Business Processes Management and Knowledge Management System for an interactive-intraorganizational communication in Open Schooling

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Abstract

Open and Distance Education systems represent an effective solution to the rapidly increasing demand for tertiary education. To meet the needs of Mexican students in Open and Distance Universities during the COVID-19 pandemic, alternative approaches mediated by open, distance, and online methods and technologies seek to ensure learning continuity. Naturally, developing mechanisms for a flexible education requires support from administrative and academic procedures. Although day-to-day management and organization of the work might be repetitive and well-structured, for continuous reconfiguration of the instructional methods, mode of access, and learning activities, visible value requires procedures to face highly variable and data-intensive situations based on creative thinking. Under these conditions, open educational systems in Mexico face difficulties with effective service provisioning with immense workloads and unsatisfactory consequences for students and involved profiles. This paper proposes a model of the procedure evolution supported by a system that interacts with its different stages to communicate representations of the work, document current states, and improve understanding of how processes create and deliver customer value supported by Business Processes Management and Knowledge Management System.

Keywords: *interactive workflows, knowledge management system, cognitive search, business process management, open and distance education.*

Context of the problem

Open schooling represents an alternative to conventional schooling. The lack of students presence is replaced by resources and means to allow students to achieve their distance training, as well as the possibility of completing their studies by gaining qualifications. This sort of system provides opportunities for flexible study, such as part-time, distance, and hybrid student profiles (Latchem, 2018).

The educational system must be able to offer alternative routes to formal qualifications and on-demand examinations. Also, its degree of flexibility and openness depends on the system's self-access to didactic resources, technologies, information systems, telecommunications equipment, teaching, and academic staff, supported by modes of work organization and structure.

Particularly, in Open and Distance Universities (ODUs) modes of work, organization includes many different processes, such as administrative workflows, academic, information technology, Human Resources, finances, student support, public relations, etc.

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These examples are far from being a complete list of the moving parts at play in the average ODU. Processes are constituted by workflows or procedures and a data-collection form. Indeed, in ODUs, there must be support for a high degree of flexibility in order to respond immediately to standardized activities, as well as to non-routine tasks that do not fit in well-structured environments. This situation clearly defines an orientation to procedures and their tracking. Thus, both highly dynamic procedures with a strong focus on communication and predefined, well-structured procedures need to be supported within one overall system (Drăgan, Ivana, & Arba, 2014).

However, despite advances in technologies, ODUs still manually perform some of their activities to complete administrative and academic work, as is somewhat typical in Mexico and other similar countries. Mexican tertiary's system is characterized by disparities in quality between ODUs; for example, in admission criteria, ODUs vary greatly (Monroy, 2019).

The situation is complex and, moreover, with the COVID-19 pandemic, a growing number of Mexican students are accessing open and distance schooling (SEP, 2020).

As the Secretariat of Public Education in Mexico stated, Mexico is expected to be one of the world's top 20 countries in terms of the highest number of tertiary students.

In terms of management and administrative support, the actual situation has represented an incremental increase of continuous assessment, accompaniment, monitoring, and remote feedback of teachers and tutors, but also difficulties in controlling activities and establishing efficient communication between staff, students, sponsors, and government (Mendiola, y otros, 2020).

For those who work in a Mexican ODU, difficulties are well-known; as happens in other countries (Denagama, Manuraji, Toman, Bandara, & Syed, 2019), an immense workload arises – the processes of dealing with excessive files and emails are recurring, disjointed procedures which lead to duplicate work, time delays, and errors (for example, in financial aid applications).

Ensuring students, staff, and all involved have access to pertinent and opportune information they need for a quality education requires open universities to be open to a substantial range of possibilities (Latchem, 2018).

The main problem we intend to face is represented by effective service provisioning, adapted to each school system with its unique procedures, priorities, and mechanisms to implement adequate decisions.

Unfortunately, there is little guidance available on how to ensure the achievement of strategic objectives when procedures vary constantly; thus, planning and scoping innovative educational solutions represent an important issue (Denagama, Manuraji, Toman, Bandara, & Syed, 2019).

