneously, reflecting their categorial fuzziness. In this case, context analysis can be considered a method and relate to a content question from the perspective of an information architect, or it can provide information about an organization's context as an object of analysis and relate to a context question. Consequently, the questions relating to both context and content categories were merged into one category of context- and content-related questions. The final section, interview follow-up, contained the administrative questions to recruit the potential participants for a follow-up interview and was not aimed to provide any data for this research.

Surveys are recommended to be arranged in three sections: an introduction, a substantive questions section, and a classification questions section (Peterson, 2000). In our survey, the introduction to the research and its purpose were presented at the beginning of the consent form (see Appendix F: Online Survey Consent Form) electronically introduced before the online survey on SurveyMonkey. The substantive questions section comprised the questions essential to our research and were grouped based on the conceptual framework. The classification questions at the end of the survey related to the demographic information, namely, the experience, training,

[10] See Chapter 3 *Conceptual Framework*.

and years in the professional field of a participant, and included the predetermined general categories in the form of multiple choice to provide a context of their work (see questions 11-13 in Appendix D: Online Survey).

The survey was pretested by the thesis supervisors, who is an expert in IA for IM, and was improved based on their feedback. Unfortunately, pilot testing was not possible due to the limited number of participants and the scarcity of information professionals specializing in IA for IM.

4.4.1.2 Follow-Up Interviews

The second data collection method involving humans was the follow-up interview, a research tool "to access people's experiences and their inner perceptions, attitudes, and feelings of reality" (Wildemuth, 2017, p. 239). The results of the surveys were used as a ground for conducting the follow-up interviews providing a deeper exploration of the study topic to answer the research questions.

Stuckey (2013) distinguishes three types of interviews: structured, semi-structured, and narrative. For this research, a semi-structured format of the interview was selected as it provides considerable flexibility in the interview process and, at the same time, valuable insights into various ways an individual understands numerous concepts related to IA for IM. In addition, a semi-structured interview is helpful in clarifying or elaborating on particular topics (Wildemuth, 2017). The follow-up interview guide (see Appendix E: Follow-Up Interview Guide) was examined by one of the thesis supervisors, who is an expert in IA for IM, and thoroughly modified based on the provided recommendations.

4.4.1.3 Job Postings

The third type of data was collected from the most recent job postings of the leading web platforms, such as Linkedin, Monster, Quora, Indeed and Google Jobs, dedicated to job search, professional networking, and expert discussions. The keyword 'information architect' was applied in the search engines of these platforms. To find more sampling units, the researcher included several locations encompassing the following English-speaking countries: Canada (12 sampling units), the USA (32 sampling units), the UK (2 sampling units), and Australia (4 sampling units). The main focus of text sampling was finding current IA job postings related to IM. The job postings collected within the period of October-November 2022 were included into the data sampling. However, the job postings with the same title of information architect but related to the IT sector were later discarded. Nonetheless, some of the job descriptions that could be considered borderline between IM and IT were included in the analysis[11].

4.4.2 Data Collection Procedure

The surveys of information professionals were administered online by means of SurveyMonkey. The survey contained the embedded consent form (see Appendix F: Online Survey Consent Form) as its first page where the topic, objectives, voluntary nature, confidentiality of the research, data security and protection were presented. The survey data were collected between February 2023 and June 2023.

Five survey participants expressed their interest in taking part in the follow-up interview after completing the online survey, and all of them were invited for a 30–45-minute session.

[11] The results of this analysis are described in Chapter 5 *Findings*.

Consent for participation in the follow-up interviews was sent to the participants via email with a link to SurveyMonkey, where the participants were provided with the digital consent form to familiarize themselves and to sign electronically 24 hours before the interview (see Appendix G: Follow-Up Interview Consent Form). The interviews with information professionals were conducted via Zoom or MSN Teams at a time convenient for them between March 2023 and June 2023.

A sample of 50 publicly available job postings was compiled in Word format (see Appendix I: List of Job Postings with Source Codes and URL) from March 2023 to May 2023. The sample consists of 29 documents from LinkedIn, 1 from Quora, 12 from Indeed, 1 from Monster, 7 from Google Jobs.

Thus, the data from this research were collected from multiple sources, such as surveys, follow-up interviews and job postings, to draw valid conclusions and minimize the weaknesses of each data set.

4.5 Data Analysis

Several steps were taken to prepare the data for analysis. First, the surveys were transferred from SurveyMonkey to the institutional cloud storage in Microsoft Word format and then scrubbed for any personally identifying information to preserve the anonymity of the participants. Then the audio data from the follow-up interviews were automatically transformed into the textual format by Zoom or MSN Teams and transferred to the institutional cloud storage in Microsoft Word format. Data were manually edited to correct speech recognition mistakes made by the software. Textual data were changed into non-verbatim transcripts, i.e., the texts excluding all unnecessary speech elements such as fillers or word repetitions to make transcripts more readable without modifying their meaning. All personally identifying information was also

manually removed from the transcribed data retrieved from the audio-recorded interviews. Each interview participant was identified using a code. Finally, the job postings were copied from their sources and pasted into Microsoft Word.

As a result, 21 major data sources were used for analysis (see Appendix H: List of Sources and Source Codes). The assigned source code starting with conventional "S" indicating 'source' followed by a two-digit number (e.g., 01, 02… 15, 16) was applied to each source. Moreover, a separate table of the job postings with the assigned source codes was created (see Appendix I: List of Job Postings with Source Codes and URL). This list reflects the source codes for job platforms with an additional number to identify individual job posting. For example, S17 stands for LinkedIn, and S17-1 represents the source code of the job posting 'Information Architect' found on this platform.

The next step in data analysis was defining the units of analysis. Krippendorff (2004) determines the following types of data collection units:

- *Physical distinctions* are journals, books, documentaries, etc.
- *Syntactical distinctions* can be a word, a phrase, a sentence, a paragraph, a chapter in a book, a headline in a newspaper, a film scene, etc.
- *Categorial distinctions* are members of a class that have something in common. Any sign representation relating to a particular object, event, person, act, country, or idea provides a common reference relying on taxonomies.
- *Propositional distinctions* are such semantically related elements as subject, verb and object deconstructed from complex statements.

- *Thematic distinctions* include the description of a subject or topic of discourse that can be based on motives, needs, goals, instrumental activities, etc., for instance, discourse genres or sexist and racist themes.

In this research, *syntactical distinctions* (Krippendorff, 2004) were chosen as the units of analysis since each concept or idea facilitating answering the research questions were represented with a phrase, sentence, or paragraph (see Table 2: Code Scheme). A more detailed version of the code scheme with examples for each level can be found in Appendix J: Code Scheme.

Table 2. *Code Scheme*

Level 1	Level 2
Content	Concept of IA
	Elements of IA
	Final products and services as the output of IA design
	Methodologies and practices in designing IA
	Tools for designing IA
Context	Culture
	Existing technology
User	Analysis of customers' needs and expectations
Designer	Challenges in the role of information architect
	Education, skills, knowledge and competences required for an information architect
	General duties not directly related to IA
	Professional roles and responsibilities

For example, to answer the question of what IA is, the whole sentence "An information architecture is a foundation for classifying information, built upon metadata, taxonomies and a semantic representation that supports content organization and content search" (S06) was coded as *Content* → *Concept of IA* as all the elements of this sentence relate to the description of one single concept – IA. Another example relates to the question about the IA elements. Since each element can be considered as an individual entry of the code *Content* → *Elements of IA* , such an

answer as “An information architecture includes a metadata schema, taxonomies and a semantic representation of the organization where there are links between metadata elements (e.g., business process and a file plan number)” (S06) is dissected into three code entries: metadata schema; taxonomies; and semantic representation of the organization where there are links between metadata elements (e.g., business process and a file plan number).The third example can be the answer to the question about the challenges an information architect may encounter. When a challenge is described in several sentences, it still can be considered as one conceptual element, although it might reflect a series of cause-and-effect relationships that cannot be broken down into individual effects as the logic might be distorted during the data analysis. For example:

> Another common challenge is clients who wish to directly represent the information architecture functionally in a SharePoint site structure. This relies on users understanding the functional model and navigating to the correct location for content to be adequately managed, which can cause friction when employees don’t think functionally and can't figure out where to store their files. This leads to content governance issues, where content stored incorrectly leads to the inappropriate application of poorly fitting compliance rules. Users, to some degree, tend to think organizationally (e.g., ‘I belong to HR’, and not necessarily, ‘this is the business process I’m engaged with at present’). (S06)

This passage was coded as *Designer → Challenges in the role of information architect* as the main challenge relates to understanding a functional model by users triggering a cascade of effects, such as content governance issues and inappropriate application of compliance rules because users “tend to think organizationally” (S06).

Wildemuth (2017) differentiates two types of content: manifest and latent. *Manifest content* contains salient aspects of text that are explicitly expressed. For example, the occurrence

of a word in a text can be observed and counted. Manifest content can be enhanced by various techniques associated with textual analysis that include syntactic, syntagmatic, and pragmatic aspects of text (White & Marsh, 2006).

Latent content is conceptual and implicit, for example, emotional states that can be inferred from word connotations used in a certain context to evaluate research anxiety among students at the library. Although latent content cannot be directly observed or counted, its characteristics can be measured using manifest indicators (Neuendorf, 2017). *Manifest indicators* can be the words expressing emotional connotations of anxiety in the context of library experience narratives. The rules of inference, *analytical constructs*, facilitating answering the research questions based on the text, are at the center of CA. In the LIS studies, analytical constructs are often presented implicitly, and "the researcher draws conclusions from one independent domain (the texts) to the other (the context)" (White & Marsh, 2006, p. 27). The source of the analytical constructs can be theories and practices, knowledge and experience of experts, and previous research (Krippendorff, 2004, p. 173).

In this study, determining units of analysis relied primarily on textual analysis of manifest content of surveys, interviews and job postings with occasional incorporation of some elements of latent content into the analysis, namely, when the research participants described a situation or problem with some details of their work environment (e.g., their legacy information systems) that could be inferred from the context only or required a clarification.

Surveys, interviews and job postings were analyzed manually and according to standard CA procedures identifying themes and key concepts in iterative rounds of recursive interactions with the data (Krippendorff, 2004; Neuendorf, 2017; Wildemuth, 2017; White & Marsh, 2006). The coding scheme was based on a *directed CA*, involving the codes derived from the conceptual

framework of Morville and Rosenfeld (2006) in combination with a *conventional CA*, entailing the codes derived from data during data analysis (Hsieh & Shannon, 2005). During the analysis, the coding scheme was refined and adjusted depending on the themes that emerged in the data. As Baralt (2011) validly points out, qualitative coding is "a process of delineating the nature of a phenomenon by continuous interaction with and re-reading of the data" (p. 223).

In addition, the *constant comparison* approach (Glaser & Strauss, 1967; Boeije, 2002) to data analysis also assisted in the refinement of emerging categories and relationships as well as in the comparison of new data or patterns with the old ones. Together with the constant comparison approach, the *immersion* and *crystallization methods* (Crabtree & Miller, 2023) were applied. These methods consist of "cycles whereby the analysist immerses into and experiences the text, emerging after extended reflection with intuitive crystallizations, until reportable interpretations are reached" (Crabtree & Miller, 2023, p. n/a[12]). Based on the processes of gathering, reflexivity, interpretation and analysis, this conceptualization style includes data reduction, display, conclusion drawing, and verification throughout the research.

The coding scheme was pretested on 5 survey sampling units (S06-S10), which helped to confirm that it required refinement before proceeding to the analysis of the whole sample. The unit analysis of these samples allowed to adjust the code scheme and create two levels of categorization that were applied to the whole sample. Nonetheless, the ongoing modification of the code scheme took place throughout coding as the processes of constant comparison, immersion and crystallization provided new insights and grounds for schema refinement (see Table 2 and Appendix J: Code Scheme).

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[12] This reference is in digital format that does not indicate page numbers. The citation can be found in Chapter 13 *Immersion/Crystallization Organizing Style of Analysis* of the book.

Only the principal investigator coded data due to resource limitations; intercoder reliability was not conducted. Nonetheless, approximately two months following their interviews, participants were contacted via email to ensure accuracy in interview data transcription and interpretation of their data via a summary of key themes identified in their interview data. They were invited to redact, revise and clarify any sections made in the interview. Participants were afforded two weeks to review their transcript and the summary of the key themes. three interview participants out of five replied and asked to revise some parts of their data, which was addressed by the researcher and helped improve intercoder reliability.

After all transcripts and summaries of key themes were verified and refined by the participants, the coded data were analyzed to answer the research questions and meet its objectives.

4.5.1 Analytical Software

To support the data analysis, a web-based application NVivo was used to organize and analyze research data. Qualitative research based on such data as text, video, audio, images, etc. can be conducted with the assistance of computer-assisted qualitative data analysis software (Baralt, 2011). To analyze various forms of data, including survey and interview data, NVivo has been used in many library and information science studies (Phillips & Lu, 2018). Although there are many advantages in using software for data analysis (Woods et al., 2016), Baralt (2011) validly states that despite the fact that this software is a powerful tool for a researcher, “the human mind is what drives coding decisions and the analysis” (p. 239).

This researcher utilized NVivo to facilitate data management, coding and analysis of large amounts of qualitative data retrieved from surveys, interviews and job postings in the same workspace. NVivo was used to create nodes, i.e., tags or labels that are applied to data to

categorize and group them by means of tree and free nodes. Although the initial coding was based on the conceptual framework adapted from Morville and Rosenfeld (2006), new codes emerged during the analysis.

For data analysis, software was used to identify patterns and themes within the data by implementing the coding tools and exploring the relationships between different data sources to inform the research questions. NVivo's advanced search provides a feature to identify specific keywords or entire passages within its data to determine relevant content and analyze it in more detail. Besides, codes themselves can also be searched, which allows finding all text excerpts or data types with assigned code or multiple codes due to categorial fuzziness. Furthermore, searching among codes greatly facilitates revising and restructuring the code scheme.

Finally, NVivo was also used to support quantitative analysis of qualitative data. The frequency of specific codes across all data sources was identified to provide valuable insights into the distribution and prevalence of different themes in the data.

None of NVivo's visualization tools (e.g., word clouds, charts, graphs, matrix coding, cluster analysis, concept and heat maps) (Labelle, 2021) were used to represent information in the findings, as these features have significant limitations for the purposes of our research. These tools do not allow determining the most frequent IA phenomena but reflect the most frequent words occurring in the text. Nevertheless, cluster analysis and concept maps were useful in the code scheme refinement. All the data visualizations for this research were fulfilled with the help of Excel and PowerPoint.

In sum, NVivo assisted in sorting data and assigning and refining emerging themes and categories for data. It facilitated identifying patterns and themes in the data and exploring

relationships between different concepts and enabled a more transparent examination of the steps taken in the methodological procedure and coding decisions (Baralt, 2011).

4.6 Research Quality

Trustworthiness is an essential component of the research process which should be adequately established at all stages of qualitative research based mostly on interpretation. Lincoln and Guba (1985) propose four criteria to assess the research quality: credibility, dependability, transferability, and confirmability.

Bradley (1993) defines *credibility* as the "adequate representation of the constructions of the social world under study" (p. 436). Lincoln and Guba (1985) offer the following strategies to promote credibility: continuing observation, prolonged stay in the field, triangulation, investigation of negative cases, examination of interpretations in correspondence to data, feedback facilitation from colleagues and confirmation of results with group members. Moreover, the design of transparent coding processes and clear coding procedures are mandatory to ensure credibility as internal validity (Wildemuth, 2017; White & Marsh, 2006).

In this study, data from multiple sources (online surveys, follow-up interviews and job postings) were combined to yield the results. In addition, the researcher iteratively compared the developed and emerging categories to ensure consistency and avoid mutually exclusive categories. The coding scheme (see Appendix J: Code Scheme) represents the exhaustive and mutually exclusive categories providing the likelihood that they were not affected by the researcher's fatigue and subtle changes in conceptualizations of the coding scheme (White & Marsh, 2006). Some of the coding results were shared with five interview participants who were asked to review and refine their interview transcripts and the summary of their key themes. Two

of them provided feedback that enhanced the applied constant comparison (Glaser & Strauss, 1967; Boeije, 2002) and immersion/crystallization methods (Crabtree & Miller, 2023).

Dependability refers to "the coherence of the internal process and the way the researcher accounts for changing conditions in the phenomena" (Bradley, 1993, p. 437), indicating the emphasis on consistency of the research processes via inquiry audit (Lincoln & Guba, 1985). An inquiry audit involves another researcher who can examine the decision path of the research investigator as well as the output of their study. In this regard, although the data, the results, the inferences and the interpretations were thoroughly registered and described in this study, it is unlikely that another researcher would reproduce the same results due to the possibility of subjective interpretation of the data grounded in personal experience and knowledge of the researcher.

Confirmability denotes "the extent to which the characteristics of the data, as posited by the researcher, can be confirmed by others who read or review the research results" (Bradley, 1993, p. 437). It is determined by the internal coherence of the research output: the data, the results, the inferences with interpretations, and the recommendations. In other words, conceptual consistency between the observation of data and the conclusion is determined. Explicit criteria for judging, as well as auditing research procedures and results, are the main strategies to demonstrate confirmability.

