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Information architecture for the implementation of a technological platform that manages research production in higher education institutions

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Abstract. Scientific communication and diffusion is one of the challenges of higher education institutions, related to the implementation of strategies of free access to the scientific and technological productivity of the teachers and researchers of the institutions, which allow to increase the visibility and impact of the research, for which a model of information architecture of the technological platform for the management of the investigative production of teachers and researchers was designed, under an environment focused on satisfying the information needs of the users that allows to organize, to group and to visualize the information by means of metadata. The research is of exploratory-descriptive type, through which the products of science, technology and innovation that should be visible in the technological platform were identified, generating as a result an architecture model-view-controller, with data storage in a relational database, which has access through a RESTful API made in Java, the views and controllers were made in HyperText markup language and JavaServer pages respectively. MySQL was used as a relational database engine to store information and MYSQL Workbench as a platform for the construction of the relationship model between entities, tables and columns; which will be used as a framework for the design, planning and implementation of the technological platform.

1. Introduction

Universities are all the time generating, administering and financing the way to obtain information generated from the substantial activities of their institutional work. Information that is not known by researchers, much less by the general public, which makes much of the work invisible to society.

The Universidad Francisco de Paula Santander (UFPS), as an institution that generates knowledge, requires processes and tools that facilitate scientific communication to its researchers. Currently most unpublished documents, such as grey literature, institutional projects, are lost due to limited accessibility, affecting the visibility of researchers' production. Likewise, the University's assistant of research and extension vice-rectory (REVR) brings together research projects [1], however the products are not disclosed for use by the external academic and research community or the Institution.

From this point of view, Perez-Montoro (2010) proposes that the construction of an information architecture (IA) will allow to structure, organize the information in spaces that can be located (or access) and present the data in interactive and non-interactive information systems [2]. For this, the information architect must determine the objectives, contents and functionality of the website, facilitating navigation and search for future modifications and access through organizational systems, information that must be labeled.

Having an information architecture (IA) will allow the safeguarding of the production generated from the research results, helping to bring together in the same place the academic and research production that is represented: in theses, degree works, books, monographs, brochures, institutional journals, articles from national and international journals, advances and final research reports, manuals, teaching modules, student publications (journals and newspapers), works of an artistic nature, scripts, catalogues and film heritage, among others, which may be presented in different formats: printed, audiovisual and/or electronic [3].

2. Research
The objective of the research is to propose guidelines for the office of the assistant REVR of the UFPS that requires structuring a software application [4] or a technological platform for the Management of the research production of teachers and researchers that allows them to make decisions, supported by the data and research products resulting from the projects of the researchers of the different research units. The research is of exploratory-descriptive type in which the typology of science and technology products that can be available by the academic community was identified, allowing to give visibility to the scientific and technological production [11]. Subsequently, the research is classified as applied, where a scheme or model is proposed to formulate the design of an information architecture (IA) for the assistant REVR of the UFPS; being a way to enrich the documentary research with practice and applied. Finally, the design of the IA is achieved, which is adapted to the vice-rectory and to the research units, where its epistemological aspect can be applied in other similar units.

Since 2010, the vice-rectory began with the project for the administration of the information system for the administration of research groups and seedbeds (CGIS), which aimed to date the vice-rectory of a technological tool to administer projects and products by researchers of research groups and seedbeds (ceased to be used more than four years ago).

Analyzing the above, and considering an alternative for the implementation of a software application that supports the production of researchers, and allows for automated integration, it was considered the construction of designing the IA that guides the support of the decision-making process and allows researchers to easily access research products to support the decision-making process in the REVR.

Taking Garcia (1999), what is an information system construct (IS) that allows users to easily access information (historical and current) to support decision making, which would be very difficult to present or access through traditional storages [5].

The objective of the research is to design an information architecture (IA) of the technological platform for the management of the investigative production of the teachers and researchers of the UFPS, under an environment centered on the satisfaction of the information needs of the users that allows to organize, group and visibilize the investigative production using metadata [6].

In the design of the IA for the REVR, the consolidation of the historical metadata of the information and the obtaining of the adequate information for the decision making of the different research units is proposed. For the design of the IA, the diagram of the logical model of data of the key processes is elaborated, taking as conceptual base the models of functional decomposition, in order to be able to construct and compare with the diagram of databases to be constructed.