This paper proposes the design of a model of the procedure evolution supported by a system that interacts with its different stages to communicate representations of the work, document current states, and improve understanding of how procedures create and deliver customer value supported by Business Processes Management and Knowledge Management System.

We consider an interactive approach to integrate knowledge and process management, relying on an appropriate model as a promising approach. Therefore, our contribution is an attempt to bring aspects of

structure, automation, and integration of static and dynamic information into a procedure, considering deadlines.

Methods

Study design

Enterprise information provides an extensive trajectory in the optimization of organizations worldwide. On the other hand, educational management tends to focus on teaching and learning methods (Enríquez, Troyano, & Romero-Moreno, 2019). Advantages of strategic information related to education are scarce in the educational literature. In this study, before designing processes, our main goal was to obtain concepts to support the design of a model.

Semi-structured interviews were used to collect data (Leedy & Ormrod, 2005). Our interviews focused on questions related to standards for behavior and what specialists think a model of procedure evolution should be and do, according to their experience and knowledge. These interviews provided rich and detailed information from multiple perspectives concerning what it is like to define an interactive model of the procedure evolution (See Table 10.1).

Table 10.1 : Design of a semi-structured interview (Adapted from McIntosh & Morse, 2015)

Interview Type	Purpose	Interviewed profile	Role of respondent	Result
Descriptive/ interpretative	Discovery	Knower	Informant	Understanding-identification of concepts

As noted in Table 10.1, the purpose of the interview design is to elucidate the subjective response to the stimulus (McIntosh & Morse, 2015). Therefore, the design allowed the respondent to participate in the process and discuss concerns related to questions that are of primary importance to people working in open and distance education.

2.2 Study sample

To acquire relevant data collection to design a model of the procedure evolution, a pool of possible respondents was identified with proven experienced of at least 20 years in open and distance education. Six profiles were selected from the following areas: Technology, Education, Social Science, and Engineering. Additionally, two expert profiles in administrative and academic management were included to support the design.

Letters of invitation were provided to potential respondents, securing their contact information, and assuring confidentiality of their answers. Face-to-face interviews were conducted within a period of three months. Interviews were conducted with two hours' duration per profile; thus, respondents were made as comfortable as possible to expose their ideas.

One respondent was interviewed per day, allowing the interviewer to establish a rapport with each respondent and gain their cooperation. Field notes were taken to preserve acquired information.

Field situation

Mexican ODUs tend to be conducted by asynchronous modes in time and space from the learner, based on the belief that open access to knowledge is critical, with strong potential to improve the society. Because of this, these systems include those people with conditions most likely to be excluded from formal schools, as well as the underemployed, on account of having limited resources. This sort of educative system has been noted for being efficient in terms of time and cost.

However, it is only within the past few years that the notion of ODU being a mechanism for the pursuit of formal accreditations has been recognized (Table 10.2).

Table 10.2 : Number of students in Open and Distance Universities in Mexico in 2020 (SEP, 2020)

Open and Distance University	Total of Students
Public programs	305, 884
Private programs	563,672

The capacity of Mexican ODUs to achieve access, equality, lifelong learning, and social mobility has been greatly intensified by the arrival of the Internet and more recently, the mass adoption of smartphones and other mobile devices and social media. Synchronous and asynchronous concepts, methods, and technologies for accessible, equitable and quality teaching and learning are well-informed by research.

Under the above context, semi-structured interviews began with a set of questions for respondents to introduce themselves, then share their experience and knowledge on topics of interest.

Questions

Table 10.3 : Questions to elicit ideas for designing a model.

In what way do you consider the relationship between service provision and administrative and academic management?	Based on (Delias, Lagopoulos, Tsoumakas, & Grigori, 2018)
Can you identify relevant processes at play in most ODUs?	Based on (Pérez-Álvarez, Maté, Gómez López, & Trujillo, 2018)
How strong do you think the relationship of ODUs and workflows is for improving user's satisfaction?	Based on (Pérez-Álvarez, Maté, Gómez López, & Trujillo, 2018)
What are missing parts of administrative and academic management in ODUs?	Based on (Pérez-Álvarez, Maté, Gómez López, & Trujillo, 2018)
What is procedure evolution?	Based on(Grigori, Castellanos, Dayal, Sayal, & Shan, 2004)
What do your experiences tell you about the main attributes of procedure evolution?	Based on (Grigori, Castellanos, Dayal, Sayal, & Shan, 2004)

By digging deep into topic areas generated by participants, semi-structured interviews helped us to understand concepts and provide data to support more rigorous contrast to literature.

