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On the Use of JBPM for the Rapid Prototyping of Processes

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Abstract

Scientific research laboratories are characterized by complex processes, many of which are traditionally performed manually, leading to reduced efficiency and increased errors. Therefore, there is a need for tools and methodologies that simplify these processes, enhance accuracy, and facilitate collaboration among stakeholders.

In this project, we developed a workflow application for the LINFI lab at the Mohamed KHIEDHER University of Biskra. We employed the BPMN methodology for designing and modeling laboratory processes and utilized the JBPM platform to leverage its tools for the development, implementation, and testing of the workflow application.

At the conclusion of this project, we present the interfaces of our application, along with the analyses and results obtained from the experience of using this application. This demonstrates how the application can improve process efficiency, accuracy, and collaboration in the laboratory environment.

Keywords: BPM, BPMN, JBPMN, automation, and process.

Résumé

Les laboratories de recherche scientifique se caractérisent par des processus complexes; dont beaucoup sont traditionnellement effectués manuellement , ce qui entraine une efficacité réduite et des erreurs . Par conséquent , nous avons besoin d'outils et de méthodologies pour simplifier ces processus, les rendre plus précis et permettre la collaboration entre les parties prenantes .

Dans ce projet , nous développons une application de workflow pour le laboratiore LINFI de l'Université de Biskra .Nous utilisons la méthodologie BPMN pour concevoir et modéliser les processus de laboratoire, ainsi que la plateforme JBPM pour exploiter ses outils dans le développement, la mise en oeuvre et les tests de l'application de flux de travail . A la fin de ce travail, nous présentons les interfaces de ntre application, ainsi que les analyses et résultats obtenus grace a l'expérience d'utilisation de cette application .

Mots-clés: BPM, BPMN, JBPMN, automatisation et processus.

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General Introduction

In the realm of contemporary business strategies and operational optimization, the strategic utilization of advanced tools and methodologies is essential for achieving unparalleled efficiency and adaptability. Among these methodologies, Business Process Model and Notation (BPMN) stands out as a standardized graphical representation, enabling seamless visualization and comprehension of intricate business processes. Alongside BPMN, workflow management systems (WMS) play a crucial role in orchestrating and automating these processes, ensuring flawless execution and real-time monitoring.

This study delves into the essence of BPMN, workflow management, and particularly the trans-formative capabilities of the JBPM platform (JAVA Business Process Model). It highlights their indispensable significance in streamlining business operations, enhancing productivity, and fostering a culture of innovation. Mastery of these paradigms not only lays a solid foundation for impeccable process management but also underscores their paramount importance in shaping the contemporary landscape of organizational efficiency.

Amidst the myriad of workflow management systems, JBPM emerges as a robust platform epitomizing the virtues of agility, adaptability, and scalability. Built on open-source foundations, JBPM empowers organizations to embark on their digital transformation journey, offering a comprehensive suite of tools for process modeling, automation, and refinement. With its user-friendly interface and extensive functionalities, JBPM enables businesses to navigate dynamic market conditions, streamline operations, and drive innovation

The synergistic integration of BPMN, workflow management, and platforms like JBPM encapsulates the evolutionary trajectory of contemporary business process management. By embracing these conceptual frameworks and cutting-edge technologies, organizations can transcend conventional boundaries, foster collaborative synergies, and unlock new avenues for sustainable growth and competitive advantage.

0.1 Problematic & Research Questions

Laboratories are essential for scientific research and industry, but their operations can be complex and time-consuming. Traditional management methods often lead to inefficiencies and errors. Implementing a BPMN-based management application using JBPM offers a promising solution, improving organization and efficiency while reducing errors. However, challenges must be addressed for successful implementation and adoption.

Research Questions:

- What are the key features and functionalities that should be included in laboratory workflow management applications to enhance task organization and automation?
- How can the JBPM platform be effectively utilized to develop a laboratory workflow management application?
- What are the potential benefits of adopting a laboratory workflow management application using BPMN and the JBPM platform?
- What are the primary challenges and bottlenecks faced in managing laboratory tasks and workflows using traditional manual methods?
- What steps are necessary to gather and analyze information on current laboratory processes to identify weaknesses and deficiencies?
- What criteria should be considered when designing and implementing a workflow management system in a laboratory environment?
- How can a BPMN model be implemented on the JBPM platform?
- How can workflow processes in JBPM be customized and adjusted to meet the specific needs of a laboratory?
- What is the impact of implementing a workflow management system on the effectiveness and performance of laboratory staff?

0.2 Objectives

Our project aims to develop a workflow application for laboratories using the JBPM platform. By leveraging JBPM, we intend to streamline and automate complex laboratory processes, thereby enhancing productivity, accuracy, and compliance with industry standards. This project will explore JBPM's capabilities in addressing the unique challenges faced by laboratories, aiming to improve process efficiency, reduce manual errors, and enhance data integrity.

Our project focuses on digitizing pedagogical processes through a case study modeled with BPMN and implemented using JBPM. Specifically, we aim to design and implement a workflow application for the effective management of laboratory processes at the Departement of Computer Science, University of Biskra. The objectives of this project are:

1. **Gathering and Analyzing Current Process Information:**
    - Conduct a thorough analysis of the existing laboratory processes to understand the current workflow and identify areas for improvement.
    - Document the existing processes using BPMN to create a clear and standardized visualization.
2. **Improving Workflow Efficiency:**
    - Identify inefficiencies and bottlenecks in the current laboratory processes.
    - Propose optimized workflows to streamline operations and reduce delays.
3. **Automating Laboratory Processes:**
    - Utilize BPM tools and low-code development technology to automate the identified processes.
    - Develop a JBPM-based application to manage laboratory tasks, ensuring consistency and accuracy.
4. **Enhancing Task Management:**
    - Implement features that facilitate better task assignment and tracking.

- Ensure that tasks are completed in a timely manner with minimal errors.

5. **Increasing Efficiency:**

   - Leverage automation to reduce manual work and increase the overall speed of laboratory processes.
   - Monitor the performance of the new workflows to continuously improve efficiency.

6. **Improving Collaboration:**

   - Foster a collaborative environment by providing tools that enable better communication and coordination among laboratory staff.
   - Ensure that all stakeholders have access to real-time information and updates on workflow progress.

By achieving these objectives, we aim to create a robust and efficient workflow management system that enhances productivity, accuracy, and compliance with industry standards within the laboratory environment at the Faculty of Computer Science, University of Biskra.

0.3 Organization of the report

This report is organized into four chapters:

This report is organized into four chapters, each detailing a specific aspect of the project from foundational concepts to the final implementation and results. Below is an overview of each chapter:

1. **General Introduction**

   The introduction provides an overview of the report's structure and highlights the primary focus areas. It sets the stage for a detailed exploration of workflow management, process modeling, and the development of a laboratory workflow application using JBPM.

2. **Chapter 2: Workflow Approach**

This chapter outlines key concepts in the field, including groupware, workflows, application types, and details about workflow applications. It sets the foundation by explaining the significance of workflows and how they are applied in various contexts.

3. **Chapter 3: Processes and Modeling**

   This chapter discusses the theoretical techniques and tools used for the process of modeling and developing our application. It includes a detailed exploration of Business Process Model and Notation (BPMN) and how it is used to visualize and improve business processes.

4. **Chapter 4: Conception and Realization**

   This chapter contains the project's analysis and design, presenting the different proposed diagrams and models. It covers the steps taken from conceptualization to the realization of the workflow application, providing insights into the design decisions and methodologies employed.

5. **Chapter 5: Experimentation and Results**

   The final chapter showcases our implementation steps and the developed application. It documents the practical aspects of the project, including the experimentation process, challenges encountered, and the results achieved. This chapter demonstrates how the theoretical concepts were applied to create a functional workflow application for laboratory management.

6. **General Conclusion**

   The conclusion summarizes the key findings and accomplishments of the project. It reflects on the overall process, highlighting the success of the implementation and the improvements achieved in laboratory workflow management. The conclusion also discusses potential future enhancements and the broader implications of the project for workflow management in educational institutions.

Chapter 1

Backgrounds: Workflow Approach

1.1 Introduction

Groupware technology, such as Workflow, plays a crucial role in enhancing productivity and competitiveness within companies by effectively organizing and distributing work processes. By automating tasks and facilitating concurrent activities, Workflow technology expedites information flows, leading to improved efficiency. Recently, businesses have been adopting process-based work structures as an alternative to traditional hierarchical setups to optimize group work and achieve desired performance levels. Initially utilized for automating administrative processes like paper transfer between departments, Workflows have evolved to successfully simulate industrial processes, particularly in software engineering.

In this chapter, we will first explore groupware technology and its significance in modern business environments. Then, we will delve into Workflow, examining its typology and fundamental elements. Finally, we will present the different types of existing workflows and the most recent reference model for workflow management systems.

1.2 Groupware

Groupware serves as a technology tailored for collaborative work, especially beneficial for remote collaboration across diverse time zones and locations [7]. It stands apart from individual productivity software by adopting a nuanced perspective on technology, acknowledging the social and organizational context inherent in collaborative endeavors. In essence, groupware comprises an array of methods, techniques, and software tools crafted to elevate teamwork, communication, and information sharing within work-groups.

This technology enables electronic communication and remote document sharing. Its toolkit encompasses diverse elements such as messaging tools, shared calendars, document spaces, contact management software, workflow tools, and electronic conferencing. By doing so, groupware aims to enhance the overall environment for collaboration, coordination, and communication within work processes.

Groupware represents a collection of processes harnessed by workgroups to attain shared objectives, placing a strong emphasis on fostering teamwork and facilitating information sharing (Figure 1.1).

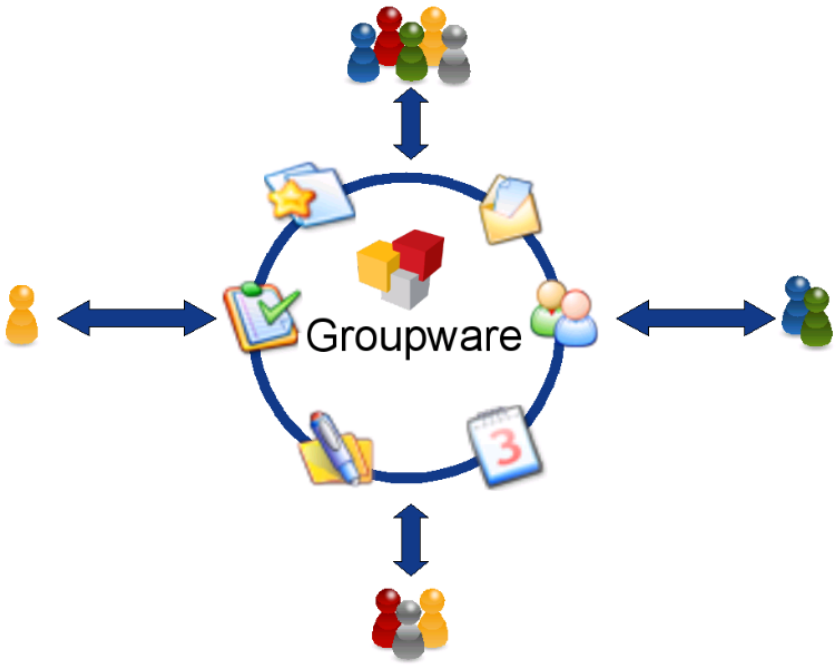


Figure 1.1: Groupware collaborative work

1.2.1 Definition: *Groupware*

In 1980, mentors Peter and Trudy Johnson-Lenz coined the term "groupware," blending the concepts of group collaboration ("*group*") and technology ("*ware*" from "software"). This technology, focused on communication improvement, encompasses tools like messaging, group agendas, and information sharing.

The 1981 definition highlighted that groupware prioritizes the human aspect, emphasizing a combination of technologies and organizational structures to facilitate effective communication and coordination within a group.

Groupware involves various functionalities, including asynchronous and remote collaboration, data usage, and communication among multiple participants. It supports structural changes, tracking, process organization, and quantification through statistics.

In essence, groupware refers to technologies and methods for electronic communication that enable information sharing within collaborative work-groups. This includes software tools facilitating remote document sharing and collaboration over networks, involving shared agendas, document spaces, forums, and conferencing tools. [9]

1.3 Workflow Approach

Currently, the business world is interested in the role that IT can play in the organization of work. The workflow is a tool that provides real assistance in the organization, execution and optimization of a work process .

1.3.1 History

In the 1990s, the notion of workflow originated from research into software tools aimed at fostering collaborative work. Workflow was specifically tailored for structured or potentially structured processes that engaged various participants within an organization. Its central objective was to boost productivity and quality by tackling challenges like document flow, queueing, delays, and coordination. This concept became intricately linked with Electronic Document Management Systems (EDMS) or Document Management Systems (DMS).

Workflow solutions introduced in the 1990s typically comprised an engine and a language, with some incorporating graphical modelling environments. These systems aimed to assist developers in areas where tasks were assigned, and workflow patterns dictated the flow of these tasks. They found significant application in domains where task management was paramount, such as imaging and document management systems. In such cases, workflow engines played a key role in automating processes, managing unstructured business data, and defining task movements through workflow patterns.

In recent years, the field of workflow management has experienced substantial transformation owing to progress in technologies such as Artificial Intelligence (AI), Robotic Process Automation (RPA), and machine learning. These technological advancements have facilitated intelligent decision-making and the automation of processes. Workflow management continues to be essential for ensuring organizational efficiency as businesses work towards optimizing their processes, reducing manual workloads, and fostering smooth collaboration among different aspects of their operations. [15]

Where Are We By the End of the 90's?

Workflow engines had successfully understood the patterns involved in communication between mobile systems (Petri-nets, pi calculus and other maths). Languages had been formed that could provide high-level access to these patterns.

1. Unstructured information could be easily attached to tasks managed by a workflow engine.

2. Run-time execution reflected the utilization and consumption of resources, allowing for more advanced understanding of these costs.

1.3.2 Definition: *Workflow*

A workflow is a system whose elements are activities, related to one another by a trigger relation and triggered by external events, which represents a business process starting with a commitment and ending with the termination of that commitment. [17]

A workflow is a case-based business process , every action performed in a workflow corresponds to some case. Typically, cases are generated by the workflow's environment. The goal of the workflow is to handle cases as efficient and effective as possible. [24]

1.4 Typologies of workflow applications

Workflow applications come in diverse types, each tailored to meet specific organizational requirements. They vary not only in functionalities but also in technical architectures. Establishing a typology based on different process types is essential for comprehending the nature of workflows, providing decision support for specific field problems. The examination of technical criteria enables the creation of two classifications: technical and functional. This categorization aids in understanding the essence of workflows and serves as a decision-making guide for organizations .[10]

1.4.1 Technical typology

Based on technical criteria which will establish a classification according to the dominant technology: messaging or database. It will determine the integration implications with the organization's network infrastructure as well as other existing applications called by the workflow [12].

1. **Messaging Engine**

   A messaging engine accompanied by functional extensions can be used to develop certain workflow applications. Either the workflow is developed from classic applications written in visual basic for example, to which messaging is coupled. These solutions support simple and lightweight workflows involving a relatively small number of participants.

2. **The Database Or Server Approach**

   The database or server approach is developed either around a market product or around a proprietary product. The workflow and the majority of its features are server-based. This type of environment supports heavier workflows, based on more sophisticated management rules.

1.4.2 Functional Typology

Based on functional criteria which will establish a classification centered on the workflow depends on the function that the process requires of it. The segmentation proposed by the Workflow Management Coalition (WFMC) is very useful for functionally representing the different workflow applications [12], [19].

1. **Production Workflows:**

   Workflow is best suited for operational and repetitive processes critical to overall company performance, particularly those contributing significant added value. The objective is to optimize these processes, ensuring a high standard of quality and precision for tasks that are relatively routine.

   These processes typically involve basic operational participants, with clearly defined and well-established rules guiding their predefined routes. Instances of each process tend to unfold in a standardized manner. This workflow type is marked by a formal procedural framework where actors understand their roles at each stage, and interactions and decisions are predetermined . [19]

2. **Administrative workflows:**

   This workflow category focuses on automating administrative document processes to improve the efficiency of collaborative groups. It primarily targets relieving companies of repetitive administrative tasks characterized by simplicity and predictability. Automation in these workflows enhances group productivity by simplifying routine tasks and reducing human errors. These systems facilitate the linkage of documents and information to administrative tasks, streamlining the filling of forms. Typically, this type of workflow has a stable and enduring structure, requiring minimal modifications and not necessitating access to multiple information systems during execution. [19]

3. **Collaborative workflows:**

   This type of workflow concerns processes intended to optimize group work. These groups can consist of small project-oriented groups up to widely dispersed groups with common interests. Processes are far from rigid and can be changed frequently. [19]

4. **Ad hoc Workflows:**

   Ad-hoc workflows automate exceptional, occasional, or unique procedures, managing processes that are challenging to define and predict in detail. These systems enable users to swiftly and easily create or modify process definitions to adapt to unique situations. Typically associated with administrative routines, examples include managing institutional correspondence with intermediate reviews and approvals, as well as the recruitment process for specific skills. Ad-hoc workflows provide a flexible solution for automating less structured and more unpredictable procedures. [19]

1.5 Basic Workflow Concepts

Basic workflow concepts are explained using *Ronni Marshak's* '3R' (Routes, Rules, Roles) [19].The ***3R*** described as follows:

1. ***The routes***

   function of workflow was document, information, or task routing. This involves defining the pathways (routes) that results take between activities and participants.

2. ***The rules***

   The management of rules for coordinating activities is complementary to routing because the route of a process depends on the rules which define both the nature of the information and its methods of transport from one person to another. These rules can be simple, complicated or complex, but what is certain is that they are essential to the workflow.

3. ***The roles***

   Ultimately , you have to manage the different roles. It's about managing the different people who carry out tasks and who communicate with each other. Here, it is important to note that in fact, we do not manage people as individuals but as roles, that is to say functions.

1.6 The Relationship Between The Workflows and The Groupware

The classification of groupware applications is closely tied to specific types of collaborative processes, such as those found in industry, commerce, and administration. These applications are designed to facilitate the coordination and collaboration among various participants throughout the progression of these processes, often referred to as "workflows."

Workflows represent a specific type of groupware responsible for managing the flow of documents and information between different participants at key stages of the collaborative process. By automating these workflows, organizations can ensure that tasks are completed in a structured and efficient manner, reducing the likelihood of errors and delays.

1.7 Fundamental Workflow Terminology

1.7.1 Workflow

The automated execution of a business or laboratory process, involving the transfer of documents, information, or tasks between participants, be it machines or humans. This follows a set of procedural rules, creating an organized and repeatable pattern of business activity [13].

1.7.2 Process

Contains all necessary information about the process to enable it to be executed by the workflow enactment software, including start and completion conditions , constituent activities with navigation rules , user tasks, application references, workflow data definitions, and more . [16].

1.7.3 Activity

Refers to a specific task or operation that is part of the overall process. It is a unit of work that contributes to the completion of the entire workflow. Each activity has a specific purpose and contributes to the overall goal of the workflow, facilitating the systematic and efficient completion of the entire process [23].

1.7.4 Task

Tasks are individual steps or actions that must be performed (usually within a designated time period) in order to complete a workflow or process. Examples of tasks include sending emails, creating documents, data entry, labeling products, or creating reports. Many types of tasks can be automated to improve the employee experience and free up resources and time for more valuable activities .

1.7.5 Actor

An actor ,also Known as a "agent", "participant", or "user", is an entity within the organizational model that participates in and performs specific roles or tasks within a workflow . This entity, whether human or material (such as a machine or computer device), is responsible for carrying out activities assigned to it through roles defined in the organizational structure .

1.7.6 Data (Resource)

Refer to the information, materials, or assets that are processed, or generated during the execution of activities within the workflow . Examples include internal databases, customer orders, raw materials, and external reports . [8].

1.8 Workflow application areas

Initially, workflows were used primarily for automating administrative processes, such as the transfer of paper documents between departments. Over time, they have evolved to simulate more complex industrial processes, particularly in the field of software engineering. Workflows have multiple applications in today's world. The evolution of the company's organizational processes leads to the use of this tool. It responds to a need for optimization of work processes in terms of use of resources and effective time [27]. Modern workflows are capable of handling intricate processes that involve multiple participants, diverse tasks, and extensive information flows.

The workflow is led to play an important role in the IT world, such as the process of developing software by integrating the cooperative work aspect within the workflow, we can link the progressive integration of the elements of software with the planned organization. The project manager thus has a control tool over the progress of the project and the consistency of the system in terms of details .

In software engineering, for example, workflows are used to manage the development lifecycle, from requirement gathering and coding to testing and deployment. Groupware applications in this context ensure that developers, testers, project managers, and other stakeholders can collaborate effectively, adhere to project timelines, and maintain high-quality standards.

1.8.1 Types of Collaborative Processes

Collaborative processes can be broadly categorized based on their application in different sectors:

1. **Industry:**

   In industrial settings, workflows are used to manage production processes, quality control, and supply chain operations. Groupware applications facilitate communication and coordination between different departments, such as engineering, manufacturing, and logistics, ensuring that each step in the production process is completed efficiently and on time.

2. **Commerce:**

   In the commercial sector, workflows streamline activities such as order processing, customer relationship management, and sales operations. Groupware applications help sales teams, customer service representatives, and managers collaborate effectively to meet customer demands and improve service delivery.

3. **Administration:**

   In administrative environments, workflows automate routine tasks like document approval, scheduling, and resource allocation. Groupware applications enable administrative staff

to work together seamlessly, improving organizational efficiency and reducing the administrative burden on employees.

1.9 Workflow in Administration:

It is a set of activities through which all management tasks are organised with the aim of increasing efficiency through coordination between members at work, distributing tasks to employees and knowing all the necessary information easily from the time required for each task and who will perform it, as well as communication in case of questions and methods of cooperation between employees, as well as setting dates for all tasks in order to avoid delays and ensure the workflow. As well as analysing projects and modifying processes if necessary

1.10 Research Laboratory Case

Laboratory workflows are essential for the systematic management of various tasks and processes within a research laboratory. These workflows encompass a wide range of activities, including sample handling, instrument usage, data entry, quality control, safety measures, collaboration, and equipment maintenance. By organizing these tasks into well-defined processes, laboratory workflows ensure efficiency, accuracy, and regulatory compliance

In summary, workflows in the laboratory organize tasks, allocate resources, and define schedules, leading to effective and high-quality results while optimizing operations. By implementing structured workflows, research laboratories can enhance productivity, ensure compliance with regulations, and maintain high standards of safety and quality.

1.11 Advantages of workflow

Implementing workflows in organizational processes offers numerous advantages, including:

- **Increased productivity, efficiency, and transparency:** Streamlined processes reduce the time and effort required to complete tasks, enhancing overall productivity. Clear work-

flows improve transparency, making it easier to track progress and identify areas for improvement.

- **Effective risk management:** Workflows help identify and mitigate potential risks by standardizing procedures and incorporating checks at critical points, reducing the likelihood of errors and adverse events
- **Reduced communication effort:** Automated workflows facilitate seamless communication between team members, reducing the need for repetitive updates and minimizing misunderstandings.
- **Faster response times and improved customer satisfaction:** Efficient workflows enable quicker response to customer inquiries and requests, enhancing customer satisfaction and loyalty.
- **Fewer errors:** Standardized processes and automated checks reduce the incidence of errors, leading to more accurate and reliable outcomes.
- **Faster data entry:** Automated data entry processes minimize manual input, reducing the time and effort required to record information and decreasing the potential for errors.
- **Quick decision-making:** Real-time access to data and streamlined processes enable faster decision-making, allowing organizations to respond swiftly to changing circumstances.
- **Flexible adaptation to changing circumstances:** Well-designed workflows are adaptable, allowing organizations to modify processes quickly in response to new challenges or opportunities.
- **Resource optimization and cost reduction:** Efficient workflows optimize the use of resources, reducing waste and lowering operational costs.
- **Enhanced data accessibility:** Centralized and standardized data management ensures that information is easily accessible to authorized personnel, facilitating better analysis and decision-making.

- **Clear expectations for employees:** Defined workflows provide employees with clear guidelines and expectations, improving accountability and performance.

Incorporating workflows into organizational processes can significantly enhance operational efficiency, reduce costs, and improve overall performance. By leveraging the benefits of workflows, organizations can achieve higher levels of productivity and quality, leading to sustained competitive advantages.

1.12 Conclusion

In this chapter we introduced the concept of groupware, then we defined the workflow. Secondly, we looked at the basic concepts, technical typologies, and functionalities. Finally, we talked about The main functions of a workflow application. In the next chapter, we will focus on the presentation of the concept of process and its modeling using the BPMN method .

Chapter 2

Methods And Tools

2.1 Introduction

In this second chapter of the project, we will discuss "Methods and Tools" for process management. We will explore the definition of processes and their types, as well as delve into the realm of business process management (BPM) and business process modeling techniques and methods. Additionally, we will conduct a comprehensive study of PBMN (Process-Based Management Notation) and specifically focus on a detailed analysis of JBPMN.

2.2 Definition of a process

A process is a systematically connected set of tasks designed to achieve operational goals. It can be visualized as a sequence of interrelated activities executed over a specific time frame, transforming input elements into output elements. Resources such as personnel, equipment, materials, and information are integral to the facilitation of this process.

The primary objective of any process is to produce a product or service that aligns with the needs and expectations of customers, ultimately fulfilling business objectives. This customer-

centric approach underscores the creation of value for the end-user. The commencement of a process is contingent upon internal and/or external business events, particularly changes in the states of system components [6].

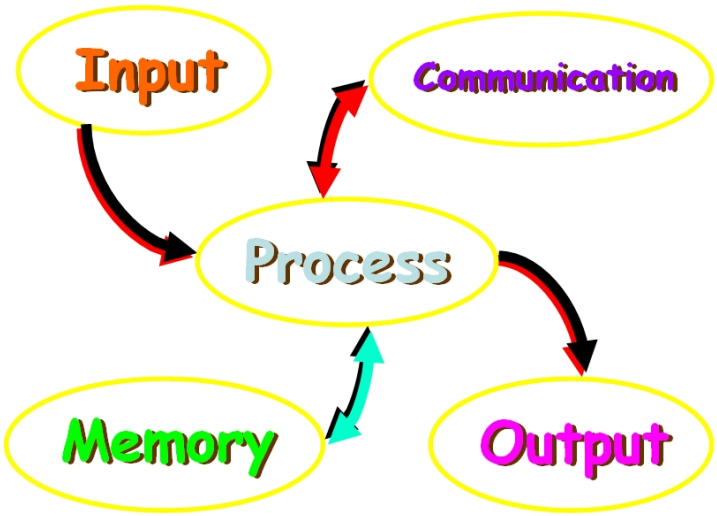


Figure 2.1: General outline of a Process

Process Characteristics :

Understanding the characteristics of business processes is essential for effectively managing and optimizing organizational operations. Here, we outline the key characteristics that define business processes:

- Business processes offer a dynamic view of organizational operations, establishing specific goals and objectives.
- Each process is defined by a singular input and output, showcasing the transformation of resources throughout its execution.
- Processes consist of sub-processes and activities, where activities serve as the fundamental units of action.
- Activities involve the conversion of input resources into output resources, encapsulating the essential functionality of the process.

- The process is visually represented through an activity graph, illustrating the sequential flow of tasks necessary to attain the defined objective.
- The core objective of a business process is to enhance the value of goods or services offered by the organization.
- A transition function oversees the procedural progress, ensuring seamless flow and effective coordination between activities.
- Resources, encompassing means, knowledge, or tools, play a crucial role as components used by activities to fulfill their tasks.

2.3 Types of Processes

Organizational processes can be categorized into various types [26], each serving a specific function within the structure and operations of an organization. Here are some common types of organizational processes :

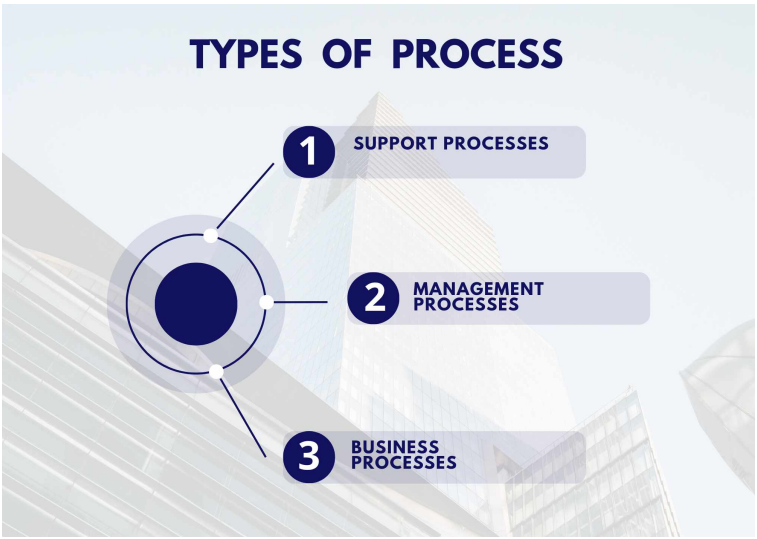


Figure 2.2: Processes Classification

2.3.1 Support processes

Support processes play a key role in enhancing overall efficiency and managing the product life cycle. Despite not directly generating revenue, these processes are strategically vital, serving as the backbone that sustains and enables the success of an organization.

Support processes in organizations, such as product development and marketing are crucial for ensuring the smooth operation of core business functions.

2.3.2 Management processes

Management processes play a pivotal role in organizational success by restating strategy, setting goals, and directing quality initiatives for continuous improvement. They involve planning activities, managing improvement, and defining and monitoring goals .