Next, it is necessary to establish the corresponding relationships between the information architecture model for the research units and the functional requirements that would make up the technological platform to be proposed. From this analysis, the adaptability between the design and the proposed platform is defined. Due to the quantity of the existing production in the research units, research has as its scope the planning and control of research results. Although the design of the technological platform interface is not part of the scope, only the design of the IA is proposed as such.

3. Fundamentals of information architecture
The objective of the information architecture, also called by the acronym IA, is to classify and label information that facilitates access to the different blocks contained, ensuring their future scalability and consistency.

A good information architecture is based on the organizational context in which it is developed, the content it stores and the users who access and consult it. For this reason, it is important to know the type of user to whom the information is addressed. A good IA is one that is intuitive, flexible, consistent and scalable; in short, it is one that in a short period of time is easy to learn how to handle, allows supporting the tasks of the different user profiles, allows predicting the behavior of the system during the interaction and allows the growth of the contents according to an established model. For the construction of an IA it is necessary to start from the analysis of the needs resulting from the different blocks of content, where its structure must be related to the access model (includes navigation), tools and orientation.

3.1. How to build an information architecture

It should be kept in mind that every IA has at least the following characteristics: a) high performance, a key factor in the success of the IA and b) scalability as a determining factor.

On the other hand, other characteristics are considered important at the operational database level at the external database level, such as: that users learn to manage it in a short time, i.e. that it is intuitive, that it supports the different users in the performance of tasks (flexible), that it makes it possible to predict the system's behavior while users interact (consistent) and that it has a capacity for content growth (scalable) [7].

For its construction, the analysis of functional needs results in several blocks of contents, which allow to analyze, classify and label the information; likewise, the access model (navigation), the search tools, the context where it is developed, the classification, the types of contents, the grouping of the same in extension and depth and their labeling are considered as fundamental elements for construction.

In addition to the above, the component of an IA must be identified from two perspectives, one is the structure of the metadata and the other the components required for construction. [8,9]. The structure of the data should take into account the current data and the old data. In such a structure, all data with a high level of detail is massively stored and is expected to be accessed frequently.

The final component of the IA is metadata, where it is placed in a different dimension than other IA data. Figure 1 presents the structure of the Information Architecture for the UFPS.
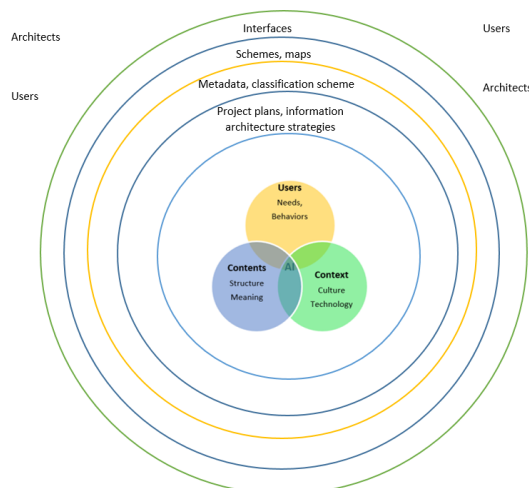

Figure 1. Structure of the Information Architecture UFPS.

4. Design of an information architecture model for the REVR

It is important to highlight the nature of the information to be used and the users to whom it is addressed: the researchers and administrator of the REVR for decision making assistance. The information requirements identified above were used as the basis for the IA design. The identification of the data sources and the transactions necessary to obtain the logical data model of the IA, design that will be confirmed by the entities and relations that allow to solve the needs of the VAEI. To this end, the following phases were considered: planning, analysis, design and implementation. In the planning

phase, strategies must be created and implementation methodologies must be proposed. In the analysis phase, available data sources and specifications required by end users must be specified.

In the design phase, the data architecture of the IA must be detailed, where the data sources and metadata [10] are fundamental, as well as the process of extraction, storage, administration and their handling. The tools for the end user, the design of the physical data model for the database and the definition of the connection processes in the IM must also be detailed.

5. Results

A study was carried out of the users involved and the products obtained, and based on the theoretical assumptions and criteria of the digital collection, the architecture of the technological platform was designed according to the typology of products established by Colciencias in the measurement model of the National System of Science, Technology and Innovation, allowing the visibility and impact of productivity to be enhanced.

It was designed from a model of an information architecture (IA) of the technological platform for management of the investigative production of the teachers and researchers of the UFPS.

5.1. Information architecture design

A model-view-controller architecture was made, where the data are stored in a relational database, they are accessed through a RESTful API made in Java, the views and controllers were made in HTML and JSP respectively.

