



Administrative Processes in Public Administration: A Systematic Review of Literature to Identify the Use of Knowledge Engineering

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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 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. This article seeks to probe, through a systematic review of scientific literature, how academic research has approached the topic of using knowledge engineering on digital administrative processes in recent years.

Keywords: Ontology, administrative process, knowledge engineering, electronic process

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 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. This article seeks to probe, through a systematic review of scientific literature, how academic research has addressed the theme of the use of knowledge engineering about digital administrative processes in recent years.

Keywords: Ontology, administrative process, knowledge engineering, electronic process

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 continued to be carried out using paper documents, now edited and printed. Even though this is already a remote phase in many organizations, folders of these official documents are still physically moved to collect stamps and signatures. In this second phase, in an incipient form, electronic document management platforms proliferate, ensuring greater efficiency and productivity, attesting to an inevitable trend.

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

According to UCHÔA; AMARAL, (2013), the following benefits can be expected with the implementation of the electronic public administration process:

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- Reduction of financial and environmental costs associated with printing (printers, toner, paper, printing contracts);
- reduction of operational costs related to the delivery and storage of documents and processes;
- reduction of time spent opening, handling, locating and processing documents and processes;
- elimination of undue loss, misplacement and destruction of documents and processes;
- simultaneous sharing of documents and processes, for the purposes of contribution, monitoring of progress or simple consultation;
- assistance to employees in their routine, with the provision of models and guidance on how to proceed in specific situations;
- increase in the publicity of processes, making it easier for employees and administrators to monitor them, and for them to be controlled internally and by society;
- expansion of knowledge management and the possibility of improving processes, due to the creation of a single platform that will allow the analysis of process flows, their comparison between different bodies and improvement based on successful experiences;
- increased possibility of defining, collecting and directly and cross-using data and indicators, due to the creation of a set of databases of the same nature.

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 analysis and manifestation. In the context discussed, the eventual mining of this database can 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, 2018a).

This article seeks to take a look at the opportunities 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. It aims to answer the research question: *how academic research has approached the topic of the use of Knowledge Engineering (CE) by public administration on digital administrative processes in recent years?* To this end, a bibliographical research seeks to identify typical CE techniques and tools in the analysis or improvement of processes in which, through the systematization of results, gaps and trends will be highlighted.

2. Methodology

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The definition of research terms was made based on numerous attempts to capture the universe of academic articles that reflected proposals or innovations in the area, such as the use of techniques and tools used in knowledge engineering. Thus, the keywords (in English) were selected based on terminologies originating from this universe and the expression that was most representative of “electronic process”.

In generic searches carried out on the web, we found that no common terms or expressions are used to conceptualize the management or digital processing of administrative processes, in what we understand as an electronic process. The search for the literal translation “electronic process” resulted in only two articles in the database *Scopus*, without mentioning the analysis of

procedural data. We ended up considering that the search for “administrative process”, although broader and imprecise (846 articles), can be properly refined in combination with other keywords. This resulted in a search strategy for administrative process subjects combined with expressions of technologies frequently used in knowledge engineering. Due to the context in which these technologies are inserted, it is inferred that the results of the article searches correspond to administrative processes in digital media, the object of the work developed.

3. Systematic Search Analysis

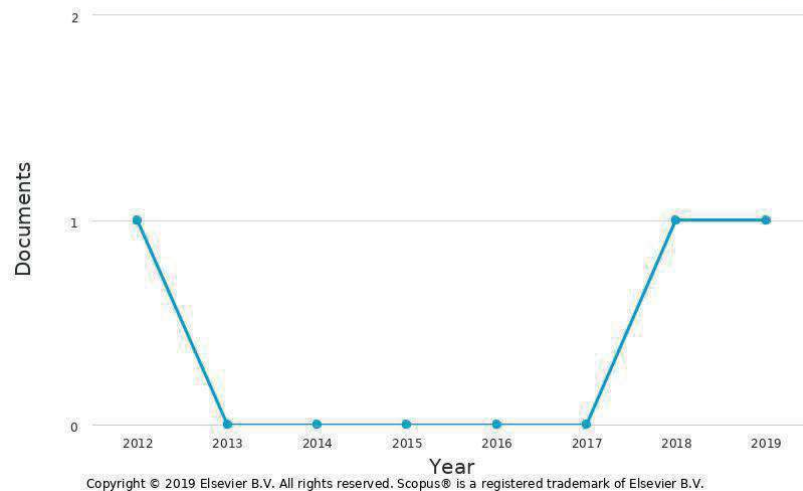
The adoption of the sets of keywords below, in searches carried out in Scopus, resulted in 29 articles (reduced to 24, due to duplicity), published between 2011 and 2019:

Key words	Scopus
“administrative process” and “e-government”	11
“Administrative process” and “machine learning”	1
“administrative process” and “linked data”	1
“administrative process” and “data mining”	two
“administrative process” and “ontology”	two
“administrative process” and “artificial intelligence”	4
“administrative process” and “algorithm”	7
“administrative process” and “big data”	1
Total articles (excluding duplicates)	24

After reading the summary of the respective articles, in an initial analysis, 13 of them that did not address the subject centrally were discarded, leaving 11 articles for complete reading. From this reading, 3 articles remained, which correspond to the final selection of the articles most adherent to the theme. The sources of publications were magazines *IEEE Access*, *International Journal Of Software Engineering And Knowledge Engineering* and *Sustainability Switzerland*, with an article in each of them. 9 authors of the selected articles were detected, with two of them (Lozano-Tello and Prieto, AE) responsible for two of these publications in co-authorship. The distribution of publications over the last 7 years is somewhat erratic, as shown in the graph below, perhaps due to the relatively scarce number of articles. The most cited article is by (PRIETO; LOZANO-TELLO, 2012), with 5 citations.