2.3.3 Business processes

Business processes are organized series of activities designed to attain organizational goals by converting inputs into desired outputs, typically delivering products or services to customers. These task sets are systematically initiated by business events, governed by established rules, and allocate resources to achieve objectives for both internal and external customers. In summary, business processes offer a systematic and repetitive method for handling tasks within an organization, ensuring efficiency and goal achievement.

2.4 Business Process Management (BPM)

2.4.1 Definition: *Business Process*

A business process is a sequence of tasks or activities that an organization performs to achieve a specific organizational goal [14]. These processes are essential for coordinating various functions within the organization, ensuring that resources are utilized efficiently and effectively to deliver value to customers and stakeholders.

A business process can also be defined as a set of linked tasks that find their end in the delivery of a product or service to a client.

Business process management is a people-driven discipline organizations use to create, manage, and optimize processes. The ultimate goal of BPM is to continually improve business results. BPM focuses on an entire process rather than individual tasks, which helps strengthen performance, KPIs, and outcomes and results in fewer errors, happier customers, and lower costs.

The process must involve clearly defined inputs and a single output. These inputs are made up of all the factors that contribute (either directly or indirectly) to the added value of a product or service.

According to Gartner, a foremost authority in BPM research, the importance of business process management lies in its ability to synchronize people, systems, and information to achieve targeted business outcomes [22].

BPM helps both project managers and business process managers improve team and organizational process performance, where it works on :

- Strengthen productivity by identifying and correcting inefficiencies.
- Streamline operational efficiency by improving business operations.
- Drives innovation by aligning organizational processes and fostering a culture of continuous improvement.

2.4.2 BPM Life Cycle

The BPM lifecycle is a framework that provides a standardized approach to designing, implementing, and managing business processes within an organization. The six phases of Business Process Management (BPM) - Plan, Analysis, Design, Model, Implement, Monitor, and Refinement - provide a comprehensive and structured approach to improving and streamlining business processes [18].

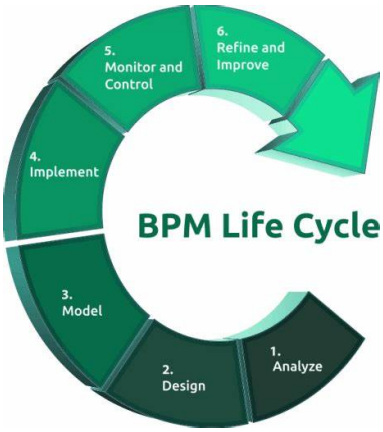


Figure 2.3: BPM Cycle

2.5 Business Process Modeling

Business process modeling is the practice of creating graphical representations or diagrams to illustrate the steps, activities, and workflows involved in various business processes. These models help organizations understand, analyze, and improve their operations by providing a visual depiction of how tasks are performed, how information flows, and how resources are utilized within the organization . [20]

There are many benefits to business process modeling:

- Gives everyone a clear understanding of how the process works.
- Provides consistency and controls the process.
- Identifies and eliminates redundancies and inefficiencies.
- Sets a clear starting and ending to the process.

2.5.1 Definition: *Model*

A model is an abstraction of reality. This representation is constructed, verified, analyzed and manipulated to master reality and better understand it [19].

A model is a designed structure capable of making a given reality intelligible by ordering and emphasizing the most significant entities or relationships, so as to know it better or act better on it.

2.5.2 Process Modeling Objectives

Multiple goals can be accomplished using a process modeling strategy:

- Models make it possible to specify the structure or behavior of a system.
- Models provide a framework that guides the construction of a system;
- Models help document the decisions made.
- The models are used in many sectors to understand, develop, and communicate.
- Enhance communication and cooperation between functional structures within one organization and across numerous organizations.

2.6 Business process modeling techniques

Business process modeling is the act of visually representing processes with the intention to analyze, improve, and optimize them. Depending on the business objectives you aim to achieve, different business process modeling techniques and methods can be employed. The primary goal is to understand and document how activities are executed, enhance workflows, increase efficiency, and reduce costs.

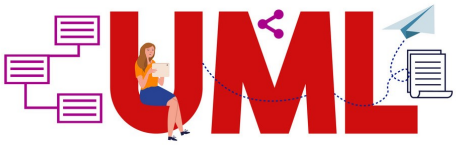
2.6.1 UML (Unified Modelling Language)

The Unified Modeling Language (UML) is widely recognized as the go-to language within the industry for the visualization, design, and documentation of software systems. It offers a uniform methodology for modeling systems, accommodating diverse software applications across a range of hardware, operating systems, and networks, making it adaptable to virtually any programming language [11].

UML is emerged to address the challenges posed by a multitude of object-oriented modeling methodologies. As a comprehensive language, UML fulfills multiple roles, including representation, specification, construction, and documentation of software artifacts, establishing a standardized framework for expressing development and construction plans. Encompassing both

abstract concepts like business processes and tangible elements such as classes and database schemas, UML functions as a graphical notation system for translating software system models.

Employing an object-oriented perspective, UML enables the representation and design of systems irrespective of their nature, whether they are conventional management applications or intricate embedded real-time systems.



2.6.2 BPMN (Business Process Management and Notation)

The primary goal of BPMN is to provide a notation that is easily understandable by all stakeholders involved in business processes, including business analysts who draft processes, technical developers responsible for implementing technology, and business personnel managing and monitoring processes.

By using BPMN, organizations can create Business Process Diagrams (BPDs) that depict the flow of activities, events, and decisions within a process, along with the interactions between different process participants.

2.7 Study of BPMN

2.7.1 Introduction

Organizations rely on collaboration and communication for task completion and sharing knowledge. To enhance effectiveness and productivity while reducing costs, they are increasingly turning to business process modeling (BPM). BPM allows organizations to understand how business processes are executed, how parties collaborate, and how to boost productivity.

The primary goal of BPMN (Business Process Model and Notation) is to provide a notation system that is easily understandable by all stakeholders, from business analysts to technical developers to business managers. BPMN serves as a standardized bridge between business process design and implementation, facilitating seamless communication and understanding across different teams and roles within an organization .

2.7.2 Definition

BPMN (Business Process Model and Notation) is a standardized graphical language for modelling business processes, providing a visual representation of activities, events, flows, decisions, and more. It is designed to be understood by both business users and IT professionals , facilitating communication and collaboration. BPMN diagrams help document, analyse, and improve complex business processes by visualizing them effectively. Maintained by the Object Management Group (OMG), BPMN supports process visualization, documentation, and communication through a basic set of notations. It offers various elements like flow objects, swim lanes, connecting objects, and artifacts to represent different aspects of business processes, aiding in the theoretical representation of processes. [21]

2.7.3 History of BPMN

He inaugural version of Business Process Modeling Notation (BPMN) was introduced in 2004, establishing itself as the standard for business process modeling (White, 2004) [5].

Over time, BPMN has undergone extensive scrutiny and analysis within the academic community, leading to widespread acceptance and support across various industries. The adoption of BPMN has been facilitated by the availability of numerous tools designed to support its implementation, a trend highlighted by *Eve´quoz and Sterren* in 2011. Industry interest in BPMN tools has arisen in response to growing awareness of the potential advantages offered by BPM methodologies.

BPMN version 1.0 was initially proposed in May 2004 and subsequently ratified by the Object Management Group (OMG) in February 2006. This initial version was succeeded by BPMN 1.1 (OMG, 2008), with the latest iteration being BPMN 2.0, released in 2011 (OMG, 2011).

2.7.4 BPMN 2.0 standards

The elements within BPMN were meticulously crafted to ensure they are easily distinguishable and employ shapes familiar to most modelers.

The primary goal driving the development of BPMN is to provide a user-friendly mechanism for creating business process models, while still accommodating the complexity inherent in such processes , To address this dual objective, the graphical aspects of the notation were organized into distinct categories .

These four foundational categories serve as the framework for representing business processes in BPMN are :

1. Flow Objects
2. Connecting Objects
3. Swim-lane
4. Artifacts

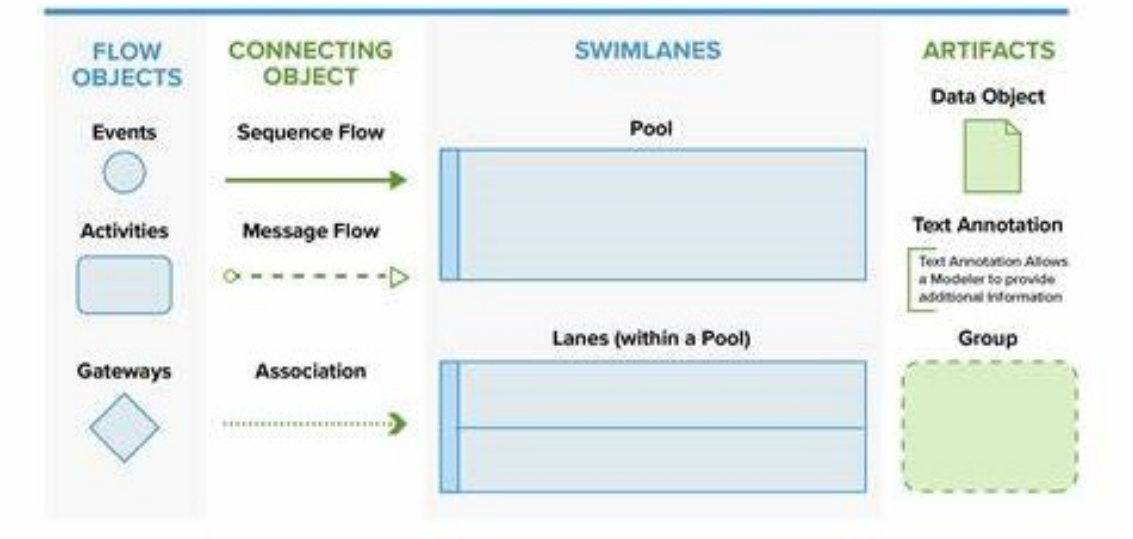


Figure 2.4: Flow elements

2.7.5 Flow Objects

These flow objects help to illustrate the sequence and interaction of activities , events, and gateways. The three main types of flow objects in BPMN are :

1. ***Events*** Events Are circular symbols that serve as a “happens” during the course of a business process. These Events affect the flow of the process and usually have a cause (trigger) or an impact (result).

   There are three types of Events, based on when they affect the flow : Initial, Final, and Intermediate .

   - ***Initial Events***

     ➔Initiates the business process, serving as the starting point .

     ➔Indicates the commencement of the workflow .

     ➔They are symbolized by a circle with a thin line .

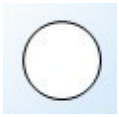
Type	Description	Symbol
Basic	Without any specific information about the trigger,the event is initiated. It can also be used to show that a sub-process is running.	
Condition	The occurrence is brought about by the affirmation of a rule.	
Link	Source and destination link of an activity	
Message	The event starts after one person receives a message from another	
Multiple	When one or more triggers are not activated, a process's execution is halted.	
Timer	The event is triggered after a delay	

Table 2.1: BPMN Initial Event

- ***Intermediate Events***

  ➔Occurs within the course of the business process, affecting the flow .

  ➔Often triggered by specific conditions or events .

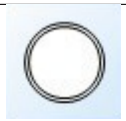
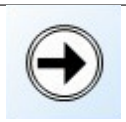
Type	Description	Symbol
Basic	It denotes one or more process state shifts. Only intermediate events situated in the primary activity flow of the business process continue to fall under this category of the event.	
Error	Exceptions that arise during the procedure are handled using this event	
Link	Source and destination link of an activity	
Message	While awaiting the receipt of a message from a participant, the procedure is interrupted	
Multiple	hen one or more triggers aren't activated, a process's execution is halted.	
Timer	While awaiting the passage of a specific amount of time, the procedure is halted.	

Table 2.2: Intermediate event of BPMN

- ***Final Events***

➔The termination event in a business process signifies the outcome of the workflow.

➔A process concludes when all active paths lead to termination event.

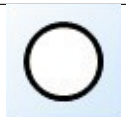
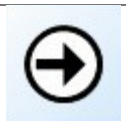
Type	Description	Symbol
Basic	is the fundamental one and enables a generic representation of all situations.	
Link	A token arriving on this event is immediately forwarded to the target process's associated initialization event or intermediate event.	
Stop	implies that all process activities must end right away after this one is executed. Of course, this includes any instances that might occur throughout the process .	
Multiple	enables the possibility of triggering multiple events at once. For instance, to send numerous messages at once (an event of Fin of type "Message" cannot be used because it would only send one message), or to send a message, a signal, and an error all at once. As a result, it makes it possible to create a procedure ending with the desired elements .	

Table 2.3: Final event of BPMN

2. ***Gateways***

   Gateways control the flow of the process by determining which path should be taken based on specified conditions.

   Gateways have internal markers that give additional detail to show how the flow is controlled [25].

   - ***Gateway exclusive (XOR)*:** Is a type of gateway used in business process modelling

to represent a decision point where only one of several outgoing paths can be taken.

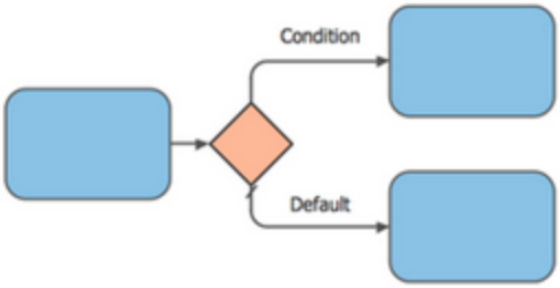


Figure 2.5: Merge XOR

- ***Gateway inclusive (OR):*** Inclusive Gateway is used to model decision points where multiple outgoing paths can be taken based on conditions.

  The Inclusive Gateway allows for more flexibility, as it permits the flow to split into multiple paths when multiple conditions are true.

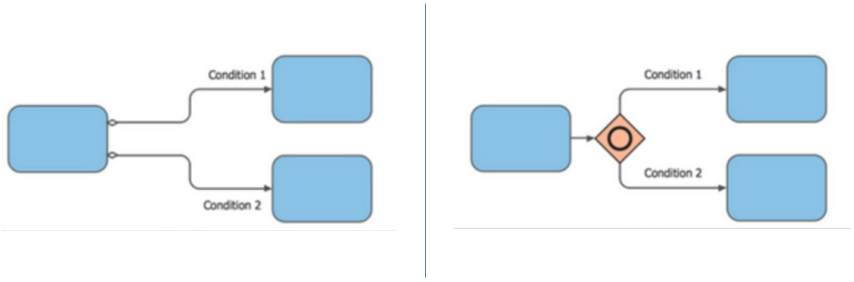


Figure 2.6: Join OR

- ***Gateway parallel (AND):*** The Parallel Gateway allows the flow to split into multiple paths, and all paths are taken if the conditions for each path are satisfied.

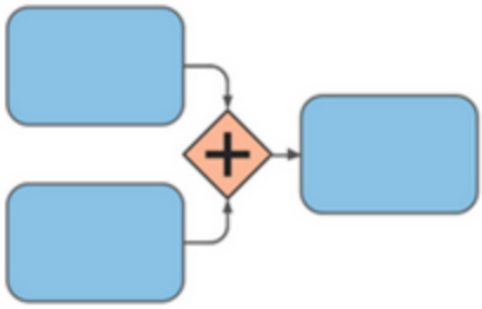


Figure 2.7: Gateway parallel

- ***Event Gateway:*** Is a specialized type of gateway that handles events and can route the process flow based on incoming events.

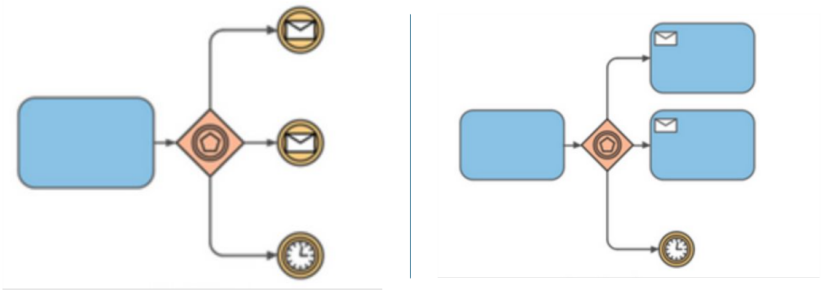


Figure 2.8: Event Gateway

3. ***Activities*** Activities represent the work or tasks that need to be performed within a business process. They can be either manual (performed by a human) or automated (performed by a system) .

   An Activity is represented by a rounded-corner rectangle and is a generic term for work that company performs . Here are the main types of activities in BPMN:

   - **Tasks:** Represents a single unit of work that is not further subdivided in the process diagram. Each task has a beginning and an end and therefore a task can only start if the previous task is finished .

     Types of tasks include User Task, Service Task, Script Task , a sending, a receiving, a manual task, or an abstract task.

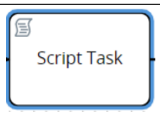
Tasks	**User**	**Service**	**Script**
Description	As suggested by the name these are tasks carried out by a person within the flow of a process.	Through services, they enable connectivity between an external system and the process.	Permit writing system code to act within the flow of the process without human interaction
Symbol			

Table 2.4: Table of tasks

- **Sub-processes:** A sub-process is a group of tasks that fit together well. Sub-processes are used to modularization and organize complex workflows, making it easier to understand, analyze, and manage business processes. It is represented by a rectangle with rounded corners and a small "+" to access the details. A double click on a task with a "+" sign opens the detailed model of the task. There are two main types of sub-processes : reusable and embedded .

Sub processes	**Reusable**	**Embedded**
Description	It includes a group of tasks that can be called from various phases of the procedure because they are independent of the beginning of the procedure.	Contains a number of activities, but none of them stand alone from the initial process.
Symbol		

Table 2.5: Table of tasks

- **Called process:** A "called process" in the context of business process modeling refers to a sub-process or a separate process that is invoked or executed from within the

main or parent process. This concept is often used to modularization and organize complex workflows.

2.7.6 Connecting Objects

The Flow Objects are connected together in a diagram to create the basic skeletal structure of a business process.

There are three different kinds : sequence flows, message flows, and associations.

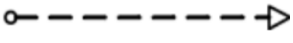
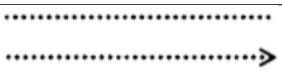
Type	**Sequence flow**	**Message flow**	**Association**
Description	Is used to show the order (the sequence) in which activities, events, and gateways are performed in a Process .	Indicates a message sent between two separate Process Participants .	An Association is connect artifacts or annotations to other elements, providing additional information.
Symbol			

Table 2.6: Connecting Objects

2.7.7 Swimlane

Swimlanes enhance the clarity of process diagrams by visually illustrating the distribution of tasks and responsibilities among participants or groups.

"Pools" group all processes and activities involving the same participant, while "Lanes" within Pools organize activities and processes further.

BPMN supports swim lanes with two main constructs.

(a) Pool

Represent larger organizational entities or external participants. Often used to show the overall scope of the process and the involvement of different organizations.

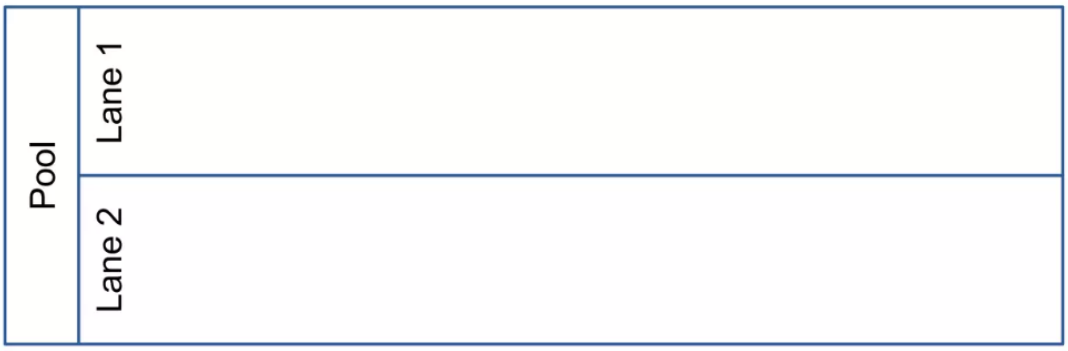


Figure 2.9: Representation of a Pool in BPMN

(b) Lane

A Lane is a sub-partition within a Pool and will extend the entire length of the Pool . Lanes are used to Help in organizing and grouping related activities within the process.

Figure 2.10: Representation of a lane in BPMN

2.7.8 Artifacts

artifacts are graphical elements that provide additional information and context to the process diagram. Artifacts are not directly involved in the flow of the process.

(a) Data object

A data object in the context of Business Process Model and Notation (BPMN) represents data used or produced within a process. It serves as a mechanism to illustrate how data is required or generated by activities within the process. Data objects are typically connected to activities

through associations, providing a visual representation of the data flow in the process. They play a crucial role in enhancing the understanding of how data is utilized and exchanged throughout the business process .

Figure 2.11: Data object

(b) Groups

Used to visually group and organize related elements within a BPMN diagram .The grouping can be used for documentation or analysis purposes.

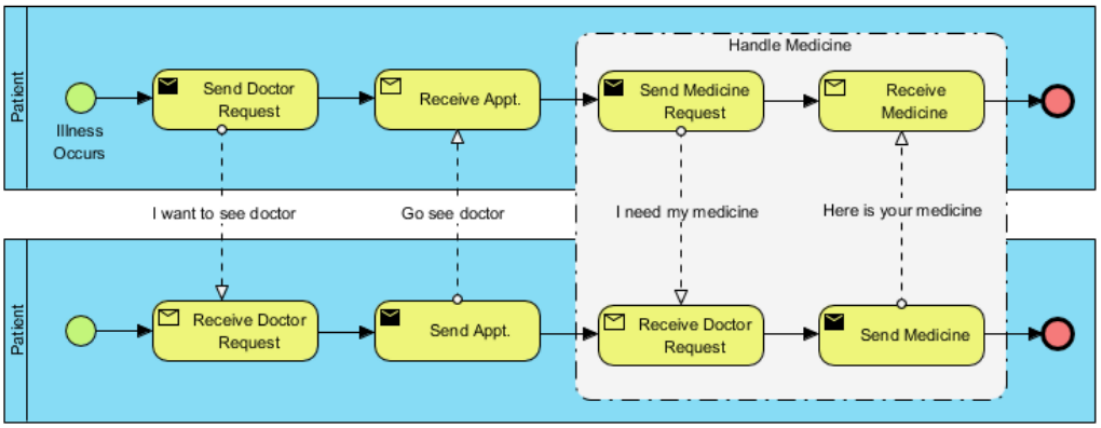


Figure 2.12: Groups

(c) Text Annotation

- A textual element used to add comments, notes, or explanations to specific parts of the process.
  - Enhances the understanding of the process and provides additional information.

Figure 2.13: Text Annotation

2.8 Java Business Process Management jBPM

jBPM (Java Business Process Management) is an open-source, flexible BPM suite written in Java (It can operate in any Java environment) and developed by JBoss , compliant with BPMN 2.0 specifications . It enables the modelling, execution, and monitoring of business processes throughout their life cycle. The suite focuses on executable business processes, bridging the communication gap between business users and developers by using higher-level, domain-specific concepts that can be directly executed [3].

jBPM supports adaptive and dynamic processes, providing flexibility to model complex, real-life situations that may not easily conform to rigid process structures.

Notably, jBPM empowers end users by allowing them to control the execution of specific process parts . It is not merely an isolated process engine , it supports the modelling of complex business logic by combining business processes with business rules and complex event processing.

Figure 2.14: jbpm logo [3]

2.9 JBPM features [1]

JBPM features encompass a range of capabilities essential for efficient business process management. Figure 2.15 depicts the essential features of jBPM.

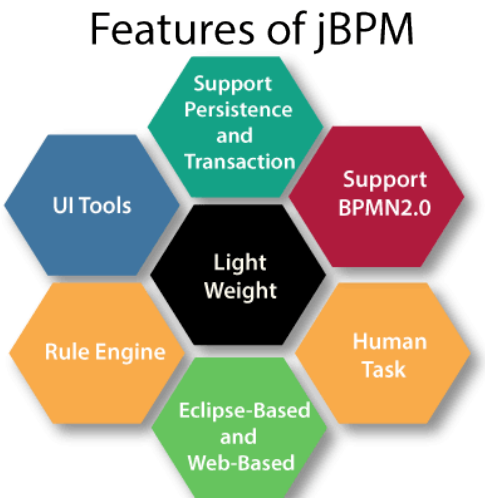


Figure 2.15: jbpm-features

[1]

1. **Light-Weight** JBPM is designed to be lightweight, meaning it is resource-efficient and does not impose unnecessary overhead on the system. This makes it suitable for various environments and applications .

2. **Support BPMN2** JBPM focuses on BPMN 2.0 specification as the process definition language.

3. **Support Persistence and Transaction** JBPM provides support for persistence, allowing the state of business processes to be stored in a database. Additionally, JBPM supports transactions to ensure the consistency and reliability of business process execution .

4. **UI Tools (User Interface Tools)** JBPM offers user interface tools that facilitate the design, monitoring, and management of business processes .

5. **Eclipse-based and Web-based** The Eclipse-based tooling allows developers to work within the familiar Eclipse IDE, while the web-based tools provide a more accessible interface for a broader audience .

6. **Rule Engine** JBPM includes a rule engine, which is a system for defining, managing, and executing business rules. Business rules are logical statements that define the behaviour of a business process based on specific conditions .

7. **Human Task Services** JBPM supports human task services, allowing integration of human tasks into business processes. This enables processes to involve human decision-making or actions, such as approvals, reviews, or other tasks that require human intervention .

2.10 jBPM Services

jBPM Services provide a comprehensive framework for managing and executing business processes efficiently [4].these services offer a robust toolkit for orchestrating complex workflows. In this section, we will explore key jBPM services including Deployment, Definition, Process, Runtime Data, and User Task services. Each service plays a pivotal role in different phases of the BPM lifecycle, empowering organizations to streamline processes, optimize resources, and drive business success.

1. **Deployment services** Its primary role involves the deployment or removal of units, providing details on the available deployment units and their corresponding Runtime Manager instances.

2. **Definition services** This tool is utilized to examine process definitions, analyzing the structure to extract crucial details. These details serve as input for informing users about expected functionalities. The Definition Service offers insights into various elements including process definition, process variables, service tasks, user tasks, as well as input and output information.

3. **Process services** Process Services are primarily geared towards runtime functionalities and should be employed solely when there's a necessity to modify process instances. They facilitate access to the execution environment, enabling actions such as initiating new process instances and managing existing ones.

4. **Runtime Data services** This service pertains to the real-time data of process instances and serves as the primary information hub. Its functionalities include:
    - Initiating process instances
    - Executing node instances
5. **User Task services** This service is used to manage the individual user task from start to end. User Task Service allows:
    - Modify Selected Properties.
    - Access to Task Variables.
    - Access to Task Attachments.
    - Access to Task Comments.

2.11 Main Component of JBPM Project [3]

Core Engine and the Business Central are the main components in JBPM project and we define them with details :

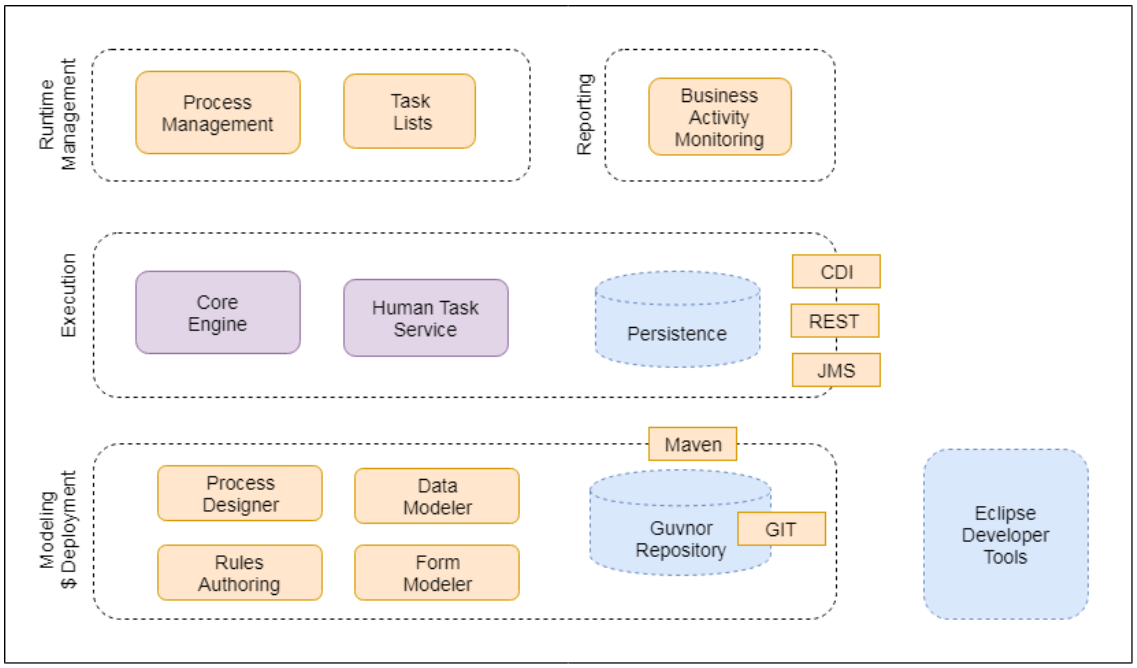


Figure 2.16: JBPM components

[3]

2.11.1 Core Engine

Is The central component of jBPM project . It's a core engine is responsible for executes our Business Processes in a flexible manner. Whether integrated directly into your application or deployed independently as a service . from it's features are the these :

- Solid, stable core engine for executing your process instances.
- Native support for the latest BPMN 2.0 specification for modeling and executing business processes.
- Strong focus on performance and scalability.

