The Retrieval of Procedural Information Using the Methodology CommonKADS

The Retrieval of Procedural Information with the Use of the CommonKADS Methodology

José Tadeu Silva[1]

Summary
With the increasing computerization of public administration, administrative processes have followed the trend of electronic management, through systems that allow for faster and more transparent processing, additionally adding greater productivity and efficiency. This movement, virtually irreversible, establishes the necessary conditions for major innovations, as it allows knowledge engineering (CE) techniques to be applied to repositories inexorably formed by large volumes of data, whether for their improvement towards better service to citizens or as support for public servants in decision-making. Through the application at the Brasília Environmental Institute - IBRAM of organizational modeling, proposed by the CommonKADS methodology, this article seeks to analyze the feasibility of developing a knowledge-intensive system capable of assisting in the analysis of environmental licensing processes. The difficulties highlighted demonstrate that the biggest challenges are related to the organization's culture and the complexity of the knowledge involved, which can be worked on gradually with generic functionalities of administrative processes.
Key words: CommonKADS, administrative process, knowledge management, electronic process, SEI

Abstract
With the increasing computerization of public administration, administrative processes have followed the trend of electronic management, through systems that allow its processing faster and more transparent, additionally adding greater productivity and efficiency. This virtually irreversible movement establishes the necessary conditions for major innovations, as it allows knowledge engineering (EC) techniques to be applied to repositories inexorably formed by large volumes of data, either for their improvement towards better citizen service or as a support to public servants in decision making. Through the application at the Instituto Brasília Ambiental - IBRAM of organizational modeling, proposed by the CommonKADS methodology, this article seeks to analyze the feasibility of developing a knowledge-intensive system capable of assisting in the analysis of environmental licensing processes. The difficulties evidenced show that the greatest challenges are related to the culture of the organization and the complexity of the knowledge involved, which can be worked gradually with generic functionalities of administrative processes.
Keywords: CommonKADS, administrative process, knowledge management, electronic process, SEI

1. Introduction

Administrative process is the way in which the Public Administration makes its decisions, whether on the initiative of an individual or on its own initiative. It is the sequence of Administration activities, interconnected and duly documented, which aims to achieve a certain final effect provided for by law. The wave of computerization, upon reaching public administration, initially simply replaced the old typewriters. Administrative processes they continued to follow in paper documents, now edited and printed. Even though it is already a remote phase in In many organizations, folders of these official documents are still physically moved to collect stamps and signatures. In the second phase, in an incipient form, electronic document management platforms proliferate, ensuring greater efficiency and productivity, attesting to an inexorable trend.

When adopting administrative process management systems, public administration most often incorporates valuable resources. The agility obtained with electronic processing, information sharing and structuring

1   Master's student in the Knowledge Engineering program at the Federal University of Santa Catarina,member of the Information Technology Governance and Management Research Group at the UFSC Distance Education Laboratory.*giga ex.tadeu@gmail.com*

of its administrative processes, have been the most common sources of this evolution, even with some loss of interoperability between public systems. The digitalization of administrative processes, or electronic processes, is usually a milestone, as it improves the performance of administration processes, with gains in agility, costs and productivity. In the case of Brazil, the National Electronic Process (PEN) is a joint initiative of bodies and entities from different spheres of public administration to build a public infrastructure for electronic administrative processes. As part of this infrastructure, the Electronic Information System (SEI) was adopted for procedural management.

Even though we are consolidating this phase, it is important to highlight its potential in breaking old paradigms. The storage of procedural information in digital and electronic media opens the doors to a broad revolution in public service, far beyond the archival implications. Since these processes are digital, a structured base of information is necessarily stored in databases, in addition to a variety of attached documents, such as images and files of different extensions, necessary for procedural analyzes and manifestations. In the context discussed, the eventual mining of these repositories can now be done more easily, which allows not only the extraction of knowledge from the processes, but also its use in greater support for users.