In addition, confirmability can be realized through triangulation and reflexivity (Lincoln & Guba, 1985). The conceptual consistency and study results were thoroughly examined and audited by the thesis supervisors. Besides, triangulation and reflexivity also related to research credibility and described earlier in the chapter were applied. To preserve neutrality and avoid any bias in the sample selection (Patten, 2005; Wildemuth, 2017), the data from all the participants

who agreed to contribute to the research were analyzed, which also enhanced the study's confirmability and credibility.

Finally, *transferability,* or external validity, refers "to the extent to which the researcher's working hypothesis about one context applies to another" (Bradley, 1993, p. 436). Thick description is a way to provide sufficient data with extensive descriptions so that scholars can transfer the research results from one context to another (Lincoln & Guba, 1985). Although thick description was applied to describe the data, the results, the inferences and the interpretations, the practice of non-probabilistic sampling was based on the collection of data from a smaller number of people due to the limited availability of information professionals specializing in architecting information systems and the scope of the master's thesis research. Consequently, the research findings are not generalizable.

In sum, despite the study limitations (see Section 4.7), the data collection and analysis can be considered trustworthy, sound, and reliable as it is in alignment with the four criteria for the assessment of the research quality: credibility, dependability, transferability, and confirmability (Lincoln & Guba, 1985).

4.7 Limitations

As Krippendorff (2004) states, any research method has its strengths and weaknesses. This research also has some unavoidable limitations due to its nature and scope as a master's thesis.

First, generalizability of the research findings is not possible as data were collected from a smaller number of people due to the limited availability of information professionals specializing in architecting information systems, a low response rate of prospective participants, and the scope of the master's thesis research. Nonetheless, Sandelowski (1996) points out that small samples are fundamental to this approach to support the depth of qualitative research. Thus, the

human sample size (11 participants) is sufficient to provide meaningful qualitative data. Moreover, the sample size of the textual data is justified by the principle of saturation and pragmatic considerations (Vasileiou et al., 2018) due to the increased nature of content repetitions of the job descriptions and the lack of new codes and concepts emergence.

Second, the reproducibility of this research is limited, which is typical of qualitative research involving non-numeric data. While complete objectivity is rarely attainable in qualitative research, one of the crucial steps to mitigate it in this research was reflexivity that "exposes the inherent subjectivity of research to the sunlight" (Crabtree & Miller, 2023, p. n/a[13]). Reflexivity is an essential constituent of the *immersion* and *crystallization methods* applied to data coding and analysis (Crabtree & Miller, 2023).

Third, errors in the data may occur through the subjects' reactions and interactions in the process of scientific inquiries. These types of errors may relate to the participant's awareness of being tested, the expectations that the researcher brings to the role of a respondent, the effects the researcher may produce on a participant, etc. (Webb et al., 1966). Since these effects are subtle and may be present at the unconscious level, their identification is not possible within the scope of this investigation. It should also be noted that some participants could not fully share their professional activities due to working with classified information in government institutions, which may limit the scope of IM practices and methodologies examined for this research.

Finally, snowball sampling may carry the potential for sampling bias (e,g., non-randomness), compromising the representativeness of the sample as the method relies on existing participants to refer additional individuals. This reliance on referrals may introduce homogeneity

[13] This reference is in digital format that does not indicate page numbers. The citation can be found in Chapter 3 *Reflexivity* of the book.

liming the diversity of viewpoints and experiences in the collected data. Such a lack of heterogeneity may lead to limitations in generalizability of the findings across a wider population (Emerson, 2015). Nevertheless, snowball sampling proves effective in accessing hard-to-reach populations and is particularly well-suited for our exploratory research to understand nuanced perspectives within the specific community of information architects. Additionally, the triangulation technique was employed to enhance the diversity of the data by cross-verifying information from multiple sources.

In conclusion, despite the stated limitations, content analysis, being at the core of this research, is a powerful method that is context sensitive. Therefore, it allows "the researcher to process as data texts that are significant, meaningful, informative, and even representational to others" (Krippendorff, 2004, p. 41).

5 Findings

This chapter 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 experience of the research participants as information architects ranges from 1 year to more than 25 years, with a median experience of 11 years. These statistics indicate the extensive range of knowledge and expertise in IA design among information architects.

Out of 11 research participants, five (45%) possess formal academic training in the field of IA design, i.e., courses offered by an academic institution, and six have professional training in IA design, i.e., courses offered by a professional organization or business. Besides, three of them have both academic and professional training, and three of them do not have any formal training.

Moreover, to obtain informal training in IA design, nine out of 11 research respondents (82%) participated in informational sessions, i.e., minimally or non-participatory sessions such

as webinars, podcasts, and conferences. Eight of them read publications, i.e., information gained by reading books, whitepapers, articles, blogs, or forums. Seven received coaching, i.e., one-on-one or small group mentoring in a professional environment. All of them had their informal training one way or the other, but only fived received all listed types of informal training.

In addition to these data 50 job postings from five professional platforms devoted to job search and expert discussions (see Appendix I: List of Job Postings with Source Codes and URL) were analyzed in terms of the professional roles, responsibilities, knowledge and skills that are expected from the information architect in the current job market.

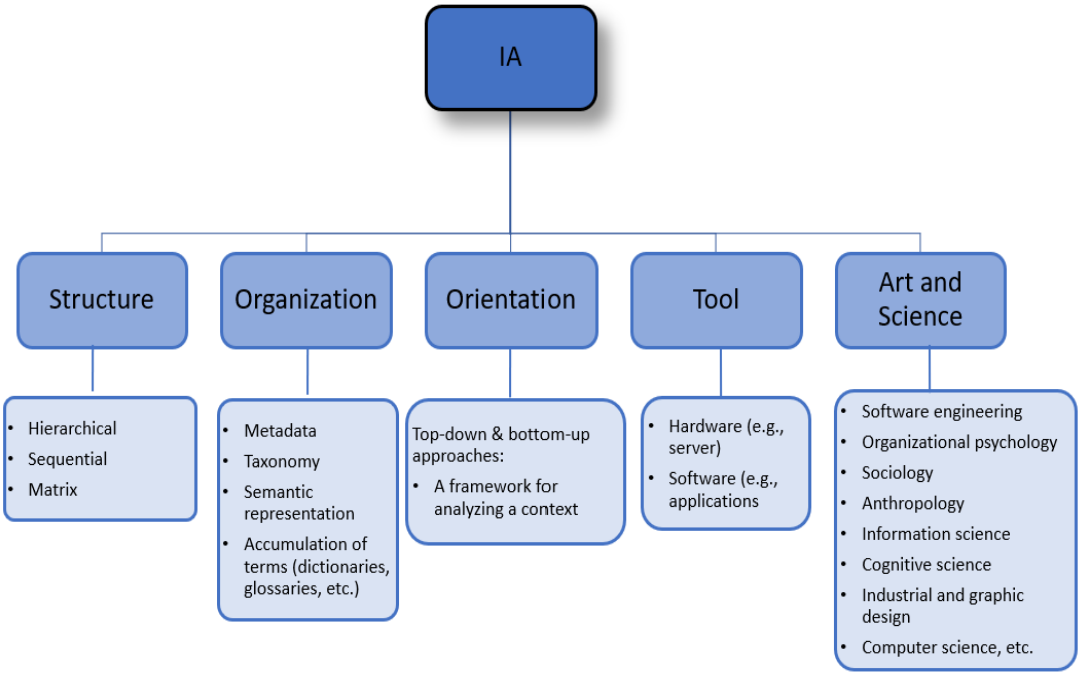
It should be noted that often, there was no consistency in the terminology used to denote IA phenomena, including methodologies and practices in IA design. Moreover, the concepts were sometimes used interchangeably at high and low levels of categorization. Thus, the researcher inferred that some of the terms were used synonymously, or some practices or techniques were part of a broader methodology based on the literature review and the researcher's experience.

The findings are organized into three themes that facilitate answering the research questions: (1) What are IA and its elements? (2) What methodologies, methods and practices are employed to design IA for IM? (3) What education, roles, responsibilities, knowledge and competences are expected from information architects in today's job market?

5.1 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 7)[14].

Figure 7. *The Concept of IA Based on the Aspects Discussed by Almeida et al. (2020) and Morville and Rosenfeld (2006) and Supported by the Data*



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. It can also be represented from the *organizational* perspective focusing on categorizing information into

[14] The concepts of structure, organization, orientation, tool, art and science (Morville & Rosenfeld, 2006; Almeida et al., 2020) presented in Figure 7 are described in detail in Chapter 2. *Literature Review*, Section 2.1. *Information Architecture and Its Definition*.

certain groups by means of metadata, taxonomies, semantic representations, and collections of terms. For example, IA is defined as "a foundation for classifying information, built upon metadata, taxonomies and a semantic representation that supports content organization and content search" (S06) to achieve compliance requirements in accordance with records management and the Access to Information Act and to make information actionable in information systems, for example, Microsoft 365 (S06). Thus, 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 (S14; S15).

In a similar vein, IA is seen as a practice of organizing shared digital environments "by defining the underlying structure of the informational context (often as metadata, taxonomies, and information systems) and enabling information search, discovery, and compliance through information classification and structuring information systems" (S09).

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 (S03; S08). Another bottom-up orientation

perspective includes an accumulation of widely used terms facilitating the management of information resources (S11).

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 (S13). 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 (S13).

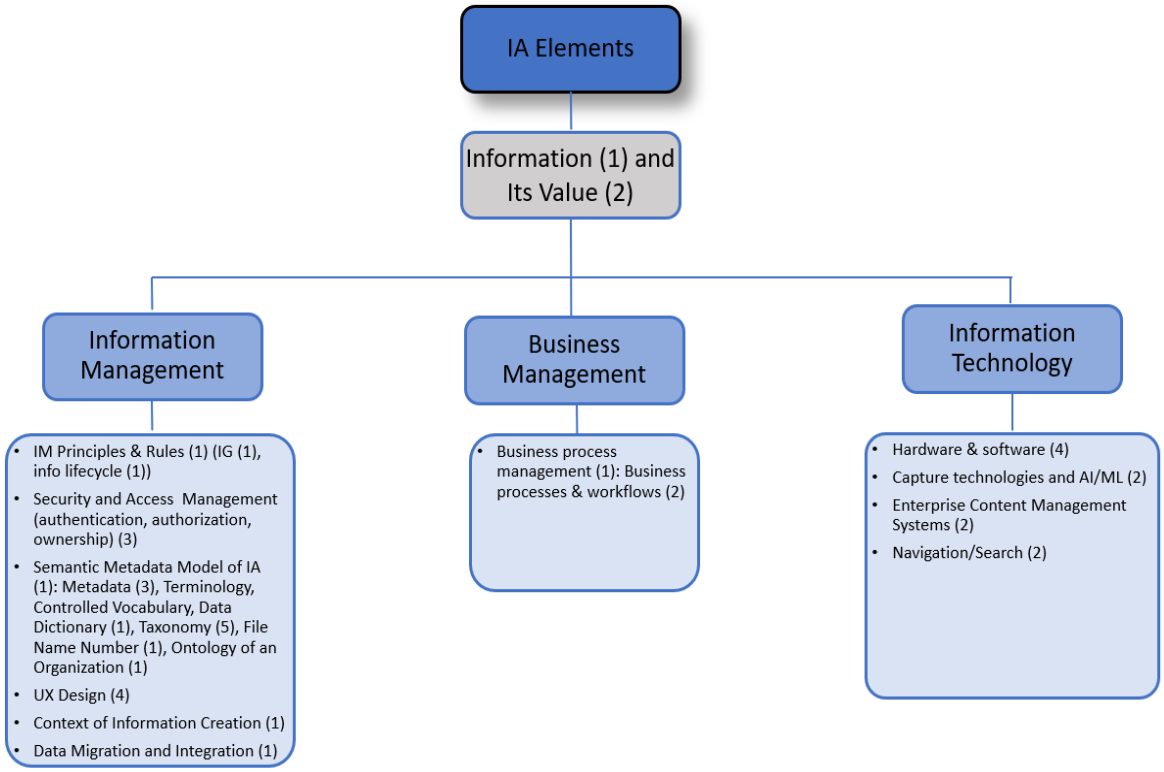
Also, IA is seen from the *art* and *science* perspective and is interpreted as an art and a science to create an IA that is useful, feasible, and valuable (S15). The IA aspect of art and science can include such domains as software engineering, organizational psychology, sociology, anthropology, information science, cognitive science, industrial and graphic design, computer science, etc.

The *elements* or constituent components of the IA concept (see Figure 8) include information and its business value that is "considered for the organization as an asset or as a liability" (S03), as well as the IA elements themselves to create an appropriate IA design through the prisms of information management, business management, and information technology. Figure 8 also shows the frequency of IA elements (indicated in the brackets) mentioned in the survey data for the category "Elements of IA" of the coding scheme.

Thus, from the perspective of *Information Management* (IM), IA requires an understanding of key IM principles and rules, such as information governance and information lifecycle, as well as the context of information creation and usage, including policies and directives of an organization with which IA is to be aligned (S02). For example, "Information architecture

includes elements such as metadata schemes, taxonomies, information lifecycle governance, and information systems design and navigation" (S09) or "…information governance (policy and/or records management) should also be considered" (S15). In addition, access management and an understanding of security that includes user authentication and authorization as well as ownership or accountability for the information are also key elements of IA. A semantic metadata model of IA is then constructed that includes a metadata schema, one of the most frequent IA elements, based on a combination of the business process metadata, the retention metadata and the system metadata to make information more actionable or responsive to business and user needs and to automate the recordkeeping process (S01).

Figure 8. *The Elements of IA and Their Frequency in the Brackets Found in the Survey Data for the Category "Elements of IA" of the Coding Scheme*



Furthermore, a web of interrelated metadata is arranged in accordance with the needs of the organization where an ontology of an organization is an important IA element that can be presented in the form of "a semantic representation of the organization where there are links between metadata elements (e.g., a business process and a file plan number or a business process and organizational units)" (S01). For the construction of a semantic metadata model, along with a taxonomy, the most frequently mentioned IA element is professional terminology and jargon compiled into a controlled vocabulary, data dictionary or data catalog (S01; S11). Moreover, IA includes User Experience (UX) design (S10; S13) and understanding of data migration and integration, i.e., the connection of data, applications and devices (S9).

From the perspective of *Business Management* (BM) and business process management, business processes and workflows are essential IA elements. For instance, the most important IA elements are "taxonomies, user design and business processes" (S07). From the *Information Technology (IT)* perspective, IA also involves information systems design that may include enterprise content management system and navigation/search facilitating the identification of key information and related locations. Specific hardware (e.g., servers) or software (e.g., applications) are utilized to store and access information. Moreover, capture technologies for digitizing paper documents and Artificial Intelligence (AI) with Machine Learning (ML) are applied, requiring the integration of various subsystems into a single functional unit. For example:

> Content repository, database, user interface(s), security\user authentication and authorization, integrations, rules, workflow, capture technologies, and AI\ML at different points. These sets of technologies allow the storage and retrieval of content based on business needs and governance. (S13)

To sum up, IA is described from the perspectives of structure, organization, orientation, tool, and art and science. The IA elements are classified from the perspectives of IM, BM, and 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.

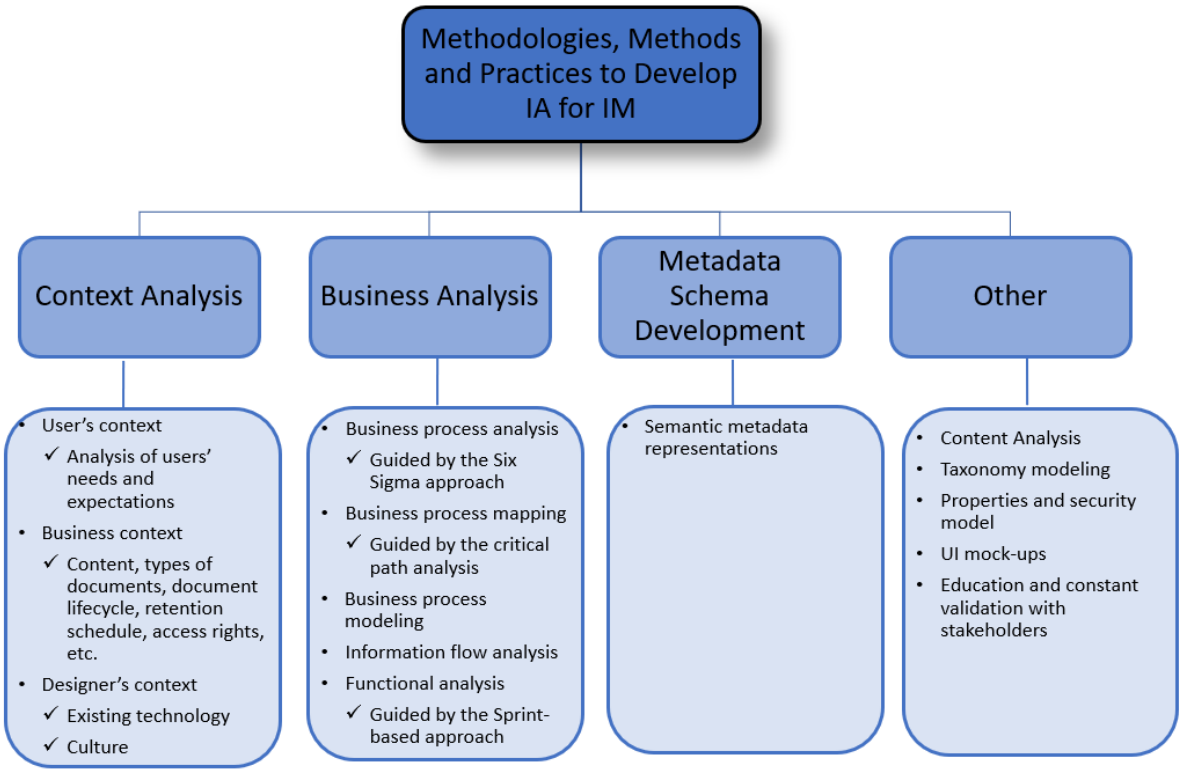
5.2 Methodologies, Methods and Practices to Develop IA for IM

Multiple methodologies, methods and practices were identified via content analysis of the data. It should be noted that each methodology and related methods can be undertaken in various combinations and in a different order, depending on the nature of an IA task and the scale of the project. Thus, these types of methodologies, methods and practices should not be considered as separate categorial entities organized in hierarchical order. For example, context analysis can be found as part of each analysis in Figure 9.