Human Task Service

The human task service is an optional core service that can be used to manage human tasks when human actors need to participate in the process,in implementation it is based on the WS-Human Task specification and manages the life cycle of the tasks, task lists, task forms..

Persistence Runtime

In optional core persistence runtime the history log is essential for access to historic information as runtime persistence only stores the current state of all active process instances. It can be used to store all current and historic states of active and completed process instances, and for any information related to the execution of process instances, monitoring and analysis..

2.11.2 Business Central

web-based application offers a comprehensive solution for BPM projects, covering authoring, execution, and monitoring. It integrates various web-based tools into one configurable platform for managing assets and runtime data . Key features include:

- Repository service
- User-friendly interface
- Collaboration

Process Designer

- It allows you to model your business processes in a web-based environment.
- It offers a graphical editor for viewing and editing your business processes, similar to the Eclipse plugin.
- It supports round-tripping between eclipse and web-based designer.

Data Modeler

Its main objectives is to elevate data models to a central role in the process enhancement journey and enable complete process automation by seamlessly incorporating data structures.

Task Inbox

If necessary, to review, approve, or provide additional information.

Business Activity Monitoring

It is not easy to develop business activity monitoring and reporting solutions on top of jBPM .

2.11.3 Eclipse Developer Tools

Eclipse Developer Tools consist of plugins for the Eclipse IDE, These tools offer various functionalities aimed at enhancing the development process . It includes the following features:

- Wizard for creating a new jBPM project.
- A graphical editor for BPMN 2.0 processes.
- The ability to plug in your own domain-specific nodes.
- Validation.
- Runtime support
- Graphical debugging to see all running process instances of a selected session.

2.12 Conclusion

In this chapter, we have introduced the concept of a business process, emphasizing its critical role in achieving organizational goals through a structured sequence of tasks and activities. We explored the essential characteristics of business processes, highlighting their dynamic nature, defined inputs and outputs, hierarchical structure, and the transformation of resources into valuable outcomes.

In the next chapter, we will apply these concepts and techniques to the analysis and design of our workflow application. Using the graphical notations of BPMN, we will model the business processes specific to our project, providing a clear and detailed representation of the workflow. This modeling will serve as the blueprint for the subsequent development and implementation phases, ensuring a robust and efficient workflow application.

Chapter 3

Case Study: Analysis And Modeling

3.1 Introduction

This chapter first presents the "L'INFI" laboratory, addressing its members, internal organization, and assigned tasks. Next, it provides a detailed description of the workflow process, activities, and involved actors, modeled with the JBPM graphical software. After the modeling phase, we will proceed to generate a workflow application using the open-source JBPM software, to design and implement our proposed process model .

3.2 Presentation of the laboratory "L'INFI"

The Laboratory of Intelligent Informatics (LINFI) is composed of 27 researchers divided into four teams, focusing on research areas in artificial intelligence and web applications, computer vision, semantic web, and geographic information systems. Their missions include theoretical and applied research, training, and technology transfer through collaborations with companies and international projects. LINFI aims to develop formally validated solutions and to train researchers at the doctoral and master's levels while contributing to both the national and inter-

national economic and scientific environments [2].

Figure 3.1: LINFI Laboratory logo

3.2.1 Tasks

The Laboratory of Intelligent Informatics (LINFI) undertakes diverse and essential tasks, including theoretical and applied research, with a focus on developing validated solutions in artificial intelligence, such as machine learning, reasoning, pattern recognition, and multi-agent systems. LINFI's missions encompass three main areas: research and development, training, and technology transfer of skills and research results, facilitated through contracts with companies and international collaborations. The laboratory addresses four major research themes: artificial intelligence and web applications, computer vision and shape recognition, the semantic web and interoperability, and geographic information systems. Additionally, LINFI is dedicated to training researchers at the doctoral and master's levels, significantly impacting both the national and international economic and scientific environments. [2]

3.2.2 Organization chart of the laboratory

- **The general organization chart of "LINFI" is represented as follows:**

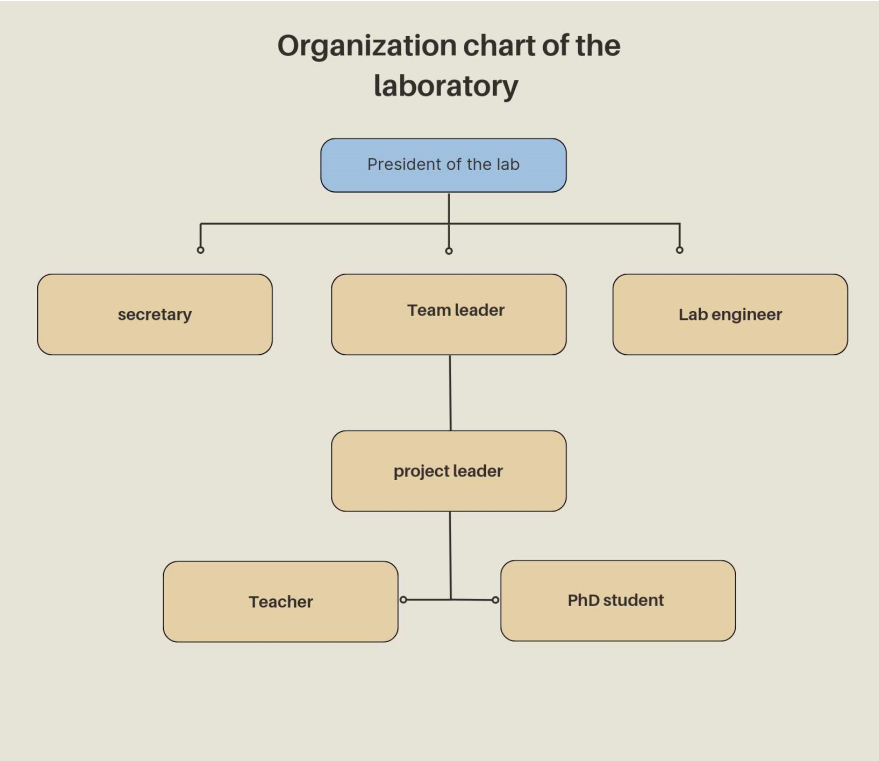


Figure 3.2: Organizational Chart

Members of the laboratory and their tasks

✔**President of the lab:** A teacher of Professor rank.

✔**Team leader:** A lecturer class A rank teacher (MCA) or professor

✔**Project leader:** A lecturer class A rank teacher (MCA). who will be appointed project leader after their project has been accepted by the ministry or by the 'DGRSDT' (national research directorate).

✔**Teacher:** A teacher can have one of these grades (Professor, lecturer, Assistant, Ph.D. student).

✔**PhD student:** A student who has passed the doctoral examination. He remains in the laboratory as a member until his defense or his resignation. He can ask for integration in the laboratory, he can ask for a plane ticket, and he can also be a member of a research project.

✔**Lab engineer:** He Manages and operates equipment and systems in the laboratory, performs maintenance and updates, prepares reports, and provides technical support to lab members.

✔**Secretary:** He manages the office, coordinates between management and employees, organizes appointments, and meetings, and manages correspondence.

The organizational structure private of the "LINFI" laboratory

The organizational structure of the Automated Information Laboratory revolves around enhancing efficiency and innovation through the formation of specialized work teams and centers of excellence that focus on specific research areas. This structure consists of a leadership team that includes the laboratory director, secretary, engineers, and team leaders. Each team includes a group of project leaders to manage research projects, in addition to permanent members and temporary members.

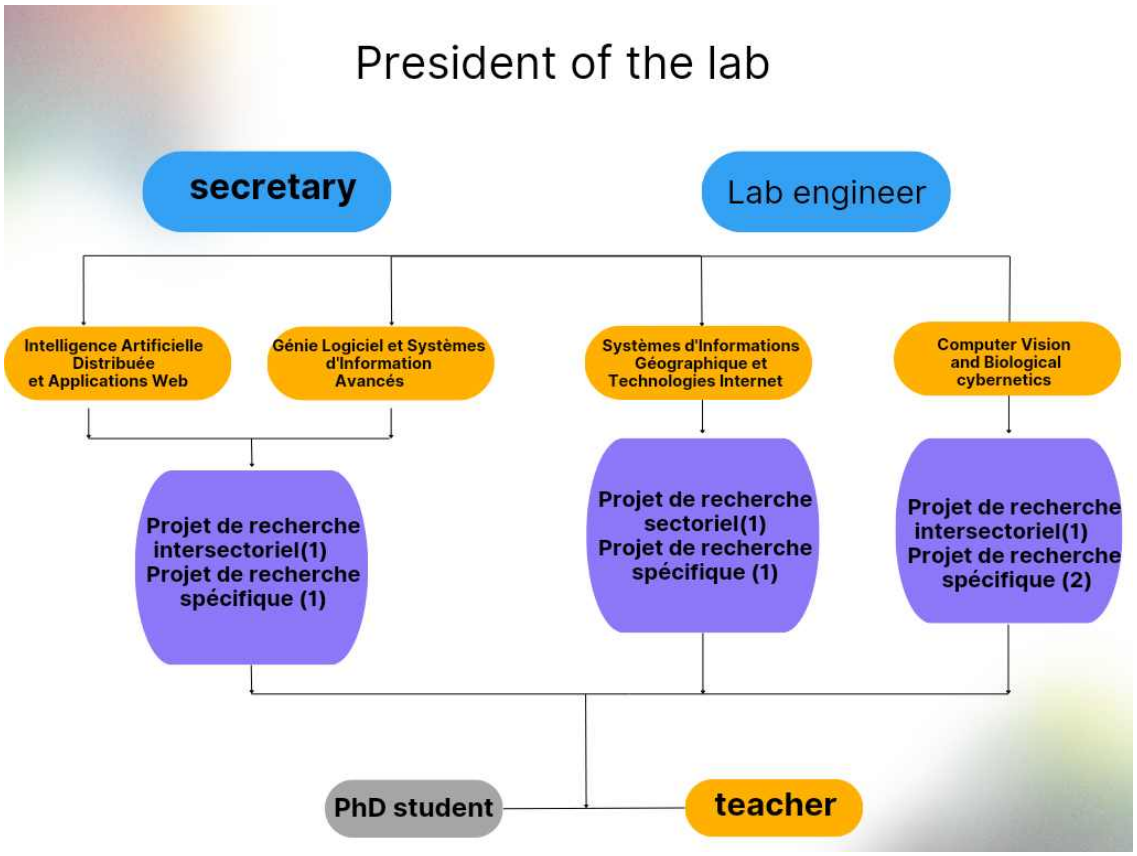


Figure 3.3: Organizational Chart

3.2.3 Purpose of Lab Process Digitization

The digitization of the process in a research laboratory presents several issues that may vary depending on the objective and environment of each laboratory. The digitization process can bring benefits in terms of efficiency, speed, and accuracy of data, but it can also pose challenges in terms of data management, system compatibility, security, training, and costs. It is important to carefully plan digitization and implement effective strategies to overcome these challenges. We were able to identify the following shortcomings and deficiencies in the research laboratory:

- Poor task allocation and role disruption.
- The large volume of information processed manually sometimes generates errors.
- The difficulty of correctly managing documents (misclassified files in the laboratory make access and research difficult).
- Information insecurity.
- Loss of information records.

3.3 Analysis And Modeling

The objective of this part of our project is the modeling of some processes that occur in the research laboratory, using BPMN and JBPM open source. Existing processes.

The objective of this part of our project is to model specific processes that occur in the research laboratory using BPMN and the JBPM open-source platform. By analyzing and documenting existing processes, we aim to streamline and automate them, thereby enhancing efficiency, accuracy, and compliance within the laboratory.

Process 1: Creation of a new research project

Table 3.1 detailed the creation of the research project process.

Task	Actor	Description
Preparing a request to create a new research project.	A teacher with the rank of Messiah (project leader if his project is accepted).	The request contains the project name and description, in addition to a list of members (project teachers or PhD students).
Send the request to the lab president.	Project leader teacher.	Send a description and all project information.
Reception of the request by the president of the lab .	President of the lab.	The laboratory head studies the request and prepares for the meeting.
Organization of the lab council meeting.	President of the lab.	Here the project is studied and discussed and a decision is made.
Sending the decision.	President of the lab.	After the council ends, the laboratory head sends the decision to the project leader.
Receipt of the decision.	The project leader.	Here, according to the decision received, it can be revised and sent again to the president or transmitted to the faculty of the project.
Send the project validated by the lab council to the faculty	President of the lab.	If the request is accepted, the laboratory council will send the project to the faculty.

Table 3.1: Creation of a new research project (Process 1).

Annual budget request (Process 2).

once the request has been validated by the laboratory chief (LC), it will be sent to the rector's post-graduation(PG). Table 3.2 detailed the annual budget request process.

Task	Actor	Description
Prepare the budget request	President of the lab.	The laboratory head prepares a response document for the budget request.
Organization of the lab council meeting	President of the lab.	Here the processes studied and discussed.
Send the budget request to the rector's PG (post-graduation)	President of the lab.	Once the request has been validated by the LC, it will be sent to the rector's PG.

Table 3.2: Annual budget request (Process 2).

Process 3: Lab Structure Update

Laboratory structure update is detailed in table 3.3.

Task	Actor	Description
Update the lab structure to the president of the lab.	Secretary	The secretary reviews the Excel file of the laboratory structure and updates it according to the course of events(new team leader, resignations, elections for new president ...etc).
Send the new structure to President of the lab	Secretary	Present the Excel file to the head of the laboratory after updating it .
Reception of the new structure	President of the lab.	The head of the laboratory reviews the new structure of the laboratory .
Organization of the lab council meeting	President of the lab.	The details of the new structure of the laboratory are presented and discussed, and the decision(approval or rejection) is issued.
Send the new structure of the lab to the PG (post-graduation) service of the rectorate	Lab President	The new structure will be sent to the Director General of the administration after the Council approves it .

Table 3.3: Laboratory Structure Update(Process 3).

Process 4: Integration of new members in the laboratory

The new member integration process is detailed in table 3.4.

Task	Actor	Description
Request to join the laboratory	Teacher	The teacher wishing to join the laboratory prepares an integration request and sends it to the head of the laboratory.
The request is received by the head of the laboratory	President of the lab	He reviews the request and prepares for the meeting
Organization of the lab council meeting	President of the lab.	The request is studied and a decision is made to accept or reject the integration of the member.
Integration of the teacher in the lab and update of the lab structure	Secretary	The structure is updated and the teacher is added as a member of the laboratory if approved by the council.

Table 3.4: Integration of new members in the laboratory (Process 4).

Process 5: Request a plane ticket

Table 3.5 detailed the plane ticket request process.

Task	Actor	Description
Preparing a ticket request and sending it to the head of the laboratory	Lab member	A plane ticket request prepared by a lab member and sent to the laboratory head.
Organization of the lab council meeting	President of the lab.	In this process, the request is reviewed and a decision is made by the laboratory council .
Preparing an order for the purchase of a ticket	Secretary	The secretary prepares the purchase request document after the council's approval.
Send the purchase order to PG	Secretary	The secretary sends a copy of the purchase order to PG.

Table 3.5: Request a plane ticket (Process 5).

Process 6: Request for the purchase of equipment for the lab

Table 3.6 depicts details of a request for the purchase of equipment for the lab process.

Task	**Actor**	**Description**
Prepare the purchase request	president of the lab	The president of the laboratory prepares a document for the purchase of equipment.
Organization of the lab council meeting	president of the lab	Here there is already a description of this process
Send the request for purchase to the PG service of the faculty	president of the lab	After the laboratory council approves the request, it is sent to the PG of the faculty.

Table 3.6: Request for the purchase of equipment for the lab (Process 6).

Process 7: Organization of a scientific event

the organization of a scientific event process is detailed in table 3.7.

Task	**Actor**	**Description**
Prepare the request for the organization of a scientific event.	Lab member	A laboratory member prepares a request for a scientific event and sends it to the laboratory head.
Organization of the lab council meeting	President of the lab	This process it is a study and review of the request, then the decision to accept or reject the request.
Send the laboratory council decision	President of the lab	The decision to reject or accept the request is sent to the concerned member.

Table 3.7: Organization of a scientific event (Process 7).

Process 8: Organization of a meeting of the laboratory council

The last process of organizing a meeting with the laboratory council is detailed in table 3.8.

Task	Actor	Description
Establishment of a convocation.	President of the laboratory.	The convocation is created, which includes the subject of the meeting, its date, and the points to be discussed.
Sending of the convocation to the team leaders and the project leaders .	President of the laboratory.	sending of the convocation to the team leaders and the project leaders by the president of the laboratory.
Receipt of the convocation by the team leaders and Project leaders.	Team leaders. / Project leaders.	Each team leader and Project leader concerned receives the convocation.
Processing of the convocation by the team leaders and the project leaders .	Team leaders/project leaders	The convocation is processed by the project leaders and team leaders.
Establishment of the response by the team leaders and Project leaders .	Team leader / Project leaders	The decision to accept or reject the convocation is made by both the team leaders and Project leaders.
Sending of the response to the president of the laboratory by the team leaders and Project leaders .	Team leaders / Project leaders	Send the response to the president of the laboratory to attend the meeting.
Holding of the meeting of the members and study of the files	Lab council members	The meeting will be held if the number of participants exceeds three, otherwise, it will be canceled.
establishment of a PV " process verbal" of the council of the lab	President of the laboratory.	Create a document containing meeting information and council decisions.
Announcement of "PV"	President of the laboratory.	PV is a paper document

Table 3.8: Organization of a meeting of the laboratory council (Process 8).

3.3.1 Process modeling with BPMN

In today's fast-paced business world, optimizing processes and achieving efficiency are top priorities. This requires a thorough understanding of internal workflows and effective organization. In this context, business process modeling plays a vital role as a tool to enable companies to analyze, document, and improve workflow. At this stage, the sequence of executing various tasks in the process is determined. We have chosen to use the BPMN (Business Process Modeling and Notation) method for its ability to visually represent processes in a simple and understandable way for analysts. After studying laboratory processes, we prepared their representation using BPMN, which was then set up for execution on the open-source JBPM platform.

Modeling our process:

we will showcase our process, which has been modeled using BPMN notation with the JBPM graphical tool.

Process 1: Creation of a new research project.

This is the process where a new research project is created after the approval of the request submitted by A teacher who has a lecturer class A grade by the lab council.

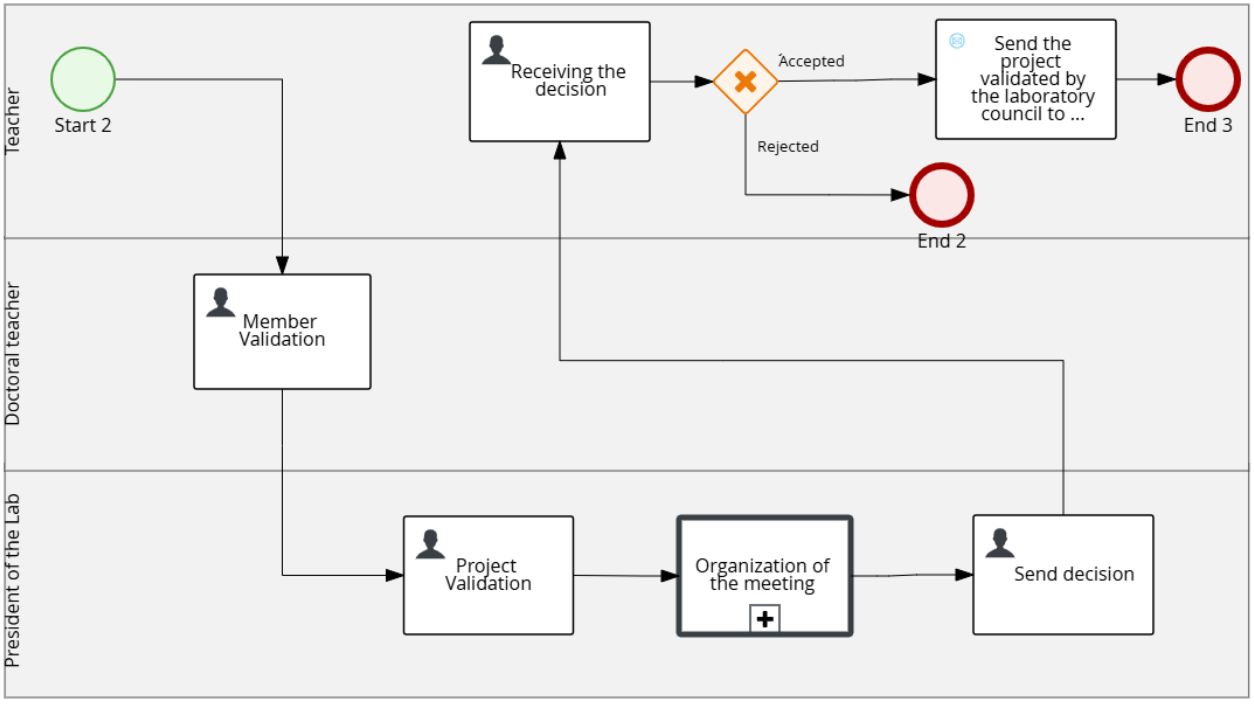


Figure 3.4: Process 1 BPMN model

Process 2: Annual budget request.

In this process, the President of the lab sends the budget request to the university president after studying and discussing it with the council members.

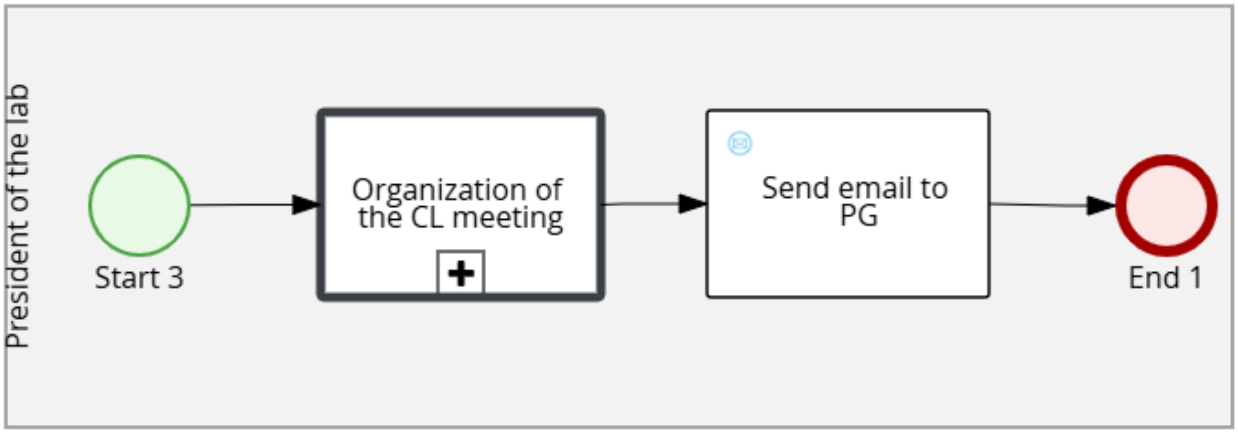


Figure 3.5: Process 2 BPMN model

Process 3: Lab Structure Update.

This process updates the laboratory structure and sends it to the PG (post-graduation) service of the rectorate after the Council approves it .

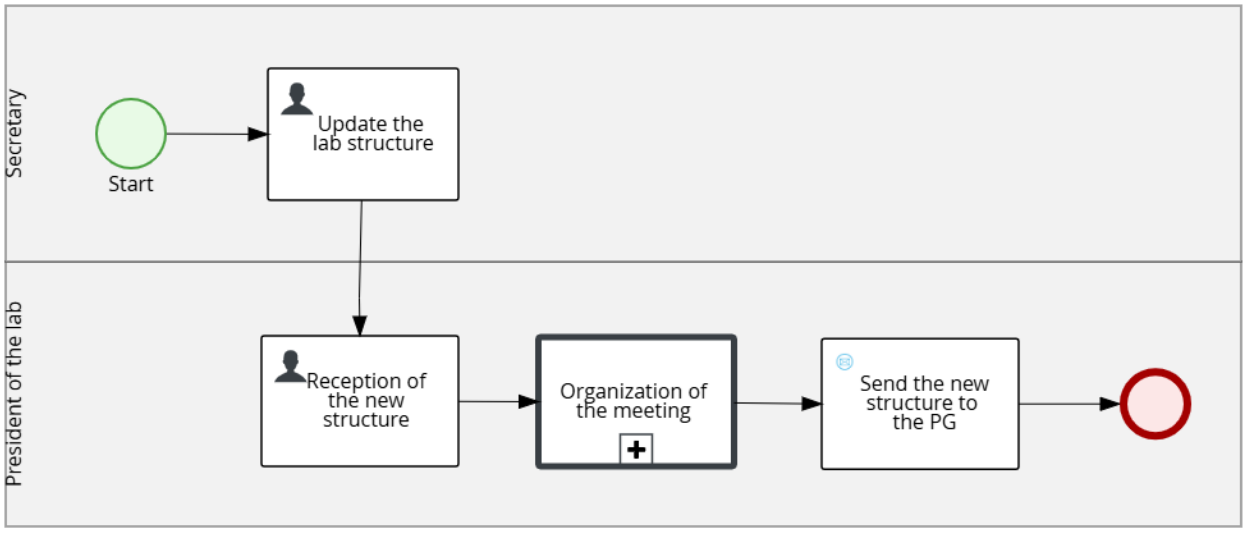


Figure 3.6: Process 3 BPMN model

Process 4: Integration of new members in the laboratory.

This process aims to integrate members interested in joining the laboratory after their requests have been reviewed by the council .

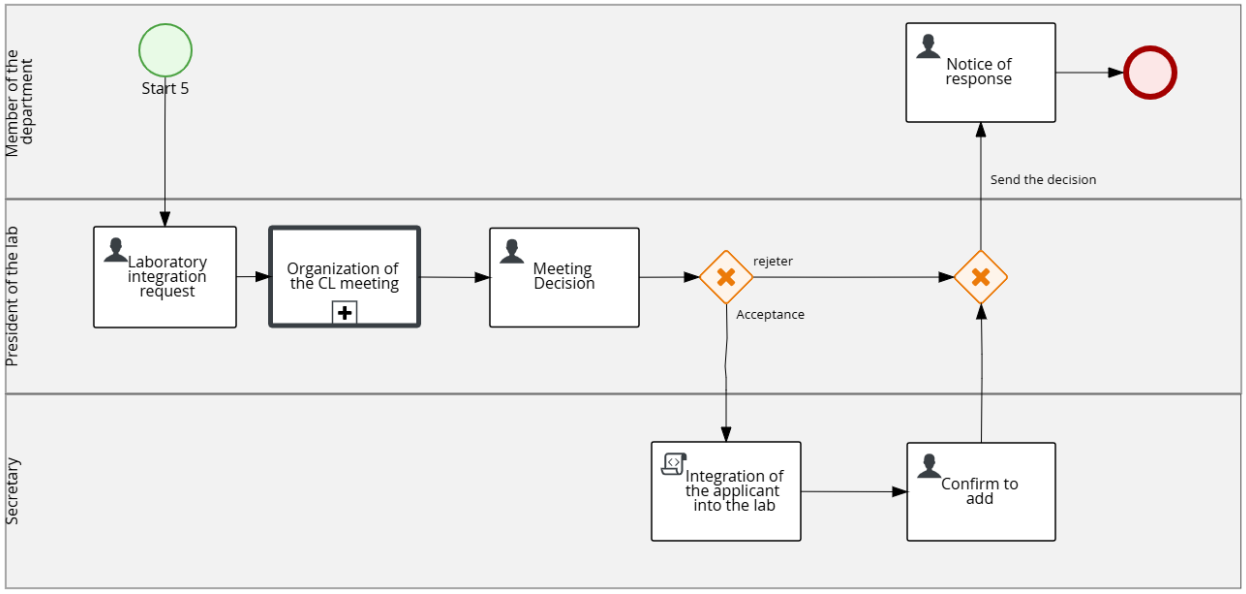


Figure 3.7: Process 4 BPMN model

Process 5: Request a plane ticket.

This process prepares a purchase request for an airline ticket for one of the members after their request has been approved by the council .