Over the past few years, public administrations have been providing systems for electronic processing procedures and files to ensure compliance with regulations and provide public services to citizens. Although each administration provides similar services to its citizens, these systems typically differ from an internal information management perspective as they often come from different products and manufacturers. The common framework that regulations demand and that public administrations must respect when processing electronic files, provides a unique opportunity for the development of intelligent agents in administrative processes (LÓPEZ; GAYO; DE PABLOS, 2018).

Based on the typical complexities of administrative (electronic) environmental licensing processes, This article seeks to identify the organizational context of the Brasília Environmental Institute (IBRAM), processes and knowledge assets and its feasibility for developing a knowledge-intensive system related to the subject, using the CommonKADS methodology as a reference. It seeks to look at the opportunities and solutions that the exploration of such repositories of data, information and files can bring, outlining the contours of a possible third phase of evolution of the theme, where CE acquires a central role.

2. CommonKADS Methodology

In general, the development of a CE project involves teams of professionals such as Knowledge Manager, Project Manager, Engineer, Specialist, System Developer and Knowledge User (SCHREIBER et al., 2001). These professionals, working in an integrated manner, generally have diverse training, involving numerous disciplines. This allows organizations to appropriate their knowledge, eventually dispersed in these knowledge workers, documents and systems, and with it add value to their products and services (ABEL, 2013).

To achieve this objective, modeling knowledge engineering applications involves the use of different methodologies, constituting a reference basis for how several people will work together to achieve an objective. In Knowledge Engineering, the methodology defines the approach in which domain experts and knowledge engineers will build associated projects based on knowledge (AUER; HERRE, 2007).

Among the new methodologies that have been introduced throughout the CE maturation process, the approach is generally the Methodological Pyramid model where, from bottom to top, the blocks formed by the "world view", the "theoretical concepts" are stacked. ", the "methods", the "tools" and the "use", with feedback in the process flowing from one layer to another.

Aligned with this model, the CommonKADS methodology emerged as a result of the need to support CE in creating solutions to organize and distribute knowledge in an organization in a structured way. It has a strong influence from the methodologies used in software engineering, which facilitates the construction of intensive systems

in knowledge. Its technology was developed over many years by several universities and has been used practically throughout the world.

Just like in software engineering, CommonKADS has several features aimed at developing an expert system, such as organizational analysis, project management, knowledge modeling and systems implementation. This method also presents a set of six models that determine what the knowledge management application process should be like, including aspects related to the organization, HR, implementation and interaction of these areas.

CommonKADS is today the most widespread methodology, capable of meeting the most complex knowledge modeling needs. Whether for the development of knowledge-based systems or for applications focused purely on KM in organizations, understanding and appropriately treating the organizational context is a critical success factor for knowledge systems and other knowledge management measures (Pacheco, 2006) .

Adopting three-layer modeling, CONTEXT, CONCEPT and ARTIFACT, CommonKADS expands several existing methodologies:

Fig 1: CommonKADS Methodology Models
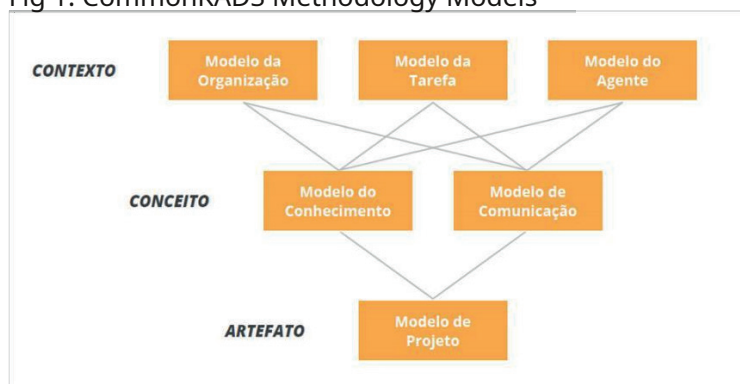
CONTEXT (analysis of the organizational environment): Organization Model - Organization characteristics, problems and opportunities. Task Model - Layout of the global task, resources and skills required. Agent Model - Characteristics of agents, communication links necessary to perform the task. CONCEPT (conceptual description of problem-solving functions): Knowledge Model - Types and structures of knowledge used to perform a task. Communication Model – Modeling the communication transaction between the agents involved. ARTIFACT: Converts other layers into technical specifications for implementing software. Project Model - Based on previous models, it provides the technical specification of the system.

