

Specifics of Business Processes Analysis in the University Document Management System

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Abstract: These days, IT departments are focusing on selecting and implementing Document Management Systems (DMS) to streamline decision-making and automate various workflows. Using DMS, documents are stored and accessed much more efficiently through the digitization and automation of processes, significantly reducing the time and costs associated with manual document management. Consequently, it is essential that DMS function efficiently and meet the needs of users. This includes ensuring robust security measures to protect sensitive information and providing intuitive user interfaces to enhance user adoption. Despite the critical role of DMS in IT infrastructure, there is a lack of comprehensive analysis of these systems. This work aims to fill that gap by providing high-quality, reliable information based on real-world analysis of university DMS and their impact on business processes.

Keywords: Document Management Systems (DMS), workflow efficiency, automation, software.

1 Introduction

With the vast amount of information generated and managed by enterprises today, a strong document management system is a must. In a desire to maximize operational effectiveness, modern organizations have systematically evaluated internal processes that consume significant time and have transitioned them to digital formats. The worldwide market for document management systems was valued at over 7.52 billion USD in 2020 and is projected to attain a value of 14.82 billion by 2029. [1]

AIIM states that Document management, sometimes referred to as Document Management Systems (DMS), is the process of storing, organizing, and monitoring electronic documents as well as scanned copies of paper-based data using computer systems and software. [2] Productivity level of companies rises because of saved time and effective procedures which helps employees to focus on other more productive tasks. Moreover, using a DMS improves environmental security, which is another justification for conducting business electronically. [3]

In case study of another research Croatia government usage of DMS showed many benefits, including providing public employees and departments with access to a range of information, enabling effective document handling and communication. Nevertheless, almost half of the DMS implementations are unsuccessful. [4] Experts have different opinions about the reasons of failure; however, the most common reasons are:

1. Poor execution technique, allowing for only limited system use.
2. Procedure was not accurately and completely stated while dms was implemented.
3. Lack of professional knowledge of employees executing the integration.
4. Challenges with integration when the solutions don't work well together.
5. Possibility of errors in the integrated software systems [4].

The real case example of DMS implementation failure could be the Iraqi unsuccessful attempt to implement E-government using DMS, which experts believe caused by the limited amount of a united DMS framework. [5]

University DMS (Document Management Systems) differ significantly from those utilized in other enterprises due to their focus on student services and academic processes. While traditional DMS in businesses prioritize document storage and retrieval for operational efficiency, university DMs encompass a broader scope, incorporating functionalities tailored to the unique needs of educational institutions. These systems not only manage administrative documents but also facilitate

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student record management, academic program coordination, and collaborative research efforts. Consequently, university DMS plays a pivotal role in enhancing the overall academic experience by streamlining processes, ensuring compliance with regulatory standards, and fostering seamless communication among faculty, staff, and students.

The purpose of this study is to conduct a comprehensive analysis of the operation of the process to improve the quality of the processes and reduce the time of the full cycle of the process.

The main methods of our research are time analysis and analysis of the stage of processes, methods of visualization of our data.

2 Literature Review

Despite the critical importance of Document Management Systems (DMS) in modernizing university operations, the academic literature on the standardization of this system remains scant. This section will review existing studies and publications by various authors to better understand the landscape of DMS implementation and its analysis.

Discussions in scholarly articles like "Document Management System – A Way to Digital Transformation" outline critical success factors for DMS implementation, including detailed planning, active involvement of all stakeholders, and strong management support. These factors are essential for overcoming implementation barriers and ensuring that DMS meet the specific needs of academic environments. [6]

This standard is particularly relevant for DMS analysis as it provides a basis for assessing whether a DMS can adequately manage records through their lifecycle. Key considerations include the DMS's ability to:

- Ensure records are identified and managed in a systematic way.
- Protect records from unauthorized access, alteration, and deletion.
- Support compliance with applicable laws and regulations regarding records management.
- Enable efficient and accurate retrieval of documents.