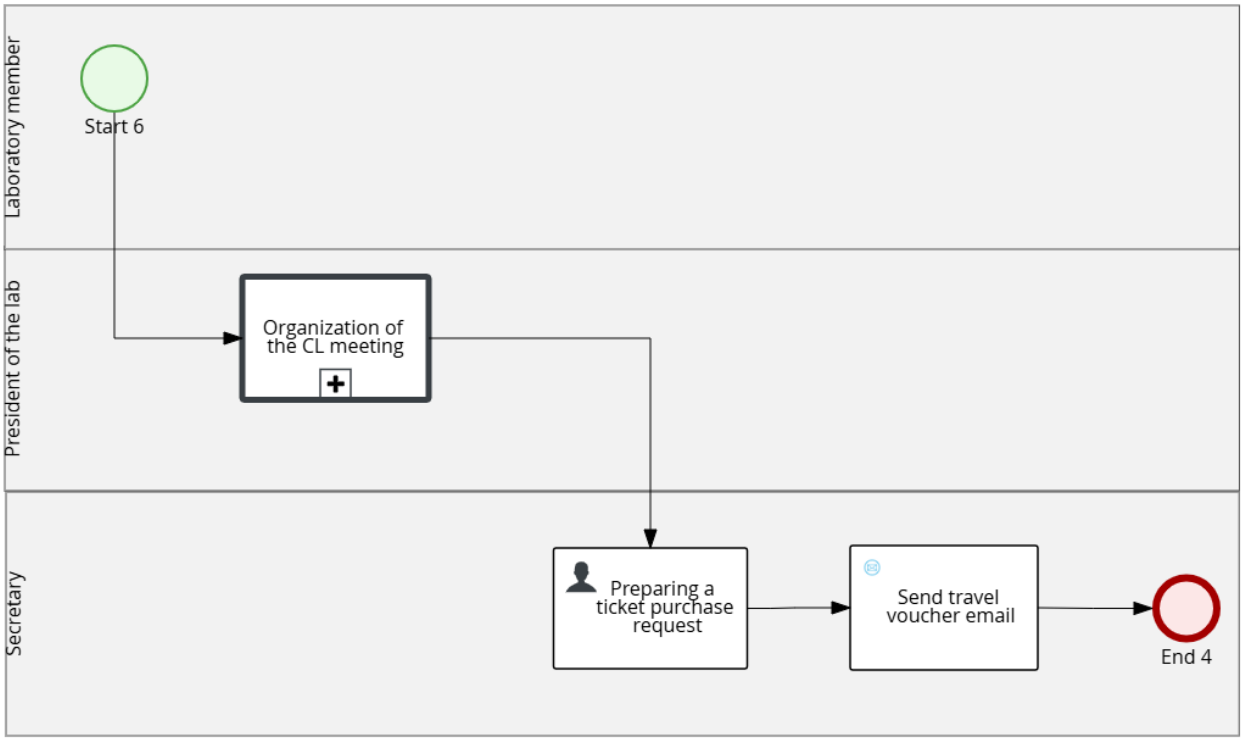


Figure 3.8: Process 5 BPMN model

Process 6: Purchase request for lab equipment.

This process aims to purchase laboratory equipment based on the request submitted by the laboratory head and approved by the council .

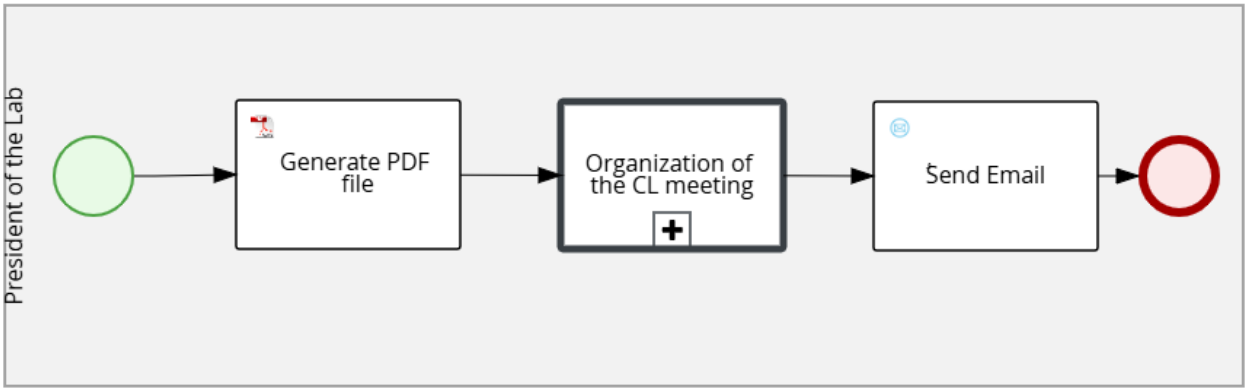


Figure 3.9: Process 6 BPMN model

Process 7: Organization of a scientific event.

This process aims to obtain approval for Organization of a scientific event .

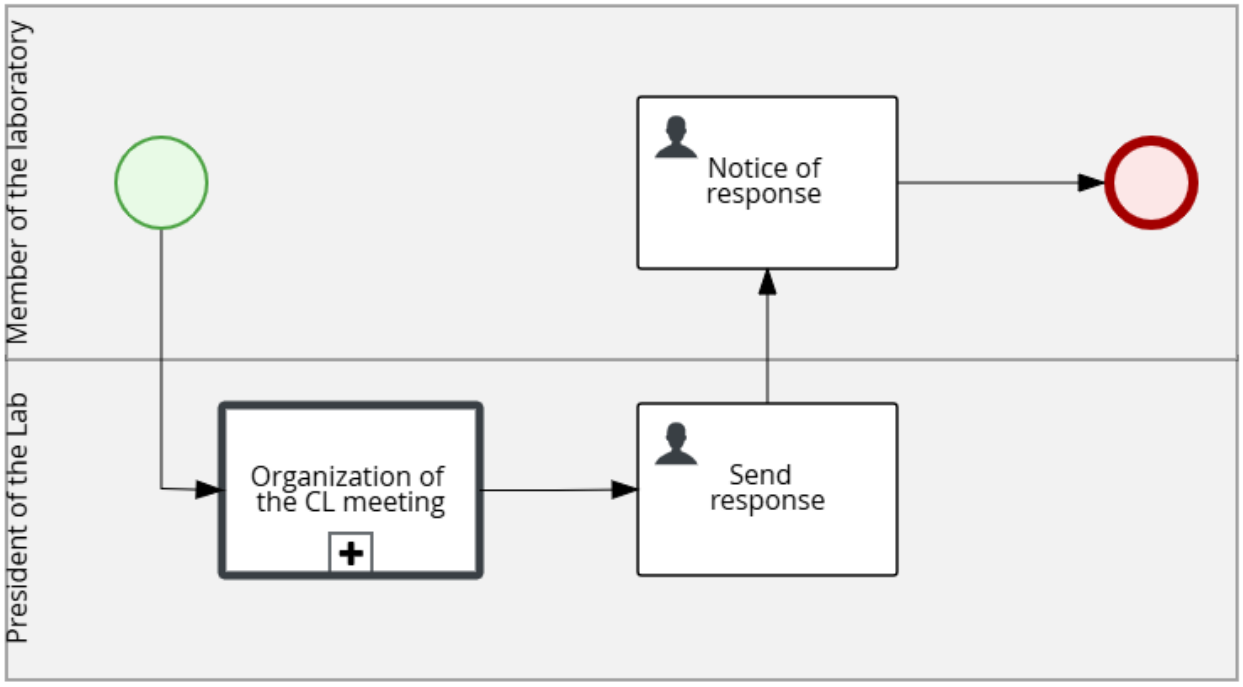


Figure 3.10: BPMN Model for Process 7

Process 8: Organization of a meeting of the laboratory council.

This process is invoked by a call activity in the preceding processes and is responsible for organizing a meeting of the laboratory council .

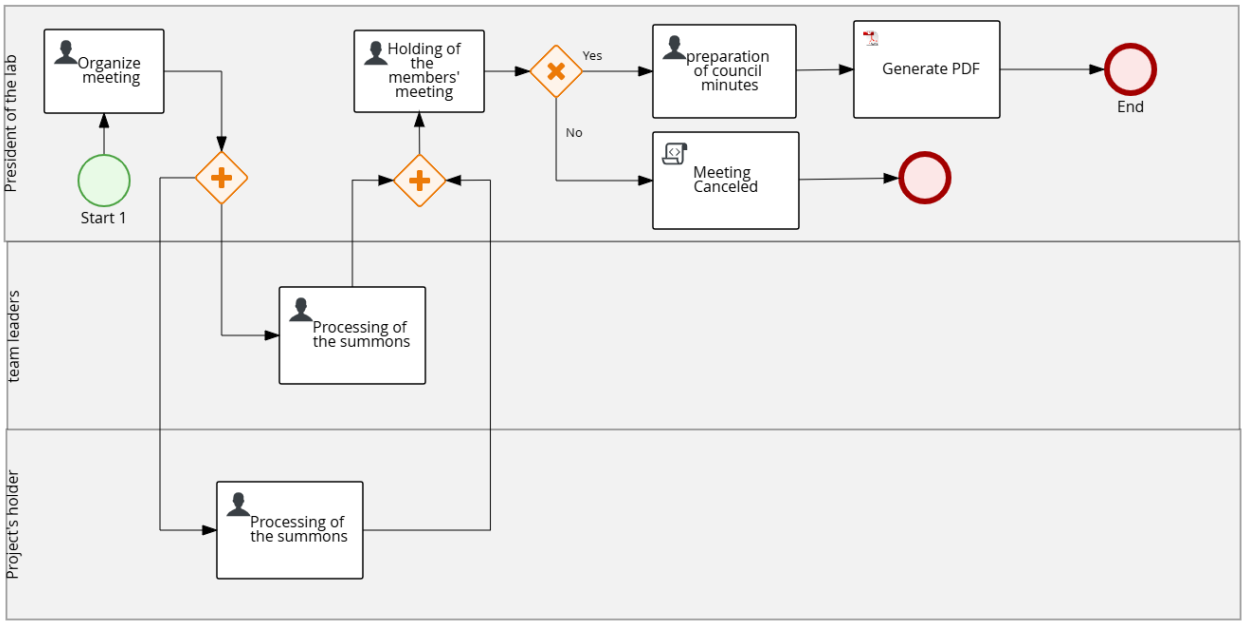


Figure 3.11: Model for Process 8

3.4 The role of Java in enhancing efficiency and flexibility in business process management using jBPM

- **JAVA** is a powerful programming language that is widely used in various industries . Whether you're running a small startup or a large enterprise , java can provide the solution needed to optimize your business process ,as has a proven track record of both stability and reliability , offering a strong cornerstone for building mission-critical applications .

3.4.1 The key advantages of Java

- **Cross-Platform Compatibility ;** java can run on multiple platforms, allowing you to write code once and deploy it on different operating systems . This reduces costs and enhances efficiency .

- **Scalability and Security ;** Java is designed to be scalable and secure, marking it suitable for businesses of all sizes. Its server-side capabilities enable handing larg volumes of data while ensuring smooth operatuion .

- **Object-Oriented Programming ;** java's Object-Oriented Programming model simplifies the creation and management of complex business logic .By defining objects and their relationships, code organisation becomes intuitive and adaptable .

- **Data Management ;**java offers a rich set of tools and libraries for effective data management. It facilitates database connectivity, CRUD operations, and structured application of business logic, ensuring efficient data handling .

- Overall, Java provides a robust foundation for building and optimizing business processes,making it a valuable asset for companies seeking to enhance their operations .

3.5 Using Java of our Application

Using Java in developing workflow applications provides an integrated and effective solution to manage and improve daily operations in organisation . Thanks to its flexibility , security , and scalability . Below I will show an example of how we use java in our application :

Step 1: General setting

➔Go to **Project** , and choose **Add Asset** .

➔choose **Data Object** .

➔We set the following parameter values (Figure 4.12) :

- **Name :** Add name in the data object .

- **Package :** Choose your project Package from the offered options list .

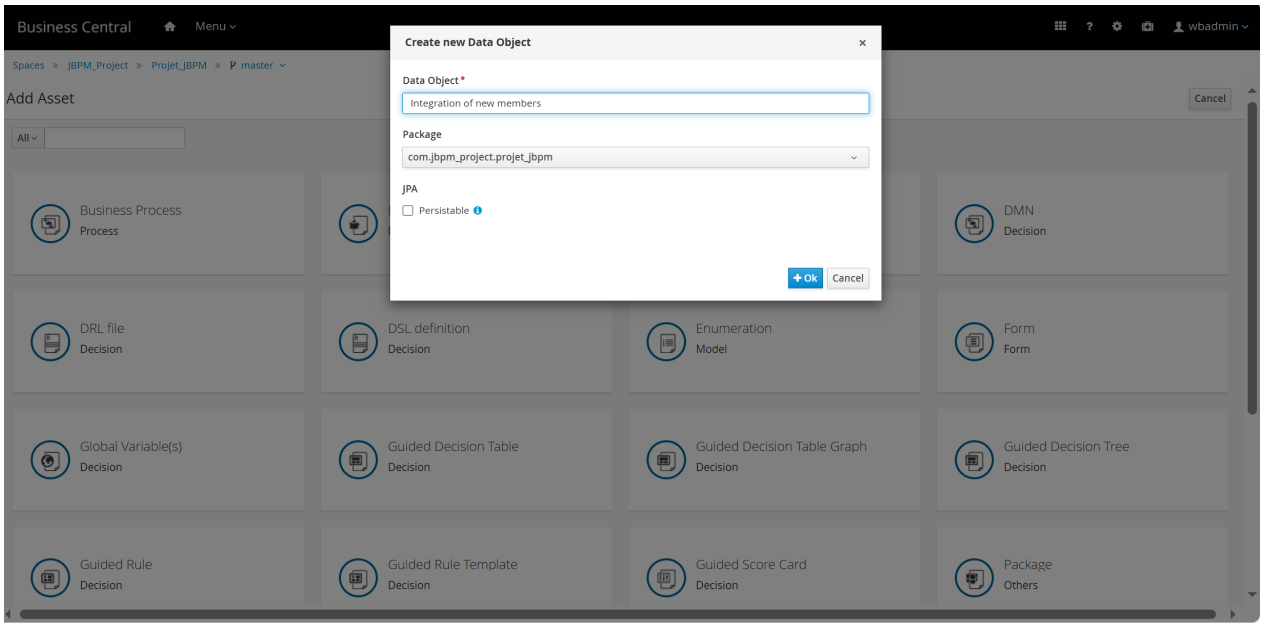


Figure 3.12: Step 1

Step 2: Writing the code

➲I will present here a task management code that stores data in the MYSQL database using the basic categories in java (Figure 4.13) :

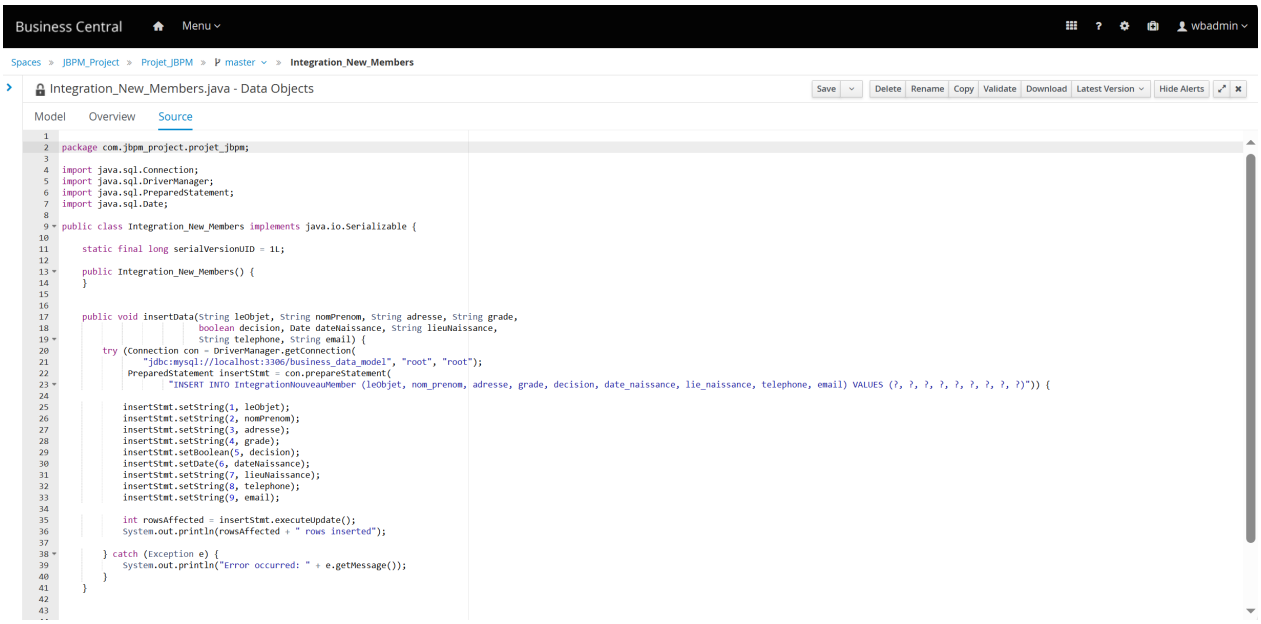


Figure 3.13: Step 2

Step 3: The process of implementing the Java code

- Go to the process BPMN .
- choose the required task .
- From the settings menu, choose Implementation / Execution .
- Write the code as show in the figure (Figure **??**) .
- After these steps, we will have a java code that enters data into the MYSQL database.

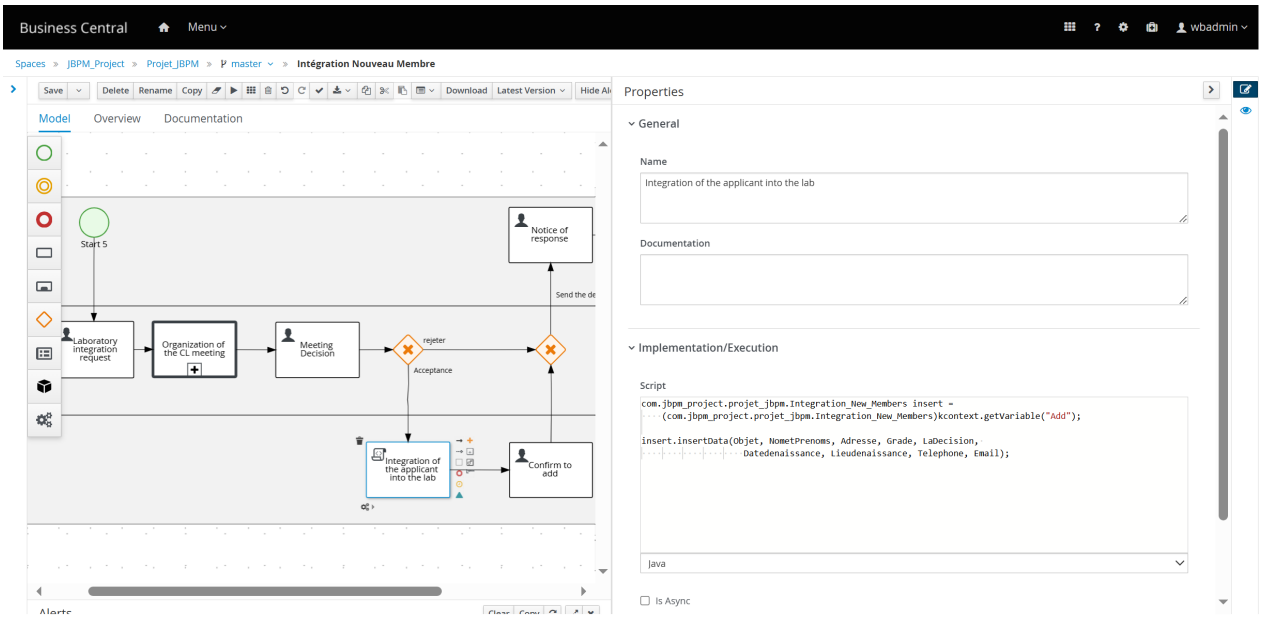


Figure 3.14: Step 3

Using Java , it is possible to create an integrated management system that contributes to improving laboratory efficiency, saving users time and effort, and ensuring that data is updated accurately and effectively . By developing this system , educational institutions can improve the management of their laboratories .

3.6 Conclusion

This chapter provided an overview of the "L'INFI" laboratory's activities. Members, internal organization, and we described our processes. Then, we proceeded to its modeling the different activities of the processes, and the actors involved in each activity. We graphically modeled our process on JBPM. Now we can begin implementing our workflow application using the open-source JBPM software.

Chapter 4

Experimentation And Results

4.1 Introduction

In this chapter, we describe the step-by-step implementation of our workflow application using BPMN and the JBPM platform. The focus will be on how to create a new BPMN diagram, set up a project, and add assets within JBPM.

4.2 Presentation of our Application

In this section, we will present our workflow application, starting with an overview of the first facade of Business Central (Figure 4.1), which serves as the user interface for managing and interacting with the processes we have modeled and implemented using BPMN and JBPM. Here is a visual representation of the first facade of Business Central

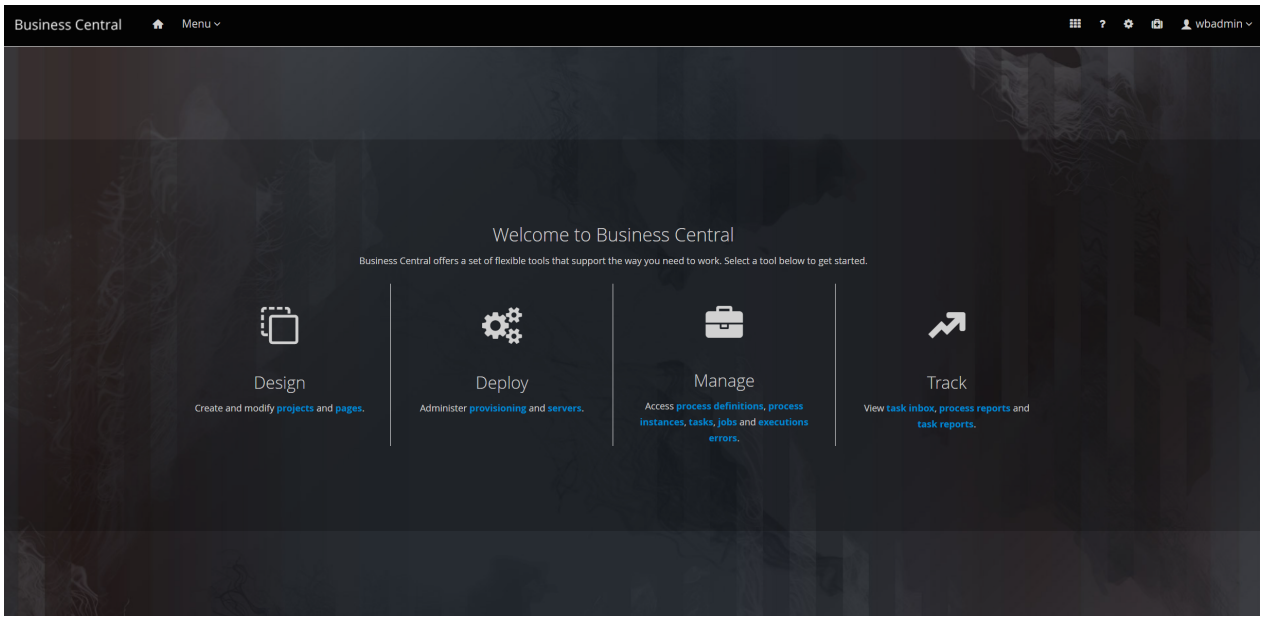


Figure 4.1: Business Central dashboard

4.2.1 Project Management

This section allows users to create and manage projects. Each project contains related assets, including BPMN diagrams, decision tables, and forms. Users can organize their work into different spaces and projects for better management and collaboration. To create a new BPMN diagram in JBPM, follow these steps:

- Add a space first, then add a new project, and choose to add asset. Figure 4.2 depicts the jBPM Studio.

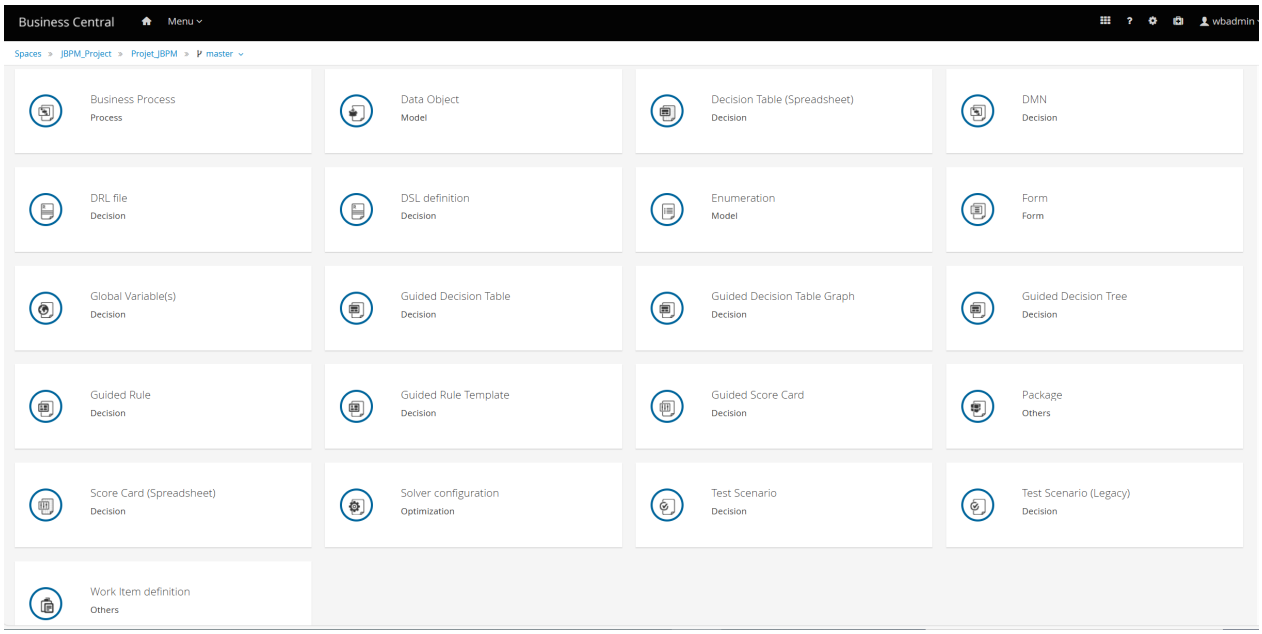


Figure 4.2: JBPM Studio

- Create new Business Process (Figure 4.3).

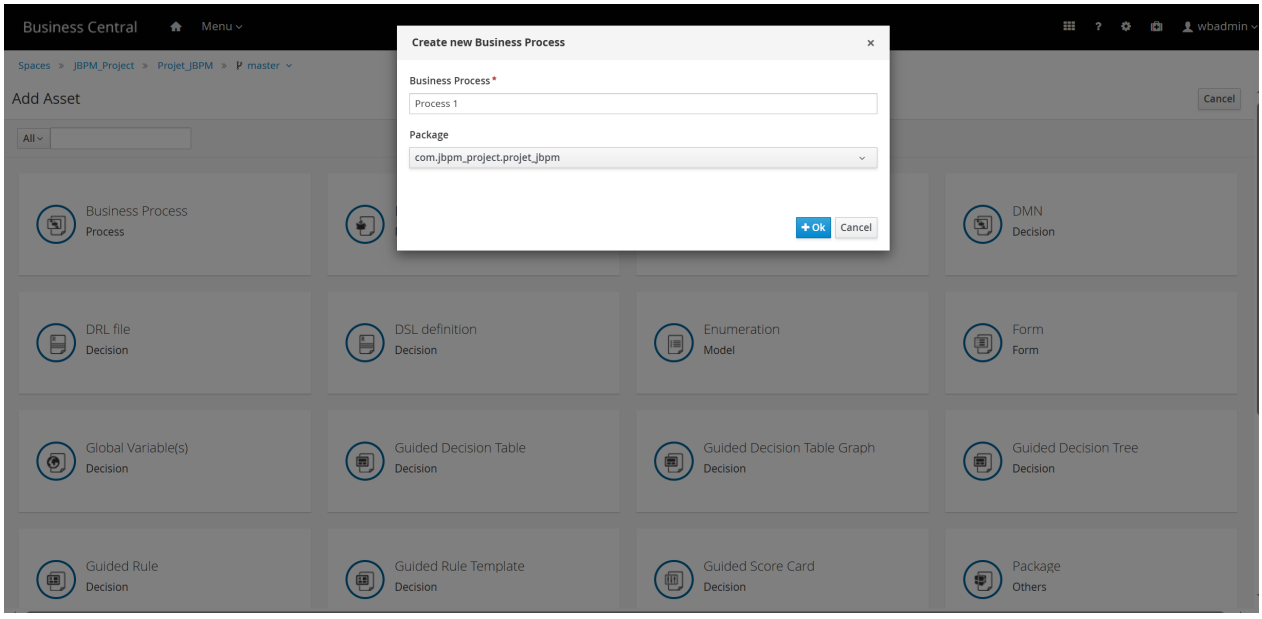


Figure 4.3: Create new Business Process

- Select diagrams (Figure 4.4).

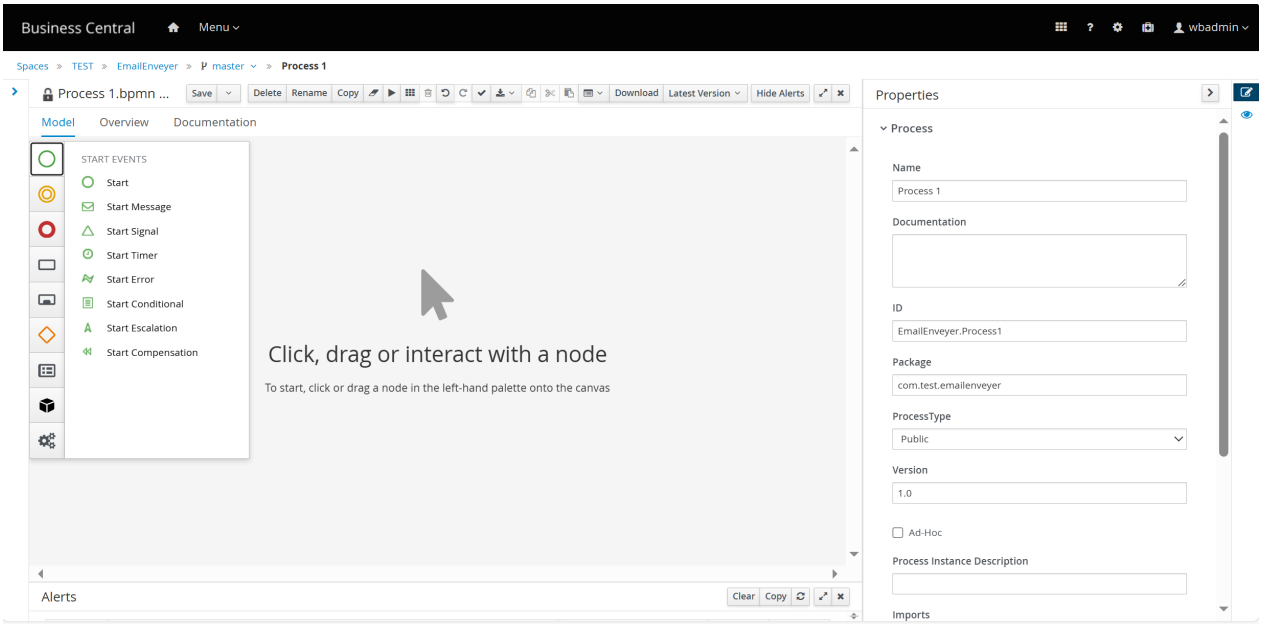


Figure 4.4: First screen in the project

- Configure elements palette(Figure 4.5).