Emerging issues

Each Friday, we conducted face-to-face interviews in a warm and calm environment. During the interviews, it was possible for the interviewer to clarify questions when the participant appeared confused. Additionally, when an answer required more precision, the interviewer followed up so that the respondent could better elucidate his or her ideas. Unplanned prompts were useful because they provided an opportunity for respondents to expand on substantial concepts not accounted for in the interview guide.

Content analysis was performed on the completed interviews, revealing concepts and observations to consider as possible means to model procedures in ODUs.

Our analysis revealed that to define a model of the procedure evolution, it must include:

(a) Identification of procedures
(b) Procedures diagrams and their tracking
(c) TI tools
(d) Key Performance Indicators
(e) Options to automation
(f) Assignation of procedures and different profiles
(g) Interactive options for communication, including experiences
(h) Mechanisms of control
(i) Options to store documentation and experience
(j) Activity hierarchies
(k) Options to search information

Additionally, from content analysis analysis we were able to retrieve ideas of different methodological alternatives, as an opportunity to explore the latest developments (Fig 10.1.)

Source: Prepared by the authors

Figure 10.1 Word Cloud

As shown in Figure 10.1, there are many keywords revealed in our interviews that we could focus on. It is not possible to cover all of them in this paper, but three key themes are worth mentioning further: Business Process Management, Knowledge Management Systems, and Cognitive Search.

Business Process Management

Mathias Weske (2019) defines a business process as a set of activities that are performed in coordination in an organizational and technical environment. According to the author, these activities jointly realize a business goal, where each business process is enacted by a single organization, but it may interact with business processes performed by other organizations, therefore, "Business Process Management (BPM) includes concepts, methods, and techniques to support the design, administration, configuration, enactment, and analysis of business processes".

Business Process Management (BPM) is recognized as a successful approach in fostering efficiency and productivity in many areas of application. BPM has the potential to drive innovation in the digital world. BPM's planning and scoping are supported by a range of methods, techniques, and tools. For open schooling, themes could be outlined by BPM Systems, themes of management (strategic alignment), process modeling, Artificial Intelligence (AI), data and process mining, process design, incorporation of TI, and coordination and interoperability.

Knowledge Management Systems

Knowledge is a vital resource that educational systems could use to improve decision-making. Groff and Jones (2003), defines Knowledge Management (KM) as "the tools, techniques, and strategies to retain, analyze, organize, improve, and share business expertise". A knowledge management system is defined by HubSpot (2022), as "any kind of Information Technology (TI) system that stores and retrieves knowledge to improve understanding, collaboration, and process alignment."

Knowledge Management (KM) is related to the concept of intellectual capital, which is the most critical challenge of ODUs. There are 3 types of intellectual capital: human capital (individual), organizational capital, and codified experience (databases, manuals, processes) etc. Information technologies can speed up the knowledge management process to manipulate data and share information. Knowledge management systems are based on KM mechanisms as well as technologies to support the knowledge management process.

Cognitive Search

Cognitive search focuses on queries formulations that uses artificial intelligence technologies to improve users' search queries and extract relevant information from multiple and diverse data sets (Kato, Yamamoto, Ohshima, & Tanaka, 2014).

Cognitive search allows you to find digital content from multiple sources. It is an AI-powered search technology that can be used for ODUs to anticipate the needs of students and other customers. Cognitive search employs AI techniques and natural language processing to organize information from multiple sources, understand and organize data, and enable developers to build search applications. It also handles a variety of data sources, including unstructured data like video, images, or audio.

Critical Analysis

Business Process Management

Business processes allow organizations to execute their strategies. Thus, a structured approach to manage business processes is essential to achieve strategic goals (Bandara, y otros, 2010).