Research [6] offers a compelling exploration of how maturity models can significantly enhance the effectiveness of Document Management Systems (DMS) within organizations undergoing digital transformation. A central theme in the article is the use of the Process and Enterprise Maturity Model (PEMM) to assess an organization's maturity level, which is shown to substantially impact the management and lifecycle of DMS. The findings suggest that higher maturity levels correlate with more successful implementation and utilization of DMS, leading to enhanced organizational efficiency, compliance, and sustainability practices. This relationship underscores the importance of maturity models in providing a structured framework that helps organizations not only adopt DMS more effectively but also to optimize their document management processes and align them with broader digital transformation goals.

The article [8] emphasizes the growing necessity for efficient document management systems to enhance information dissemination, security, and compliance with standardized rules. The review discusses the broader application of DMS in various sectors such as education, government, and business, noting the significant benefits of digital transformation in document handling which include cost reduction, improved efficiency, and enhanced collaborative capabilities. The review highlights the critical functionalities of DMS such as document storage, retrieval, and indexing, which collectively contribute to streamline administrative processes and better governance. The discussion is anchored on how these systems facilitate real-time access and sharing of information, thus meeting the dynamic needs of modern organizations and driving operational efficiencies.

However, despite the advantages highlighted in these studies, there are notable challenges and disadvantages that have not been fully addressed. For instance, while the research provides valuable insights, it does not adequately demonstrate how DMS can be efficiently integrated into an organization's existing infrastructure. Additionally, implementing such systems can be complex and resource-intensive, often requiring significant time, financial investment, and training. There are also concerns about data migration, user resistance, and the potential for technical issues during the transition period. These challenges underscore the need for further research on practical strategies and best practices for overcoming these obstacles to ensure the successful adoption and optimization of DMS in various organizational contexts.

In this paper, we aim to analyze the existing Document Management System (DMS) with a focus on enhancing the business processes integrated into the core framework of the software. Our objective is to identify areas for improvement that can lead to more efficient and effective management of documents within the organization.

3 Methodologies

This study aims to analyze the effectiveness and identify bottlenecks within the Document Management System (DMS) at the university. The methodology involves several advanced data analysis techniques to understand user behavior, predict process durations, identify anomalies, and optimize processes.

This paper is based on quantitative and empirical research methods. In order to analyze DMS of local university the following actions can be implemented:

1. **Data Collection:** Gathering relevant data from multiple sources within the university to ensure a robust dataset for analysis.
2. **Time Consumption Analysis:** Evaluating how much time each process consumes, highlighting areas of inefficiency.
3. **Root Cause Analysis:** Investigating the underlying causes contributing to significant time consumption or inefficiencies in the system.
4. **Solutions and Recommendations:** Proposing actionable solutions based on the analysis to optimize the efficiency of the DMS.

The following sections will describe these steps.

3.1 Data Collection

Data for this study was collected from the DMS database of the local university, comprising 404138 rows and 30 columns. In total, 60 processes are actively used in the DMS. The dataset contains detailed information about the process, including the start and end times of document processing, the IDs of the stages and processes involved in each process. This comprehensive data set made it possible to analyze the efficiency of processes and bottlenecks in the system.

We demonstrate just some examples of tables that have affected the whole DMS system: FlowData, DocumentData, ProcessData. This tables show the relationships between the data and their processing. Figure 1 illustrates a column-based Entity-Relationship (ER) diagram showcasing a subset of tables.

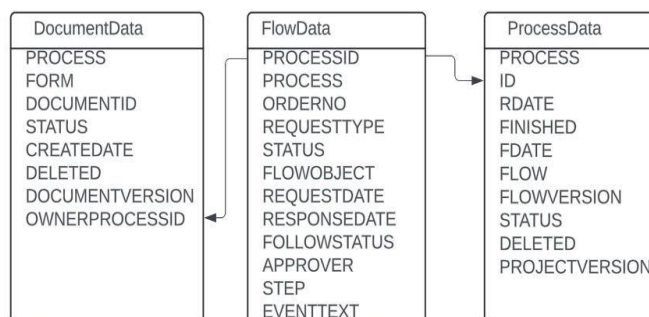


Fig. 1: Entity-Relationship (ER) diagram.