  The Elements Palette for BPMN enables the selection of various elements to construct diagrams, including events, tasks, gateways, sub-processes, and more. This tool offers visually coherent documentation, aiding in process flow analysis and improvement identification. It further supports model conversion into executable code, fostering inter-team communication through a shared language .

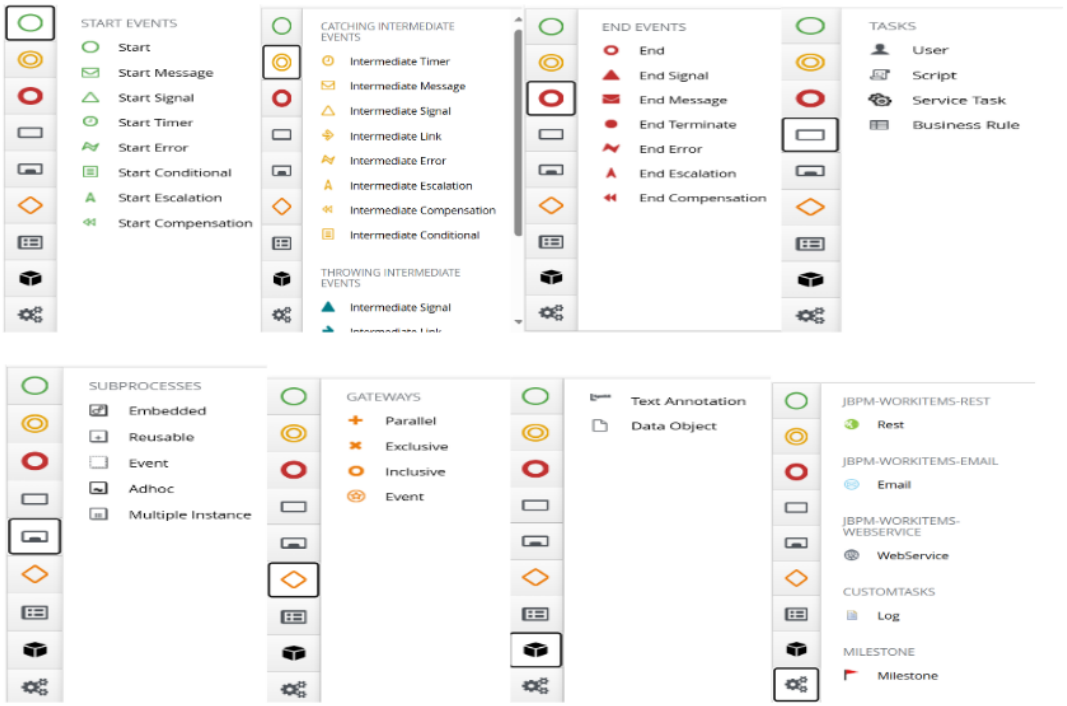


Figure 4.5: Elements palette

4.2.2 Definition Of The Business Data Model (BDM)

The Business Data Model (BDM) is a crucial component of workflow applications, enabling the structured representation and management of data within the business processes. In JBPM, defining and configuring the BDM involves setting up data sources and drivers to ensure seamless data integration and utilization. Here is a step-by-step guide on how to define the BDM in Business Central:

1. **Accessing Settings:** Begin by clicking on the Settings menu in Business Central. This menu provides access to various configuration options for managing your workflow application.

2. **Navigating to Data Sources:** From the Settings menu, navigate to the Data Sources section. This section allows you to manage the data sources that your workflow application will use.

3. **Adding a Data Source:** To add a new data source, follow these steps: (i)Add Data Source: Click on the option to Add Data Source. This will open a form where you can specify the details of the data source you want to add. (ii)Specify Data Source Details: Enter the necessary details such as the data source name, type (e.g., database, file, etc.), and connection information. Ensure that the details are accurate to establish a successful connection.Figure 4.6 depicts the data source page and Figure 4.7 depicts the new data source configuration page.

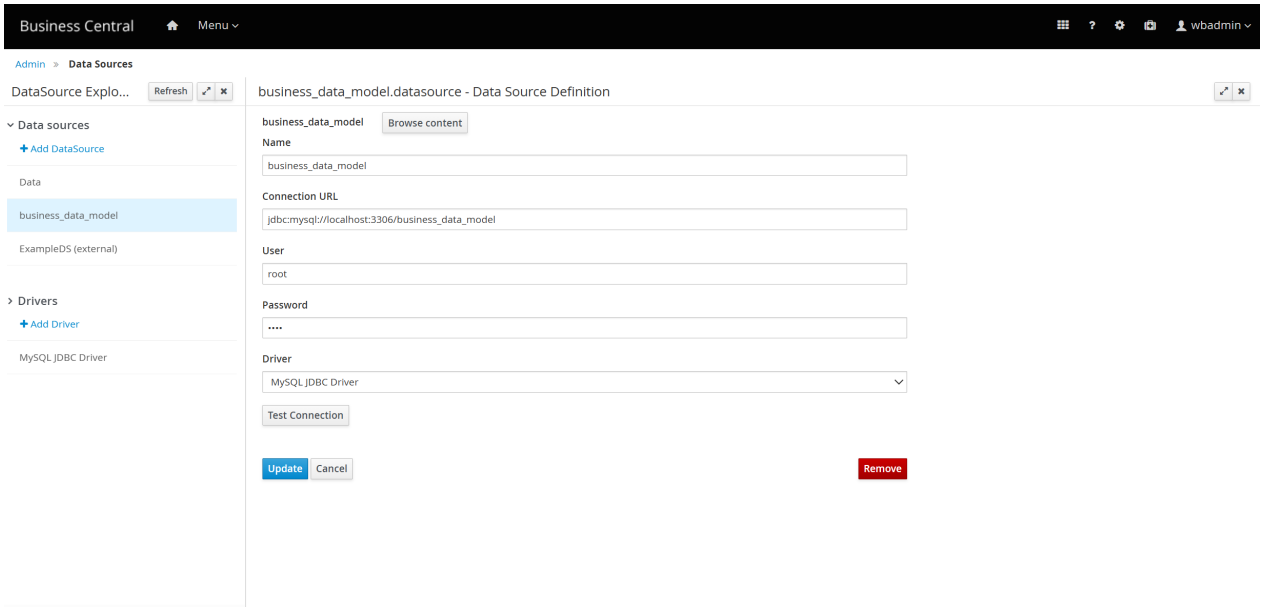


Figure 4.6: Data Sources page

For example: click on Settings , Choose from the Data Sat menu ,then : new data set , then SQL to create business objects.

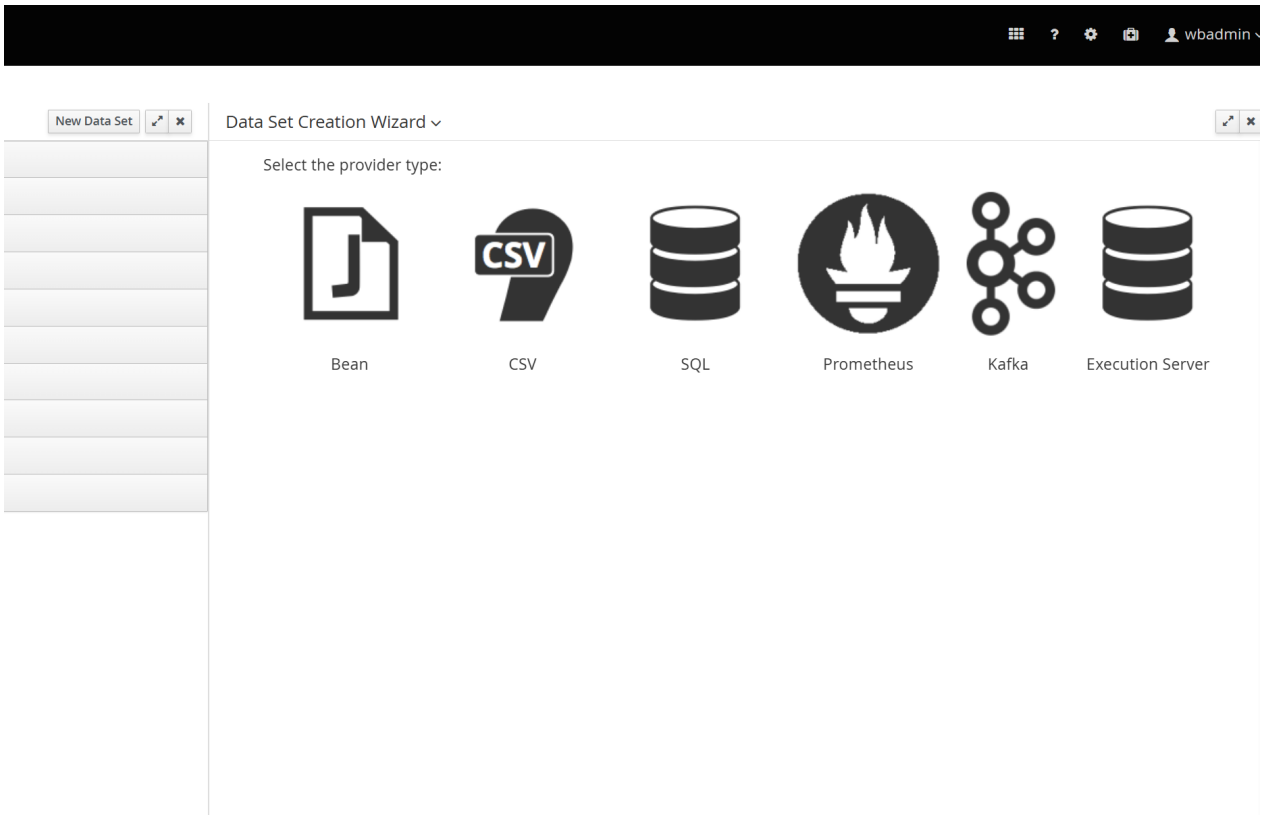


Figure 4.7: New Data Set

4. **Adding a Driver:** After adding the data source, you may need to add a driver to enable the connection to the data source: (i) Add Driver: Click on the option to Add Driver. This will allow you to specify the driver required to connect to the data source. (ii) Specify Driver Details: Provide the details of the driver, such as the driver name, version, and location of the driver file. This step ensures that JBPM can communicate with the data source using the correct driver. Figure 4.8 depicts the data driver page.

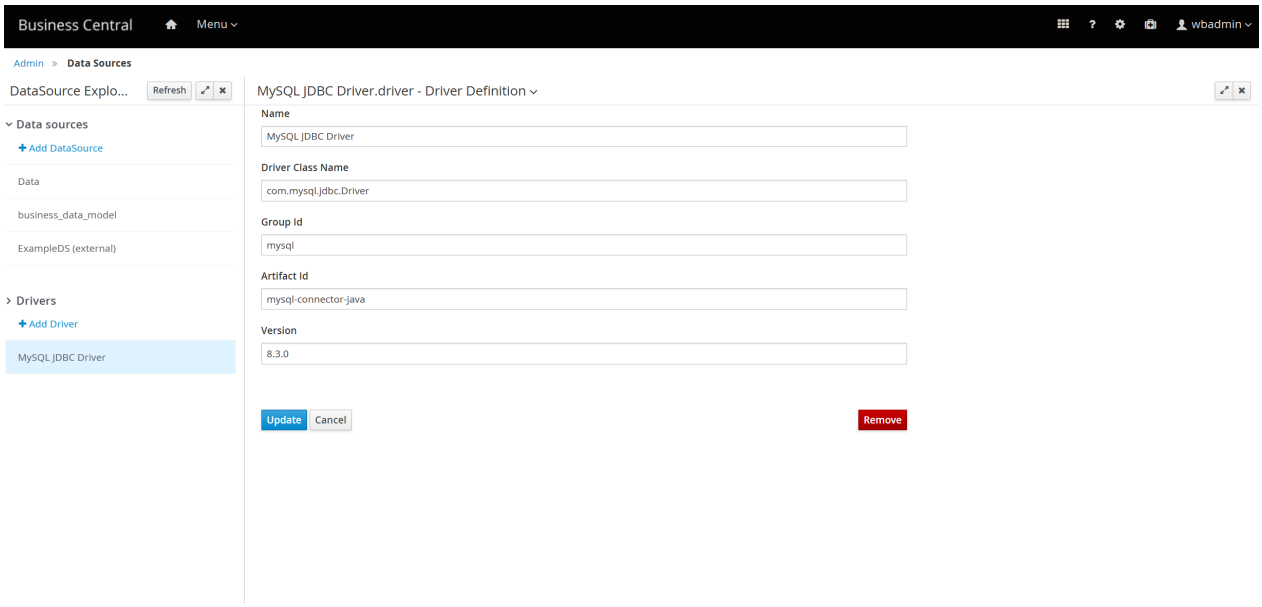


Figure 4.8: Data Driver page

For example, On the menu, after clicking on " SQL , Add table data then define your data (Figure 4.9) by adding/ Editing business variables (Figure 4.10).

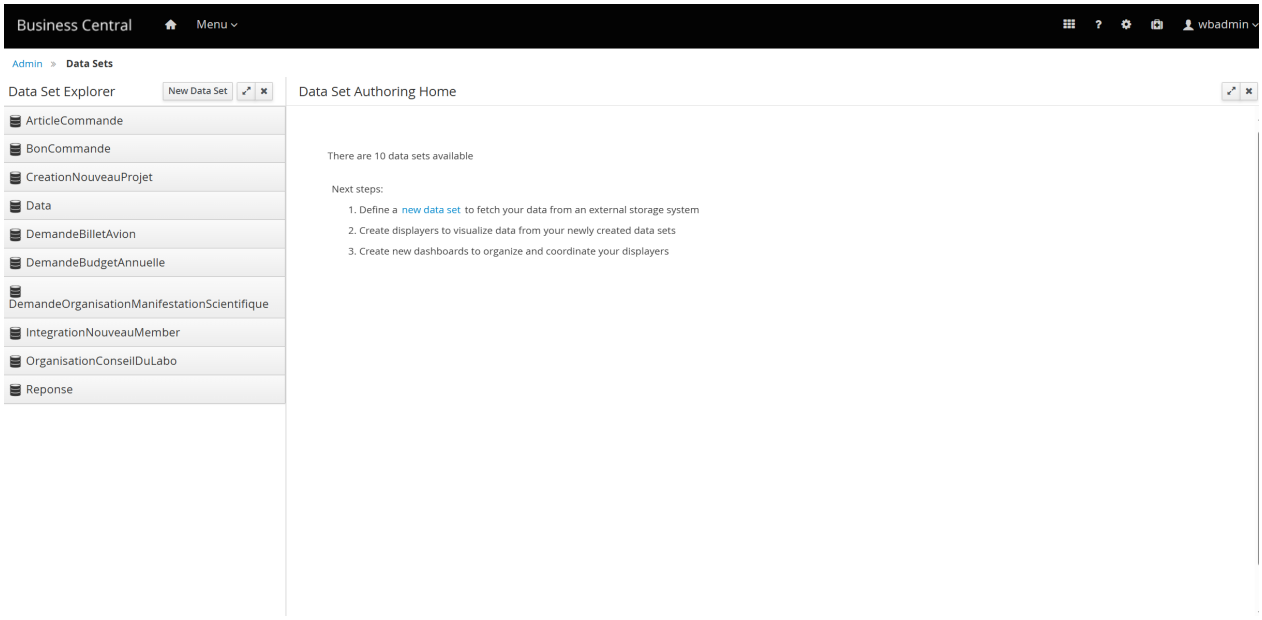


Figure 4.9: Business data model

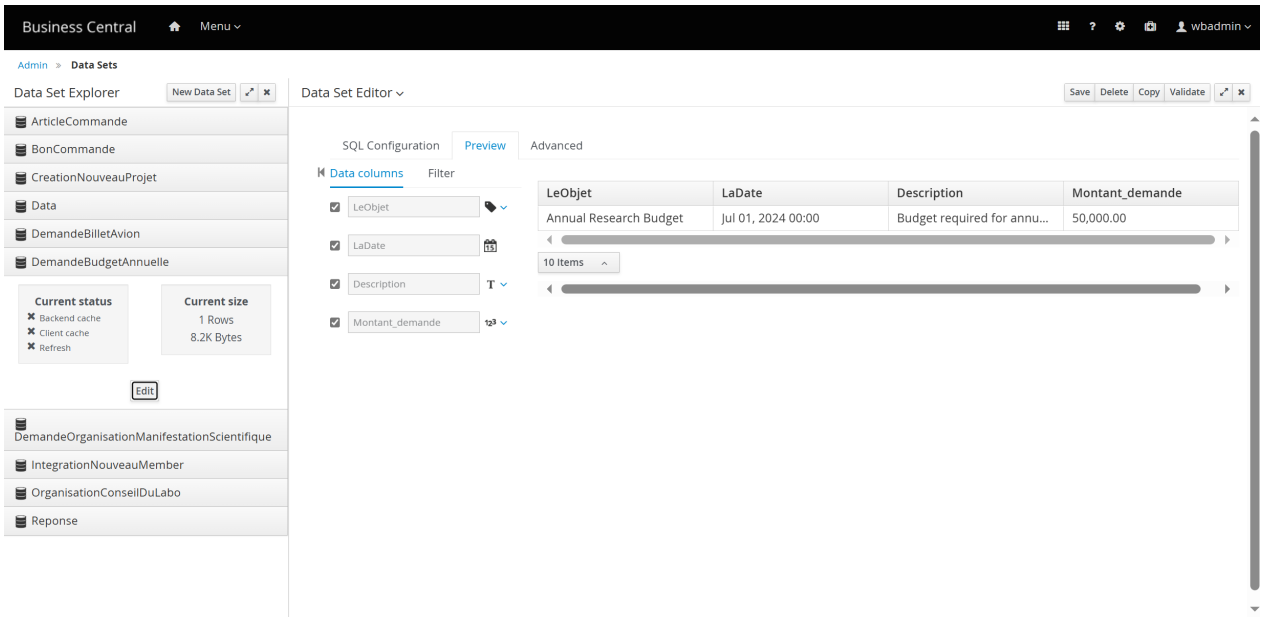


Figure 4.10: Adding data and attributes

4.2.3 Definition of Process Data

A Process Data is composed of inputs and constraints. Inputs are pieces of information that must be provided for the process or the human task. The constraints are applied to the input to check that the values of the inputs are valid. It means that it links the processes and the Base Data Model. Figure 4.11 shows process's specif data addition.

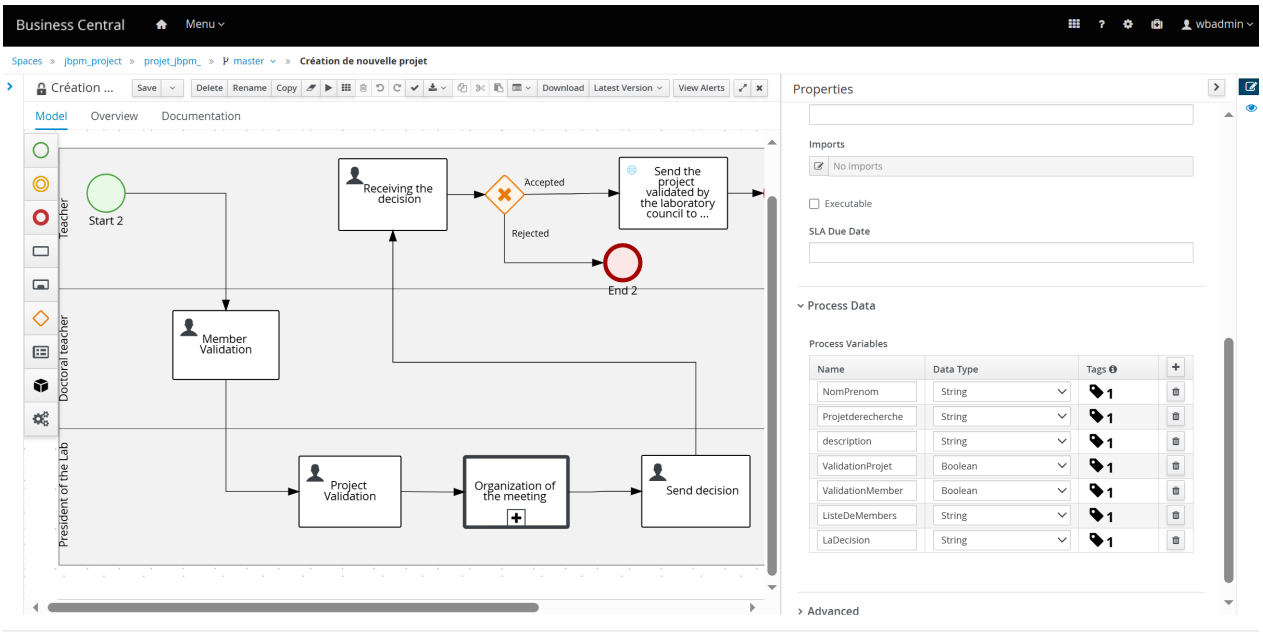


Figure 4.11: Define Process Data

4.2.4 Definition of Email Connectors

The Email Connector feature in JBPM allows seamless integration of email communication within business processes. This feature is particularly useful for automating notifications, alerts,and updates throughout the workflow. We have utilized the Email Connector in various processes to ensure timely and effective communication.

Email Configuration: To enable JBPM to send emails, the email settings need to be configured correctly. Follow these steps to set up the email configuration (Figure 4.12):

Step 1: General setting

➲Go to **Project** , and choose **Settings** .

➲Click on **Custom Tasks** then **install** Email .

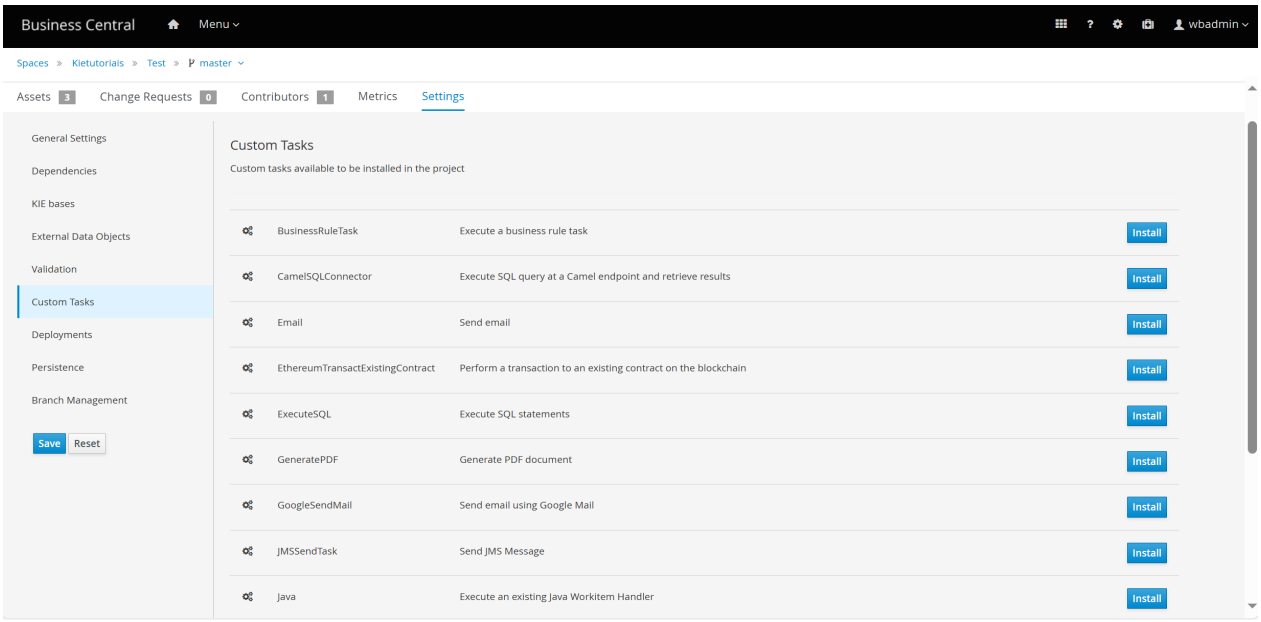


Figure 4.12: Step 1 of the procedure

Step 2: Server setting

➲We set the following parameter values (Figure 4.13) :

- **SMTP Server :** We entered our SMTP server address .
- **Port :** We specify the port number of the SMTP server .
- **Username :** We entered the username .
- **Password :** We entered the password to authenticate the SMTP server .
- Click on **Install .**

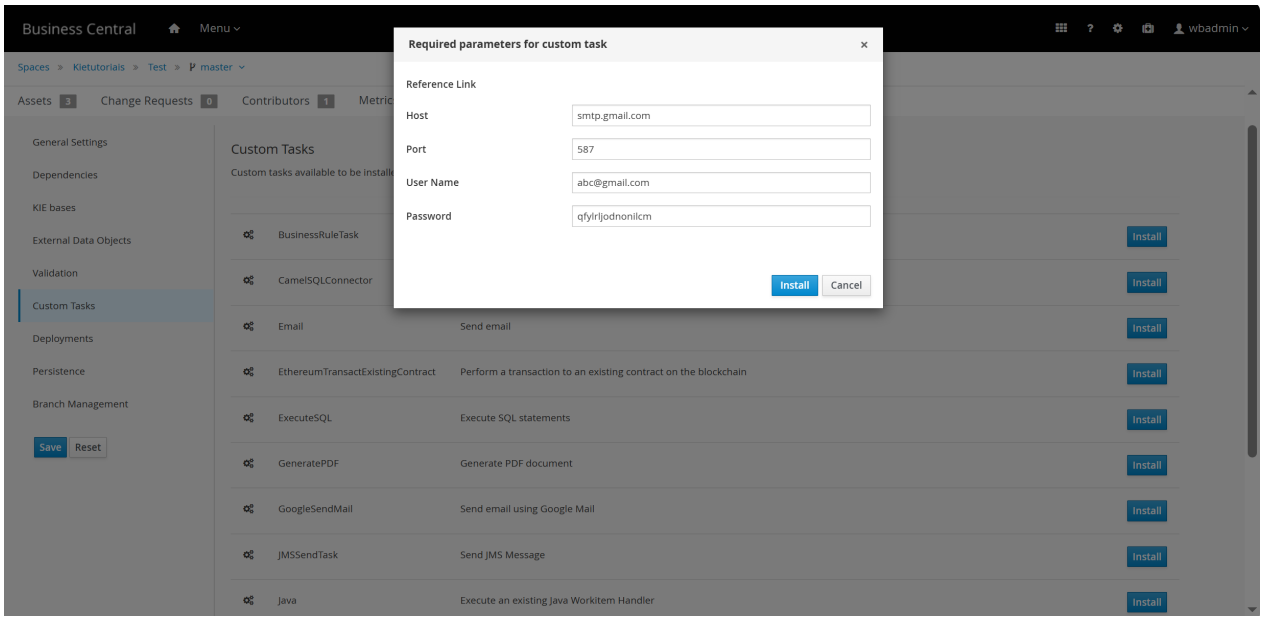


Figure 4.13: Step 2 of the procedure.

Step 3: sender setting

➲From : Specify the email address from which the emails will be sent (Figure 4.14) :

➲To : Specify the email address of the recipient.