Fig 2: Context analysis in CommonKADS
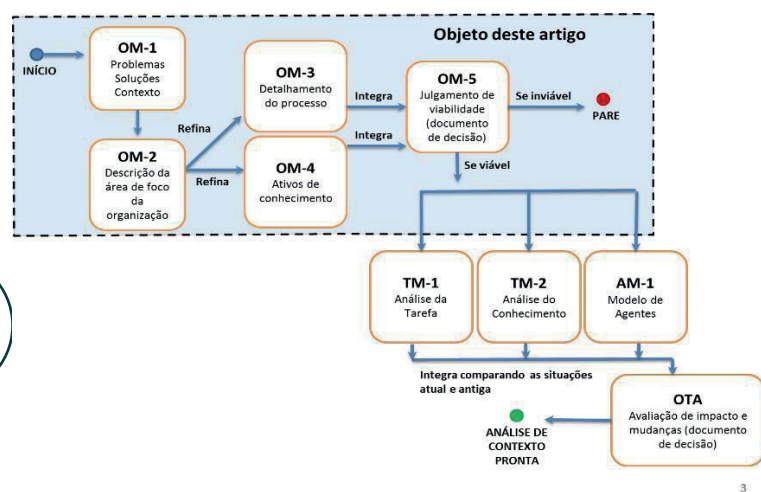
Knowledge systems and their engineering are not entirely unrelated entities to other forms of information and management systems. The CommonKADS methodology, faithful to the interdisciplinarity that permeates the discipline

of CE, "(...) has influences from other methodologies, such as analysis and design of structured systems, object orientation, organizational theory, reengineering process and quality management." (Pacheco, 2006).

CE allows you to identify opportunities and bottlenecks in how organizations develop, distribute and apply knowledge resources, thus providing tools for organizational knowledge management. CE provides the methods to gain a broad understanding of the structures and processes used by knowledge users – even where much of the knowledge is tacit – leading to better integration of information technology in supporting the knowledge worker. CE helps, as a result, to build better knowledge systems: systems that are easier to use, have a well-structured architecture, and are simpler to maintain.

3. Organization Model

With the Organization Modeling proposed in CommonKADS, we created a set of spreadsheets (fig. 2) that record their context, processes and knowledge assets and the feasibility of developing a knowledge-intensive system related to the subject.

3.1. Organization Data

History: The Brasília Environmental Institute – IBRAM - has been in existence for 12 years and is responsible for implementing the Federal District's environmental policy. Among the countless activities developed, the most relevant to society is the licensing of economic activities. Professionals from different specialties participate in environmental licensing processes, responsible for analyzing potential impacts on the environment. From this analysis, mitigation measures, compensation or licensing are denied.

Branch: Public Sector – Environment.

Employees: Approximately 500.

3.2. Knowledge System Identification

What: Recovery of knowledge in the analysis of electronic environmental licensing processes, available at SEI – Electronic Information System, part of PEN.

What for: To ensure legal compliance, coherence and greater productivity.

Why: To avoid delays in analyzing new processes and reducing errors, which negatively impacts the granting of licenses to new economic ventures.

Where: IBRAM's core areas, particularly the Environmental Licensing Superintendence.

When: First half of 2022

How: Proposing the recovery of information from electronic processes using techniques such as KDD or KDT.

3.3. Papers and Artifacts

Knowledge specialists: Environmental analysts responsible for each group of economic activity (Directors).

System user: Environmental analysts responsible for analyzing each process. System developer: Software Factory.

Knowledge manager: Consulting company.