Business Process Management (BPM), in practice, covers a wide umbrella of applications; for example, process technology and automation, process analysis and monitoring, and governance and strategic alignment (Reijers, 2021). In the case of ODUs, the purposes of BPM focus primarily on:

(a) Education and training, to state a base for employees (vom Brocke, Mendling, & Rosemann, 2021)

(b) Government, for the management of strategies and initiatives, the adoption of process standards, governance structures, and business process architectures (Denagama, Manuraji, Toman, Bandara, & Syed, 2019)

(c) Process analysis and monitoring, to include indicators and tracking options, possibilities of applications, process predictions, and process mining (Reijers, 2021).

Knowledge Management Systems

There are several processes to implement a Knowledge Management System (KMS). (Becerra-Fernandez & Sabherwal, 2015) define processes and threads for KMS (Ermine, 2018).

The first step is Discovery (combination, socialization), with Capture (externalization, internalization) at the same level, then Sharing (socialization, exchange) and Applications (directions and routines). On the other hand, (Shabahat & Ermine, 2021) establish four steps: discovery of knowledge, capturing of knowledge, sharing of knowledge, and application of knowledge. (Shabahat & Ermine, 2021) describe a framework for KM processes based on the Daisy model, which carries out the implementation and management in a company. Finally, (Dominguez & Martins, 2017) establish three steps: knowledge creation, knowledge storage, and knowledge sharing.

For the purposes of this research, we group the stage of discovery and creation in the creation stage, and we consider the storage stage relevant to emphasize the elements and resources to be used, as well as the stage of sharing knowledge, a stage that all authors share. Although we are not contemplating the application stage due to the definition of the problem we are addressing, it is important to consider it as part of the stages of a KMS.

Proposal

A natural way to start creating a KMS is to share information that we use daily but is not yet documented. This information is found naturally in the processes carried out within institutions. Employees learn for themselves as they engage with the institution, and communication with those involved is vital at this stage of learning. Much information obtained from these processes can be found in a long list of mailings, repositories, memos, and documents that are forwarded and used as many times as necessary

to share this information. The rotation of personnel results in employees working in processes that are unknown to them; if they are not given clear instructions of the institutions' processes they may make mistakes that can be avoided.

Currently, there are some tools that allow the automation of processes; however, many companies are not willing to invest in these. The digital automation of processes is based on the digital transformation of processes, but it will require the investment of these software tools, in which many companies are not willing to invest. Thus, the objective of this proposal is to have viable alternatives that allow us to document and know the processes in an agile and viable way.

Sharing knowledge will never be a simple task, but when it comes to processes that are implemented and maintained for an extended length of time it can be of great help to institutions. A natural way to start a knowledge management system is by documenting and searching for processes within the institution. The search and organization of information should be simple, so we suggest an interactive way in which these resources can be used.

The way institutions handle information can make all the difference. The integration of knowledge management into business processes can increase competitiveness and allows access to information in an easy and organized way in a common repository where everyone has access to the same information.

The existence of knowledge alone does not ensure success and growth; it must be shared and integrated into business processes to be useful. Incorporating knowledge management systems will improve collaboration, facilitate employee onboarding, and allow continuous improvement.

In this paper we suggest the development of a process-based knowledge management system, which can be a viable option for its implementation in those educational institutions that do not have a high budget and want to start creating a knowledge management system to give an appropriate follow-up to all the processes implemented, as well as the proposal of other new processes.