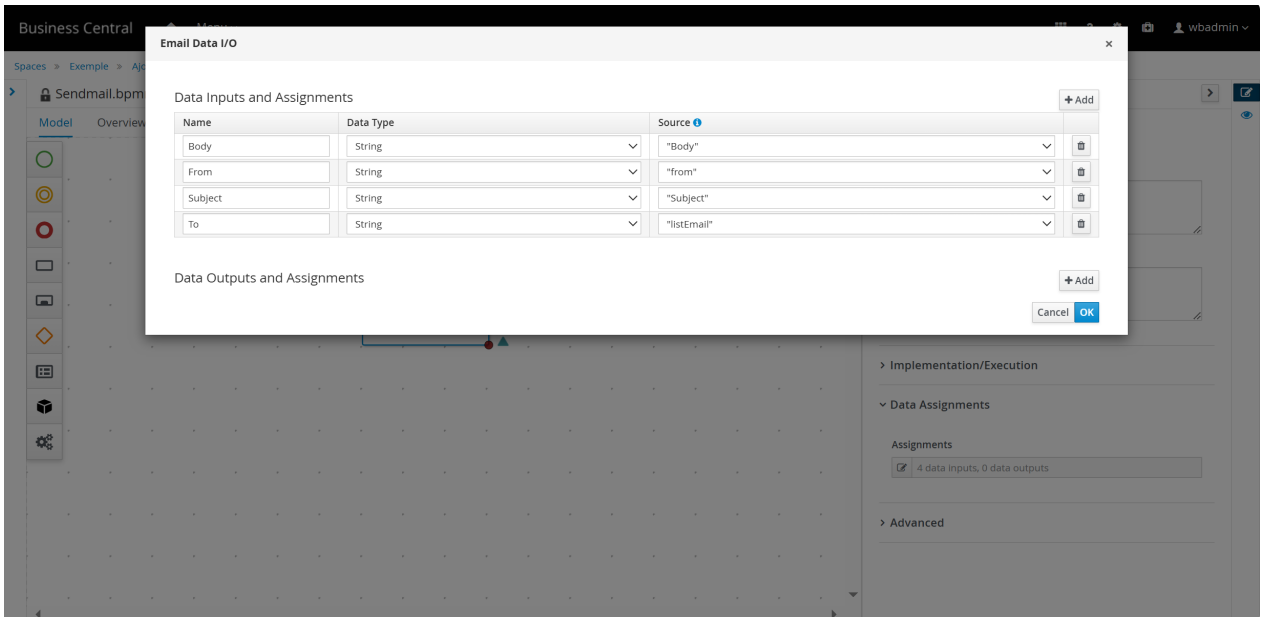


Figure 4.14: Step 3 of the procedure.

Configuring and utilizing the Email Connector in JBPM significantly enhances the ability to automate and manage communication within business processes. This integration ensures that all relevant parties are promptly informed about task assignments, process updates, and any issues that require attention, thereby improving the overall efficiency and effectiveness of the workflow .

4.2.5 Definition of Generate Pdf

In JBPM , Creating a PDF file can include creating documents as part of the business process. This is usually done in response to a specific event in the process or as a step within a business process, such as creating an invoice, report,or certificate . This feature is useful as it reduces the need for manual intervention and increases efficiency and accuracy in preparing documents .

- Follow these steps to set up the PDF file configuration inside JBPM (Figure 4.15):

Step 1: General setting

➲Go to **Project** , and choose **Settings** .

➲Click on **Custom Tasks** then **install** Generate PDF .

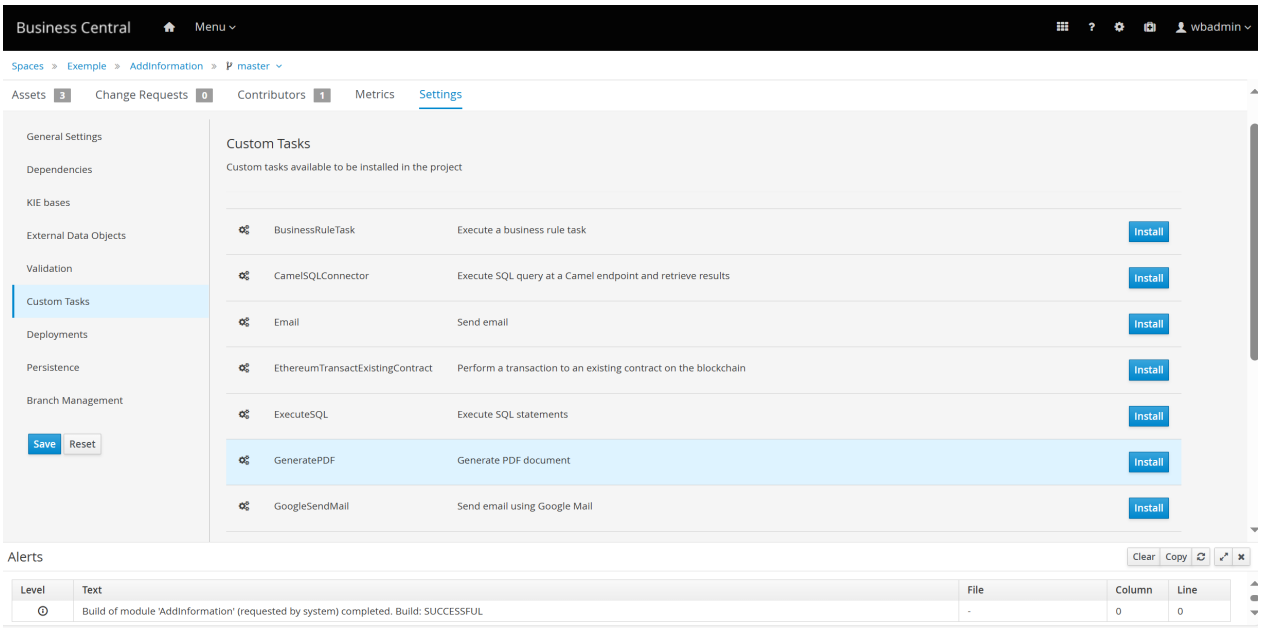


Figure 4.15: Step 1 of the procedure.

Step 2:

➔Go to **Deployments** , and choose **Work item handlers .**

➔We set the following parameter values (Figure 4.16) :

- **Name :** GeneratePDF .
- **Value :** new org.jbpm.process.workitem.pdf.GeneratePDFWorkitemHandler() .

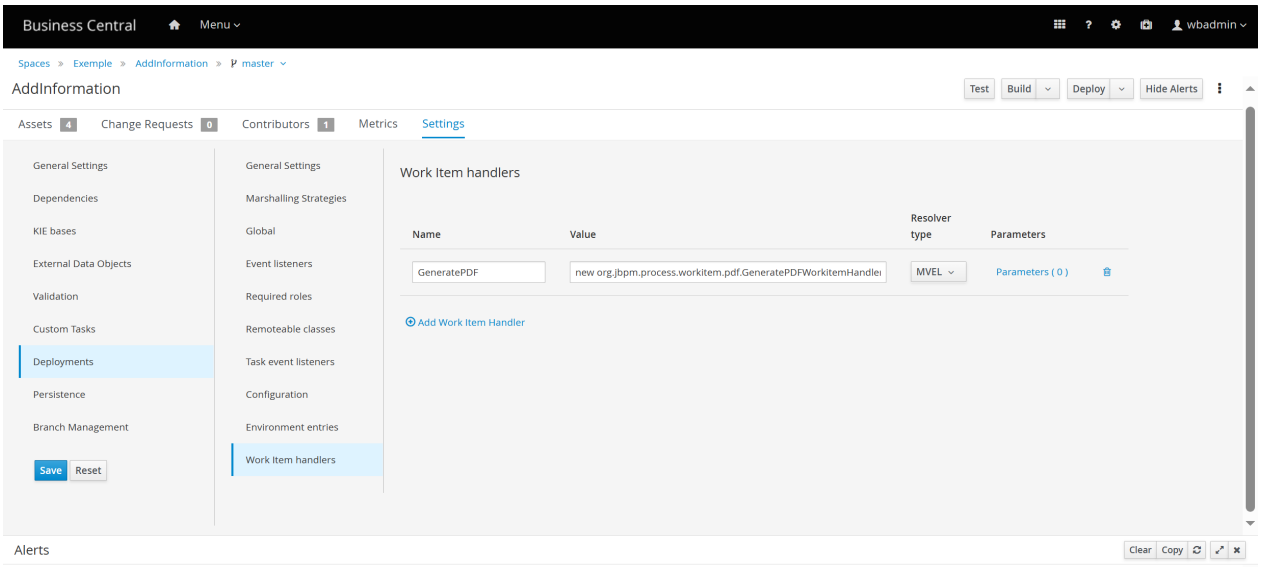


Figure 4.16: Step 2 of the procedure.

Step 3:

➔Go to **Deployments** , and choose **Marshalling Strategies .**

➔Click on **Add Marshalling Strategies** Then set the following parameters (Figure 4.17) :

- **Name :** new org.jbpm.document.marshalling.DocumentMarshallingStrategy();

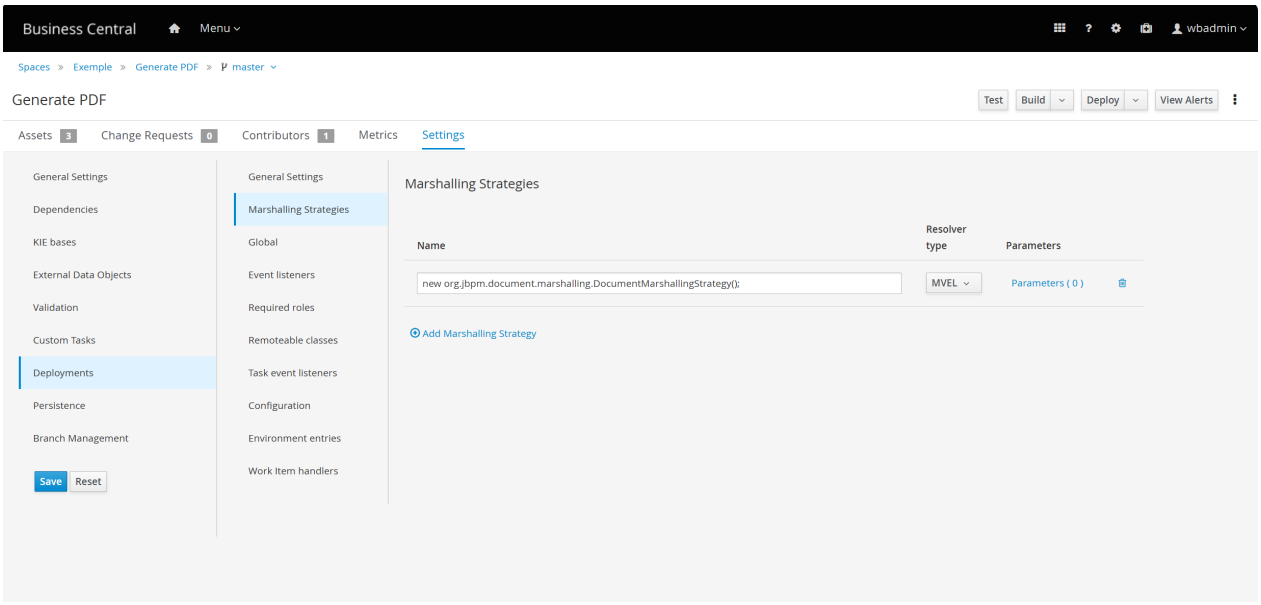


Figure 4.17: Step 3 of the procedure.

Step 4 :

➔Go to **Dependencies** , and choose **Add Dependenc .**

➔Fill in the following information (Figure 4.18) :

- **Group ID :** org.jbpm.contrib .
- **Artifact ID :** pdf-workitem .
- **Version :** 7.42.0.Final .

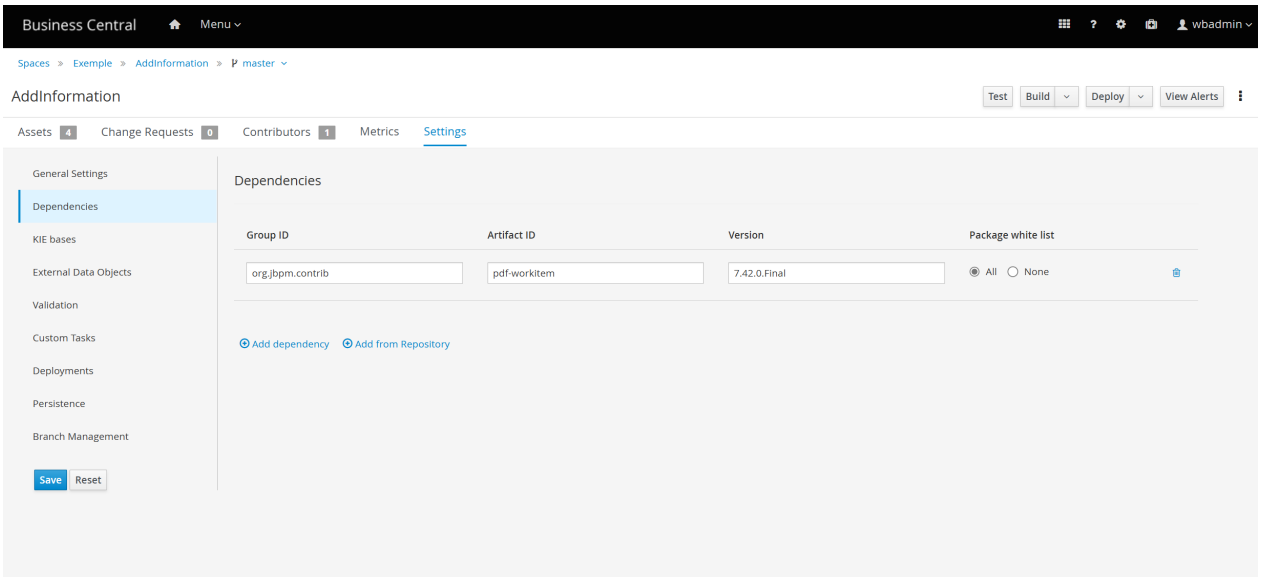


Figure 4.18: Step 4 of the procedure.

Step 5 :

- **PDFName :** Specify the file PDF name (Figure 4.19) .
- **TemplateXHTML :** HTML text represents the document template .
- **PDFDocument :** Represents a ready PDF file .

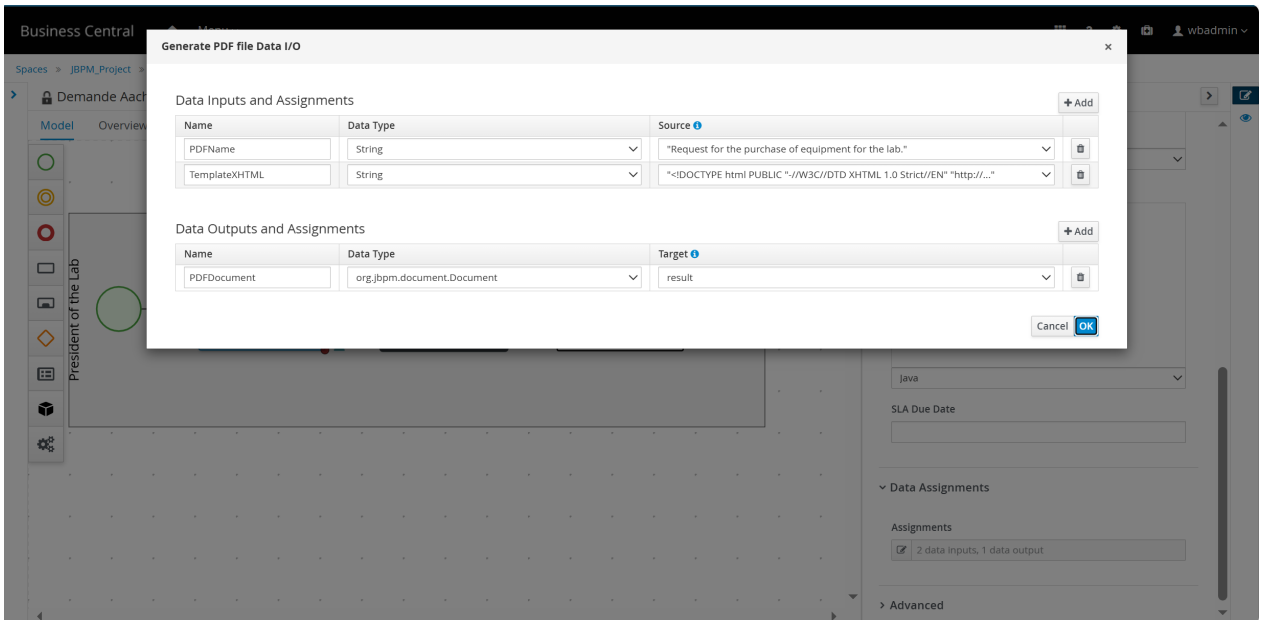


Figure 4.19: Step 5 of the procedure.

Using PDF within JBPM provides accuracy in preparing documents without the need for manual intervention . Specific inputs and outputs are used to configure service tasks within the workflow, ensuring that documents are generated correctly and consistently .

4.2.6 User Interfaces Configuration

Configuring user interfaces in JBPM is essential for ensuring that users can interact with the workflow tasks effectively. This involves generating forms that are used for data entry and task management within the business processes (Figure 4.20). Here are the steps to configure user interfaces by generating forms automatically in JBPM:

➲**Select the Task:** Navigate to the specific task within your workflow for which you want to generate a form.

➲**Generate Forms for Selection:** This action will automatically create a form based on the attributes defined in the business model .

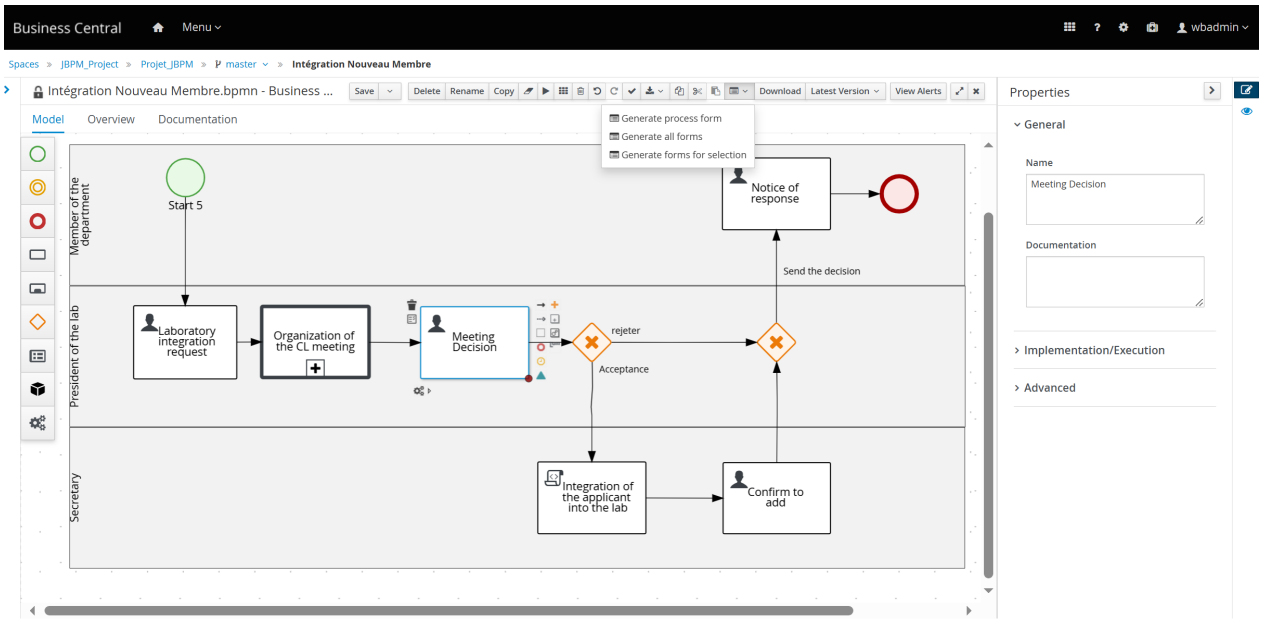


Figure 4.20: Forms Creation

Figure 4.21 refers to the form modification page of the JBPM editor .

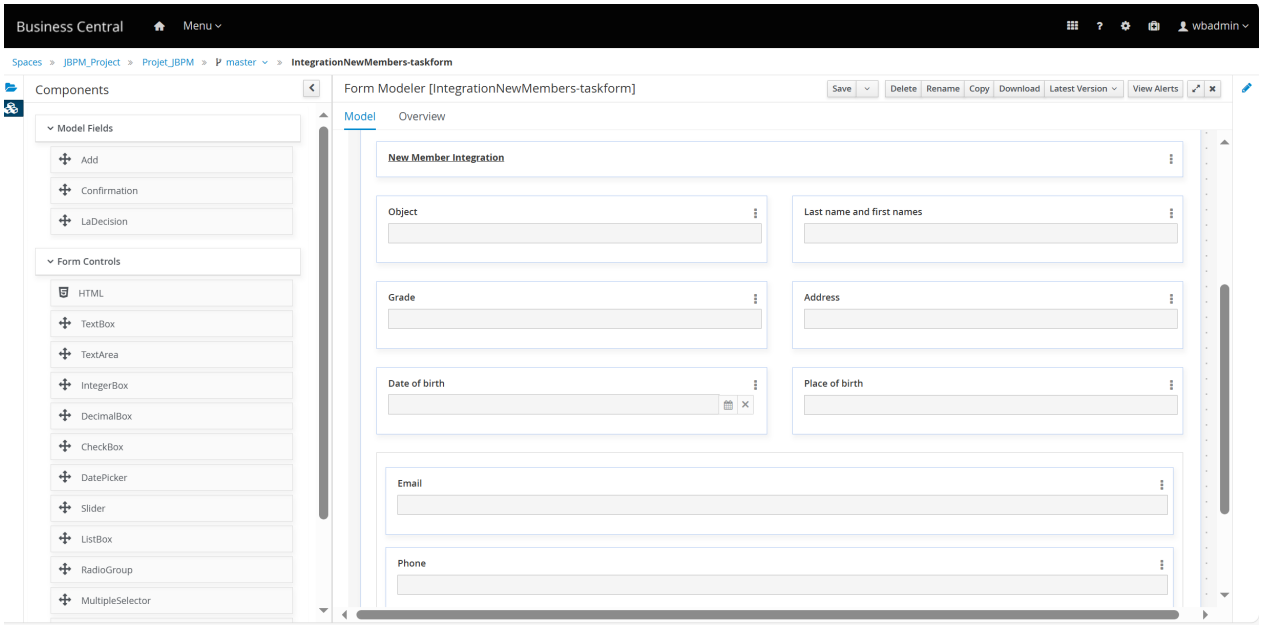


Figure 4.21: Form modification page of the JBPM editor

Figure 4.22 presents ours task manager page .

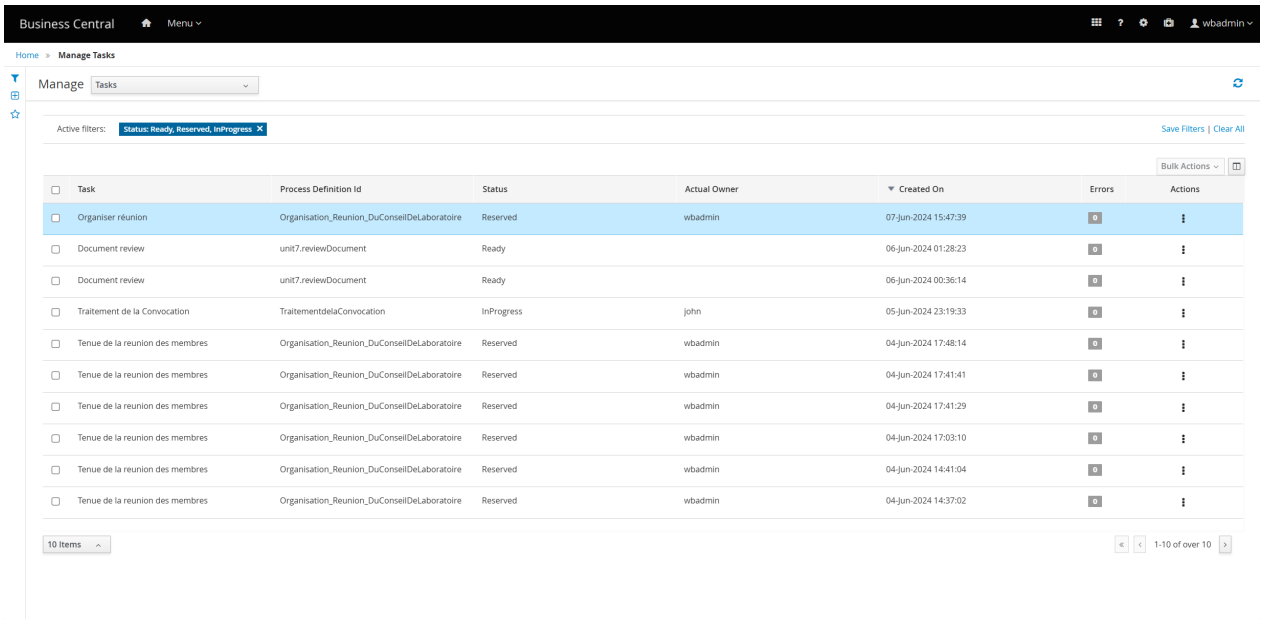


Figure 4.22: The Final form of task manager page

- adds the groups :

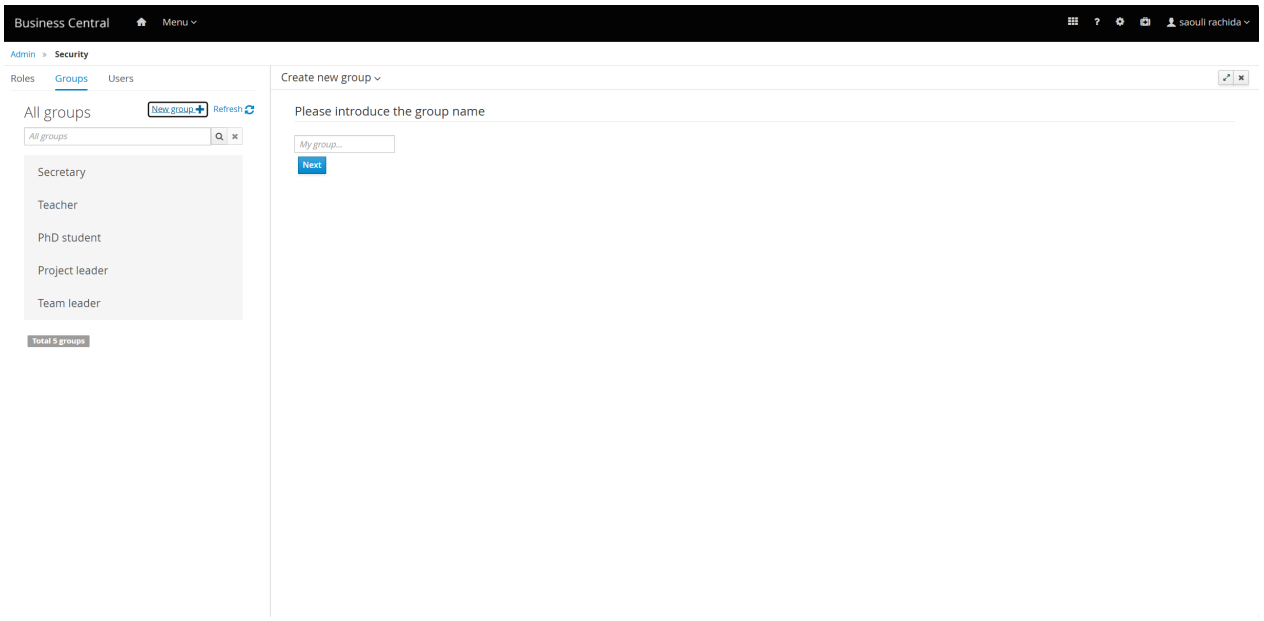


Figure 4.23: Add groups

- adds the users :

  We add users last names and first names .

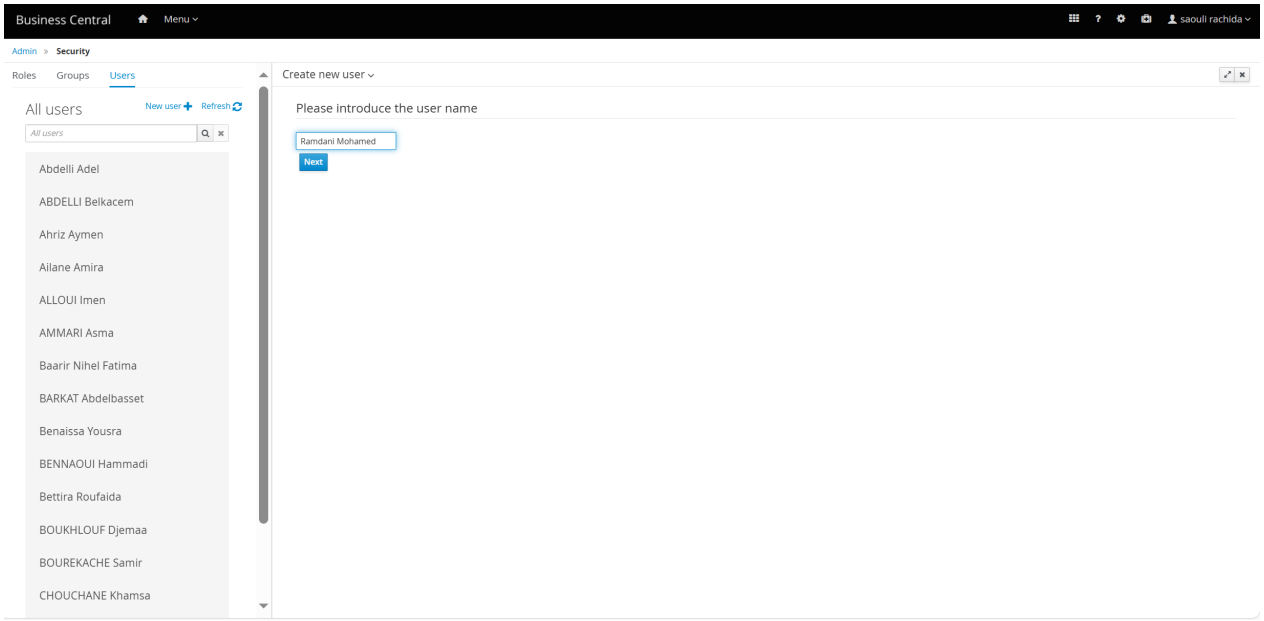


Figure 4.24: Add Users Step 1

After clicking **Next**, choose **Add to groupe** from the interface, and then specify the group to which this user belongs (Figure 4.25).