Context analysis is the step in designing IA from which almost any project starts to develop "a situational awareness of what information architecture has been there before" (S02) to try to use whatever is already there.

To understand the *user*'s *context*, first, an IA designer conducts the *analysis of users' needs and expectations*, including the gap analysis of where they are and where they need to be to govern their information properly (S04; S09). Customers' expectations relate to problems such as the inability to find files relying only on keywords or lack of compliance rules, which can be solved by appropriate metadata. If they are primarily interested in "hands-off content classification, there will be much more of a focus on layering automatic classification on top of the information architecture" (S06).

Figure 9. *Methodologies, Methods and Practices to Develop IA for IM Based on the Survey and Interview Data*



Here is another example of the stakeholders' expectations:

> For most federal departments, they want an information architecture that leverages taxonomies with some semantic representation for consistently tagged, consistently retrievable content. There is some level of business metadata that enables users to organize and find their files. The expectation is that the delivered information architecture, represented through a semantic model, will automate the selection of metadata, so it is as easy for users as possible when tagging content. (S06)

However, the user's needs and expectations may not be fully addressed due to the limitations of IT resources or conflict with IM practices and policies, causing the restrictions to the choice of methodologies in IA design (S08). Thus, sometimes the IA designer tries to balance

the needs of the clients with the needs of the IM team, “like building models to align with their individual team or directorate needs, but at a higher level reflect broader information classification for us that would assist with retention and disposition” (S10). Based on the user’s needs and expectations, the project’s scope and the IA methods required to achieve that goal are defined (S09).

To understand the *business context*, the designer analyzes current policies, procedures, and consistency of their implementations. They collect an existing functional classification, mapped business processes, file plans, entity relationships, etc. if available (S02). To collect these data, questionnaires, forms, templates, interviews, and semi-structured interviews with the stakeholders (quite often it is an IT department) can be used to determine their needs and “to consider the processes the employees use when handling information to build a system that works for them” (S12). The initiated research may include questions related to the *content, types of documents, document lifecycle, retention schedule, access rights,* and *target repository,* affecting the variables the designer has to choose from (S03). Based on the collected data, a framework of functional business classification is usually built (S02).

Sometimes, the context of an organization, especially in large organizations, impacts their choice of tools. Such aspects as sharing documents outside the organization, using a vault or repository within the organization, and determining an interface and applications to connect with the main repository of the organization are considered (S03). Moreover, in large organizations like banks, application programming interfaces that bridge the gap between different applications are often reviewed in order to understand where information comes from and the interdependencies between the different systems, as the organization has different database systems (S03).

The *designer's context* of architecting information systems is considered from the perspectives of *existing technology* and *culture*. For instance, some legacy systems with a heavy technical debt could not be appropriate for managing information and data as they do not allow adding a necessary architecture structure, specific metadata, or retention and disposition rules. There could be many systems to manage information and data within one organization, which "makes it difficult to try and map out the entity-relationships as each system has different field labels, retains different metadata, is used differently by each team" (S10). These systems are not integrated, which also creates room for human error (S05). As a research participant states, "We don't currently have one that kind of is all-encompassing, so we don't have a system that really meets the needs for managing our information as well as our data" (S05).

Another example of the context that requires consideration is that in the past, several companies or agencies were merged into one organization; however, their terminology knowledge was lost. The usage of terminology also varies from one team to another. As a result, the designated fields in the information systems could also be used inconsistently or even randomly because there is no appropriate box within the system (S05).

The IA designer also may be working in a chaotic environment involving multiple factors where there is no protocol or procedure on how the IA design can be initiated in the organization. The misconceptions about IA practices among stakeholders may influence the IA designer in their decision-making on what methodologies are to be used due to the imposed restrictive timeframes, which may lead to a sacrifice of work quality (S03). In addition, "culture remains a big impediment to our success – with day-to-day business being so busy from September - March, it's hard to sell people and get buy-in to correct issues that have occurred in the past" (S10). Many research participants point out that they have to consider their business culture as

the executives and employees are reluctant to support and accept change, which is usually required with IA implementation (S12; S14).

The most frequent methodologies and methods employed were business analysis, context analysis, metadata schema development, and content analysis (see Table 3). Being part of *business analysis*, i.e., "the practice of enabling change in an enterprise by defining needs and recommending solutions that deliver value to stakeholders" (International Institute of Business Analysis, 2015, p. 28)[15], *business process analysis* is an approach to analyzing business operation processes to improve business outcomes (IBM, 2021) where business process is "the way that customers are provided value by transforming an input to an output that is not manufacturing-based" (Maleyeff, 2020, p. 205). Business process analysis includes the techniques of business process mapping and modeling. *Business process mapping* is a visual representation of the flow of a business process, reflecting the interconnected activities and interacting departments involved with the process (Maleyeff, 2020). *Business process modeling* is a visual representation of an examined business process and its sub-processes that provides detailed insights into the functioning of the process and associated tasks (Milani, 2019).

Part of business process analysis can be *information flow analysis*, which is "the building and understanding of how information and documents and data moves through your organization and through organization's processes" (S04). It is usually presented as the flow of activities and information in business process maps and business process models (Maleyeff, 2020), visualizing how and where information is generated, by whom it is generated, how it is managed, how it is used within an organization, how it is accessed and what its lifecycle is. So, information flow

[15] The references introduced in the findings pertain to the description of new terms mentioned by research participants and the establishment of their association relations. This is done to facilitate readers in comprehending the text. Some of the references relate to important documents utilized by research participants as IA tools.

describes data and documents generated by processes, units, and other work within the organization (S04).

Table 3. *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

Business process analysis is guided by the *Six Sigma approach* (S14) – "a quality system that seeks to improve the competitiveness of a firm by reducing variations in its processes that cause defective products or unacceptable services" (Maleyeff, 2020, p. 210). It is a collaborative approach to analyze the efficiencies and restraints of a business and to eliminate tasks and resources not providing business value. The Six Sigma framework within which business process analysis is conducted consists of five major steps: Define-Measure-Analyse-Improve-Control (DMAIC) (Maleyeff, 2020; IBM, 2021). Besides, business process mapping can be conducted with the subsequent *Critical Path Analysis* (S11), requiring mapping out all key tasks for successful project completion and including the amount of time necessary for an activity and interdependencies of each activity (Maleyeff, 2020).

In addition, *functional analysis* as a part of business analysis is a widely used methodology for identifying the functions, sub-functions, activities and/or processes supporting the functions to determine record categories and to group the processes to achieve the intended objectives of a business (Weis, 2012). In this regard, the *Sprint-Based Approach* is used "to onboard functional entities of the business" (S15) in a structured and iterative way within certain timeframes or sprints with an emphasis on collaboration, flexibility, and continuous improvement (Magistretti et al., 2020; Hidalgo, 2019). The sprint-based approach also applies to metadata identification, process mapping, and analysis of business processes and their content, where the functional requirements from IM and IT are considered (S15). For example, "a starter IA is created and put forward to a representative of the content creators for their feedback. We iterate with this time-based approach until final sign-off and acceptance" (S15).

Frequently, the designer has an understanding of how businesses work, and the support functions are pretty standardized across businesses (S04). Moreover, for the functional model

development, the Generic Valuation Tools (GVT, 2022) or Information Management Common Core (Treasury Board of Canada Secretariat, 2015) are applied to identify common functions and business processes. The results of functional analysis are validated with the stakeholders as these standards of common functions and business processes may not be organizationally appropriate.

On the other side of the functional model, operational activities are identified based on but not limited to the APQC's Process Classification Framework (PCF, 2022), as there is no similar industry standard for the federal government. Thus, *content analysis* and *content review* of supporting documentation (e.g., an organization's mandate or a parliamentary report) are implemented to identify the operational activities that are also validated by the stakeholders. As a result, an operational functional tree representation is created based on the integration of a standard, for example, PCF (2022), *content analysis* and organizationally specific terminology (see Appendix K: An Example of Functional Decomposition (S01)). Finally, the functional model is validated for accuracy by the stakeholders. From this point, business process analysis can be initiated (S01).

Another frequent practice mentioned by research participants relates to *metadata schema development* or *metadata modeling* that results in a set of metadata descriptions that can be used for IM. Electronic Documents and Records Management Systems (EDRMS) (e.g., SharePoint) are considered in the metadata schema development process as they impact the choice of metadata models. In the context of the Government of Canada (GC), the GC Recordkeeping Metadata Application Profile (GC RKMAP) along with the GC Recordkeeping Metadata Element Set (GC RKMES) are mentioned (S01) as a set of "business rules delineating the use of records management metadata elements declared in the GC Records Management Metadata Standard (GC RMMS)" (GC RKMAP, 2006, p. 1). The GC RKMAP integrates locally defined

GC records management elements with elements from the Dublin Core Metadata Initiative (DCMI) (Dublin Core, n.d.). The Information Management Common Core (Treasury Board of Canada Secretariat, 2015) is an extension of these documents, representing a standard for EDRMS. Thus, "the metadata schema development process was starting with a standard and then customizing it to client requirements through content review and client interviews or stakeholder interviews" (S01), including the multiple iterations with different business units within an organization where the user-centered approach is applied. As a result, metadata are grouped on the basis of their usefulness to the whole organization with mandatory or optional statuses; more business-specific metadata would guide the development of taxonomies for each of those metadata elements. The metadata schema development is also connected to the business process mapping data (S01); this relationship is presented in the matrix of the generic administrative model (see Appendix L: The Matrix of the Generic Administrative Model (S01)) including a depiction of interrelated functions, sub-functions, processes as well as core and specific metadata.

In the context of the metadata schema development, *semantic metadata representations* based on facet relationships were described (S01) (see Appendix M: An Example of Facet Relationships (S01)). They can include the relationship between a business department (e.g., Finance), functions, business processes and a piece of business-specific metadata (e.g., fiscal year).

Metadata schema development is tightly interwoven with *content analysis,* which involves examining examples of organisation's documents to identify relevant metadata (S06) and *taxonomy modeling*, organizing and classifying information to create a structured hierarchy (Baan, 2013). In addition, *properties and security model*, *UI mock-ups*, including working demos

(S13), and *education and constant validation with business stakeholders* (S14) are methodologies, methods and practices identified by participants. Education relates to "change management and training along with demonstrating the "art of the possible in the new platform" (S15).

In summary, 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.

5.2.1 Tools to Design IA for IM

The description of the tools to design IA for IM is based on the major classes of instruments for IA compiled by Kotusev et al. (2022), who emphasize the inconsistent nature of IA instruments in the extant literature. These classes (Kotusev et al., 2022) were significantly modified to describe the collected data (see Table 4).

Table 4. *The List and Frequency of the Tools to Design IA for IM Retrieved from the Survey Data*

Class of Tools to Desing IA for IM	Tools to Design IA for IM	Terminology Synonyms and Relevant Concepts	Number of Occurrences in the Survey Data
Relationship matrices and entity-relationship diagrams	Conceptual data diagrams	Concept maps; data diagrams; visual diagrams; data mapping tools; mind maps; organizational models; conceptual metadata relationship diagrams	9

Class of Tools to Desing IA for IM	Tools to Design IA for IM	Terminology Synonyms and Relevant Concepts	Number of Occurrences in the Survey Data
	Business process maps	Process maps; process models; Business Process Model and Notation (BPMN) process maps; workflow diagrams; change management diagrams	7
	ER diagrams		4
	Metadata schemas	UX metadata structures; Metadata management tools	4
	Taxonomies		3
	Knowledge graphs		1
	Entity lifecycle models		1
Entity, attribute and association definitions, catalogs, dictionaries and glossaries	Business glossary; data catalogs; data dictionaries	Classification of documents and their properties	8
Information standards, rules and guidelines	IM policies, directives and guidelines	IM policies, directives and guidelines; security policies; IM guidelines; directives and policies; IM related policies; information security management guidelines; information governance policies/procedures	7
Information audit tools	Information audit surveys; questionnaires; business analysis elicitation use cases	Surveys	3

The first class of IA tools is *relationship matrices* showing the connection between data entities and other business elements (e.g., entity-to-system, entity-to-function). This class was merged with *entity-relationship diagrams* depicting organization diagrams with data entities, their attributes and relationships. This class is the most representative (29 occurrences), where

the conceptual data diagrams, business process maps, metadata schemas and taxonomies are the most frequent IA tools. In some answers, the Entity-Relationship (ER) diagrams were not specified; hence, their elements are unknown.

An interesting example of an ER diagram was a knowledge graph, which overlaps with ER diagrams and "where we are defining objects, properties and relations and putting that into a structure and then using that as a computational mechanism to inference and understand better the object of study" (S04). A knowledge graph may also incorporate organizational modeling where elements of the organization and individuals in the organization can become nodes. It may also reflect the relationships between people, their roles and business units (S04). Moreover, entity lifecycle models can include, besides a retention and disposition schedule, information resources of business value and the office of primary interest, i.e., who is responsible for the ownership of information (S05).

The second class is *entity, attribute and association definitions, catalogs, dictionaries and glossaries* that provide textual definitions of the logical meaning of data entities, their attributes and relationships. The main IA tools within this class are business glossaries, data catalogs and dictionaries. For instance, "a dictionary is essentially used to explain the content of a metadata schema" (S03). A business glossary serves to review "what already exists, what can sort of be consolidated and what would be the best option to use going forward if we have the opportunity to design the database and the database tables in which this data will live" (S05).

In addition, the classification of documents and their properties where the information about how to find certain data items and how to work with them was mentioned (S13). The second class is also quite representative and includes 8 occurrences in the survey data.

The third class, *information standards, rules and guidelines*, includes documented requirements to manage information within an organization. For example, “In the government, we run on principles, internal and external standards, guidelines and various best practices” (S14). Part of this IM documentation can be information security and information governance policies (7 occurrences).

Finally, the fourth class is *IA audit tools* used to elicit necessary information to design an IA for IM from the users and stakeholders. It includes surveys, questionnaires, and business analysis elicitation use cases (3 occurrences). Information audit surveys are implemented in process analysis and business value document identification. They “might be used to identify the business processes that a specific business unit is involved with and the types of files they produce coming out of those business processes. And then further whether they have any unique metadata requirements” (S01).

To sum up, 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.

5.2.2 Final Products or Services as the Output of IA Design

Similar to the tools to design IA for IM, the final products or services as the output of IA design are relatively in sync with the tools for IA design. Thus, the first three classes of the output of IA design are identical to the tools for IA. They are relationship matrices and entity-

relationship diagrams; entity, attribute and association definitions, catalogs, dictionaries and glossaries; and information standards, rules and guidelines. However, the classification for the output of IA design was modified by excluding the class of information audit tools found in the tools for IA. The final products and services were enhanced by the classes of IT solutions and education and constant validation with stakeholders (see Table 5 and compare it with Table 4).

Overall, metadata schemas, conceptual data model diagrams and taxonomies belonging to the class of *relationship matrices and entity-relationship diagrams* are the most frequent outputs of IA design. In contrast with the tools for IA, business process maps are not a usual final product, which can be explained by the fact that business process maps are used for constructing an IA at the intermediary stage of IA design. Although a metadata schema is the most frequent product output, its complexity may vary dramatically. For instance, it can be presented as "a metadata matrix showing the intersection between metadata elements and different levels in the functional model" (S06). So, a metadata matrix represents "which metadata elements show up in a given classification scenario, usually based on the business process" (S01).