Stage 1. Knowledge Creation

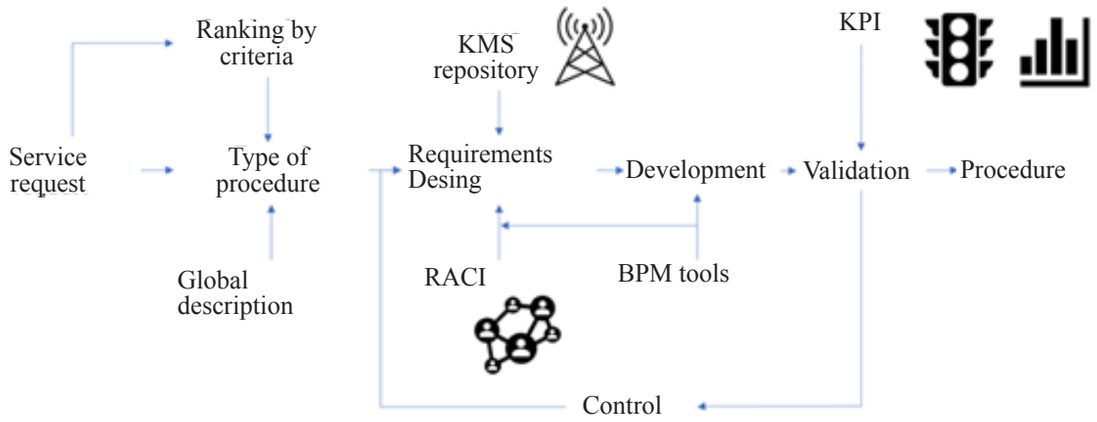
There is a myriad of information related to the processes of companies in different sectors, but the documentation and identification of the processes in educational institutions can cover a range of alternatives that are summarized below:

Table 10.4 : Processes in educational institutions

General Administrative Workflows ◆ Admissions ◆ Student registration ◆ Coordinating various faculties and departments and allocating venues ◆ Processing students' course selection ◆ Registering special needs students ◆ Ensuring that there are no serious schedule clashes ◆ Managing attendance records and sick notes, exam deferments, etc. ◆ Coordinating graduation, honor roll, and academic and sports awards ◆ Organizing maintenance and janitorial services, etc.	**Academic** ◆ Library and laboratory allocation and administration ◆ Acquisitions ◆ Researching proposal approvals ◆ Researching assistance ◆ Accessibility/student support infrastructure (headsets, Braille-compatible devices and printers, etc.) ◆ Scheduling appointments, seminars, guest lectures, etc. ◆ Online learning management systems (LMS) administration ◆ Managing examinations, invigilation, grading, etc. ◆ Cultural and sports/athletics events
Finance ◆ Grants ◆ Bursaries ◆ Purchase orders/procurement ◆ Invoices/accounts payable ◆ Payroll ◆ Student financial aid applications ◆ Budgeting (departmental and institution-wide) ◆ Bookkeeping	**Information Technology** ◆ Computer lab administration ◆ Hardware and software requisitions ◆ Support/helpdesk tickets ◆ LMS support ◆ Managing printing and copying facilities and student accounts (loading credits, etc.) ◆ Setting up campus email and on-campus wifi ◆ Allocating and managing loan devices ◆ Software updates, etc.
Information Management ◆ Information capture ◆ Recordkeeping and filing ◆ Database updates (e.g. student academic records) ◆ Information backups ◆ Data security considerations, etc.	**Human Resource Management** ◆ Recruitment ◆ Onboarding ◆ Staff training and development ◆ Vacation requests ◆ Travel requests ◆ Complaint resolutions ◆ Staff evaluations, etc.
Student Support ◆ Counseling ◆ Career services scheduling ◆ Support for international/transfer students ◆ Support for disabled students ◆ Student housing administration, etc.	**Health and Safety** ◆ Campus health services registration, scheduling, recordkeeping ◆ Staff and student safety administration ◆ Incident reporting ◆ Disciplinary procedures, etc. **Public Relations** ◆ Alumni community management ◆ Marketing/promotion ◆ Public events, guest speakers, etc. ◆ Fundraising endeavors, etc.

Identifying processes is a key stage in documenting them. Once they have been identified, we can move on to the knowledge creation stage. This stage involves the following steps:

(a) **Process Identification**



Source: Prepared by the authors

Figure 10.2 : Process Identification

The identification of processes will require contemplating some elements in order to provide complete and adequate information about the content and objective of these elements. Among the elements that we must contemplate, it is important to keep in mind the hierarchy of criteria, to know how to identify which processes are more relevant and which are strategic, operational, and support processes.