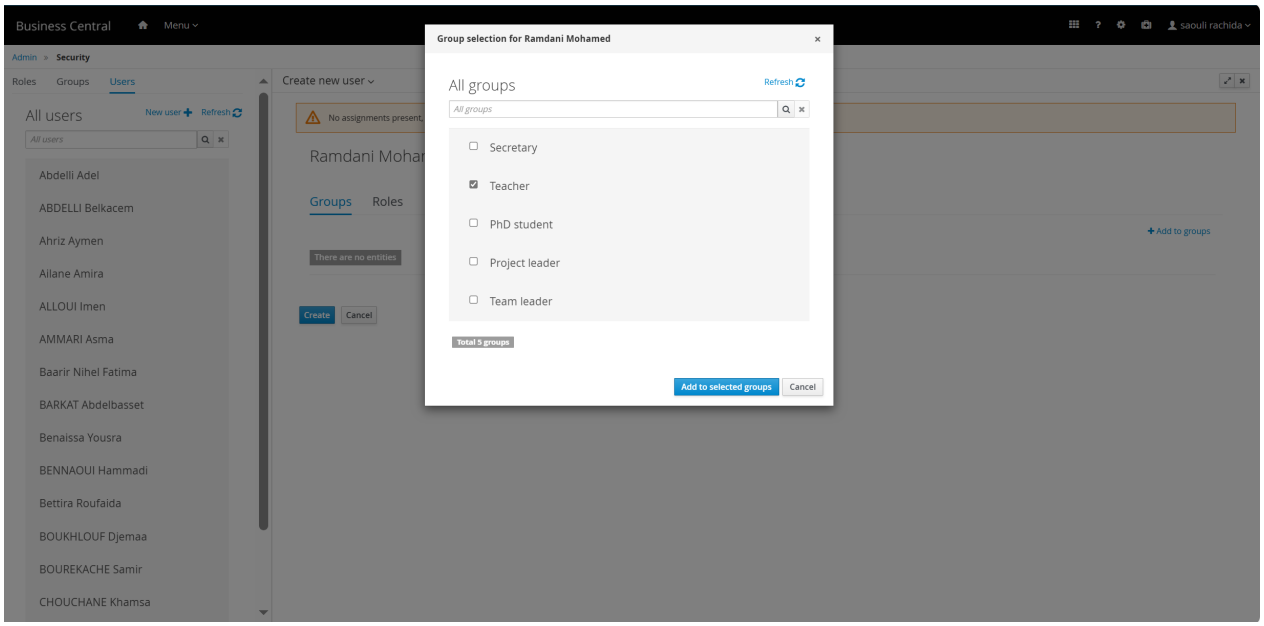


Figure 4.25: Add Users Step 2

click **Add roles** from the interface, and then specify the roles to which this user belongs (Figure 4.26).

There are a variety of roles that define the powers and functions that users can perform . Here is an explanation of the different roles I mentioned :

process-admin : Responsible for processes,has full administrative powers over processes.

Manager : Can monitor and analyze the performance of operations and make administrative decisions .

admin : Has broad powers that include managing users and the system .

analyst : Responsible for analyzing operations data and preparing reports .

rest-all : A role that provides full access to the REST interfaces of all functions .

Developer ; Has the authority to develop and modify process models and manage software projects .

rest-project : A role that provides access to REST interfaces for specific projects only .

User : The ordinary user, who has limited permissions that enable him to work on the tasks assigned to him .

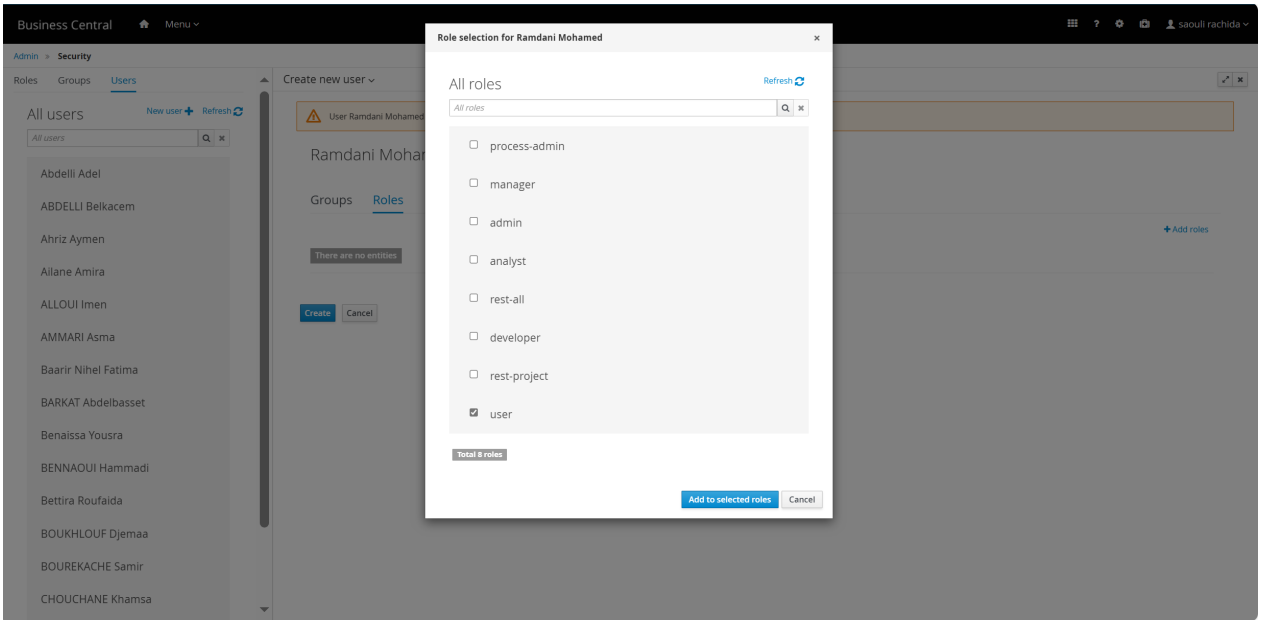


Figure 4.26: Add Users Step 3

We add users passwords (Figure 4.27) .

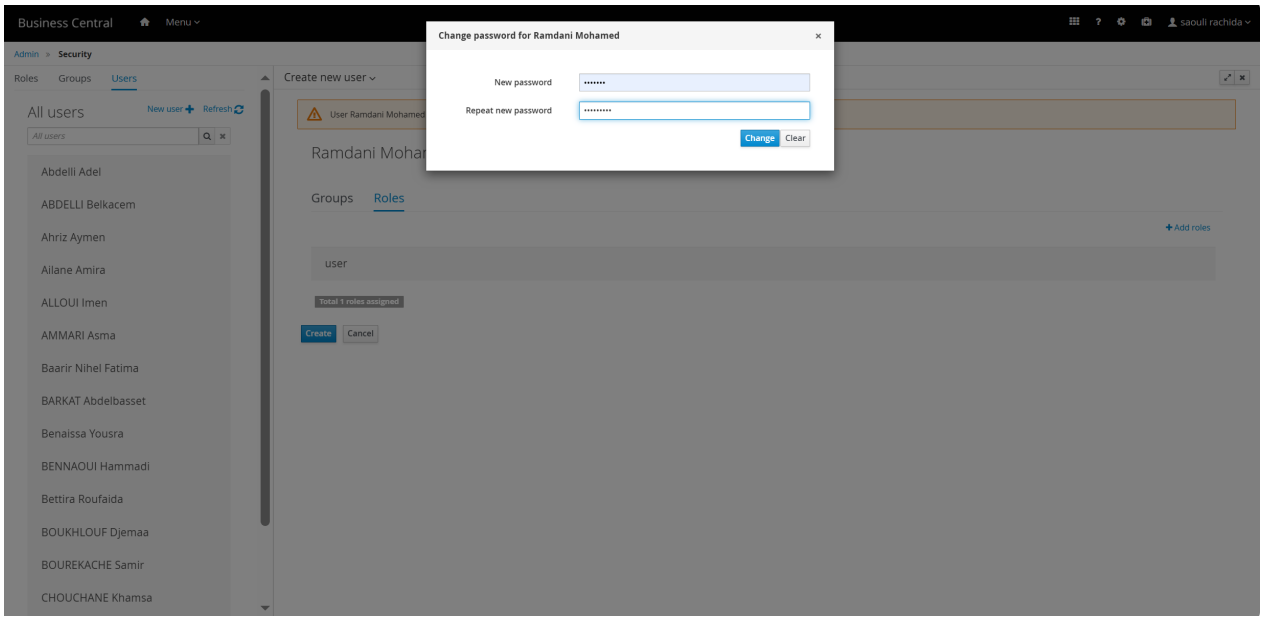


Figure 4.27: Add Users Step 4

4.2.7 A scenario about the use of the application

Laboratory members (lab heads, team heads, project headers, secretaries , doctors) can use this application . We will explain how these users interact with the system .

The login page : The login page for users is as depicted

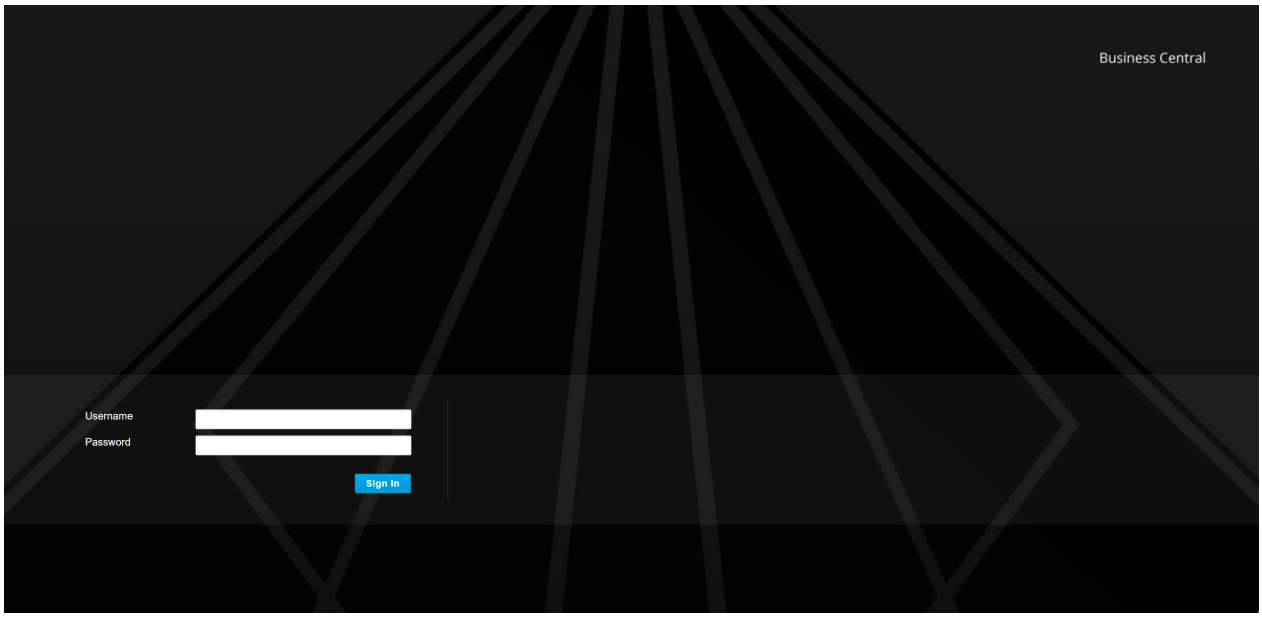


Figure 4.28: The login page

application interface :

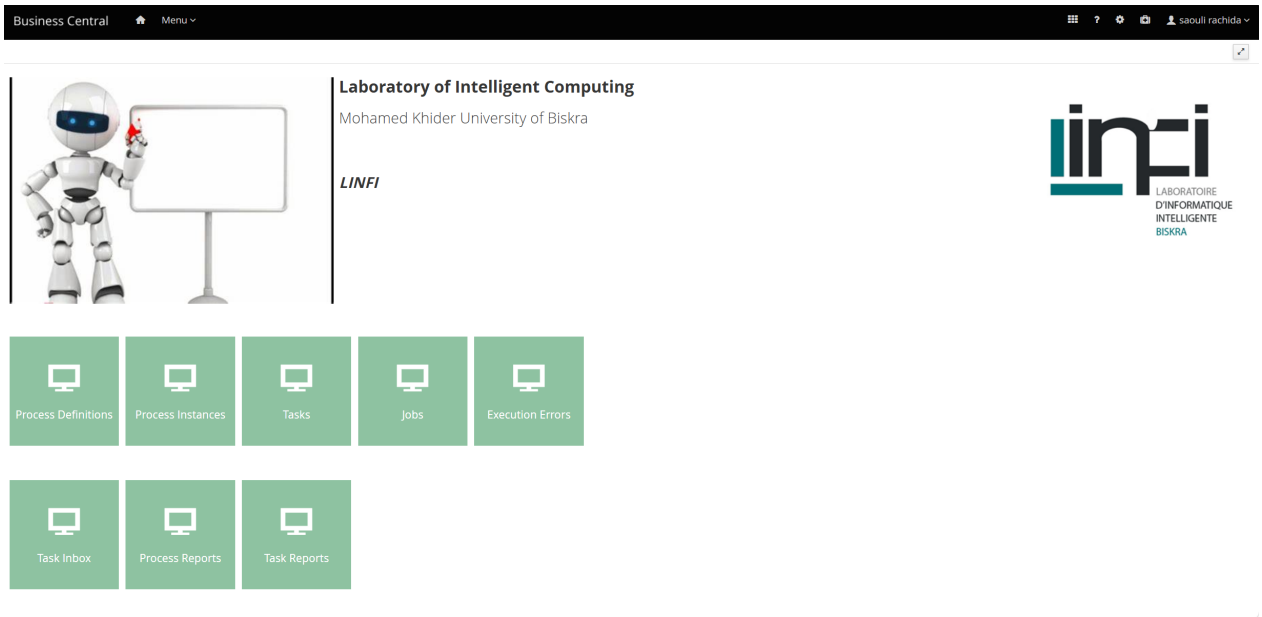


Figure 4.29: application interface

Professor's interactions(team leaders, project leaders, doctoral students) with the plat-

form, and the following figures appear :

1. **Creation of a new research project :**The professor in question (holding MCA) is preparing an application to create a new research project. The following figure 4.30 shows the information that will be filled out in the application .

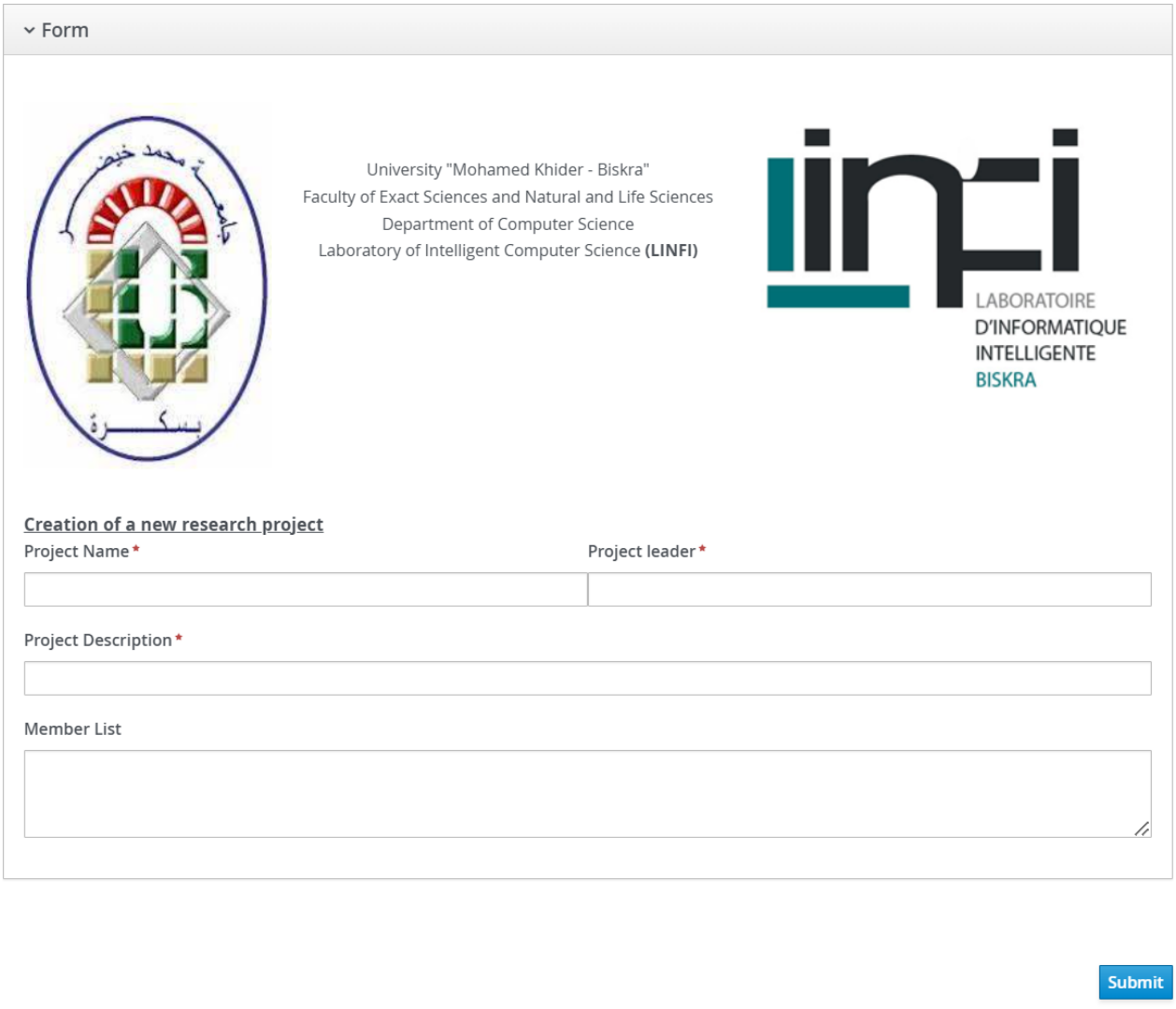


Figure 4.30: Creation of a new research project

2. **Plane Ticket Request :** During this process, a request is prepared to purchase a plane ticket. The request includes the information provided in the following form 4.31 .

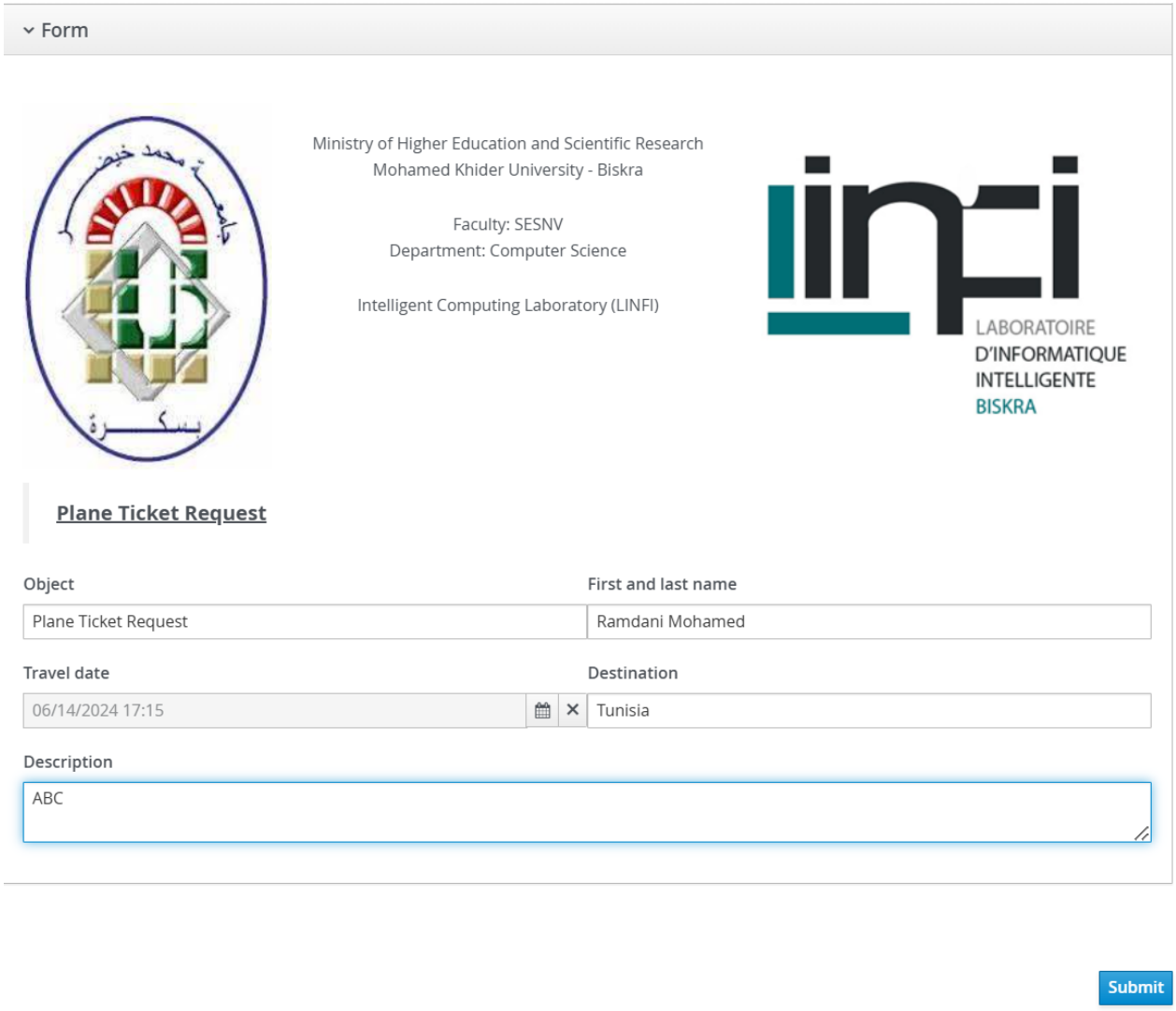


Figure 4.31: Plane Ticket Request

3. **Request for organization of a scientific event:** In order to hold a scientific event, your application must be approved by the Laboratory Council. The document 4.32 represents the details of the application .

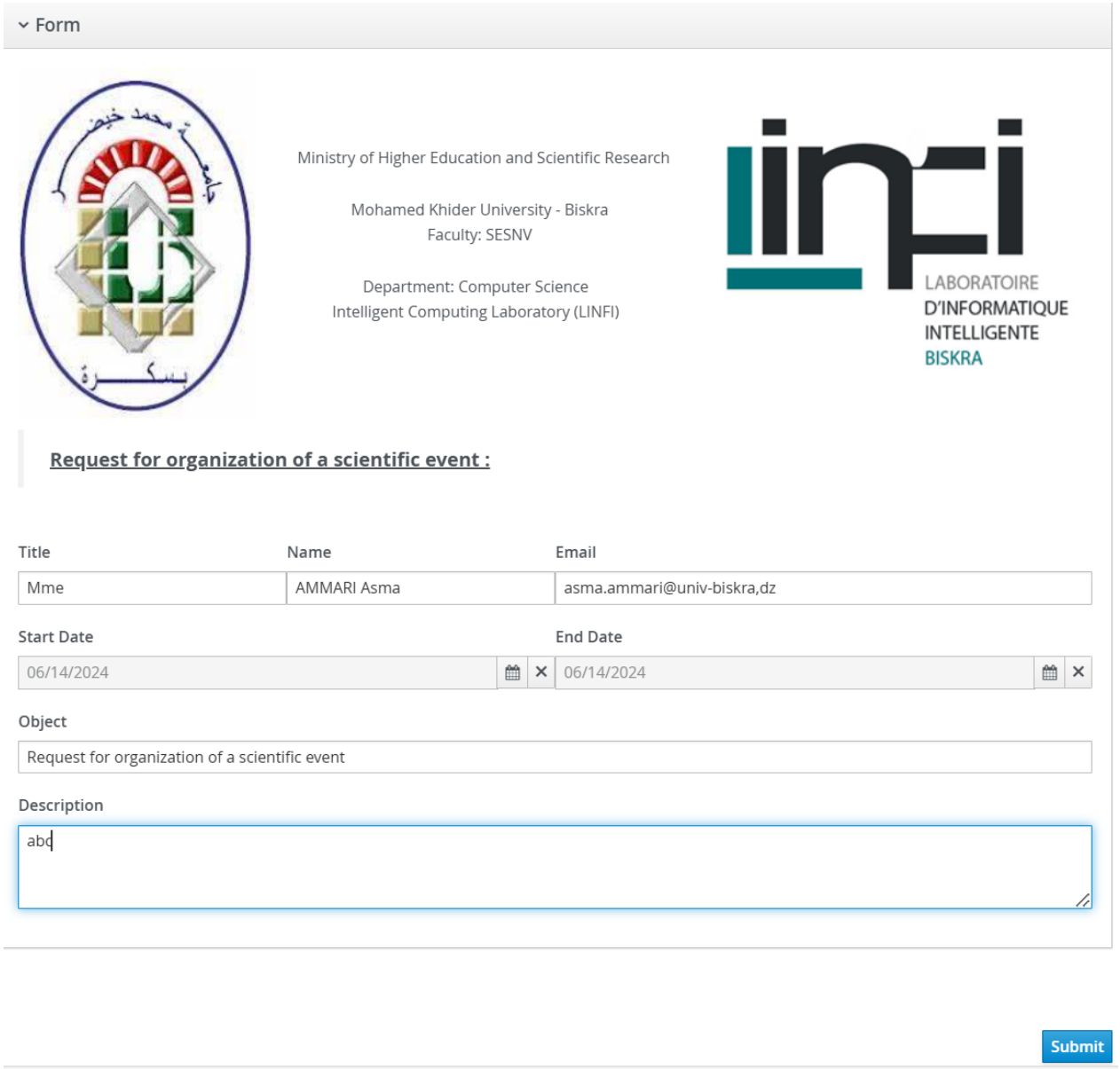


Figure 4.32: Request for organization of a scientific event

4. **New Member Integration:** A professor wishing to join the laboratory needs to send an application to the head of the laboratory the figure 4.33 shows the application form

Figure 4.33: New Member Integration

- Members receive responses to submitted requests . The following image 4.34 shows an example of the reply interface .

- To finish the task, you can choose **Complete** .

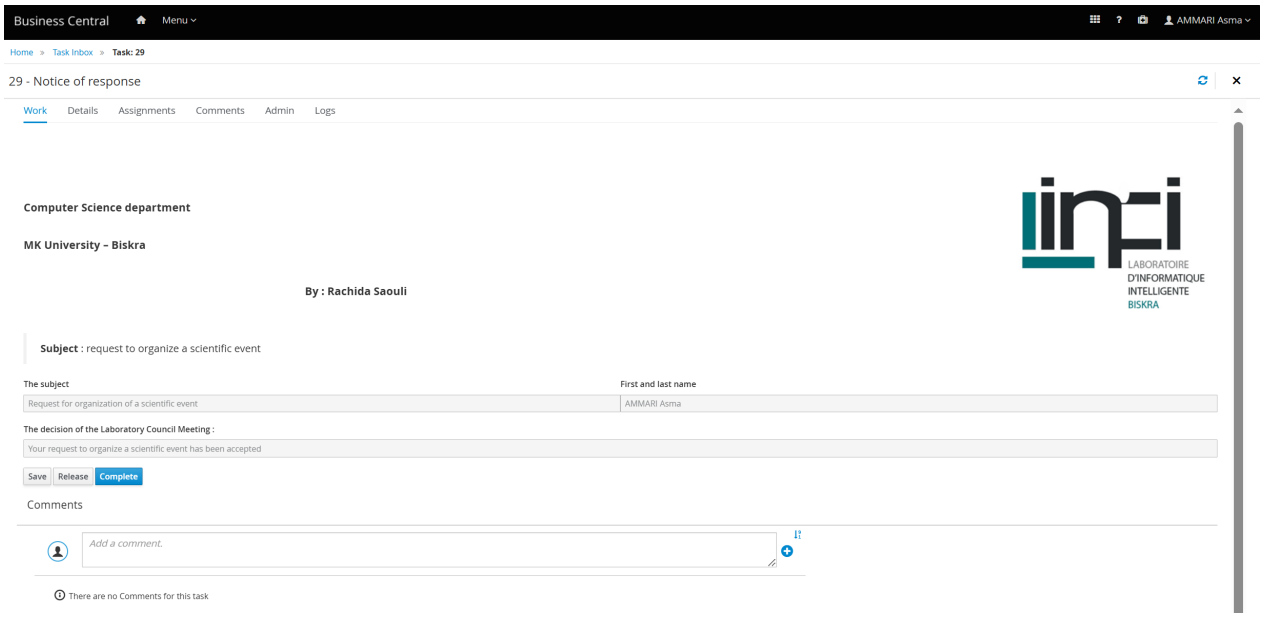


Figure 4.34: Notice of response

Laboratory head interactions with the platform

Prepare the budget request : Which will be documented in a word file by the president of the lab .

Figure 4.35 Annual budget request form

Figure 4.35: Annual budget request

We can find the attached file by choosing **process instance** and then **Documents** , Where you can download it and modify it , as shown in the picture 4.36.