Table 5. *The List and Frequency of the Final Products or Services as the Output of IA Design from the Survey Data*

Class of Final Products and Services as the Output of IA Design	Final Products and Services as the Output of IA Design	Terminology Synonyms and Relevant Concepts	Number of Occurrences in the Survey Data
Relationship matrices and entity-relationship diagrams	Metadata schemas	Metadata scheme; metadata; contextual metadata definitions; metadata structure	6

Class of Final Products and Services as the Output of IA Design	Final Products and Services as the Output of IA Design	Terminology Synonyms and Relevant Concepts	Number of Occurrences in the Survey Data
	Conceptual data model diagrams	Conceptual semantic data model diagrams; conceptual diagrams of the folder structures; configuration diagrams; file plan architecture; data diagram	5
	Taxonomies	Business taxonomy design; taxonomy design	4
	Business process maps		2
	Security model		1
	Classification plans for the EDRMS		1
	Functional models		1
	Semantic spreadsheets		1
	Software integrated data model		1
	Site architecture		1
	Retention schedules and how to apply them		1
	Capture process		1
Entity, attribute and association definitions, catalogs, dictionaries and glossaries	Data dictionaries, controlled vocabularies and information inventories	Information on naming conventions; template design; contextual metadata definitions; content inventory	6
Information standards, rules and guidelines	Policies, best practices and infographics	Information governance	5
IT solutions	Artificial intelligence	Knowledge graphs; machine learning models	4
	IA for SharePoint Online		1
	Content repository		1
	Training		1

Class of Final Products and Services as the Output of IA Design	Final Products and Services as the Output of IA Design	Terminology Synonyms and Relevant Concepts	Number of Occurrences in the Survey Data
Education and constant validation with stakeholders	Reviews and revisits to changes within the organization structure		1

Taxonomies are primarily represented in MS Excel sheets (S06), and conceptual data model diagrams can reflect folder structures (S10) or a file plan architecture (S07). The security models include access control lists for users and groups (S13). Classification plans for Electronic Documents and Records Management Systems (EDRMS) with as many as three levels (S03; S08) are used for information retrieval to facilitate the end user and to group some documents in a folder.

> You will have the geographical scope, you will have one of three business sectors that are allowed to use it or not, and you may have up to three metadata fields that need to be filled out for that particular document (e.g., the date, the location, and the name of the entity that is related to that). (S03)

Semantic spreadsheets show "metadata elements and metadata value links" (S06). A software integrated data model represents a set of relationship matrices and entity-relationship diagrams and is offered as a final product when a company sells taxonomy management and classification software (S06). Retention schedules and how to apply them relate to "which fields represent the detention and from which field you calculate the amount of time the information needs to be kept" (S08). A capture process is "typically modeled to create a baseline of documentation for future changes or issues that may occur later" (S13). Overall, this class accounts for 25 occurrences.

The class of *entity, attribute and association definitions, catalogs, dictionaries and glossaries* is also representative (6 occurrences) and includes data dictionaries, controlled vocabularies and information inventories. The information or content inventory describes the major process and various sub-processes related to the specific business where the following information about each activity can be included: a kind of documentation produced, a security level, the system in which the information is located, the office of primary interest, and the retention period (S05). It should be noted that if an information inventory is represented in the form of a diagram, it can relate to the class of relationship matrices and entity-relationship diagrams. Moreover, the described class includes the contextual metadata definitions that "are related to the business, i.e., critical path analysis to ensure clarity of terms" (S11).

The class of *information standards, rules and guidelines* is also representative (5 occurrences). For example, "through the intranet, they [employees] also have access to best practices, infographics, the information inventories, relevant policies" (S08). Best practices include guidelines on how to manage information and what information is of business value versus what is transitory information, as well as what kinds of documents might appear in different business activities completed (S05). Infographics can be broader than IA and cover security, managing workload, and "best practices related to the use of the systems as well as best organizing your information" (S05). An interesting example of information governance related to information standards and guidelines is also noted.

The class of *IT solutions* (6 occurrences) is represented by AI "supporting information, including identified patterns that may support metadata value selection" (S06) and includes knowledge graphs and machine learning models (S09). It should be noted that knowledge graphs were included in the class of relationship matrices and entity-relationship diagrams when the

data about the tools to design IA was described. This purposeful change in categorization is explained by the shift in the perspectives of tools vs. final products, where knowledge graphs serve for automated processes.

Machine learning models are "basically models that know how to tag elements from the knowledge graph onto information resources in the organization" (S04). Usually, these machine learning models are used for unstructured textual information, although they can be used for images, too (S04). They map input from an information resource into categories of the knowledge graph, and "it is like an index or a mapping from text to knowledge graph entities" (S04).

A content repository as a ready-made database of digital content with a set of data management, search and access methods can also be an output of IA design. IA for SharePoint Online was mentioned in regard to the produced software:

> Our product allows a business user to centrally create the sites, content types, columns, and taxonomy along with several navigational elements and permissions that are published to SharePoint online, creating the infrastructure that users interact with for content creation. … Our product also has a visual report showing all of the structural elements and how they are related, and you can come to an agreement before publishing is done. (S15)

The final class of *education and constant validation with stakeholders* includes such services as training and reviews of changes within the organization structure (2 occurrences). Although this class is not highly representative, it reflects a new aspect in IA design, distinguishing it from the tools to design IA.

To conclude, 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.

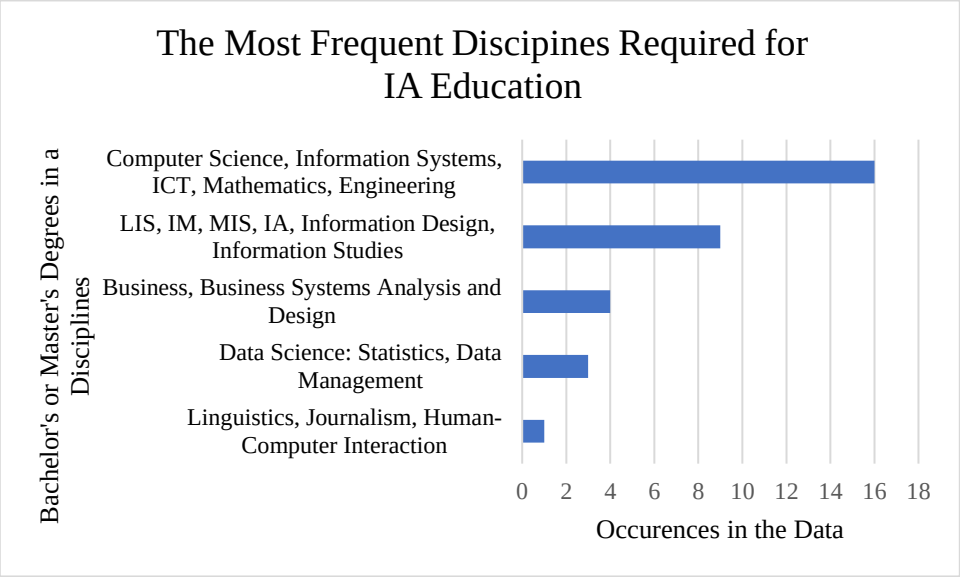
5.3 Information Architect: Education, Roles, Responsibilities, Knowledge, and Skills

A content analysis of 50 job advertisements that included the term 'Information Architect' and which were posted on jobsites in Canada, USA, Australia and UK showed significant variations in their job requirements. Data from the 11 online surveys were also included in this analysis because some of the survey questions were about the professional roles and responsibilities of the research participants, their training as information architects, and their IA tasks.

First, the requirements for *education* of information architects are generally Bachelor's or Master's degrees that relate either to the field of arts or science. The job advertisements that did not mention explicitly the required education fields were excluded from the reported statistics. The postings that mentioned both areas of education, arts and science were counted twice with the reference to both fields. As a result, Figure 10 displays the degree requirements across all occurrences. It shows that technical disciplines are in demand more often.

The technical aspect of education also includes the requirements of additional certifications such as Oracle Certified Professional, Oracle Certified Expert, Microsoft Certified Solution Expert (MCSE), and Cloud Architecture Certification (AWS, GCP, or Azure) (4 occurrences). In addition, Enterprise Architecture and Data Management certifications, such as TOGAF, CEA, BIZBOK , DoDAF, FEAF, CDMP, etc. (5 occurrences) are sought after.

Figure 10. *The Most Frequent Disciplines Required for IA Education*



The experience or expertise required falls into the following business or employment sectors: public sector and government (8 occurrences), health care and pharmaceutical (4 occurrences), finance (2 occurrences), e-commerce (2 occurrences), business and marketing (2 occurrences), as well as energy, electronics, supply chain and manufacturing, and banking (1 occurrence each). For example, “Experience with e-commerce businesses preferred, particularly in B2B Manufacturing or Distribution” (S17-16). The experience years stated in the job postings varied between 1 year for junior positions and 15 years for senior positions, with the most frequent requirement of 5 years (17 occurrences), followed by 10 years (7 occurrences), 3 years (6 occurrences) and 2 years (4 occurrences). The required experience of 1, 4, 6 or 15 years was rarely indicated (1 occurrence for each case).

Descriptions of the *roles* of information architects vary significantly. For example, the described roles can present an information architect as a connecting link between the IT department, stakeholders, Enterprise Architecture experts and strategic business outcomes:

> The Information Architect focuses on the architecture and design of connected enterprise capabilities and solutions that drive business outcomes with thought leadership, innovative approaches, and modern patterns. With that focus, the Information Architect understands the business strategy and partners with senior business leaders, key stakeholders, and technology teams to define the target state of business process flows and solutions that power the customer journey. … The role is accountable for the information architecture governance of strategic applications, ensuring their practical alignment with the information strategy in support of the strategic business outcomes and in partnership with the Enterprise Data Governance Council and Enterprise Architecture. (S17-20)

Moreover, the role of an information architect can be in the organization of information within digital products and websites with the focus on the UI and UX design. For instance,

> The AWS Website team (AWT) is looking for a strategic, results-oriented Information Architect who has the ability to take practical steps to achieve a long-term, cutting-edge vision of information management. The AWT creates and maintains a variety of marketing content, in multiple languages, for both our customers and marketing stakeholders. The ideal candidate will display an uncompromising passion for reducing user effort. They will be results-oriented and have the ability to take practical steps to achieve a long-term, cutting-edge vision. (19-3)

Another role is the creation of conceptual and logical information models using Unified Modeling Language (UML) as described here:

> The Information Architect uses a variety of data-related architecture, modeling, and analysis methods and skills to elicit and elaborate data requirements. The data requirements are interpreted by the information modeler into multiple artifacts, including

> conceptual and logical information models using Unified Modeling Language (UML) class diagrams populated with extensive metadata. (S19-4)

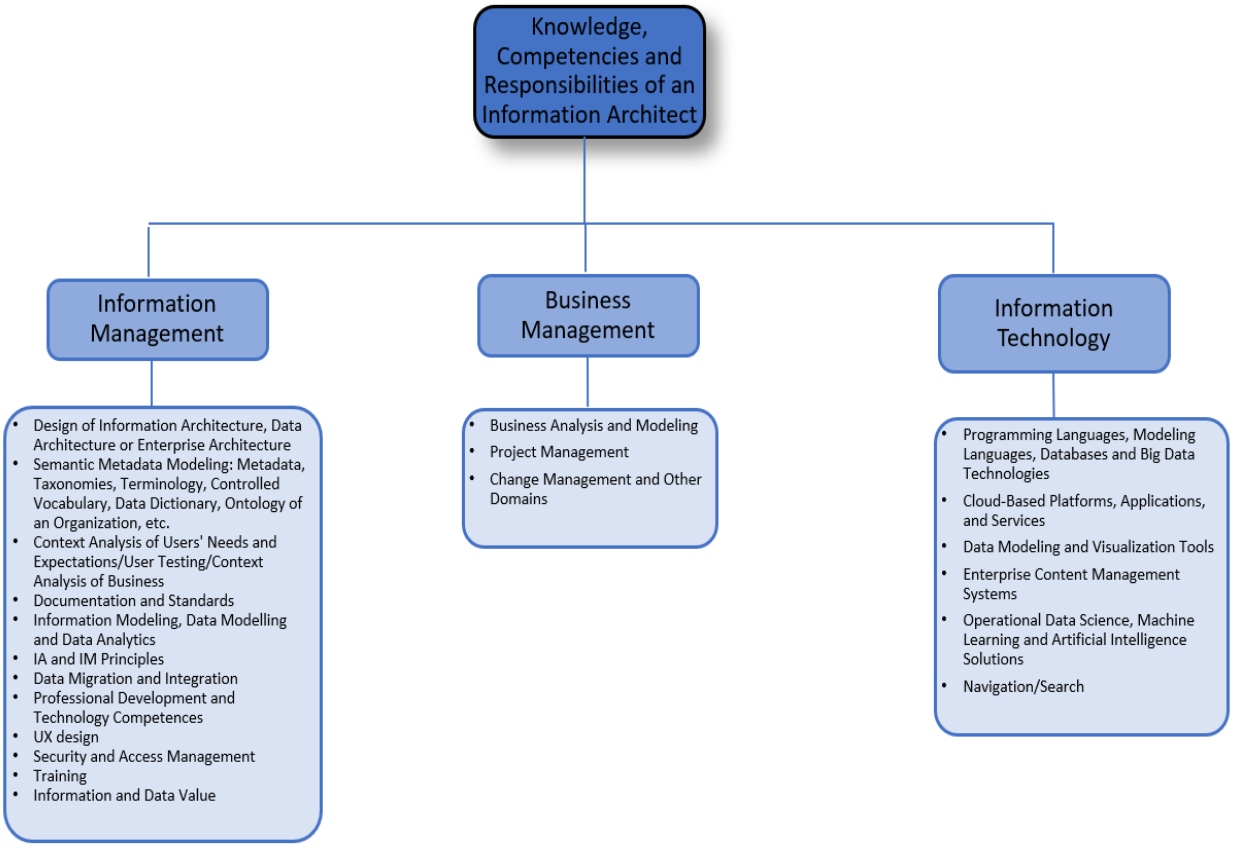
Moreover, frequently, an information architect role can be associated with the knowledge of Enterprise Architecture (EA), which is "a valuable tool to represent and manage IT and business in a holistic way by establishing connections among technology concerns and business, strategical, and motivational aspects (Pérez-Castillo, 2020, p. 1). For example:

> Commercial Information Architect, as part of the Enterprise Information Architecture (EIA) practice, for an individual who will lead the design and governance of information models and architectures, master data, transformation rules, metadata, and data lineage for our global and regional Commercial IT function. … You will work closely with Enterprise/Solution Architects and their teams to ensure Commercial IT solution architectures are built with data centric mind set, integrating Information Architecture crafts into blueprints, enabling data re-use, and supporting lean data designs. ... (S17-26)

These four major roles can be incorporated into the required *knowledge*, *competencies,* and *responsibilities* (see Figure 11). The content analysis of the job postings and online surveys yielded the results that provided a similar but also more detailed version of the findings obtained for the description of IA elements (see Figure 11 and compare it with Figure 8).

The data were organized according to the three major disciplines of Information Management (IM), Business Management (BM) and Information Technology (IT), and these data also contained a wide spectrum of categories, some of which are similar to the categories discovered for IA elements (See Appendix N: Knowledge, Competencies, and Responsibilities Required from an Information Architect Based on the Data from the Job Postings and Surveys).

Figure 11. *Knowledge, Competencies and Responsibilities of an Information Architect*



The examples for each identified category related to the required professional expertise and responsibilities together with the numbers of occurrences are provided in Appendix N. Firstly, within the IM discipline with 13 categories, the most frequent category is 'design of information architecture, data architecture or enterprise architecture'. Importantly, although all the job advertisements contained the keyword 'Information Architect', the required expertise included different types of architectures, namely, IA, data architecture, and enterprise architecture (EA)[16].

[16] The concept of IA is reviewed in Chapter 2.1 *Information Architecture and its Definition* and Chapter 5.1 The *Concept of IA and its Elements*. The concept of Enterprise Architecture (EA) was previously described in this chapter. Since IA and EA were described earlier, only data architecture requires further clarification. It is a tool describing "the conceptual, logical, and physical data assets and how they are stored and managed throughout their lifecycle" (IBM, n.d.).

Although these three concepts require a deeper investigation to identify more detailed differences and similarities, which falls beyond the scope of this research, the way these three notions are used in the job advertisements allows us to assume that the boundaries between these terms are not clearly defined.

In addition, within the IM discipline, the following knowledge, competencies and responsibilities of an information architect are frequently mentioned: 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; information and data governance framework; documentation and standards; and information modeling, data modelling and data analytics. The less frequent categories are IA and IM principles; data migration and integration; professional development and technology competences; UX design; security and access management; training; and information and data value.

Within the BM discipline, only 3 types of knowledge, competencies and responsibilities of an information architect were identified where the categories 'business analysis and modeling' and 'project management' are the most numerous, and the category 'change management and other domains' has just few occurrences.