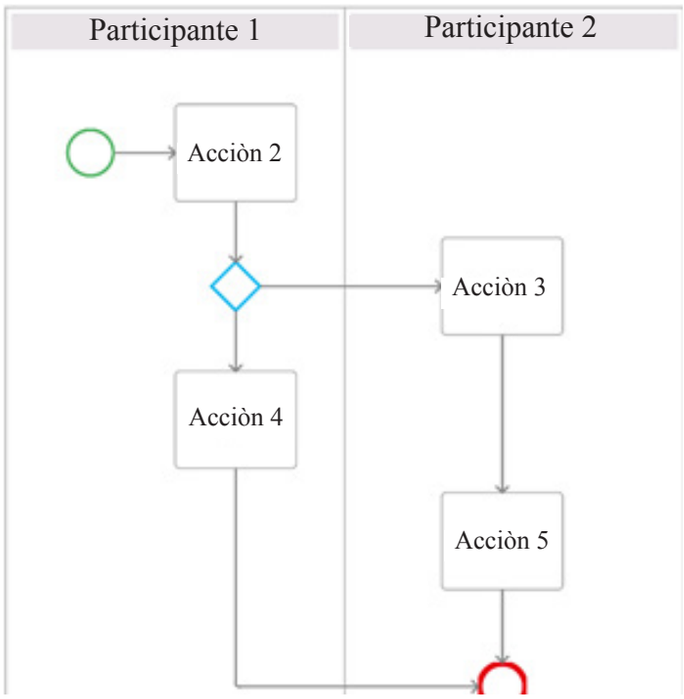
Processes must have a goal and a clear description of what they want to achieve. Additionally, all these processes have supporting information that can be obtained from the KMS repository. It will also be important to identify all participants and responsibilities through the RACI matrix, as well as through a modeling tool. Identifying the KPIs involved in each process will allow us to track these and visualize the impact on them. The validation of the processes will ensure that all the elements contemplated meet the objective and that the process has been clearly identified.

(b) **Process Modeling**

Having a visual representation of the processes, where the flow stages of the processes are appreciated, as well as the stakeholders that are involved, will help to clearly identify the start and follow-up of the processes. The visual representation has the advantage of being an easy communication tool, which allows all those involved to clearly and accurately identify the steps to carry out a process.

BPMN (Business Process Modeling Notation) is a standard notation that is used for process modeling and ensures understanding among everyone involved. A diagram allows us to visualize the logical sequence and thus to understand the flow of the process and the relationship between all those involved.

Once the processes have been identified and validated, they should be modeled using BPMN.



Source: Prepared by the authors

Figure 10.3 : A simple diagram using BPMN (bizagi software) with two participants.

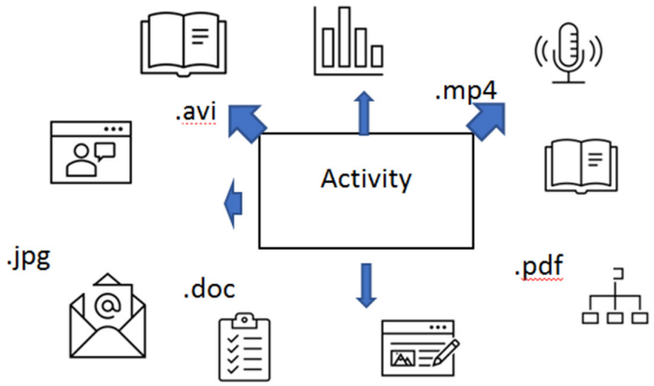
Knowledge Storage

This stage allows us to identify the sources of information that are related to all stages of the process, and which can be stored in an information repository. The processes are accompanied by information related to sources of information, such as formats, memos, reports, emails, documents, guides, manuals, etc. These, in turn, are related to elements that impact the KPIs of some departments. Linking the processes to all of these types of resources is part of the objective of this proposed system.