To begin, it is advisable to explain the concept of a business process. A business process can be characterized as a systematic arrangement of activities or tasks designed to accomplish a specific business objective or goal. Business processes may have four main types [9]:

1. **Governance processes**, which oversee the functioning of the organization. These include corporate governance and strategic management processes, such as proposal, syrtykhat.
2. **Operational processes**, which are the primary activities of the organization and directly contribute to its core functions. This includes student application submissions and student service processes, such as medcer, academalys.
3. **Supporting processes**, which provide assistance to the core business operations. Examples include accounting (avans), recruiting (workcertif), and technical support(techreq).
4. **Academic processes**, which pertain to activities related to academic functions within an educational institution. This includes academic work management processes, such as teacher plan, office hour.

3.1 Time Consumption Analysis

To facilitate a thorough analysis, processes were categorized into four main types: academic (teacher plan, office hour), governance (proposal), supporting (maintenance, gray 22) and operational (prikaz, minor). For each flow object within these categories, the frequency of occurrence was calculated, along with the mean and standard deviation of process durations. This frequency and duration analysis provided insights into how often each process is initiated and the variability in completion times.

A comparative analysis was then conducted to identify bottlenecks within each process category by comparing the metrics of processes with overall process metrics. This involved examining the frequency and duration of incomplete processes to pinpoint stages where delays or inefficiencies are most prevalent.

To effectively communicate the findings, boxplots were used to visualize the duration of processes. These visualizations highlighted significant delays in certain processes, providing a clear depiction of inefficiencies and bottlenecks within the DMS.

In Figure 2, we have illustrated an analysis of the duration of ten processes. These 10 processes out of 60 are the longest in time. You can see that it takes more than a year to complete some processes, such as HONORARIUM, TIMETABLE, TEACHERPLAN2, OFFICEHOUR.

It is noteworthy that some processes, such as the "TEACHERPLAN2", are characterized by significant variability and deviations from the norm, and their duration reaches 12,000 hours. In contrast, processes such as "HONORARIUM" are characterized by a greater concentration of shorter time periods, indicating a more stable completion time. This visualization highlights the need for targeted optimization of processes, especially those with a long-time interval, to increase efficiency and streamline operations in the organization.

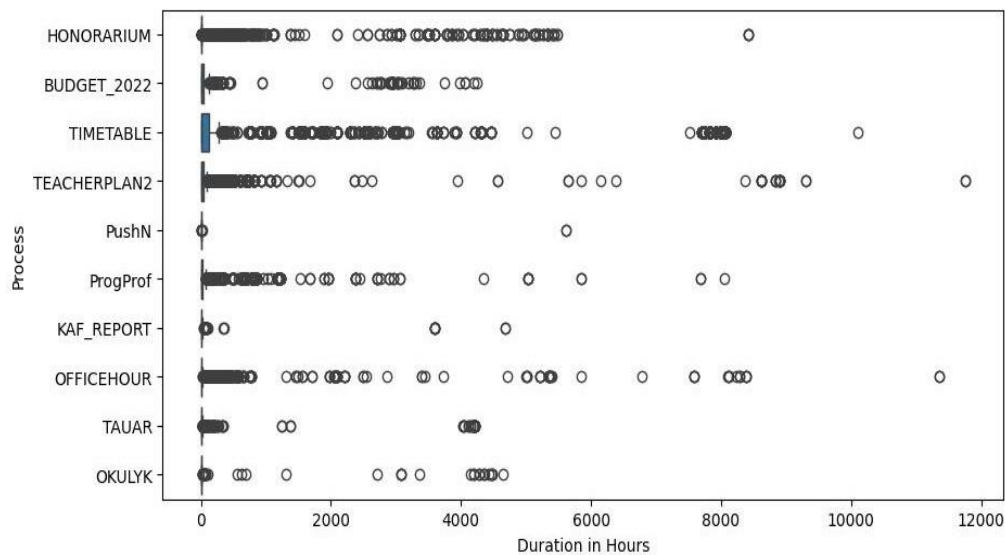


Fig. 2: Processes by duration.

By analyzing the list of problems causing these delays, we identified specific issues contributing to the inefficiencies. One particular issue was chosen to demonstrate the result, but a comprehensive analysis was conducted for all identified problems. This thorough investigation aimed to uncover and address the root causes of delays, thereby optimizing the efficiency of the DMS at local University.