Finally, within the IT discipline, six categories were identified that can compete with the most frequent categories of the IM disciplines in terms of their occurrences in the data. They are programming languages, modeling languages, databases and big data technologies; cloud-based platforms, applications, and services; and data modeling and visualization tools. Such categories as enterprise content management systems; operational data science, machine learning and artificial intelligence solutions; and navigation/search do not have many instances in the data.

In addition to the requirements for a wide spectrum of knowledge, competences and responsibilities, an information architect is also expected to possess and implement multiple *soft skills* and *personal qualities* to succeed (see Appendix O: Soft Skills and Personal Qualities Required from an Information Architect Based on the Data from the Job Postings and Surveys). Among 19 soft skills and personal qualities, the following are the most frequently described: communication: written and verbal; research, analysis and problem solving; collaboration and teamwork; and leadership. Agility, interpersonal skills, and public speaking/presentation are also often required. Multitasking, mentoring, negotiation, curiosity, intellectual rigor and creativity, complexity tolerance, attention to detail and pattern recognition, business acumen, organization, listening, sharing and transparency, prioritization, and flexibility are important but not frequently mentioned.

Moreover, in the online surveys and follow-up interviews, the research participants indicated a list of *tasks* they consider *not relevant to IA*, but which nevertheless they are required to perform as part of their responsibilities (see Appendix P: Task not Directly Relevant to IA Design Required from an Information Architect Based on the Data from the Online Surveys and Follow-Up Interviews). These include training, documentation and content, technical and software support, project management support, coordination and intervention, reference work, and business analysis and optimization. This suggests that these tasks overlap with the required responsibilities and soft skills analyzed in the data from the job postings described in Appendices N and O but are not considered as directly relevant to IA design by the IA experts.

To sum up, the data indicate that information architects can function as an IA and sometimes as an EA expert as well as a mediator between stakeholders, IT departments and EA experts. Their roles can include the facilitation of the UI and UX design and the creation of conceptual

and logical information models. 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; information and data governance framework; documentation and standards; and information modeling, data modeling and data analytics. 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, communication: written and verbal; research, analysis and problem solving; collaboration and teamwork; and leadership.

6 Discussion

This chapter is organized according to the themes presented in the previous chapter and align with the study's initial research questions of the study. It aims to facilitate the interpretation of the findings and provide insights into possible areas of future research.

All research results were analyzed using the conceptual framework derived from Morville and Rosenfeld (2006), where the most prominent category of *Content*, indicating a structure, permeates the methodologies and practices in IA design. Nevertheless, the categories of *Context*, *User* and *Designer* are also profoundly engrained into architecting information systems as context analysis, analysis of users' needs, and the role of a designer are essential and inseparable components of this evolving domain.

It should be noted that terminological inconsistencies in the collected data and a lack of terminological standardization and harmonization in the field of IA indicate that this domain is still developing and remains in flux. For this reason, making inferences and interpreting the data was quite challenging since various levels of categorization and conceptualization were used by the research participants to describe the same phenomena under investigation.

The interdisciplinarity of IA affects the conceptual apparatus (the set of concepts, theories, ideas and frameworks that are used to discuss a professional domain) information architects operate, as some of this study's data indicates that the research participants lean toward the IT rather than the IM perspective. The same trend is observed in the data from the job postings reflected in a broad spectrum of roles and responsibilities expected from an information architect, which often intersect with such disciplines as IT, data science, and business. Our data showed that only 45% of the participants had formal academic training in IA, which is similar to the research results (48%) described by MacDonald (2013). This means that although IA has its origin in the LIS discipline, its scope has significantly expanded, "leading to an influx of professionals who have diverse disciplinary backgrounds" (MacDonald, 2013: 29).

Nonetheless, after multiple reiterative readings and analyses of the data as well as clarifications from the experts in the IA domain, triangulation of all study data has enabled the construction of a relatively complete picture of the IA concept, its elements, methodologies, methods and practices, as well as the profession of an information architect.

6.1 The Concept of IA and Its Elements

This research data provides insights into the concept of IA and how information professionals understand it. There is no consensus on what IA means, and various perspectives on this concept were provided. Namely, it is understood from the perspectives of structure,

organization, orientation, tool, and art and science. This classification of the IA concept is a synthesis of the IA themes discussed by Almeida et al. (2020) and Morville and Rosenfeld (2006). However, the provided responses from the online surveys and follow-up interviews did not contain examples of all the IA aspects introduced by these scholars. Thus, the examples of such IA aspects as blueprints, coverage, and theory (Almeida et al., 2020) were not identified by participants, which may indicate that information experts are less inclined to perceive IA as an architectural plan, an information space, or a non-existing theory (currently, IA is based on comprehensive empirical evidence only and does not have a theoretical ground). Moreover, our findings about the IA concept support the general agreement described in our literature review that IA is an ambiguous concept with multiple interpretations due to its interdisciplinarity (MacDonald, 2013; Wusteman, 2013; Swope, 2019).

In sync with the interdisciplinary nature of IA design, the IA elements intersect within such disciplines as Information Management (IM), Business Management (BM) and Information Technology (IT), where information of business value plays a significant role. The classification of the IA elements is identical to the list of knowledge, roles, responsibilities, and competencies required from an information architect in the job postings. However, although all the IA elements were found in the job postings, the work descriptions contained a more expanded version of this list and will be discussed later in this chapter.

6.2 Methodologies, Methods and Practices to Develop IA for IM

The methodologies, methods and practices to develop IA for IM revealed in this study data are very similar to the ones described in the literature review; no innovative method has been identified. One of this study's primary research findings not found in the relevant literature is that there are three types of contexts to be considered in IA design: user, business, and designer.

Business analysis, which includes business process analysis, mapping, modeling, information workflow analysis, and functional analysis, was the most frequently mentioned method. Functional analysis can be considered an inseparable part of it; however, it was seldom mentioned in the online surveys and never discussed in the job postings despite the fact that it is thoroughly described in ISO/TR 26122 (ISO, 2008). The research findings also indicate that business functions and processes are quite standardized and backed up by the APQC Process Classification Framework (PCF, 2022). Nevertheless, there is no similar standard for the federal government, which could be the next step in supporting business and functional analyses.

Except for functional analysis, all other methodologies and practices (context analysis, business analysis, metadata schema development, content analysis, taxonomy modeling, properties and security model, UI mock-ups, education, and constant validation with stakeholders) were also listed as job requirements for an information architect.

Another support in IA design, which is currently missing in this area, can be already constructed or pre-made ontologies of some knowledge domains (e.g., a structured representation of concepts, entities, and relationships within the domain of the federal government describing the various aspects of government activities). One of the research participants stated that if ontologies existed, they could and should be integrated into IA design (S01). To assist in incorporating ontologies into IA design, the advances of terminology science, specifically cognitive terminology science, could be implemented.

Another challenge related to the methodologies, methods and practices in developing IA is that they are not well-defined and therefore do not effectively facilitate managing information in the context of complex digital environment (S08). Hence, articulating the standards for IA at the national and international levels becomes a more urgent need in order to facilitate the conceptual

organization of the methodologies, methods and practices in IA design ultimately supporting IM more effectively and efficiently. The theoretical development of the IA domain could also be helpful in integrating IA methods and practices into one holistic and logically organized picture. Currently, there is no agreement in the conceptual structures describing the methodologies and practices in IA design, even among information architects, and this lack of consensus can impede effective communication with IA clients or users.

The following three classes of IA tools proved to be the most representative:

- Relationship matrices and entity-relationship diagrams;
- Entity, attribute and association definitions, catalogs, dictionaries and glossaries;
- Information standards, rules and guidelines.

These findings are consistent with the results by Kotusev et al. (2022). The classification of final products as the output of IA design represents a similar picture to the IA tools where the same three most representative classes have been identified. Nonetheless, the class of information audit tools was not detected as the final output of IA design, which is reasonable as such tools as questionnaires and surveys play a transitional role for the final outputs. The classification for the final products and services in IA design was expanded by the classes of IT solutions and education and constant validation with stakeholders, indicating again the multidisciplinary nature of IA.

One of the innovative findings in the data which relates to the IA tools and final products is the use of knowledge graph as an example of an entity-relationship diagram. The knowledge graph was not encountered in the literature review and in future work, could be employed as a stepping stone for Artificial Intelligence implementation in IM. Further research in that context is

required to investigate how AI is integrated into the practices of architecting information systems.

To conclude, all the described methodologies, methods and practices in creating IA for IM still need multidisciplinary refinement and development to properly address the information governance requirements.

6.3 Information Architect: Education, Roles, Responsibilities, Knowledge and Skills

The complexity and interdisciplinarity of IA design are unavoidably reflected in the profession of information architect, which is itself quite a new IM role in the job market. As a result, the sought after roles and responsibilities of an information architect as articulated in the job postings may lead to confusion and misinterpretation of what this work includes.

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. Moreover, the public sector and government are the major domains where the expertise of an information architect is required.

As a result, a lot of misconceptions and confusion were identified in the diverse spectrum of knowledge and experience expected from an information architect in the job postings compiled by employers. First, the described responsibilities of an information architect are often confused with the duties of a business analyst or an enterprise architect. Secondly, there is no clear differentiation between the concepts of information architecture, data architecture and enterprise architecture, although these three concepts vary significantly in their meanings, and, as a result, they determine different responsibilities related to information modeling, data modeling, and data analytics. Future research comparing these three areas of expertise could be beneficial in identifying what IA, its elements and responsibilities of an information architect are. A precise

differentiation of these interconnected areas could potentially facilitate constructing a more structured organization of the IA domain and mitigating the categorial fuzziness of its elements.

The expected knowledge, competencies and responsibilities of an information architect align with the IA elements discovered in the surveys and interviews. From the IM perspective, the understanding of information value, IM principles and rules, semantic metadata modeling, security and access management, UX design, context of information creation and data migration and integration are at the core of the IA domain and its profession. Nonetheless, the list was expanded to the competencies related to the design of IA, data architecture or enterprise architecture, data governance framework, documentation and standards, information modeling, data modeling, and data analytics, as well as professional development and technology competences, and training. These are new additions to the initial list of IA elements related to IM.

From the BM perspective, besides the business analysis and modeling of business processes, the findings are the required knowledge and expertise in project management and change management. Finally, from the IT perspective, besides knowledge and experience with hardware and software, operational data science, machine learning and artificial intelligence, navigation and search, and enterprise content management systems, the list was enhanced by such findings as programming languages, modeling languages, database and big data technologies, cloud-based platforms, applications, and services as well as data modeling and visualization tools (compare Figures 8 and 11). It should be noted that AI knowledge requirements are present but are not significant, indicating that the requirement for this aspect is just emerging.

Interestingly, research participants indicated that some tasks do not directly relate to the responsibilities of an information architect, whereas these duties are listed as part of

responsibilities in job advertisements. They include the activities associated with the following categories: training; documentation and content; technical and software support; project management support; coordination and intervention; reference work; and business analysis associated with business optimization. This fact indicates that IA is a developing field whose boundaries are not strictly discerned, leading to the fuzziness of understanding the scope of responsibilities among IA experts.

Moreover, the three primary soft skills and personal qualities an information architect is expected to have are written and verbal communication; research, analysis and problem solving; and collaboration and teamwork. Thus, the results of this research can be used for pedagogical purposes and implemented in the curricula for LIS programs. Although the frequency of occurrences cannot be considered a statistical reflection of the IA phenomena, it can be a starting point in selecting the focus of resources in the course outlines, highlighting the most prominent aspects of these findings and addressing the most urgent job market needs.

To conclude, the IA domain is an evolving discipline with multiple inconsistencies in its terminology system, where the concept of IA is still quite ambiguous and can be understood from the perspectives of structure, organization, orientation, tool, and art and science. Although the IA elements intersect with such major disciplines as IM, BM and IT, these data show that the IT perspective in the IA design prevails over the IM perspective in this domain. All methods and practices in the IA design found in this study's data are in line with the ones described in the literature review; however, more details on how they are used in different contexts of business and federal government, as well as the frequency of their occurrences, provide a more detailed and holistic view of these common methods and practices. The analysis and results of education, roles, responsibilities, knowledge and competencies of an information architect provide more

precision on what is expected from this profession in the current job market. Altogether, these findings can be implemented to improve this developing domain, mitigate the fuzziness of its elements and methodologies and provide some pedagogical implications to organize LIS programs and train potential stakeholders.

7 Conclusion

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. 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 within the IG framework. Furthermore, the establishment of IA, grounded in robust recordkeeping practices, is crucial for managing the influx of large volumes of digital information and automating recordkeeping tasks.

The results of this research with the application of content analysis offer a comprehensive perspective on 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.

The study findings indicate that the IA concept is described through the lenses of structure, organization, orientation, tools, and art and science. In sync with the interdisciplinarity of the IA concept, IA elements are categorized within the realms of Information Management (IM), Business Management (BM), and Information Technology (IT) based on the concept of business

value. In the IM domain, prevalent IA elements include taxonomy, metadata, UX design, and security/access management. Meanwhile, in the BM and IT domains, widespread IA elements encompass business processes, workflows, hardware, and software.

Common methodologies, methods and practices for developing IA for IM include business analysis, context analysis, metadata schema development, content analysis, taxonomy modeling, properties and security modeling, UI mock-ups, and education and constant validation with stakeholders. The predominant tools to design IA for IM are relationship matrices and entity-relationship diagrams, with conceptual data diagrams and business process maps being the most frequently used instruments. The most numerous final products and services as the outputs of IA design encompass conceptual data model diagrams, taxonomies, data dictionaries, controlled vocabularies, information inventories, policies, best practices, infographics, and AI applications with knowledge graphs and machine learning models.

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 expected knowledge, competencies and responsibilities of an information architect correspond to the IA elements. From the IM perspective, required professional expertise includes designing information architecture, data architecture, or enterprise architecture, as well as semantic metadata modeling and context analysis of users' needs and business context. The knowledge and expertise in information and data governance framework, documentation and standards, as well as information modeling, data modeling and data analytics, are also in high demand. From the BM perspective, expertise in business analysis, modeling, and project management is highly sought, while the IT perspective demands knowledge of programming languages, databases, big data technologies, cloud-based platforms, applications, services, data

modeling, and visualization tools. Successful information architects are expected to possess various soft skills and personal qualities, including effective verbal and written communication, research, analysis and problem solving, collaboration and teamwork, and leadership.

Thus, 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 LIS programs and training prospective stakeholders. This study can be beneficial for further investigation of several research areas. First, valuable yet currently absent support could come from pre-existing ontologies in certain knowledge domains. 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. Third, further research is required to explore the Information Governance framework and its role in designing IA for effective IM. Finally, additional research is needed to explore the integration of artificial intelligence into the processes of architecting information systems.

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Appendix A: Ethics Certificate 2023

08/02/2023

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	S-01-23-8657
Titre du projet / Project Title	Information Management Practices and Methodologies in Architecting Information Systems
Type de projet / Project Type	Thèse de maîtrise / Master's thesis
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	08/02/2023
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	07/02/2024

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
Tatiana OREL	École des sciences de l'information / School of Information Studies	Chercheur Principal / Principal Investigator
Inge ALBERTS	École des sciences de l'information / School of Information Studies	Superviseur / Supervisor
Mary CAVANAGH	École des sciences de l'information / School of Information Studies	Co-superviseur / Co-supervisor

Conditions spéciales ou commentaires / Special conditions or comments

550, rue Cumberland, pièce 154
Ottawa (Ontario) K1N 6N5 Canada

550 Cumberland Street, Room 154
Ottawa, Ontario K1N 6N5 Canada

613-562-5387 • 613-562-5338 • ethique@uOttawa.ca / ethics@uOttawa.ca
www.recherche.uottawa.ca/deontologie | www.recherche.uottawa.ca/ethics

08/02/2023

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

Le Comité d'éthique de la recherche (CÉR) de l'Université d'Ottawa, opérant conformément à l'*Énoncé de politique des Trois conseils* (2014) et toutes autres lois et tous règlements applicables, a examiné et approuvé la demande d'éthique du projet de recherche ci-nommé.

L'approbation est valide pour la durée indiquée plus haut et est sujette aux conditions énumérées dans la section intitulée "Conditions Spéciales ou Commentaires". Le formulaire « Renouvellement ou Fermeture de Projet » doit être complété quatre semaines avant la date d'échéance indiquée ci-haut afin de demander un renouvellement de cette approbation éthique ou afin de fermer le dossier.

Toutes modifications apportées au projet doivent être approuvées par le CÉR avant leur mise en place, sauf si le participant doit être retiré en raison d'un danger immédiat ou s'il s'agit d'un changement ayant trait à des éléments administratifs ou logistiques du projet. Les chercheurs doivent aviser le CÉR dans les plus brefs délais de tout changement pouvant augmenter le niveau de risque aux participants ou pouvant affecter considérablement le déroulement du projet, rapporter tout évènement imprévu ou indésirable et soumettre toute nouvelle information pouvant nuire à la conduite du projet ou à la sécurité des participants.

The University of Ottawa Research Ethics Board, which operates in accordance with the *Tri-Council Policy Statement* (2014) and other applicable laws and regulations, has examined and approved the ethics application for the above-named research project.