KPIs and the use of dashboards and indicators will help identify areas of opportunity and potential improvements, encouraging the participation of all involved. Once the processes have been identified and modeled, the resources or subprocesses associated with each of the activities, steps, or stages will be identified. This type of resource can include:-

Regulations	- Reports	- Website
- Shapes or formats	- Guides	- Case study
- Videos	- Post office	- Good practices
- Memorandum	- Reports	- Photos
- Manuals	- Voice recordings	- Checklist
- Interviews	- Reports	

For example, if a process requires a format to be filled, that activity could be related to a particular format and a video about filling it out.



Source: Prepared by the authors

Figure 10.4 : Different data sources an activity can have

The search for these resources will allow you to have an interactive tool that allows the selection of these resources in any of the stages, phases, tasks, or activities of the process. Each process will be related to a format that allows storing the indicators and a dashboard to visualize this data.

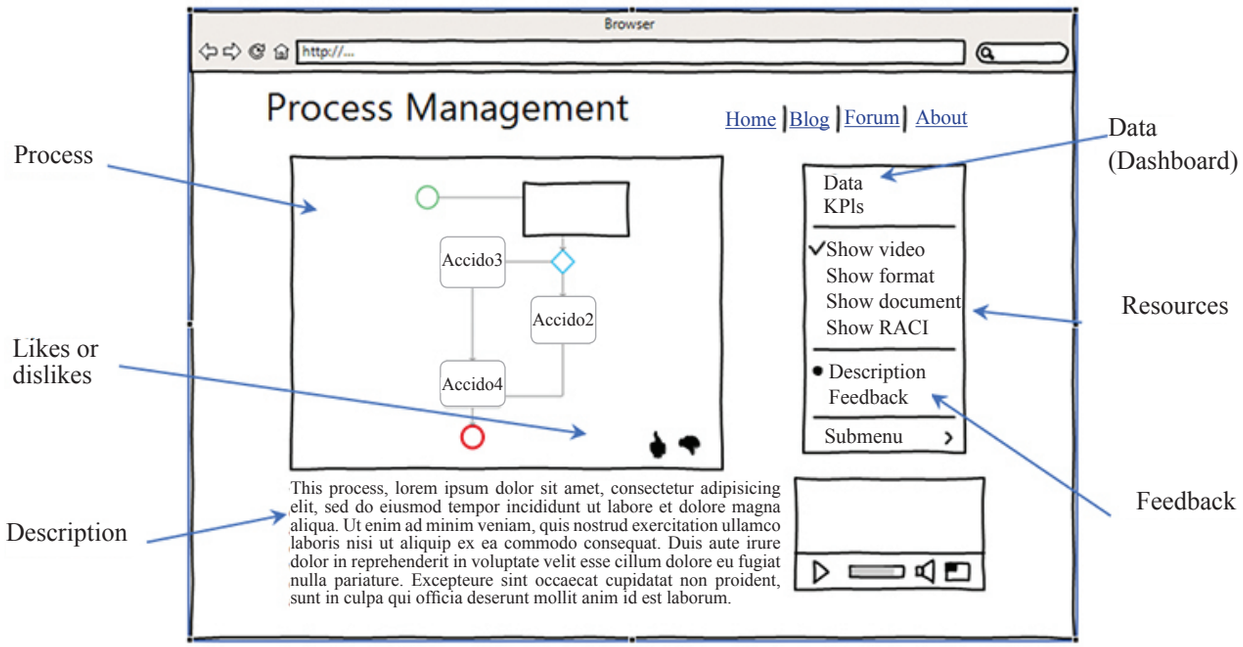
Sharing Knowledge

One of the characteristics of the presented system is that it can be interactive. In the process diagram presented, any stage, task, or activity can be selected and will be linked to a support document, whether it is a format, a support video, a checklist, a document, or a manual. Likewise, each stage of the process is linked to a data document (spreadsheet) that will allow access to the data with the corresponding permissions, as well as a visualization of the KPIs in that same spreadsheet, in addition to a dashboard. For example, for an employee hiring process you can verify a list of documents to be delivered, an interview format, a candidate data format, and a video explaining how to fill out the form. You can also have access to a spreadsheet where you can verify that Human Resources has sent an invitation to fill out and send the requested form. The interviewer may include some comments about the interview and may include in that spreadsheet some of the interviewee's documents, such as their curriculum vitae.