3.4. Organizational Analysis

Tasks: Documentation analysis, inspections, environmental impact assessment, opinions, licensing; Agents: Environmental analysts (biologists, veterinarians, agronomists, geographers, forestry engineers, environmental engineers and administrators);

Identification of the type of knowledge between tasks and agents: Codified knowledge (composed of specific standards for each economic activity and scientific knowledge in each area of   knowledge involved);

Mechanisms for reusing recurring problems: Environmental legislation, ABNT standards, normative instructions, analysis of previous similar processes.

3.5. OM-1 Worksheet: Identifying knowledge-driven problems and opportunities in the organization:

| Organization model	OM-1 Problems and Opportunities Worksheet
PROBLEMS AND OPPORTUNITIES	Perceived problems and opportunities: Slowness in analyzing licensing processes, with each study necessary environment, starting without reviewing previous studies. With the use of the SEI, the implementation of the electronic process opens up the possibility of retrieving environmental information on demand.
Key features of the organizational context:	- Con- fundamental concepts: Mission: Ensure protection and sustainable use of the environment
ORGANIZATIONAL CONTEXT	Values: Coherence, Innovation, Transparency, Ethics, Technical excellence, Effectiveness and Credibility. Human resources with high training and a reasonable quantity to carry out tasks. Tight budget, but with chances of being optimized via budget reallocation.
Important external factors that the organization must deal with:	- Pres- political and business processes for approving projects. - Huh - need to boost the economy of the Federal District, to increase revenue. Demands from civil society to maintain quality of life.
Organization strategy	- Prepare- Create and implement a Cost Reduction and Efficiency program, Increase Revenue, standardize procedures, standardize Licensing Systems, Inspection, Environmental Monitoring, Conservation Units and Protected Areas, Fauna, Flora, Rural Environmental Registry and Environmental Recovery . Integrate all sectors of IBRAM in joint action for environmental licensing. Establish procedures for the production, organization and dissemination of environmental information within the scope of the Institute. Review internal procedures, improving flows and routines, modernizing processes and establishing bases for automation.
SOLUTIONS	Possible solutions to perceived problems and opportunities: Rescue of environmental information and procedures adopted in previous administrative processes, through techniques such as KDT on the SEI electronic document repository.

3.6. OM-2 Worksheet: Description of organizational aspects that have an impact on and/or are affected by chosen knowledge solutions:

OM-2 Organization Chart
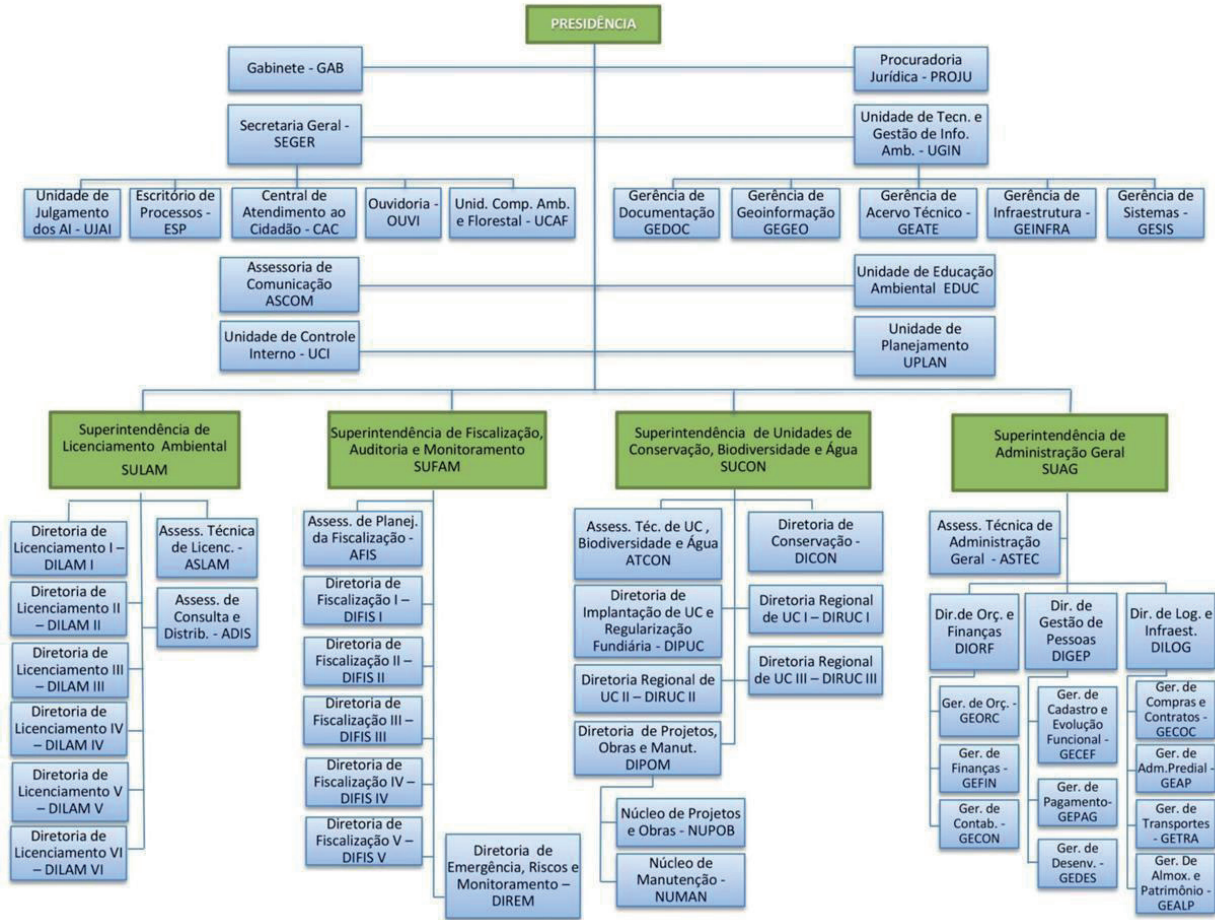
OM-2 Process

Activity diagram: *The licensing process is broken down into tasks, detailed in the OM-3 spreadsheet*
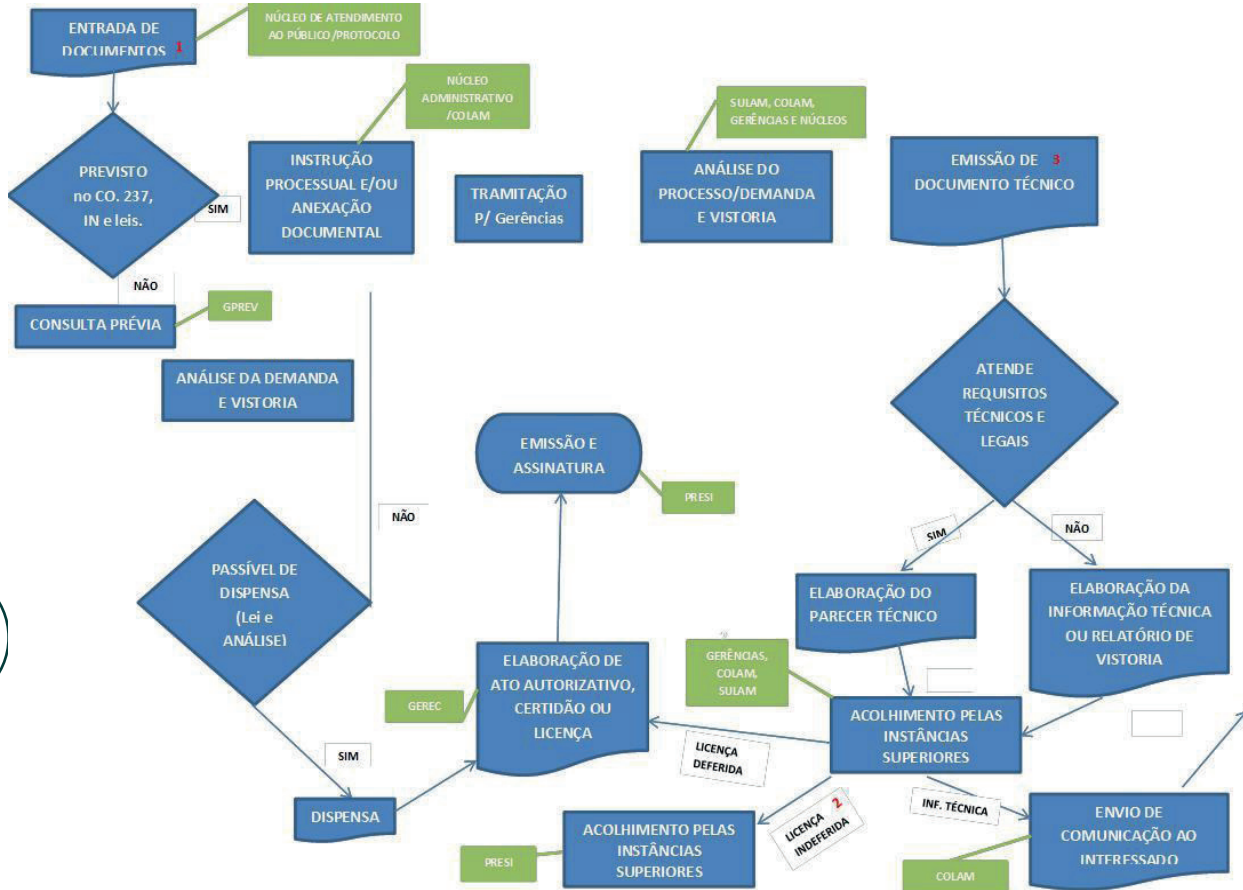
OM-2: Description of organizational aspects that have an impact on and/or are affected by chosen knowledge solutions:

Organization model	OM-2 Variant Aspects Worksheet
PEOPLE	Team members involved: Environmental analysts, administrators, knowledge specialists (specialized boards), consultant (knowledge engineer) and SEI users.
RESOURCES	Resources used for the business process. Information systems: Electronic Information System, responsible for the management of administrative processes (electronic process). Standards: Environmental Legislation, normative instructions, ABNT standards Incorporated knowledge of the processes as a whole and use of legislation, manuals and specialized technical knowledge.
CULTURE AND POWER	Relations between managers and subordinates are unstable, subject to the political situation, with frequent pressure to approve projects of political and/or economic interest. The analyzes sometimes have strong ideological components. The formal communication channels are: corporate email and SEI. All servers have access to these formal communication channels

3.7. OM-3 Spreadsheet: Description of the process in terms of the tasks that comprise it, and its main characteristics

Model of Organization						
		OM-3 Process Division Spreadsheet				
N.		TASK	RUN BY	WHERE?	ASSETS OF	INTENSIVE?	MEANS
th					KNOWLEDGE		NCIA
				ADIS			

		Agents		Knowledge	
1	Distribution Administrative	consultancy / Consultation and Distribution		Legislation and Instructions Norms coded and incorporated	1
two	Analysis from the demand Directors	DILAM I, II, III, IV, V, VI	Directories: Instructions Norms	Legislation and coded and incorporated	Knowledge 3
3	Survey Environmental	Analysts	Boards / Technical information	Knowledge tacit, codified and incorporated	5
4		Analysts Boards Environmental		Impact Assessment coded and Environmental incorporated	Knowledge 4
		Agents Presidency Administrative		Final Opinion of Process	Knowledge two encoded
5					

3.8. OM-4 Spreadsheet: Description of the component Knowledge of the organizational model and its main characteristics

Organization Model		OM-4 Knowledge Assets Worksheet		

ASSETS OF KNOWLEDGE	POSSESSED PER	USED IN	FORM CORRECT?	PLACE CORRECT?	TIME CORRECT?	QUALITY CORRECT?
					No.	
					analytics	
			Yes, the		take	
			training		time	
		Analytics				
Incorporated	Analysts	process and	technique	Yes	too much and	Yes.
	Environmental		(academic)		not always	
		inspections	of the analyst is		have the	
			considered.		objectivity	
					necessary.	
		The process is				
		extremely				
	Analysts and		Yes, the			
		regulated,				
			principles of			
	too much					
		having everyone				
Encoded			Administration	Yes	Yes	Yes.
	servers					
		you	Public take			
	of the organ	procedures				
			To this.			
		foreseen in				
		countless standards.				