Ethics approval is valid for the period indicated above and is subject to the conditions listed in the section entitled "Special Conditions or Comments". The "Renewal/Project Closure" form must be completedfour weeks before the above-referenced expiry date to request a renewal of this ethics approval or closure of the file.

Any changes made to the project must be approved by the REB before being implemented, except when necessary to remove participants from immediate endangerment or when the modification(s) only pertain to administrative or logistical components of the project. Investigators must also promptly alert the REB of any changes that increase the risk to participant(s), any changes that considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project or the safety of the participant(s).

Name redacted

Responsable d'éthique en recherche / Protocol Officer
Pour/For **Barbara GRAVES** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences sociales et humanités / Social Sciences and Humanities Research Ethics Board**

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Appendix B: Agreement Email

uOttawa
Faculté des arts
Faculty of Arts

Université d'Ottawa | University of Ottawa

École des sciences de l'information | School of Information Studies
http://www.esi.uottawa.ca/ | http://www.sis.uottawa.ca/

Desmarais Building, 11th Floo
55 Laurier Ave. East
Ottawa, ON, Canada
K1N 6N5

AGREEMENT EMAIL

Subject: Participation in a Research Project on Information Architecture for Information Management

Dear [Name of IM Director],

As a follow-up to our earlier discussion, I would like to have the opportunity to provide more detail on my research entitled "*Information Management Practices and Methodologies in Architecting Information Systems*." The purpose of the study is to provide an overview of the current trends in the field of Information Architecture (IA) for Information Management (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.

If you could provide me with this opportunity to conduct my research in your organization, I would contact your administrative assistant to detach your leadership role which may influence potential participants and to ensure the participants freely agree to contribute to this research. I would send your administrative assistant a recruitment invitation email that can be circulated amongst your information professionals engaged in the development of IA for IM or/and having substantial expertise in this area.

The data collection will consist of three steps. First, a link to the online survey will be included into the recruitment invitation email. The surveys of information professionals will be administered online via SurveyMonkey. About 6-15 respondents are anticipated to participate in the survey. It will take about 20-30 minutes to complete the survey, which will be stated in the recruitment invitation email. Then the results of these surveys will be used as a ground for conducting the follow-up interviews guided by a list of open-ended questions reflecting key themes from the survey and addressing the research questions. All the survey respondents who express their interest in participating will be invited to the follow-up interviews. The interviews with information professionals will be conducted via Zoom or MSN Teams at a time convenient for them. Each interview is expected to be about 30-45 minutes in length. Finally, approximately one month after the interview, the participants will be asked to review their interview transcripts and summaries of their data to verify the accuracy of transcription and the interpretation of their data, which might take 20-30 minutes of their time.

Several measures will be undertaken to ensure 1) the participants freely agree to participate, 2) the anonymity of the participant and the organization are respected, 3) the information relating to the participants and the organization is secured. All the data collected during the surveys and interviews will be used by me only. This research is conducted under the supervision of Professor Inge Alberts (ialberts@uottawa.ca) and Professor Mary Cavanagh (mcavanag@uottawa.ca), University of Ottawa.

If you have any questions regarding this research, please do not hesitate to contact me via email or phone.

Thank you in advance for your attention to this request.

Best regards,

Tatiana Orel
Graduate Student, School of Information Studies
University of Ottawa
E-mail: [redacted per instructions]

Appendix C: Recruitment Invitation Email

Université d'Ottawa | University of Ottawa

uOttawa

Faculté des arts
Faculty of Arts

École des sciences de l'information | School of Information Studies

http://www.esi.uottawa.ca/ | http://www.sis.uottawa.ca/

Desmarais Building, 11th Floor
55 Laurier Ave. East
Ottawa, ON, Canada
K1N 6N5

RECRUITEMENT INVITATION EMAIL

Subject: Participation in a Research Project on Information Architecture for Information Management

This email aims to solicit your participation in the research focusing on providing an overview of the current trends in the field of Information Architecture (IA) for Information Management (IM) to support information professionals with a better understanding of its concepts, practices, and methodologies as well as the required knowledge and skills to architect information systems. This Master's thesis research will be conducted by Tatiana Orel, a graduate student at the School of Information Studies of the University of Ottawa, under the supervision of Professor Inge Alberts and Professor Mary Cavanagh, University of Ottawa.

Your participation will consist of filling out an online survey of 20-30 minutes in length. The survey can be followed up by a 30–45-minute interview conducted via Zoom or MSN Teams at the time convenient for you. With your consent, it will be audio recorded. All questions will be related to IA for IM. Finally, approximately one month after the interview, you will be asked to review your interview transcript and a summary of your data to verify the accuracy of transcription and the interpretation of your data, which might take about 20-30 minutes of your time.

Name and position redacted has provided their consent to conduct this research in the organization. As a potential participant, please note you are not obliged to participate in this research. Moreover, you have the right to withdraw from the study, withdraw your data from the study, or withdraw from participation in any data collection activity.

Your participation in this study will contribute to improving methodologies and practices in the information profession and assist in a more nuanced understanding of the main activities involved in modeling information systems. Thus, it will be valuable in preparing future information specialists in the library and information studies programs. Also, participation in this project will give you an opportunity to reflect on your information architecture practices and methodologies as well as your professional activities.

If you are interested in participating, please complete this 20-minute ONLINE SURVEY at your convenience before [Date].

If you have any questions or concerns, please contact the principal investigator, Tatiana Orel, at [redacted per instructions] or their research supervisors Professor Inge Alberts (ialberts@uottawa.ca) and Professor Mary Cavanagh (mcavanag@uottawa.ca).

Thank you in advance for your attention to this request.

Best regards,

Tatiana Orel
Graduate Student, School of Information Studies
University of Ottawa
E-mail: [redacted per instructions]

Appendix D: Online Survey

uOttawa
Faculté des arts
Faculty of Arts

Université d'Ottawa | University of Ottawa
École des sciences de l'information | School of Information Studies
http://www.esi.uottawa.ca/ | http://www.sis.uottawa.ca/

Desmarais Building, 11th Floor
55 Laurier Ave. East
Ottawa, ON, Canada
K1N 6N5

ONLINE SURVEY

Title of the study: **Information Management Practices and Methodologies in Architecting Information Systems**

Principal investigator:
Tatiana Orel
Graduate Student, School of Information Studies
University of Ottawa
E-mail: [redacted per instructions]

QUESTIONS

SECTION A: Content-related questions

1. From your perspective, what is information architecture?
2. In your opinion, what elements does information architecture include?
3. What tools do you use for designing information architecture (e.g., conceptual data diagrams, entity-relationship diagrams, entity definitions and dictionaries, information guidelines, policies, principles, etc.)?
4. What are the challenges you encounter in your role as an information architect?
5. Do you integrate artificial intelligence in your practice of information architecture? If so, how?

SECTION B: Context- and content-related questions

6. What methodologies and practices do you use in designing information architecture (e.g., context analysis, functional analysis, sequential analysis, process mapping, metadata identification, analysis of business processes, activities, transactions, etc.)?

SECTION C: User-related questions

7. What final products or services do your customers receive as the output of your work (e.g., taxonomic design, metadata, conceptual data diagrams, etc.)?

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8. Do you perform any analysis of your customers' needs and expectations? If so, could you please describe your customers' needs and expectations and how you integrate them into information architecture modeling?

SECTION D: Designer-related questions

9. Please describe your professional roles and responsibilities as an information architect.

10. If you perform tasks other than information architecture tasks, what are they (e.g., create content, deliver training, create templates, etc.)?

11. How long have you been an information architect?

12. Do you have any formal information architecture training?
    If yes, please choose all that apply:
    - academic (courses offered by an academic institution)
    - professional (courses offered by a professional organization or business)

13. Do you have any informal information architecture training?
    If yes, please choose all that apply:
    - Informational sessions (minimally or non-participatory sessions, such as webinars, podcasts, and conference sessions)
    - Publications (information gained by reading books, whitepapers, articles, blogs, or forums)
    - Coaching (one-on-one or small group mentoring in a professional environment)

14. What skills characterize a successful information architect? (e.g., pattern recognition, analytical and logical thinking, good communication skills, etc.)

***SECTION E*: Interview Follow-up**

Would you be willing to participate in an online interview of 30-45 minutes with the researcher to follow up on the questions presented here?

Y/N

If yes, please provide your email address for a follow-up contact.

Email addresses will only be used to contact you for the above purposes and will be stored in a location separate from your survey responses.

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You will be contacted and invited to virtual interviews via Zoom or MSN Teams at your convenience.

THANK YOU. COMPLETE AND SUBMIT RESPONSES.

Appendix E: Follow-Up Interview Guide

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FOLLOW-UP INTERVIEW GUIDE

Title of the study: **Information Management Practices and Methodologies in Architecting Information Systems**

Principal investigator:
Tatiana Orel
Graduate Student, School of Information Studies
University of Ottawa
E-mail: [redacted per instructions]

Introduction

- Introduce myself;
- Thank the respondent for agreeing to the interview;
- Review study purpose and goals;
- Explain to the respondent that the follow-up interview is based on their input in the survey;
- Ask if the respondent has any questions about the consent form on SurveyMonkey sent via email 24 hours before the interview so that they could familiarize themselves with its content;
- Answer any questions the respondent might have;
- Tell the respondent to feel free to ask any questions at any moment; that they can end their participation to the interview at any time they wish; to inform them that they may choose not to answer a question;
- Reassure the respondent that there is no "right" or "wrong" answer. The researcher is interested in their experience; they are the expert;
- Ensure the respondent that their signed consent forms will be stored separately from the interview data;
- Invite the respondent to sign the consent form on SurveyMonkey by typing their name in the section *Acceptance*;
- If the respondent would like a copy of this consent form for their own records, they will be invited to print it or save in pdf format.
- Prompt the respondent to press the Submit button on SurveyMonkey;
- Explain the transcript review procedure;
- Inform the respondent that they will be audio recorded.

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Researcher's introduction following formal consent being provided:

I am interested in researching the current trends in the field of information architecture for information management. My purpose is to better understand its concepts, practices, and methodologies as well as the required knowledge and skills to architect information systems. So, I am going to ask you about your professional responsibilities and work activities associated with architecting information systems.
The interview will last about 30-45 minutes. I do not have a formal set of questions but will use a more informal or conversational style of interviewing. At any point in our conversation, you may end your participation or decline to answer a question.
The interview will be recorded to facilitate the analysis of data. All information collected during this interview will remain anonymous and will be treated confidentially. Only the principal investigator will have access to the data.
Please be assured there is no right or wrong answer to the guiding questions. You will have a further opportunity to ask me questions about this research when the interview is ended.
Before I begin, do you have any questions I can answer?

FOLLOW-UP INTERVIEW QUESTIONS

1. Can you please clarify some concepts you used to describe information architecture and its elements?
2. Can you please elaborate on some examples of methodologies and practices you use to develop information architecture for information management?
3. Can you provide some examples of how you integrate artificial intelligence into your practices? What challenges are you encountering in this regard?
4. Let's focus on some knowledge and skills required for the information architect you have mentioned in the survey. Can you please elaborate on how you integrate these skills and knowledge to succeed as an information architect in your organization?
5. Is there anything else you would like to tell me about information architecture and its practices and methodologies?

This concludes my questions for you.

6. Do you have any questions or comments you'd like to add?

Thank you for your time. The information provided during this interview is very important for the success of this research.

Appendix F: Online Survey Consent Form

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ONLINE SURVEY CONSENT

Title of the Study: Information Management Practices and Methodologies in Architecting Information Systems

Principal Investigator:

Tatiana Orel
Graduate Student, School of Information Studies
University of Ottawa
E-mail: [redacted per instructions]

Invitation to Participate in Survey and Consent

You have received an email with a link to this survey from the principal investigator, Tatiana Orel, a graduate student at the School of Information Studies of the University of Ottawa, who conducts this study under the supervision of Dr. Inge Alberts and Dr. Mary Cavanagh, University of Ottawa. Thank you for your interest in participating in this research study.

The **purpose of this study** is to provide an overview of the current trends in the field of Information Architecture for Information Management to support information professionals with a better understanding of its concepts, practices, and methodologies as well as the required knowledge and skills to architect information systems.

Your **participation** in this study will contribute to improving methodologies and practices in the information profession and assist in a more nuanced understanding of the main activities involved in modeling information systems. Thus, it will be valuable in preparing future information specialists in the library and information studies programs. Also, participation in this project will give you an opportunity to reflect on your information architecture practices and methodologies as well as your professional activities.

You will be invited to answer 14 questions related to Information Architecture for Information Management.

It will take **approximately 20-30 minutes** to complete this survey.

There is minimal risk to your participation in this study.

You may **withdraw from participation** at any time without suffering any negative consequences, and you may decline to answer any question.

All information provided will be treated with confidence. Data will be aggregated and anonymized so that an individual cannot be identified by their answers. If a participant is directly quoted, it will be done so anonymously.

Survey data is being collected via SurveyMonkey, a survey tool provided by the University of Ottawa. Survey Monkey is a Canadian-hosted survey solution complying with the *Ontario Freedom of Information and Protection of Privacy Act*. Once downloaded, the account for this project on SurveyMonkey will be deleted. All data will be stored on a password-secured institutionally approved cloud storage MS OneDrive. The information collected will be stored in MS OneDrive for 5 years, and only the principal investigator will have access to the data. All digital data will be securely destroyed by the principal investigator after 5 years, using the deletion procedures within the University's information policy framework (Policy 117) and the central computing facility.

Note: any identifying information will be removed, and **your answers will be anonymized prior to analysis.**

Final Study Results

When completed, the research findings will be reflected in the Master's thesis of the principal investigator, Tatiana Orel, and will be available at the uOttawa library. Also, the researchers will seek to **publish the results of the study**.

If you would like a copy of the research findings, please send a request to Tatiana Orel at [redacted per instructions]

If you have any concerns about your rights as a research subject and/or your experiences while participating in this study, you may contact the principal investigator.

If you have any ethical concerns regarding your participation in this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, 550 Cumberland Street, Room 154, (613) 562-5387 or ethics@uottawa.ca.

If you would like a **copy of this consent form** for your own records, please feel free to print or save it.

By clicking on the link to **BEGIN SURVEY** button, you have provided your consent to participate.

If you decide not to participate, click **EXIT SURVEY**.

Thank you.

Appendix G: Follow-Up Interview Consent Form

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FOLLOW-UP INTERVIEW CONSENT FORM

Title of the Study: *Information Management Practices and Methodologies in Architecting Information Systems*

Invitation to Participate: I am invited to participate in an interview conducted by Tatiana Orel as part of data collection for their Master's thesis research under the supervision of Professor Inge Alberts and Professor Mary Cavanagh, University of Ottawa.

Purpose of the Study: I understand that the purpose of the study is to provide an overview of the current trends in the field of Information Architecture for Information Management to support information professionals with a better understanding of its concepts, practices, and methodologies as well as the required knowledge and skills to architect information systems.

Participation: My participation will consist of participating in an individual interview conducted by Tatiana Orel via Zoom or MSN Teams. The interview will last approximately 30-45 minutes in duration. The session will be audio recorded. I will also be asked to review my interview transcript and summary of my data to verify the accuracy of transcription and the interpretation of my data.

Benefits: Participating in an interview will provide me with the opportunity to contribute to improving methodologies and practices in the information profession and assist in a more nuanced understanding of the main activities involved in modeling information systems. Thus, it will be valuable in preparing future information specialists in the library and information studies programs. Also, participation in this project will give me an opportunity to reflect on my information architecture practices and methodologies as well as my professional activities.

Risks: I understand my participation in this study does not entail any risk that may affect me in my work.

Confidentiality and Anonymity: I have received assurance from the researcher that the information I will share will remain strictly confidential and anonymous. I understand that the content will be used only for research purposes and that my confidentiality and anonymity will be protected. Each research participant will be assigned a number, and only the Principal Investigator (PI), Tatiana Orel, will have the list of participants and the number that has been granted. No information that can identify me in one way or another will be published.

Conservation of Data: The data collected (audio recordings, consent forms, anonymized data) will be kept in a secure manner in the password-secured institutionally approved cloud storage MS OneDrive for a period of 5 years and then disposed of in accordance with the University's Policy 117 Information Classification and Handling.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions without suffering any negative consequences. If I choose to withdraw, all data gathered until the time of withdrawal will be securely destroyed.

Acceptance: I agree to participate in the above research study conducted by Tatiana Orel, Faculty of Arts, School of Information Studies, University of Ottawa. I understand that by accepting to participate, I am in no way waiving my right to withdraw from the study at a later date.

If I have any questions about the study, I may contact Tatiana Orel at [redacted per instructions] or at [redacted per instructions]

If I have any ethical concerns regarding my participation in this study, I may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 55 Cumberland Street, Room 154, Ottawa, ON, KN16N5, Tel: 613-562-5387, E-mail: ethics@uottawa.ca

If you would like a **copy of this consent form** for your own records, please feel free to print or save it.

By clicking on the **SUBMIT** button, you have provided your consent to participate in the interview.