Documents by year

Scopus



The evidence that the topic is not adequately explored in the literature is demonstrated by the low incidence of articles found, which corroborates the feeling of incipience in the process of adopting the electronic process in state organizations. The selected articles, however, address the aforementioned opportunities for a paradigmatic break by considering the use of ontologies as a starting point for the evolution of administrative processes in the digital environment, which undeniably opens up the field for the application of numerous Engineering techniques and tools. of Knowledge.

The publications, as reported, revolve around the use of ontologies within the scope of administrative processes. activities, especially in public administration. With approaches to different problems, they basically satisfactorily cover the main obstacles to process reuse. Thus, they were divided according to the authors' perspective, focusing on the applicability related to the modularization of the solutions presented.

Theme	Article	Authors
Workflow in processes	A Hierarchical Adaptation Method for Administrative Workflows	(PRIETO et al., 2019)
Procedure modeling	Semantic modeling of administrative procedures from a Spanish Regional Public Administration	(LÓPEZ; GAYO; DE PABLOS, 2018b)
Generic ontology	Defining reusable administrative processes using a generic ontology	(PRIETO; LOZANO-TELLO, 2012)

4. Discussion

Reading the articles in question allows not only a critical analysis of the possibilities, but also the level of complexity that the innovative structuring of administrative processes presents. In each work the nuances are revealed, having in common the need for analysis and abstraction of characteristics to safeguard the required legal and organizational compliance.

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4.1. Workflow in processes

The use of workflows in business (or administrative) processes constitutes a way of efficiently ordering the steps of a given type of process, according to demand, nature and circumstances and in accordance with the organization's hierarchical model. Once established, the corresponding processes begin to follow a process procedure between departments until they are resolved by an established authority. According to PRIETO et al. (2018), in order to use them appropriately in different areas or departments of a

hierarchical organization, must be adapted to their particular conditions, respecting the general rules of the process established at the higher level. Any department can add activities, can remove them, and can choose specific users to carry them out and to define the data managed in the activities, as long as the adaptation process does not fail to comply with the restrictions established at the generic level.

According to the authors, this problem, called the hierarchical adaptation problem, also involves establishing the appropriate measures to apply when the general regulation is changed. Such measures must maintain consistency between different levels, through the propagation of changes across all adapted processes.

Typically, these workflows do not need to manage a considerable number of activities, users, or data. Problems arise when organizations need to use them in their different areas and departments, which means that job specifications can be adapted to the particular conditions of each area, while complying with the general specifications established by the law or regulation that governs the entire process. . They call this problem the problem of hierarchical adaptation of administrative processes.

They then present the hierarchical adaptation method, which is a method based on ontologies that define the rules to satisfy a generic adaptive workflow. Furthermore, it establishes the rules to satisfy the adaptations of the specific ontology. It also provides operations that facilitate both adaptations of administrative workflows and propagation of changes.

Taken to its ultimate consequences, within the scenario of possibilities of the electronic process, the method facilitates the automation of processes through the adaptability of flows to changes in hierarchy, thanks to the use of ontologies.

4.2. Procedure modeling

According to the authors LÓPEZ; GAYO; DE PABLOS, (2018a), to comply with regulations in all matters that concern access to public information by citizens, different initiatives have emerged from administrations that have led to the development of data catalogs. Taking into account the datasets published in the Spanish open data catalogue, which federates most Spanish public administrations open data catalogues, they conclude that there is a lack of homogeneity, which means that two administrations at the same level do not publish the same type of information, as well as the lack of standardized vocabularies, which means that data is represented in different ways, even if these administrations publish the same information.

Another aspect that they highlight, based on this analysis, is that information is only being published at the data level and that information about administrative processes is not being published in full.

They consider that representing processes, of any type, can be interesting for several reasons:

- Modeling processes, whether following data-bound principles or not, converts them into actionable objects at the same level as data.
- Since these processes can be represented and automatically actionable, it is possible to build intelligent agents that interact with them and perform tasks ranging from traceability to auditing.
- Administrative procedures are common to all public administrations, as they derive from the same regulations. This means that all work done on them can be reused across the public sector.

The authors maintain that the result of modeling public administration procedures can help sustainability policies in two ways:

- Improve decision-making processes
- The sustainability of administrative management.

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With this, they develop an ontology to represent administrative procedures and to facilitate tools that can make these processes actionable objects and facilitate the future development of intelligent agents that can analyze and process them, “favoring organizational sustainability through an improvement in policy decision-making” (LÓPEZ; GAYO; DE PABLOS, 2018a) .

According to the authors (PRIETO; LOZANO-TELLO; REDONDO-GARCÍA, 2011), the reuse of workflow definitions may be easier if they are divided into three distinct but related definitions: on the one hand, the definition of workflow structures data to be managed by the process activities, on the other, the users who can perform each activity and, finally, the process activities, together 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 for representing workflow terms in the domain of administrative processes, and the methods for using it in defining administrative processes. They develop a complete model supported by tools to define and manage administrative process workflows.

Final considerations

What can be inferred from this review is that there is still a very broad field for obtaining values generated from the knowledge obtained in administrative processes. Its evolution in public administration faces a series of challenges, starting with the complicated transition to electronic media. Once this new level is reached, the aforementioned second evolutionary phase, a favorable environment for a new cycle is created, with exponential gains for the entire society. Along this path, to add value, CE tools and techniques are invaluable.

That said, it is precisely from the semantic representation of the significant elements that the administrative process presents that the ingredients for most of the technologies available to knowledge engineering are obtained. In other words, everything starts from ontologies.

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