4 Results

The comprehensive analysis of the Document Management System (DMS) at local University revealed several key bottlenecks across different process categories. The identification of these inefficiencies is critical for improving the system's overall performance. Below, we present the major findings categorized by process type, along with the detailed analysis of process durations. The findings are summarized in the table below, showcasing the mean durations for key flow objects within each process category:

To provide a clear example of the identified issues, we added a duration distribution analysis by flow object for the TEACHERPLAN2 process. The analysis (Figure 3) showed that the Starter flow object, which is the initial stage in the

process, had the highest mean duration of 40 days, when the expected duration is 1.0 - 10.0 days. This significantly delayed the overall process completion time.

Table 1: Mean Duration of Key Flow Objects by Process Category.

Process Category	Process	Flow Object	Mean Duration (days)	Expected Duration (days)
Governance	Proposal	Starter	12.4	1.0 - 3.0
Supporting	TechReq	Responsible person	15.8	1.0- 2.0
Supporting	MAINTENANCE	Technician	14.5	1.0- 2.0
Operational	GPAY 22	Responsible person	16.3	1.0 - 5.0
Academic	TEACHERPLAN2	FlowStarter	40.05	1.0- 10.0

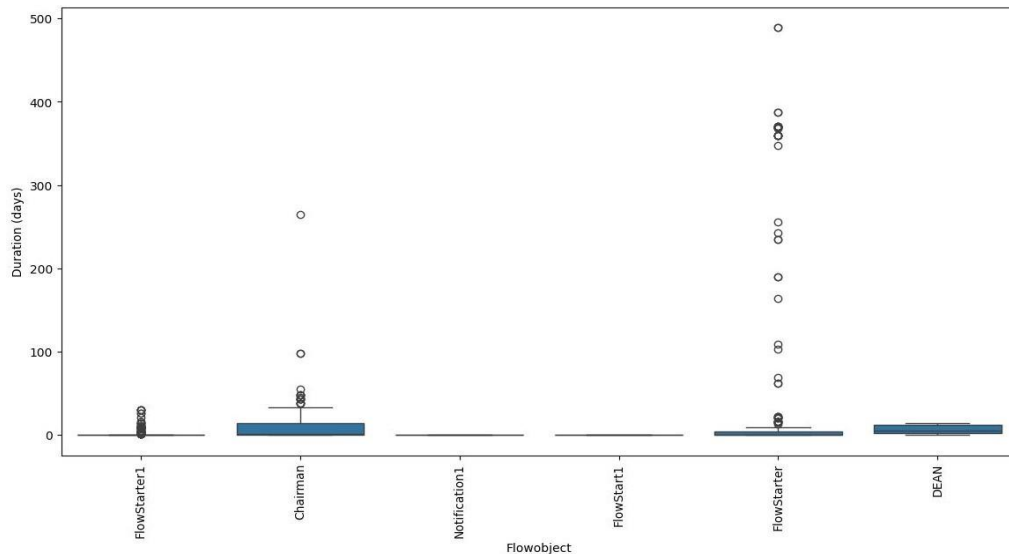


Fig. 3: Duration distribution by FlowObject for process: TEACHERPLAN2.

Additionally, we mapped out the flow of the TEACHERPLAN2 process to understand how each stage contributes to the total duration. The flow diagram (Figure 4) revealed that delays at the Starter stage create a cascading effect, impacting subsequent stages and leading to prolonged process durations. This visualization underscores the importance of addressing the bottlenecks early in the process flow to enhance overall efficiency.

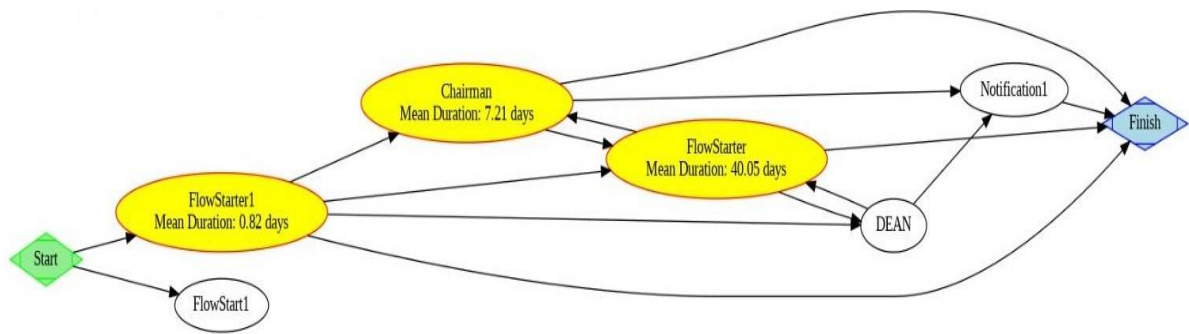


Fig. 4: Flow diagram for process: TEACHERPLAN2.