Please enter your name here. _____

Appendix H: List of Sources and Source Codes

Type of Source	Source Code
Interview 1	S01
Interview 2	S02
Interview 3	S03
Interview 4	S04
Interview 5	S05
Survey 1	S06
Survey 2	S07
Survey 3	S08
Survey 4	S09
Survey 5	S10
Survey 6	S11
Survey 7	S12
Survey 8	S13
Survey 9	S14
Survey 10	S15
Survey 11	S16
Job Postings - LinkedIn	S17
Job Postings – Quora	S18
Job Postings – Indeed	S19
Job Postings - Monster	S20
Job Postings – Google Jobs	S21

Appendix I: List of Job Postings with Source Codes and URL

Platform for Job Postings	Source Code of the Platform	Job Title and URL[17]	Source Code of the Job Title
LinkedIn	S17	Information Architect	S17-1
		Senior Information/Content Architect, Docs	S17-2
		Information Architect	S17-3
		Information Architect	S17-4
		Solution Data and Information Architect	S17-5
		Information Architect	S17-6
		Information Architect	S17-7
		Information Architect	S17-8
		Information Architect	S17-9
		Information Architect	S17-10
		Senior Information Architect	S17-11
		Information Architect	S17-12
		Data/Information Architect	S17-13
		Information Architect	S17-14
		Information Architect	S17-15
		Information Architect	S17-16
		Information Architect	S17-17
		Information Management Architect	S17-18
		Information Architect - Senior	S17-19
		Principal Information Architect, IT	S17-20
		Information Architect	S17-21
		Information Architect, IA, UX, Banking	S17-22
		Information Architect	S17-23
		Information Architect	S17-24
		Information Architect/Data Modeler	S17-25
		Commercial Information Architect	S17-26
		Information Architect	S17-27
		Business and Information Architect	S17-28
		Information Architect	S17-29
Quora	S18	Information Architect	S18-1
Indeed	S19	Information Architect	S19-1
		Principal Enterprise Information Architect, Privacy	S19-2

[17] The web addresses are provided for convenience. The links and content may change.

Platform for Job Postings	Source Code of the Platform	Job Title and URL[17]	Source Code of the Job Title
		Content/Information Architect, Amazon Web Services (AWS) Website Team	S19-3
		Information Architect	S19-4
		Information Architect	S19-5
		Information Management Architect	S19-6
		Information Architect	S19-7
		Senior Information Architect	S19-8
		Information Architect Lead	S19-9
		Information Architect	S19-10
		Information Architect	S19-11
		Content Engineer - Information Architect	S19-12
Monster	S20	Information Architect	S20-1
Google Jobs	S21	Information Architect	S21-1
		Information Architect II	S21-2
		Information/Data Architect	S21-3
		Information Architect	S21-4
		Information Architect	S21-5
		Information Architect	S21-6
		Information Architect	S21-7

Appendix J: Code Scheme

Level 1	Level 2	Level 3 (examples)
Content	Concept of IA	"The framework used to store and manage information in a way that makes it accessible and easy to understand by those who access it" (S12).
	Elements of IA	"An information architecture includes a metadata schema, taxonomies and a semantic representation of the organization where there are links between metadata elements (e.g., business process and a file plan number)" (S07).
	Final products and services as the output of IA design	"Metadata schemas, retention schedules and how to apply them (which fields represent the detention and from which field you calculate the amount of time the information needs to be kept), data dictionaries, controlled vocabularies, classification plans for the EDRMS" (S08).
	Methodologies and practices in designing IA	"Functional analysis, process mapping, business process modelling, metadata identification, information flow analysis" (S09).
	Tools for designing IA	"XMind" (S01), "controlled vocabulary" (S03).
Context	Culture	"The biggest challenge is the business culture including support and participation from executive" (S14).
	Existing technology	"So, we're currently in the process of starting a project to migrate towards having one sort of system that kind of offshoots into different parts and through tools available through Microsoft 365. Currently right now we have our own iteration of GC Docs which for the purposes of managing information it does an OK job, and you know we have the ability to create folder structures, limit access, etc." (S05).

Level 1	Level 2	Level 3 (examples)
User	Analysis of customers' needs and expectations	"One of the first steps we perform with a client is to perform an audit of the existing IA practices implemented by a client, including a gap analysis of what they are missing to properly govern their information. We use this to define their needs and align that with any expectations and/or pain points they currently have. From this we define the scope of the project along with the IA methods required to achieve that goal" (S09).
Designer	Challenges in the role of information architect	"I'd say the other thing is I don't know if I put this in my answer, but there's definitely a cultural struggle of emphasizing the importance of information management, especially within an IA" (S10).
	Education, skills, knowledge and competences required for an information architect	"Knowledge and understanding of the 4 main IA system components: organization systems, labeling systems, navigation systems, and searching systems" (S21).
	General duties not directly related to IA	"Training users, providing project management support" (S06).
	Professional roles and responsibilities	"Creation of business information architecture (e.g., conceptual and logical data models and other information analysis artifacts) reflecting business information needs and enterprise representation of data concepts" (S19-4).

Appendix K: An Example of Functional Decomposition (S01)

Level I	Level II	Level III	English Culture	French Culture	Definition
Acquisitions			Acquisitions	Acquisitions	Describes the provision of procurement services from need identification, solicitation and contract management.
	Confirm requirements and approach		Confirm requirements and approach	Confirmer les exigences et l'approche	Describes the approach to the planning and approval process with regards to any legislative, legal or organizational requirements to be considered in the acquistions process.
		Define acquisition requirem	Define acquisition require	Définir les besoins d'approvisionnement	Describes the process of identifying the needs of the requestor to ensure the goods or services being acquired is the best possible for the situation while adhering to a variety of legal frameworks. Developing the business case, the statement of work or the goods specifications, determining the security requirements and seeking approvals for expenditures are the main activities.
		Determine procurement app	Determine procurement approach	Déterminer l'approche de passation des marchés	Describes how goods, a service or construction will be procured, and will include, at the highest level, the decision to proceed competitively or non-competitively and provide applicable details in support of industrial and regional benefits or other national objectives. The strategy could be quite basic, such as the decision to use a standing offer, or could be more detailed, which would be used for major projects. The planning phase involves reviewing the statement of work and determining the method of supply or the sourcing method, and it may also include seeking a variety of approvals or legal advice.
	Manage solicitation activities		Manage solicitation activities	Gérer les activités de sollicitation	Describes the process of defining the evaluation criteria of the bidders, preparing the selection methodology, soliciting bids from suppliers, responding to inquiries, evaluating submitted bids / proposals and determining the successful bidder in accordance with the evaluation and selection methodology.
		Prepare request for proposa	Prepare request for proposal	Préparer demande de soumission	Describes the process in the preparation of documentation of with regards to defining work to be done, requesting proposals, seeking information that is used in the tendering process.
		Evaluate proposals	Evaluate proposals	Évaluer les soumissions	Describes the process of assessing and approving proposals to provide goods or services. Proposals are evaluated against criteria as defined by the organization.
		Prepare and monitor standi	Prepare and monitor standing offer	Préparer et surveiller offre à commandes	Describes the process of documenting the preparation for an invitation to a standing offer and the monitoring of delivery of services after the standing offer has been accepted.

Appendix L: The Matrix of the Generic Administrative Model (S01)

Generic Administrative Model

Function	Sub-Function	Process	Core Facets	Name	Role	Position	Organization	Function	Document Type	Title	Description	Language	Security Classification	Item Status	Date	Program Activity Architecture (PAA)	Business Value	Specific Facets	Agreement Number	Calendar Year	Case Name	Client	Company Name	Court File Number	Drawing ID	Fiscal Year	Geographic Location	Legislation	Occurrence ID	Project Identifier
Human Resources Management				x	x	x	x	x	x	x	x	x	x	x	x	x	x														
	Manage jobs and positions																														
		Develop job descriptions				x																x									
		Coordinate job descriptions				x																x									
		Classify and maintain job descriptions				x																x									
		Manage job or position change				x																x									
	Integrate staff and employees																														
		Confirm resource recruitment approach				x																x									x
		Recruit and select personnel				x																x									x
		Coordinate staffing and employee integration				x									x							x									
	Manage total compensation																														
		Maintain employee compensation information																								x					
		Conduct pay actions																								x					
	Manage employee performance, learning, development and recognition																														
		Assess organizational learning needs				x									x							x									
		Support employee learning and development													x							x									
		Develop performance standards				x									x							x									
		Manage employee performance				x									x							x									
		Facilitate employee recognition and rewards													x							x									
	Manage permanent and temporary separation																														
		Manage permanent separation													x							x									
		Process temporary separation													x							x									
	Conduct workplace management																														
		Manage complaints																			x	x									
		Manage continuous employment																			x	x									
		Manage employee discipline																			x	x									
		Manage grievances																			x	x									
		Manage modified work arrangements													x							x									
		Manage workforce scheduling													x							x									
		Provide occupational health and safety management services													x							x									

Appendix M: An Example of Facet Relationships (S01)

Function	Sub Process		Type of Relationship	Relationships Identified
Finance				
	Manage expenditures and accounts payable			
		Process vendor invoices		Client + Fiscal Year
		Process interdepartmental invoices		Client + Fiscal Year
		Process taxes and tax documentation		Client + Fiscal Year
		Process employee claims and salaries		Client + Company Name + Fiscal Year
	Manage revenues and accounts receivable			
		Process payments		Client + Fiscal Year
		Process interdepartmental payments		Client + Fiscal Year
	Manage credit cards			
		Issue / cancel credit cards		Client + Fiscal Year
		Monitor credit card use		Client + Fiscal Year
	Manage financial allocation and reporting			
		Monitor financial transactions		Client + Fiscal Year
		Manage external reporting		Client + Fiscal Year
		Manage internal reporting		Client + Fiscal Year
		Manage planning, budgeting and forecasting		Client + Fiscal Year

Appendix N: Knowledge, Competencies, and Responsibilities Required from an Information Architect Based on the Data from the Job Postings and Surveys

Categories and Number of Occurrences	Examples from the Obtained Data
Information Management	
Design of Information Architecture, Data Architecture or Enterprise Architecture (49)	"1-3 years of relevant experience related to data architecture and production of comprehensive data/information documentation, including composing data models, modeling guides, and data dictionariess" (19-4); "Plan business and information architecture change needs based on business aspirations and metamodel roadmap. Works with data architects to ensure the data architecture design supports the enterprise information architecture" (S17-28); "Providing project-level data architecture planning, design expertise and execution application on development projects, from technical designs and technology standards to Models and IA considerations" (S17-26); "Develops and maintains the enterprise architecture and capability models in alignment with the overall IT vision, supporting the information needs of the business" (S17-14); "Demonstrated experience creating information architecture deliverables such as site maps, user flows and wireframes. Maintaining global IA spreadsheet and site maps" (S17-7).
Semantic Metadata Modeling: Metadata, Taxonomies, Terminology, Controlled Vocabulary, Data Dictionary, Ontology of an Organization, etc. (39)	"Harmonising our metadata schema, identifying the appropriate retention schedule and how to apply it, documenting metadata schema, building data dictionaries" (S08); "The ideal candidate has seasoned experience in creating functional data models such as taxonomies and attribute/schema definitions including product categories/product filters/product information" (S17-6); "Develop future state content models for websites, including tagging, metadata, and other content standards. Develop site taxonomy and controlled vocabularies" (S21-1) "Analyze keywords and develop SEO-friendly names for categories, product filters, and product information; entity diagrams; Accountable for the alignment and evolution of the AZ information Architecture, Data Model, Taxonomy, Glossary and Ontologies and the application of those models in solution design and implementation in Commercial IT. Data flow design across the enterprise from System of Record to Analytics applications" (S17-26).
Context Analysis of Users' Needs and Expectations/User Testing/Context Analysis of Business (39)	"Demonstrating some experience designing and executing on user research related to IA such as card sorts, tree tests, etc." (S17-7); "Ability to aggregate data across multiple sources to draw conclusions on user behavior, with hands on Google Analytics knowledge" (S21-5); "Do you have experience in a "client-facing" role, leading and facilitating business analysis workshops, such as elicitation, elaboration and modeling of business and clinical information, data/databases, and interfaces? information/data elicitation, elaboration and modeling" (S19-4); "Requirements Analysis: Collaborating with business stakeholders and data users to understand their data needs, business processes, and reporting requirements. This involves gathering requirements, conducting interviews, and analyzing existing systems" (S17-25); "Website heuristic analysis and website audits; Develop and analyze website content inventories" (S17-23); "Ability to facilitate focus groups" (S06).

Categories and Number of Occurrences	Examples from the Obtained Data
Information and Data Governance Framework (39)	"Alignment of long-term and short-term perspectives of situations and product roadmaps; Experience of Information and Data Governance frameworks and their application in a commercial organisation" (S17-26); "IBM Information Governance Catalog for Data Governance" (S19-10); "Researches, develops, implements and maintains information architectural governance frameworks, policies and standards, as approved by management. Ensures integration with related corporate and client cluster policies and standards, and incorporation of best practices in the industry" (S17-19); "Alignment with AstraZeneca's Information Governance regulations and frameworks. Responsible for ensuring compliance and governing ongoing architecture and technology innovation. Responsible for Architectural Governance across all DA disciplines for Commercial IT" (S17-26).
Documentation and Standards (37)	"Documenting data models, data definitions, and data standards to provide clear guidelines for data management. This documentation serves as a reference for developers, data analysts, and other stakeholders" (S17-25); "Develop data management policies and best practices with input from the Data Governance Board. Develop protocols and guidelines for data management, establish goals for data quality improvement, and identify best approaches for resolving data quality issues" (S17-5); "Elaborate Information Architecture practices and standards for how data is created, distributed, migrated, secured, and archived" (S17-8); "Developing and maintaining information architecture documents, including sitemaps, wireframes, and flowcharts" (S17-15); "Define, execute & document enterprise standards, models, and guidelines including metadata architecture and methods for classification (e.g. taxonomies, ontologies, tagging, etc)" (19-7).
Information Modeling, Data Modelling and Data Analytics (34)	"Creating logical and physical data models that represent the structure, relationships, and constraints of the organization's data. This includes designing entity-relationship diagrams, data flow diagrams, and data dictionaries using industry-standard modeling techniques" (S17-25); "Creates conceptual and logical data and information models" (S17-19); "Functional data models. Focus on the Information Architecture and Data Analysis capabilities for Commercial IT. Accountable for the alignment and evolution of the AZ information Architecture, Data Model, Taxonomy, Glossary and Ontologies and the application of those models in solution design and implementation in Commercial IT" (S17-26); "Develop, document, and implement data models and diagrams to provide clear direction to the development teams as well as clear understanding to executive team" (S17-28); "Provide Conceptual information design through data models and entity relationship diagrams and be responsible for logical/physical API designs and reporting/analytical data products by partnering with data modelers, analysts, and engineering partners" (S19-2).

Categories and Number of Occurrences	Examples from the Obtained Data
IA and IM Principles (18)	"Knowledge and understanding of Information Management principles, concepts, policies, and practices" (S19-8); "Advocate and drive adoption of standard methodologies which demonstrates a strong bias for architecture principles balanced with tactical timelines, cost, and risks" (S19-2); "Evaluating both lifecycle and applicability of information resources to position function" (S11).
Data Migration and Integration (15)	"Provide advice in developing and integrating process and information models between business processes to eliminate information and process redundancies" (S17-18); "Experience with continuous integration, unit testing, static analysis, and automated integration tests. Continuous delivery experience preferred" (S19-2); "Collaborating with data integration teams to ensure seamless integration of data from various sources into the organization's databases. This involves mapping data elements and transforming data to conform to the data model" (S17-25); "You'll work tactically with agile teams to design and build cloud-based products, ensuring proper data migration and implementation based on user and ministry needs" (S19-5).
Professional Development and Technology Competences (12)	"Research technical products to become a subject matter expert and apply knowledge across projects" (S17-6); "Provide solution and architectural guidance to the program ensuring awareness of industry trends as a critical input" (S17-8); "Stay up to date with the latest trends and best practices in data architecture, data modeling, and data management" (S17-14); "Creating, evangelizing and maintaining site-wide nomenclature and taxonomic standards for the marketing organization. Evangelizing the need to adopt core information management tools as well as experiment with groundbreaking ideas" (S19-3).
UX design (11)	"Knowledge and experience with UX design methodologies, such as user research, user testing, prototyping, and usability testing" (S17-23); "Collaborating with UX designers to design and refine the user interface and user experience (S17-15) Complete UX Designs to a great standard" (S17-22); "I would say I think those are extremely important skills when we're talking about IA just because within the context of the government, I have experienced that sometimes IA like IM in general kind of comes across as a hindrance rather than like a tool to assist people, but I think it's also because sometimes we lose out on the opportunity to really heighten their user experience and really work with the clients to find out what they want and give them a system that works for them but also works for us. And so, I think that it's especially important to consider the user experience when you're developing an IA and the user interface" (S05).

