Ontology requirements elicitation in brazilian public administration: Methodologies and challenges (abstract)

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Abstract

Applied ontology focuses on the practical application of ontological principles in specific domains by creating formal knowledge models for use in computer systems and various fields. In Brazilian public administration, developing domain ontologies is key to improving knowledge management, enhancing system interoperability, establishing standardized vocabularies, and supporting efficient public services and decision-making. Many domains, such as finance, procurement, and document management, are transversal across public administration, requiring coordinated ontology development to standardize and reuse common concepts. Without alignment, ontologies can lead to redundancy, inconsistencies, and data integration issues, affecting service efficiency. Therefore, an interconnected ecosystem of ontologies is essential to meet specific institutional needs while ensuring a unified language for transversal domains. However, challenges arise in eliciting requirements, as domain experts often lack knowledge of ontologies, and ontology engineers are unfamiliar with the represented domains, leading to communication gaps that can hinder the process. ***Research problem:*** The research addresses a significant issue: how to effectively gather and define requirements for constructing an ontology ecosystem that supports interoperability, standardization, and improved decision-making processes? ***Methodology:*** The study employs a qualitative, descriptive, and exploratory methodological approach to understand the dynamics of requirements elicitation in the context of Brazilian public administration. The research involved the creation and application of an Ontology Requirements Specification Document (ORSD), designed to capture information from domain experts about the scope and representation needs of the respective ontology. The ORSD was developed based on a comprehensive literature review of existing ontology engineering methodologies, such as ReBORM, OntoForInfoScience, and NeOn. This document emphasizes the importance of defining functional and non-functional requirements, along with the identification of requirements through competency questions (CQs). Furthermore, a methodology for applying and analyzing ORSD is proposed. This systematic approach to bridge the gap between ontology engineers and domain experts, highlighting the importance of effective communication and collaboration. ***Results and Discussion:*** First, this requirements elicitation methodology included a training phase for analysts and managers to provide a fundamental understanding of basic ontological concepts. Second, the proposed ORSD is structured into key sections that guide ontology development. The *Ontology Purpose section* defines the reason for creating the ontology, outlining its objectives and the problems it addresses. The *Ontology Scope of Coverage section* specifies the knowledge domain and content to be included, while the *Ontology Scope Limitations section* clarifies what is excluded to maintain focus. The *Intended Use of the Ontology* details practical applications, contexts, and beneficiaries, and the *Ontology Users section* identifies key stakeholders, such as government officials, lawyers, and researchers. The *Non-functional Requirements section* outlines quality attributes like performance, scalability, and interoperability, and the *Functional Requirements section* defines capabilities the ontology must support, using competency questions linked to universal or particular

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concepts. Universals are broad categories (e.g., "legal document"), while particulars are specific instances (e.g., "Law Nº 12345 of 2024"). The *Pre-glossary of Terms section* lists relevant terms, their frequency, and definitions based on the domain's competency questions. Finally, the *Knowledge Acquisition Sources section* identifies the main information sources, including books, official documents, databases, and domain experts used in the development of such ontology. These sections provide a comprehensive framework for systematically gathering and organizing the requirements necessary to build an effective and relevant ontology. Third, the requirements elicitation methodology outlines how these requirements can be collected and analyzed to define both the institution's overall ontology ecosystem and the specific scope of each ontology. Collecting ontology requirements began with the distribution of the ORSD domain experts (analysts and managers), who completed it with information about their respective knowledge domains. Analysts provided detailed insights into their areas, while managers reviewed and consolidated the information. After collecting the ORSDs from domain experts, the ontology engineers applied a structured methodology to analyze the 26 completed ORSDs. This process aimed to align the ontology with user needs by identifying commonalities and differences across departmental knowledge domains. It involved four key steps: individual analysis of forms to identify key terms and categorize knowledge types (end, means, transversal, and external), reconciliation of analyses through synthesis meetings to resolve inconsistencies, development of an ontology ecosystem proposal including two reference ontologies and twelve domain ontologies, and iterative feedback-based validation from stakeholders. The result of this analysis was the proposal to develop an ontology ecosystem comprising two reference ontologies and twelve domain ontologies. These reference ontologies provided a fundamental framework, ensuring standardization and consistency across the ontology ecosystem. The twelve domain ontologies captured specific knowledge domains, addressing the unique needs of various departments within the institution. Stakeholder feedback and iteration proved to be a valuable practice throughout this study. Iterative validation and refinement, based on stakeholder feedback, ensured that the final ontologies met the specific needs of the institution's departments. This iterative approach significantly enhanced the quality and relevance of the developed ontology ecosystem. ***Final Considerations:*** This study demonstrates the success of a structured methodology for eliciting ontology requirements within the complex context of Brazilian public administration. The creation and use of the ORSD template facilitated the systematic gathering of information from domain experts, helping to bridge the communication gap between them and the ontology engineers. The study's main strength lies in its interdisciplinary approach, which fostered effective collaboration between domain experts and ontologists, leading to a cohesive and well-structured ontology ecosystem. This methodology not only extends existing literature but also offers a practical framework applicable to other public administration domains.

Keywords

Ontology Requirements Specification, Ontology building methods, Public Administration Ontologies, Ontology Engineering.