3.9. OM-5 Worksheet: Feasibility Decision Document Checklist

Final considerations

The analysis of the organizational context with the parameters proposed by the CommonKADS methodology, even if done alone, demonstrates some difficulties that constitute normal challenges in a paradigm-breaking scenario. Furthermore, alongside budgetary, political and cultural issues, it is the very complexity of the licensing process analyzed here that demands an effort that appears to be gigantic. In addition to the typicalities of the administrative process in public administration, which has specific regulations, and the issues involved with environmental knowledge, which is necessarily multidisciplinary, there is a veritable range of technical and legislative standards involved. This situation seems to point to the construction (or adaptation) of at least three ontologies: administrative processes, environment and related technical and legal standards. Therefore, if the organization has not yet developed the necessary maturity in dealing with issues involving knowledge, it is not receptive. Add to this the need for strong management sponsorship, which also greatly depends on this receptivity. A good strategy may be the gradual development of related functionalities, of less complexity and generic usefulness for any administrative process.

Regarding such possibilities, the literature addresses some initiatives already developed, which may outline a more comfortable starting point. As an example, OntoMetaWorkflow is a generic process ontology that can eventually be adapted to IBRAM's needs, even if it does not specifically address the environment.

According to PRIETO; LOZANO-TELLO; REDONDO-GARCÍA, (2011), the reuse of flow definitions work can be easier if they are divided into three distinct but related definitions: on the one hand, the definition of the data structures to be managed by the process activities, on the other, the users who can perform each activity and, finally, the process activities, along with the relationships between the three definitions. Using ontologies can facilitate these workflow definitions into three related parts. Thus, they describe OntoMetaWorkflow, a generic ontology to represent workflow terms in the domain of administrative processes, and the methods for use in defining administrative processes. They develop a complete model supported by tools to define and manage administrative process workflows.

Within the framework of a knowledge system focused on administrative processes, a generic ontology can be an interesting starting point for more specific work, not to mention immediate benefits for the entire organization. Bringing together professionals around what is common to all areas can develop the necessary synergy for more specific and larger-scale projects.

References

ABEL, Mara. **One** revision from the **engineering** of **knowledge:**Evolution, paradigms and applications. [sl], p. 1–35, 2013.

AUER, Sören; HERRE, Heinrich. RapidOWL .**An Agile Knowledge Engineering Methodology**. In: (Irina Virbitskaite, Andrei Voronkov, Eds.) PERSPECTIVES OF SYSTEMS INFORMATICS 2007, Berlin, Heidelberg. Proceedings... Berlin, Heidelberg: Springer Berlin Heidelberg, 2007.

LÓPEZ, FJH; GAYO, JEL; DE PABLOS, PO Seman�c modeling of administrative procedures from a Spanish Regional Public Administra�on.**Sustainability Switzerland)**, [sl], v. 10, no. 3, 2018. Available at: h�ps://www.scopus.com/inward/record.uri?eid=2-s2.0-85042734792&doi=10.3390%2Fsu10030633&partnerID=40&md5=38dd2758627c3b6f182796de4ff33704

PACHECO, h�ps://pt.slideshare.net/rpacheco/metodologias-da-engenharia-do-conhecimento-aula-23

PRIETO, AE; LOZANO-TELLO, A.; REDONDO-GARCÍA, JL**OntoMetaWorkflow:**An ontology for representing data and users in workflows. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), La Laguna, v. 7023 LNAI, p. 203–212, 2011. Available at: h�ps://www.scopus.com/inward/record.uri?eid=2-s2.0-81055127042&doi=10.1007%2F978-3-642-25274-7_21&partnerID=40&md5 =2e1cb974908ac76c4ce48851e1cf7740

SCHREIBER, Guus et al.**Knowledge Engineering and Management -**The CommonKADS Methodology. [sl: sn]. v. 24