Each of the processes can be evaluated by means of a like or dislike, which will allow you to evaluate if the process is fulfilling its objective; likewise, there is an item related to each process that will allow feedback through text or video, with the aim to evaluate and improve the process.

Searching for information in a simple way will impact the extent to which the system is used, so it is important that it is a simple interface. The intranet will have access to the indicated resources through a process search option:

- Search for processes (using an options menu) by:
- Area (human resources, finance, etc.)
- Type of process (strategic, operational, or supportive)
- Process name
- Role (director, teacher, coordinator, etc.)



Source https://wireframesketcher.com/

Figure 10.5 : Prototype process management tool.

Process selection and visualization

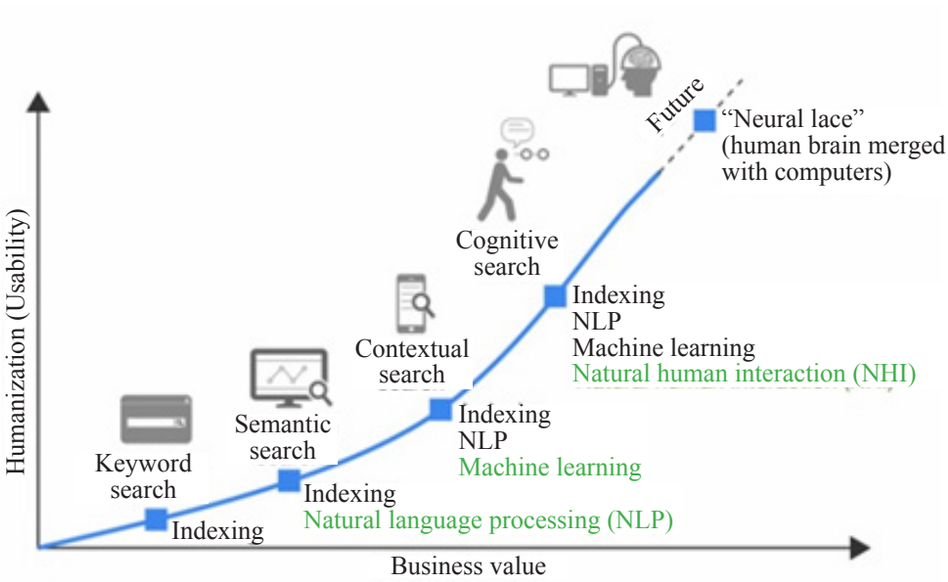
The visualization of processes will be carried out interactively, where each of the tasks associated with the process are linked to resources associated with them, as mentioned above. The elements to be deployed on the process are:

- Process diagram
- Objective of the process
- Process description
- Resources associated with each of the stages of the process (pdf, video, manual, mail, memo, format, etc.)
- Feedback (video or written; provides knowledge and ideas on process improvement)
- Data of those involved
- Like or dislike (will allow us to evaluate if the process is being used and if it is well defined)
- Dashboard
- KPIs, for instance, Net Promoter Score, Study Completion Rate, Exam Passig Rate, etc.
- RACI (involved) see reference (Denagama, Manuraji, Toman, Bandara, & Syed, 2019)

Search engine

The search of information is an element that must be included on a KSM. Recent trends involve the cognitive search, which includes natural language processing to search and gain information from the different resources on the repository.

1. Traditional search engine
2. Cognitive search



source: https://www.forrester.com/blogs/17-06-12-cognitive_search_is_the_ai_version_of_enterprise_search/

Figure 10.6 : The evolution of search engines.

Conclusion

An ODU obtaining the tacit knowledge of its employees is not a simple task, but the advantages of having a knowledge management system focused on educational processes, such as the proposed system, allow all those involved in the training of future students to look for information related to the processes, know about and learn from these processes, and gain feedback from a KMS that will ensure the success of educational processes.

By having a KMS and using it in their daily work, ODUs will raise awareness of the value of knowledge in their daily work and the positive implications that sharing that knowledge would have in their educational institutions, thus using knowledge to generate knowledge.

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