MySQL was used as relational database engine for storing the information exposed in the project, MYSQL workbench was used as platform for the construction of the entity-relation model, tables and columns. Figure 2 presents the design of the Architecture for the implementation of the technological platform for the management of the research production of teachers and researchers of the UFPS.
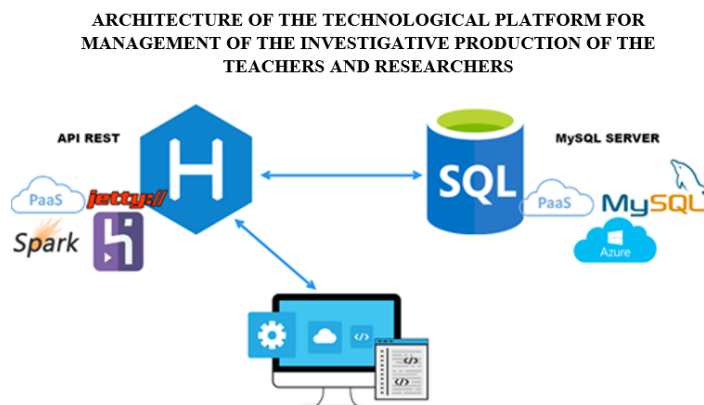

Figure 2. Architecture for the technological platform for the management of the research production of UFPS Teachers and Researchers.

5.2. Front-end, back-end technology

JAVA was defined as the programming language to be used for the development of both the front-end and back-end of the project. [12] For the front-end, JSP was defined as the language for the development of the web platform. A RESTful API was made as back-end of the application, using JSON as notation for the resources, and the standard http methods that are GET, POST, PUT and DELETE were used, through individual url per resource collection to access the information.

The Database is designed under the guidelines established in agreement N. 056 of 2012, which adopts the research system of the ufps and annex 1 of the model of measurement of science, technology and innovation 2018, definition of the requirements of existence, quality requirements, category and relative scores of the typology of products of new knowledge, technological development and innovation, social appropriation and circulation of knowledge and training of human resources in science, technology and innovation. Figure 3 presents the design of the front-end, back-end architecture.
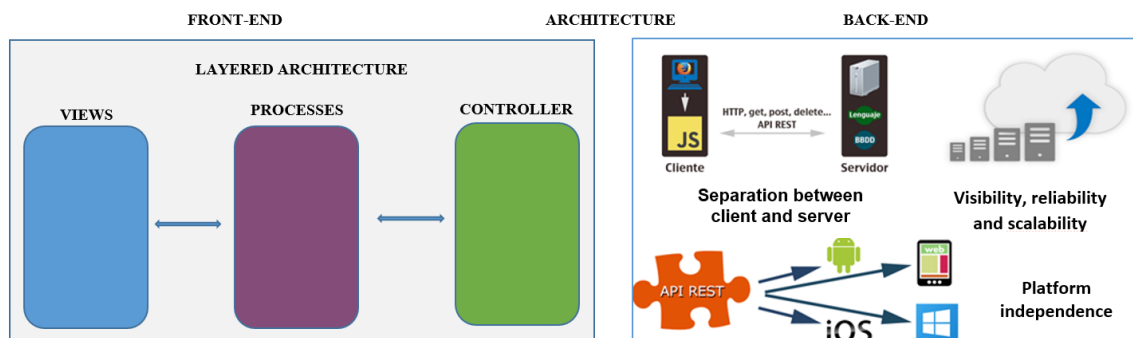
Figure 3. Front-end, back-end architecture.

5.3. Architecture of the technological platform
For the implementation of the technological platform it is recommended to build in Dspace the architecture by layers, where each layer provides services in the layer immediately superior to it, the three layers that compose this architecture are: application layer, business logic layer, storage layer.

6. Conclusions

The definition of architecture as a framework for the design, planning and implementation of the technological platform for the management of the research production of Professors and Researchers of the Universidad Francisco de Paula Santander, San José de Cúcuta, Colombia, will improve the visibility and impact of products resulting from science, technology and innovation activities that are managed through the research units.

Higher education institutions should systematize their methods of managing research production, in order to provide greater flexibility, availability and security through the implementation of technology, therefore we recommend the implementation of the technological platform for the management of research production of professors and researchers of the Universidad Francisco de Paula Santander and that will serve as a reference for institutions that develop activities of science, technology and innovation.

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