Categories and Number of Occurrences	Examples from the Obtained Data
Security and Access Management (9)	"Formulating business rules governing use of the data including security and data life cycle management" (S17-5); "Provide organized, consistent, secure and accessible content to those individuals who are empowered with the authority, accountability and decision rights for the proper control and oversight" (S21-6); "Partner closely with Domain and Privacy Architecture to influence designs to ensure integration service layers align to this framework" (S19-2); "Track the source and sensitivity of information, account for its integrity and use as well as support management of its lifecycle" (S16).
Training (7)	"Coach technical writers on content structuring decisions and document best practices" (S17-2); "Develop training materials to assist users in accessing data in the new solution" (S17-5); "Participates in information architecture workshops with other team members, product owners and stakeholders" (S17-19); "Educate the business on how the internal design team can work better" (S17-22); "Provide training and information relevant to GoC policies" (S10).
Information and Data Value (3)	"Foster value creation using the organization's data assets, as well as the external data ecosystem. This includes aiding value creation through data exploitation, envisioning data-enabled strategies, as well as enabling business outcomes through analytics, data governance, and enterprise information policy" (S17-27); "Identify the data assets that are deemed significant to the enterprise, as determined by the business impact, risk mitigation or organizational impact of the information" (S17-5).
Business Management	
Business Analysis and Modeling (21)	"Strong business analysis skills to analyze standard operating procedures and other related documentation and identify data inputs and outputs in business processes" (S19-4); "Specify at a strategic level the business functions and data subjects needed to support future business, thereby enabling the development of an information architecture. Ensure the organisation's business processes and information flows are correctly modelled and that the information architecture to support these is put in place, maintained up to date, aligned to the data management lifecycle and communicated to all levels of management" (S17-21); "Design and development of business capability models, building business process flows, connections, decomposing the events, activities, triggers, actionable items etc. within the business processes, etc. for enterprise information systems, including but not limited to asset management systems, procure to pay lifecycle, facilities management, incident management, configuration management etc; Understands the business strategies and implementation models to represent a view of the business/function/process/domain/department etc." (S21-4).

Categories and Number of Occurrences	Examples from the Obtained Data
Project Management (14)	"5+ years experience with Agile delivery methodologies (i.e., Kanban, Agile, Scrum) and lean design practices" (S17-19); "Experience leading internal technical teams and overseeing vendor technical teams, particularly in data access and modeling" (S17-5); "5+ years professional experience leading and mentoring teams, managing assignments, and organizing schedules" (S17-6); "Helps keep projects running by managing time and inputs needed from other team members, handles timeline or resource issues, shapes strategies, plans for what's next and provides clear communication so all project team members stay informed and know what's needed. Translate project goals into concrete tasks and timelines and present to project leadership" (S17-6).
Change Management and Other Domains (4)	"Change-management principles and methodology" (S17-19); "Experience in Supply Chain, Merchandising etc." (S17-9); "Change Management – foster collaboration cross-functionally; identify and manage impacts to key stakeholders; influence without authority; create alignment to achieve objectives) (S17-16).
Information Technology	
Programming Languages, Modeling Languages, Databases and Big Data Technologies (38)	"Database Design: Translating the logical data model into a physical database design that is optimized for performance, scalability, and data integrity. This includes defining table structures, indexes, and data types while adhering to database management system (DBMS) constraints" (S17-25); "The Information Architect III position requires expertise related to complex software or Web-based programs with direct application to the library or information disseminating setting" (S21-2); "Experience with big data technologies such as Hadoop, Spark, or NoSQL databases" (S17-13); "Proficiency in SQL, data querying, and performance optimization techniques" (S17-25); "Experience and knowledge of big data solutions using Data Lake, Data Warehouse, Data Products. Experience with No SQL and GraphQL technologies" (S17-29); "XML/XSD knowledge" (S21-7) Experience with Big Data, Relational Databases, streaming, and batch data processing (S19-2) "Experience using a modeling tool for UML class diagrams, such as Cameo Enterprise Architect, Rational Software Architect (RSA), Sparx Enterprise Architect, etc." (S19-4) "Familiarity with data warehousing (including data storage, movement, and security) to support developing an optimal physical and semantic data model" (S17-28); "MDM, BI, and data warehouse design & implementation techniques" (S17-4).

Categories and Number of Occurrences	Examples from the Obtained Data
Cloud-Based Platforms, Applications, and Services (24)	"Familiarity with cloud infrastructure technologies like containers, Kubernetes, and serverless computing" (S17-25); "Experience in cloud-built solutions and data solutions; You've worked on complex software development before, preferably on cloud-based or cloud-ready platforms" (S17-17); "Any experience building solutions using elastic architectures (preferably Microsoft Azure and Google Cloud Platform); Oracle including advanced Oracle tools sets (S17-3); "Expertise in Oracle data warehousing technologies, including Oracle Database, Oracle Exadata, and Oracle Business Intelligence" (S17-12); "Experience in designing and implementing data solutions in Azure cloud services, including Azure Data Factory, Azure SQL Database, and Azure Synapse Analytics" (S17-12); "Experience working in distributed/cloud-based environments (e.g., Amazon EC2, GCE, Rackspace, Azure, etc.)" (S19-2).
Data Modeling and Visualization Tools (21)	"SAP Power Designer or other Data Modeler tools like Erwin" (S17-3); "Proficiency in using Data Modeling tools like Erwin, ER Studio and DBT" (S17-25); "Experience using Microsoft Excel to perform basic financial analysis of business processes" (S17-14); "Experience with enterprise architecture repositories and tools (Abacus) Great with MS Word, MS PowerPoint, MS Visio, MS Project" (S21-4); "Experience using Microsoft Visio for process modeling, especially leveraging Business Process Modeling Notation (BPMN) 2.0 industry modeling standards a plus" (S19-4); "Technology skills (MS 365, using taxonomy management software, etc.)" (S06). "Wireframing and prototyping tools such as Sketch, Figma, or Axure" (S17-24); "Creates user flows, wireframes, site maps, mockups, and storyboards" (S20-1); "Success requires an ability to harness user data, team feedback, market research, and emerging digital design trends in developing compelling navigation models, site maps, and transaction flows" (S21-5); "Experience illustrating user flows, building annotated wireframes (web, mobile web, app, email), and prototyping using tools like Sketch, Figma, Zeplin" (S21-5).
Enterprise Content Management Systems (11)	"Experience with key Program ecosystems, platforms, and tools such as JIRA and SharePoint" (S17-5); "Experience testing and reviewing of Functionality, Operability, and Usability of Content Management Systems" (S21-2); "Open Text Content Server (all versions); and M365 SharePoint online Submission requirement" (S19-6); "Experience in SharePoint and SharePoint Online, Microsoft Teams, OneDrive for Business and other collaboration platforms, is desired" (S19-11); "Experience using an enterprise content management system like Drupal is preferred" (S19-12); "My main focus is on our M365 implementation. My main roles are to provide IM requirements to product roll outs in regard to template design, governance" (S14).

Categories and Number of Occurrences	Examples from the Obtained Data
Operational Data Science, Machine Learning and Artificial Intelligence Solutions (6)	"It leads the strategy of and innovation in Data & AI technology for the enterprise, working closely with Enterprise Architecture and Tech Innovation teams" (S21-3); "Experience in areas such as BI, NoSQL, ML/AI, technical documentation" (S19-10); "Some comfort with artificial intelligence in this space is becoming increasingly important" (S06); "I do fundamental research into IA and how it can be improved using AI tools. I also implement AI systems to automate IA tasks" (S09).
Navigation/Search (6)	"Familiar with Search Engine Optimization best practices. Develop website navigation and taxonomy" (S21-1); "Navigational systems for large enterprises. To create the underlying taxonomies, ontologies and metadata models and designs the front-end navigational systems to enable users to easily find the information they need" (S17-1); "Standardize product information for consistency in online navigation menus" (S17-6); "Define and create product filters that help online shoppers navigate and narrow down products from a large selection" (S17-6).

Appendix O: Soft Skills and Personal Qualities Required from an Information Architect Based on the Data from the Job Postings and Surveys

Soft Skills, Personal Qualities and Number of Occurrences	Examples from the Obtained Data
Communication: Written and Verbal (54)	"Highly collaborative, with strong communication skills and ability to convey ideas effectively through different formats, such as detailed documents, user stories, or diagrams; Strong engagement and relationship experience" (S17-8); "Able to communicate instructions in a clear, concise fashion" (S17-16); "Excellent written communication skills to assist in collecting and documenting information models and related content to ensure final product meets or exceeds customer requirements" (S19-4); "Strong verbal and written communication skills, and an ability to break down complex concepts for a non-technical audience using data, words, and visualizations" (19-12); "Communication skills are paramount (you're not going anywhere without being able to convince people, getting your point across, and sometimes just asking the right questions)" (S08); "Salesmanship - information politics is alive and well in most organizations" (S11).
Research, Analysis and Problem Solving (47)	"Perform high caliber qualitative and quantitative analyses" (S17-14); "A keen eye for identifying points of failure, and future-proofing logic" (S17-15); "Thrives when challenged; able to backup viewpoints with facts and achieve compromise" (S17-20); "Makes fact-based decisions. Can clearly define reality, even if it is controversial" (S17-27); "Outstanding analytical and problem-solving skills including conducting research, developing hypotheses, and synthesizing recommendations" (S17-28); "Be capable of researching independently and connecting the dots. Conduct research, identify gaps, and design new solutions" (S17-1); "Complex problem-solving skills with the ability to effectively and succinctly articulate an approach and solution for solving to both business and technology partners" (S17-28); Abstraction (S09); Conceptual thinking (01).

Soft Skills, Personal Qualities and Number of Occurrences	Examples from the Obtained Data
Collaboration and Teamwork (31)	"Collaborate with Enterprise Architecture" (S17-9); "Collaborate with business stakeholders and data analysts to understand the organization's analytical needs and translate them into data architecture requirements" (S17-14); "Working closely with cross-functional teams, such as database administrators, developers, and data analysts, to align data model designs with system requirements. Effective communication and collaboration are essential to ensure data model implementation aligns with business objectives" (S17-25); "Collaborating with the Head of Commercial Information Architecture and their delegate, you will be an active member of the Enterprise Information Architecture Practice, supporting our practice and our team; Be seen as an Information Architect expert and trusted by the extended collaborators within Commercial IT and any related third parties" (S17-26); "Work closely with information architects, process architects, business owners and subject matter experts, and IT architecture and development teams, as needed" (S19-4).
Leadership (26)	"Work with cross-functional teams to identify and solve complex information architecture problems. Demonstrated track record of leading within a sophisticated organization requiring strong influence leader" (S19-2); "Lead client meetings to present solutions, explain our methodologies, and implement client feedback" (S17-6); "Provide technical leadership and guidance to data engineers and developers working on data-related projects" (S17-14); "Ability to drive action through the activity of others in order to reach stated objectives. Also provides team members with constructive feedback relative to performance and personal development. (leadership/developing self and others)" (S17-16); "Leads and or/participates in highly sensitive information architecture investigations. Leads the implementation of the Data and Information Governance Framework for ministry" (S17-19).
Agility (12)	"Process-oriented and accustomed to a start-up pace to projects" (S17-15); "Experience working in environments with aggressive deadlines and production environments" (S17-16); "Be able to work within the CIO organization in an agile environment to design and build a resilient information architecture framework that will support a complex, growing and changing enterprise of 90,000+ employees across the globe" (S17-1); "You'll join an agile team working on digital projects for a government client" (S17-17); "They will be comfortable working in a high change, rapidly growing environment" (S19-3).

Soft Skills, Personal Qualities and Number of Occurrences	Examples from the Obtained Data
Interpersonal skills (11)	"An ability to build rapport with key stakeholders, employees at all levels" (S17-8); "Strong business acumen, relationship building, and superlative communication skills which can tailor messaging for difference audiences, breaking down complex technical issues into business language" (S17-20); "Excellent interpersonal skills to work closely with cross-functional teams" (S19-4).
Public Speaking/Presentation (10)	"Confident in delivering presentations to senior-level executives and technical audiences" (S17-8); "Great verbal communication skills with the ability to present complex technical and metadata information in a clear and concise manner to multiple technical and non-technical audiences" (S17-16); "Feels comfortable presenting technical information to groups" (S21-6); "Strong executive presence, presentation skills, and documentation skills" (S17-28).
Multitasking (6)	"Ability to juggle simultaneous tasks and multiple projects" (S17-6); "Autonomous and comfortable juggling multiple, overlapping and, at times, competing priorities" (S17-15); "Experience with managing multiple parallel streams of work" (S17-19); "Manages multiple assignments at once and has good project management skills" (S20-1).
Mentoring (6)	"Must demonstrate advanced abilities to team and mentor and possess demonstrated excellence in written and verbal communication skills" (S21-4); "Act as a mentor to team members to encourage growth within the team" (S17-6); "Lead design teams, including mentoring and coaching junior designers, facilitating collaboration, and presenting work to stakeholders" (S17-23).
Negotiation (6)	"Strong negotiation skills and a willingness to collaborate and find a middle ground" (19-12); "Leads and or/participates in highly sensitive information architecture investigations" (S17-19); "Diplomacy-ability to balance competing requirements" (S14).
Curiosity, Intellectual Rigor and Creativity (6)	"Willing to experiment with new ways to organize and deliver content online" (S17-15); "Intellectual rigor (basically you need to be self-assured and coherent in your thoughts)" (S08); "Being inquisitive, asking questions, not being afraid if you do not know the exact answer" (S13); "Enables an environment that embraces creativity and innovation" (S17-27); "Passion for new knowledge, resourceful and able to absorb concepts quickly" (S17-28); "Open to learning from others and values views different from own views" (S17-27)

Soft Skills, Personal Qualities and Number of Occurrences	Examples from the Obtained Data
Complexity Tolerance (5)	"Experience working with multiple, diverse technical configurations, technologies, and processing environments in one or more projects of similar size and complexity to BEST (S17-8); "Able to grasp technical concepts, and complex development processes" (S17-15); "Ability to plan and analyze large quantities of complex internet data" (S21-6); "Manage complex projects, including defining project scope, setting timelines, and ensuring on-time delivery" (S17-23).
Attention to Detail and Pattern Recognition (5)	"Effective conceptualization, pattern recognition and teaming skills" (S17-27); "Meticulous attention to detail" (S21-1); "Being detail oriented (a misplaced letter in a metadata schema can break things)" (S08).
Business Acumen (4)	"Solid business acumen, ability to dialogue with Business teams/leadership to understand their priorities/goals, with intense focus on delivering Business value" (S17-19).
Organization (4)	"Prioritizes workload; focuses on completion and is organized" (S17-27).
Listening (3)	"Takes the time to listen for understanding and asks questions to clarify. Encourages others to listen using active listening skills. Listens First" (S17-27); "Listening – interpreting wants and needs into solutions" (S14).
Sharing and Transparency (3)	"Openly shares information. Demonstrates Boundaryless Behavior. Actively participates and openly shares with others – is transparent. Talks Straight" (S17-27).
Prioritization (2)	"Prioritizing skills (some things are critical and cannot be overlooked, you need to concentrate on those, sometimes to the detriment of other deliverables)" (S08); "Priority recognition – understand what's important" (S14).
Flexibility (1)	"The ability to adapt to each solution's needs (don't force an artifact that is not needed)" (S13).

Appendix P: Task not Directly Relevant to IA Design Required from an Information Architect Based on the Data from the Online Surveys and Follow-Up Interviews

Task not Directly Relevant to IA Design and Number of Occurrences	Examples from the Obtained Data
Training (8)	"Creating training material, training users, training other information architects" (S06); "I deliver training on the use of IA systems" (S09); "delivers training on the EDRMS" (S10); "deliver training for the representative user or users of the business unit on the new system. This is a train-the-trainer approach" (S15).
Documentation and Content (6)	"Mostly will be to create policies to support the information architecture" (S07); "Writing directives and policies" (S08); "The governance of information (via policies and practices)" (S09); "Our IA team creates content, such as job aids" (S10); "I'm building a library of SOP'S in addition to my document control work" (S12); "I typically document (create) the requirements document, design documentation, project plan, training material or at least the outline and template" (S13).
Technical and Software Support (3)	"Perform technical support within the system" (S10); "M365 champion" (S14); "Providing information architecture related software support" (S06).
Project Management Support (2)	"Providing project management support" (S06).
Coordination and Intervention (2)	"Coordinating a positioning committee" (S08); "Intervening as a subject matter expert for different agencies of our organization" (S08).
Reference Work (2)	"Doing reference work (my organization has thousands of employees, and I help out a lost, overwhelmed soul pretty much weekly)" (S08); "I know a lot of how things work, because a lot of projects have to go through us in order to make sure it happens. So, I do have people who know my name say, or who have worked with me on a project X, Y, Z. And I have someone message me saying, hey, I'd like to talk to you, because so and so told me about you, and I think that you can help me, and every week there's one or two persons that does that. And I describe it as reference work, but it's not to find information, but it's also to find people with the exact answer to send in the organization" (S03).
Business Analysis and Optimization (2)	"Investigates and analyzes new opportunities, maps business processes" (S10); "Optimising our own processes" (S08).