After the analysis, we found out what problems we have in our workflow. After that, books and articles on optimization and process management were studied. And suggestions have been made to improve the process. To ensure consistency and efficiency of all processes, it is necessary to meet these requirements.

1. Clear definition of the stages of the process: During the analysis of existing processes within our Document Management System (DMS), it became evident that lack of clarity in the definition of process stages led to misunderstandings and inefficiencies. By clearly defining each stage, including inputs, outputs, and responsible parties, it becomes easier to understand and manage the process flow [11].
2. Consistent Terminology: Create standardized terminology for all processes. During the analysis, the flowobject names were different for different processes. And this made it more difficult to draw conclusions and took time to

check each analysis, to understand the result of the analysis. The effectiveness of standardized terminology will help when the number of processes grow, and analysis becomes easier. Consistency of terminology helps to avoid misunderstandings and helps users not to get confused in understanding the process.

3. Automated notifications: Implement automatic notifications of key events in processes, such as assigning tasks awaiting approval and that the process remains inactive for a set period (for example, one month). These notifications can prompt users to take timely action, reducing delays. During the analysis, it was noticed that there is no reminder of an inactive process. And the need to hire soon.
4. Deletion Policies: Set and apply policies to delete inactive processes. This includes automatically sending notifications to users about incomplete processes and allows users to initiate the removal of suspended processes, which ensures the cleanliness and efficiency of the system. To do this, you need to determine what constitutes an inactive process. For example: it remained untouched for a month. Sending notifications and deleting at the user's initiative.
5. Standard Operating Procedures (SOP): Document a detailed SOP for each process. These procedures should be a complete step-by-step guide that users can follow to ensure consistency. It is also necessary to study the rules for each process and set the execution time for each stage. This will help to optimize and reduce the running time of the process [10].

By implementing these proposals and detailed standardization requirements, the university can significantly improve the efficiency of its document management system, reducing delays and increasing overall process productivity.

5 Discussion

The evidence strongly suggests that the current configuration and workflow of the DMS may benefit significantly from a detailed review and restructuring. By eliminating redundant steps and introducing automation where feasible, the system can be optimized to enhance performance, reduce processing times, and minimize errors, thereby improving overall efficiency and effectiveness in handling document management at local University.

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6 Conclusions

To sum up, in this article we analyzed the Document Management System of the local university based on its business processes performances. To achieve our goal in this research, we have completed a number of tasks. Firstly, we have collected data related to the user's usage of DMS. Next, data analysis using statistics was performed in order to find any anomalies. Lastly, we made a suggestion on how to increase efficiency of current DMSs' workflow. Methods such as automation and simplification of processes and continues employees training sessions are proposed. Technical suggestions include implementation of notification functionality, reduction of process steps and adding delete functionality. By implementing notification functionality, the users will be reminded of their processes which are not active for a long period of time which ensures continues workflow. Reduction of process steps will boost the user experience and operational efficiency. Through streamlining workflows and eliminating unnecessary steps, the system will become more user-friendly and faster, reducing the possibility of congestion and user frustration. With the addition of a delete button, users can end unnecessary or inadvertently started operations. This feature keeps workflow environments neater and easier to manage by preventing processes from being stuck without action.

In the future, we plan to implement all of the above suggestions and investigate how these modifications have affected DMS over time, evaluating gains in system efficiency and user satisfaction. We also intend to analyze the UI/UX of the System and the forms of the processes. To study the UI/UX rules and ISO, IEC and our country national standards for document management. And improve not only the flow of the process, but also the form. In addition, we intend to distribute a survey to university administrators, including the elements that can affect the quality of DMS by considering the responses provided by the respondents.

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