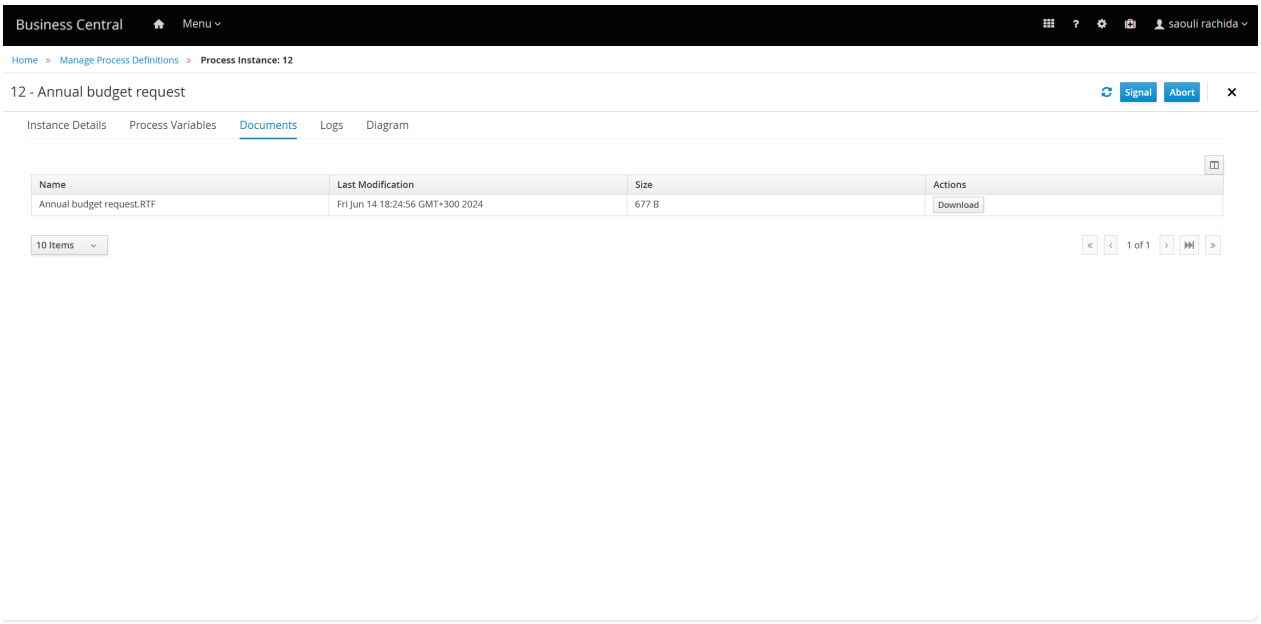


Figure 4.36: attached file

Prepare the purchase request : which will be documented in a word file by the president of the lab .

Figure 4.37 Prepare the purchase request

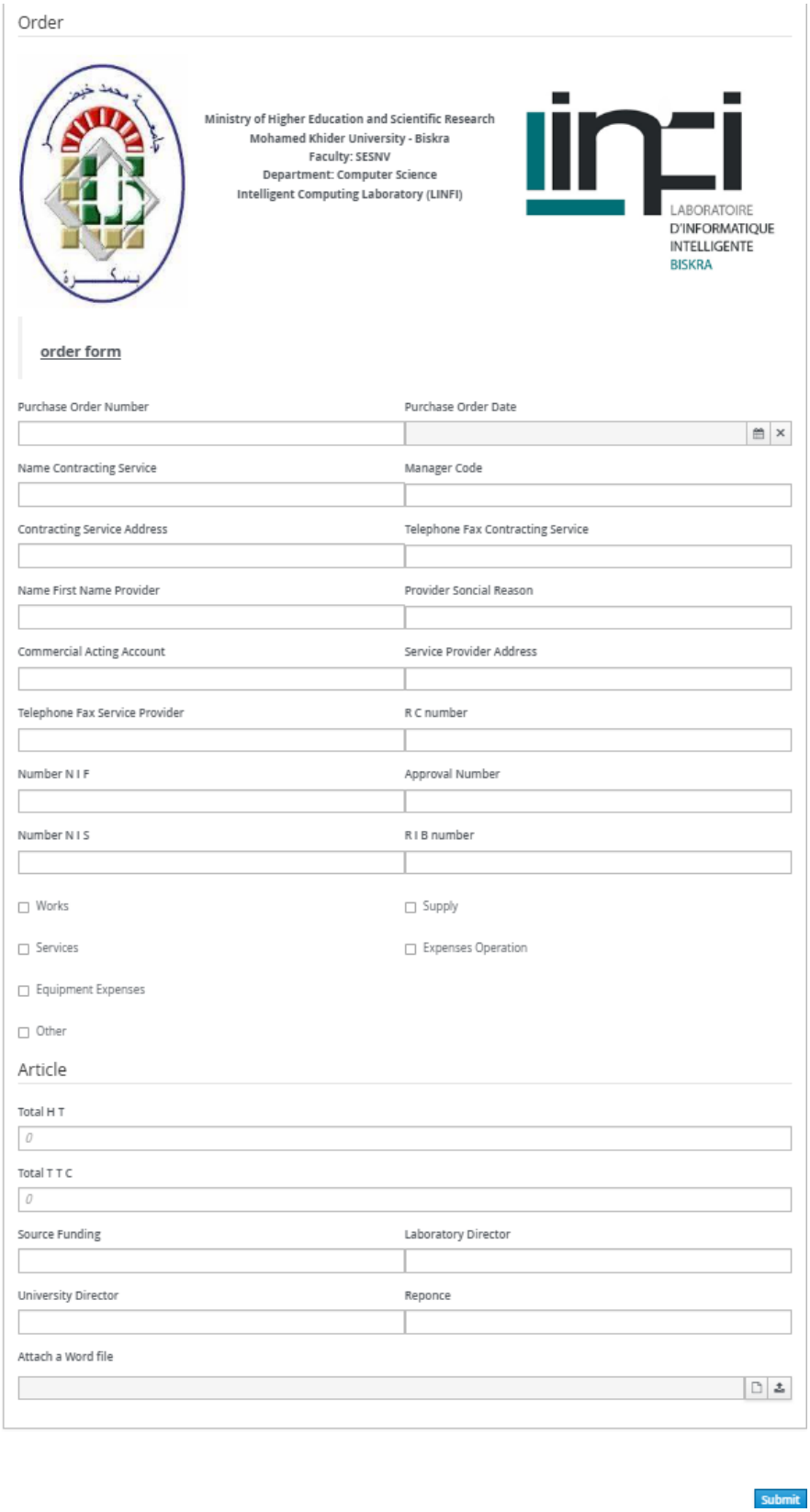


Figure 4.37: Purchase request for lab equipment

Organization of a meeting of the laboratory council : Organizing a laboratory council meeting requires careful planning and coordination to ensure that all members are informed, prepared, and able to contribute effectively . Here is a detailed explanation for organizing such a meeting

1. The Figure 4.38 show the first interface for holding the meeting .

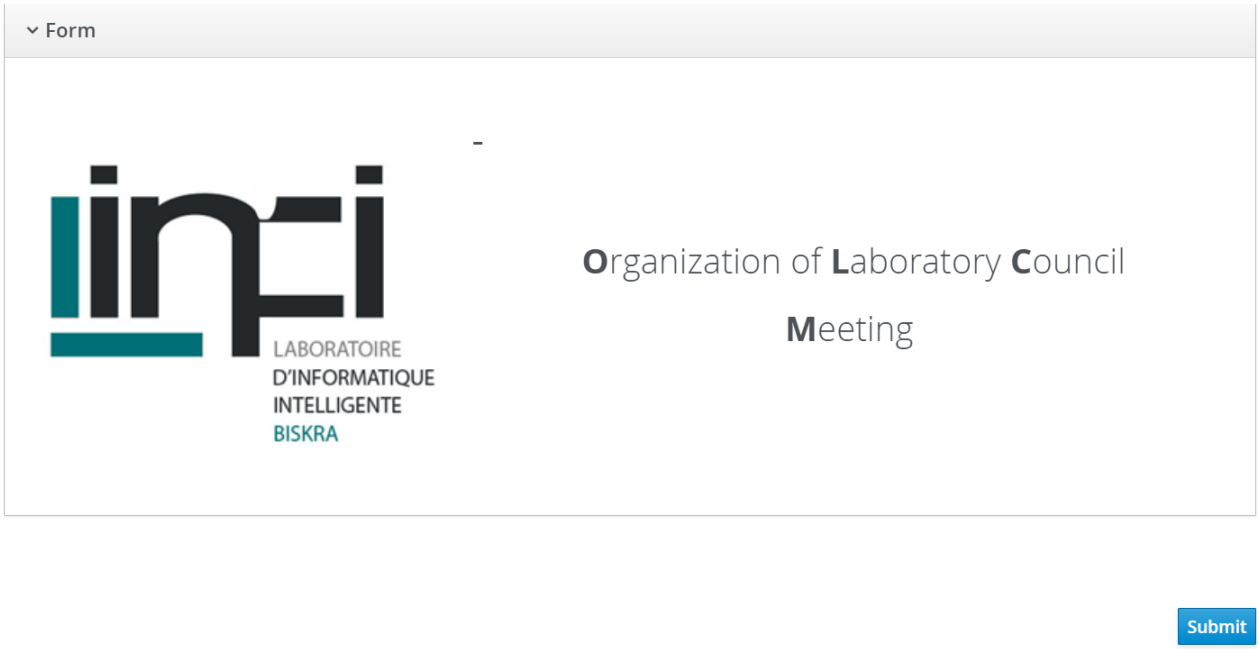


Figure 4.38: first interface

2. The head of the laboratory fill out the meeting information and sends it to the concerned members Figure 4.39 .

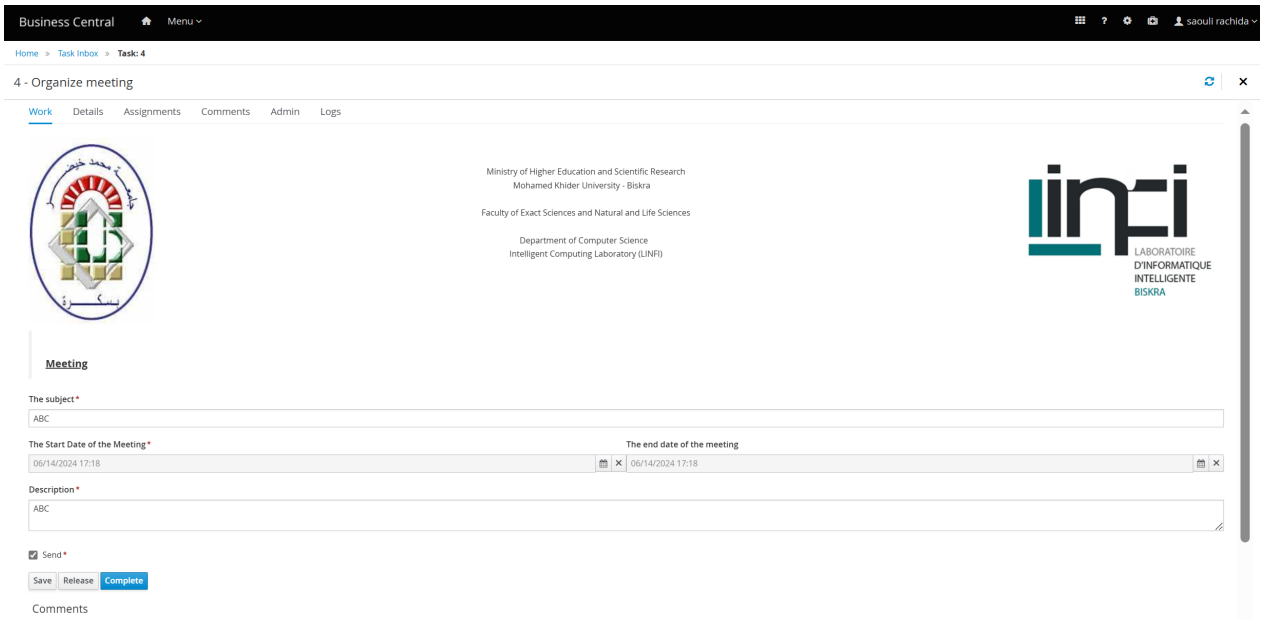


Figure 4.39: Organization of a meeting

3. After reviewing the invitation , the concerned members decide whether to attend the meeting or not. The image 4.40 shows the invitation processing interface .

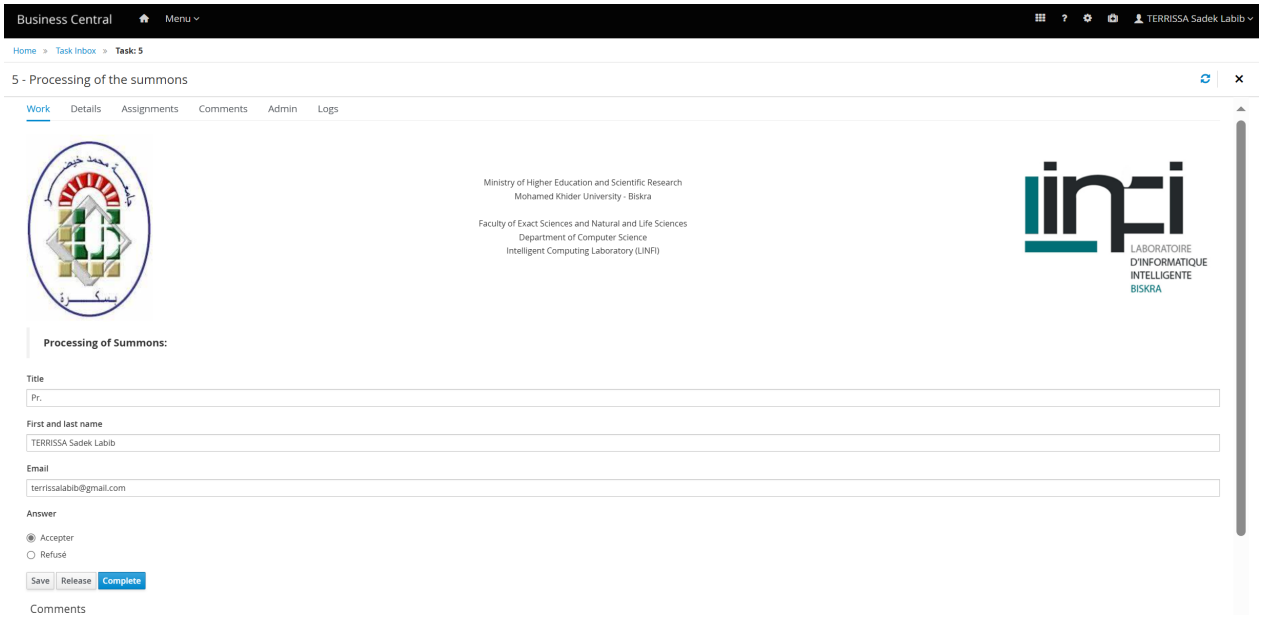


Figure 4.40: Processing the summons

4. After the and of the meeting , the head of the laboratory issues a process verbal (PV), the following figure 4.41 ,4.42 shows its most important parts .

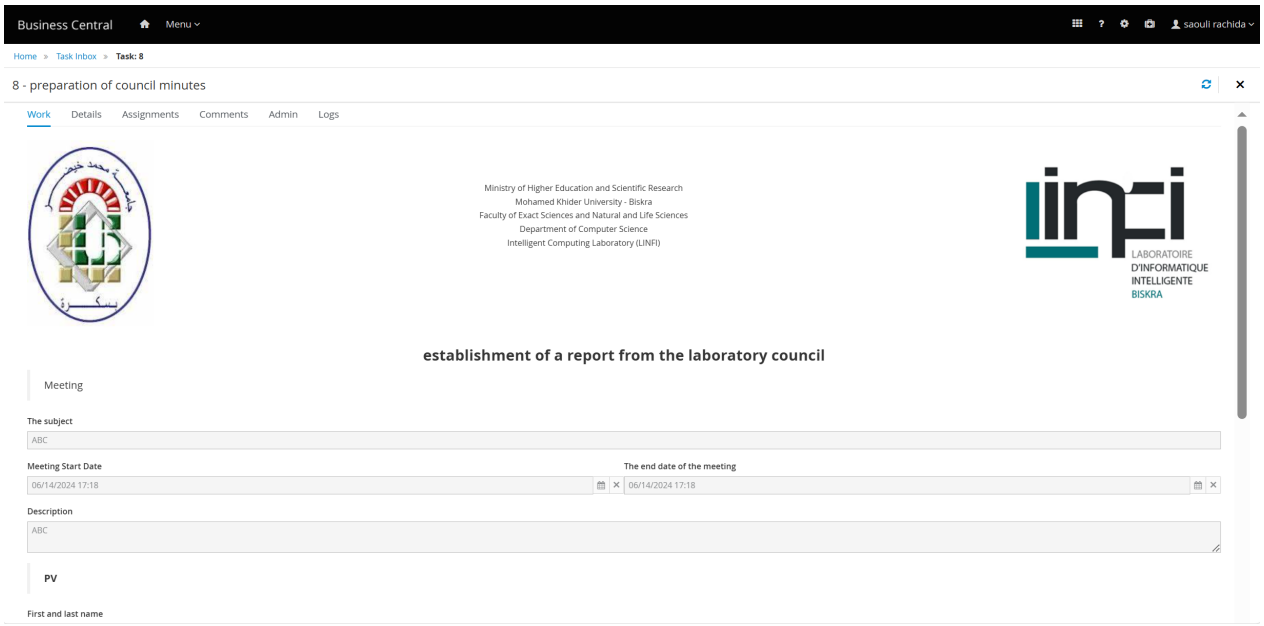


Figure 4.41: establishment of a council report

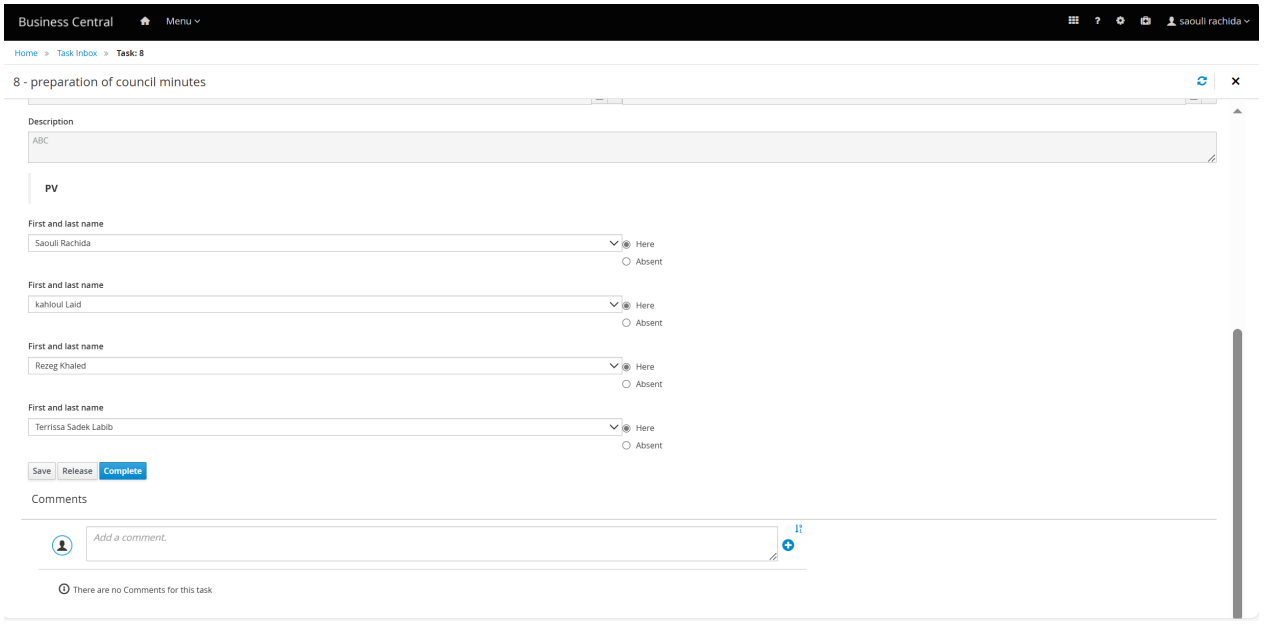


Figure 4.42: establishment of a council report

- The task inbox contains a list of tasks that the user must process, and through it users can interact with these tasks, such as starting work on them, updating their status, or ending them .

- After selecting **task inbox** it from the main menu, a list of tasks assigned to the user appears (figure4.43) . Filters can be used to display tasks based on their status, such as open tasks, completed tasks, or lat tasks .

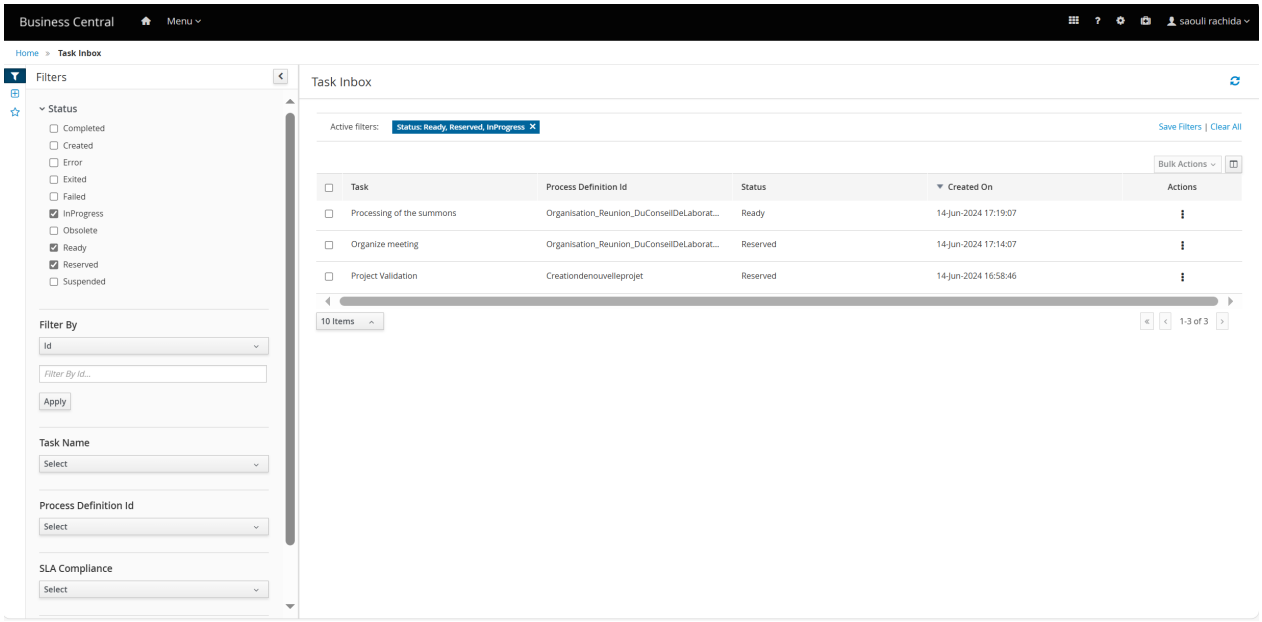


Figure 4.43: Task Inbox

- **Secretary interactions with the platform**

  Lab Structure Update : The secretary sends the new organizational structure to the laboratory head after updating it .

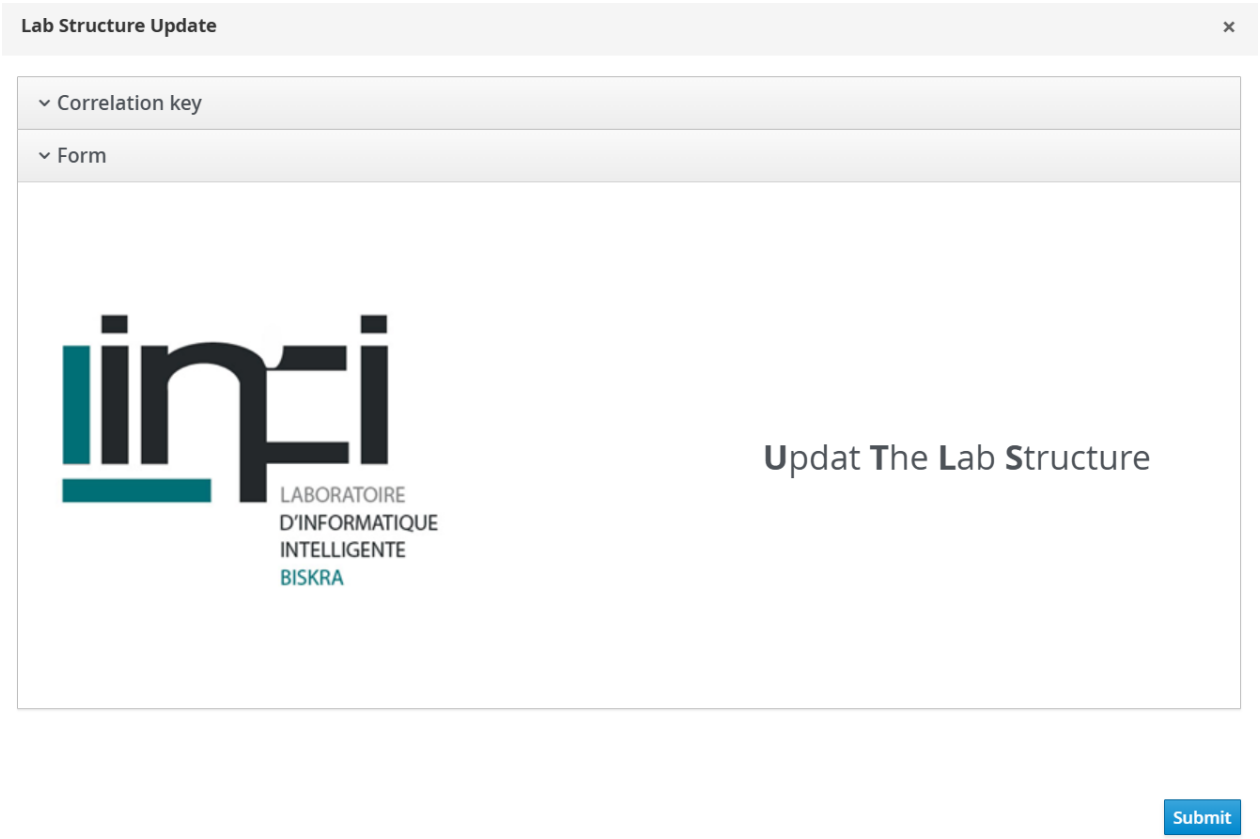


Figure 4.44: first interface

The image show the sending interface in our application .

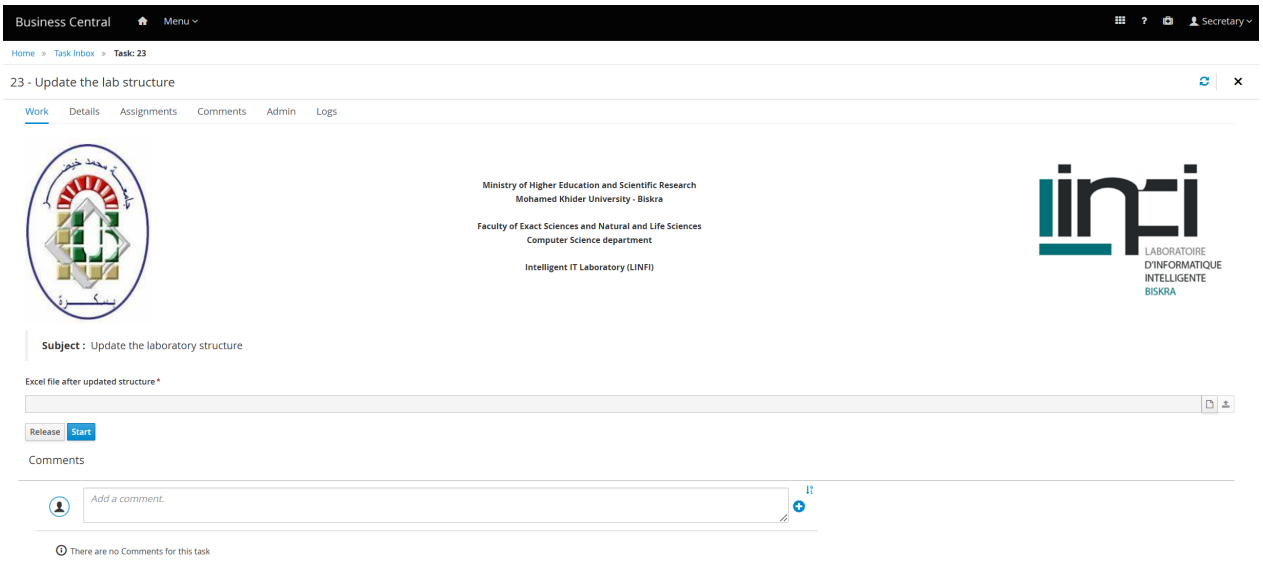


Figure 4.45: Transmitter interface

4.3 Dashboard

It goes without saying that customers building BPM solutions want to track the performance of their operations. To achieve this, they need effective monitoring and reporting tools . Therefore, the Dash-builder project is included as a core part of the JBPM ecosystem . Dash-builder is not only part of jbpm, it is also used in multiple other projects such as JBoss Tied , a data virtualization system that allows applications to use data from multiple and diverse data storage sources. With Dash-builder , user can create custom dashboards that enable them to effectively monitor and analyze the performance of their operations, contributing to improved efficiency and making decisions based on accurate data .

4.3.1 Process and Task Dashboard

The Processes and Tasks dashboard contains several performance indicators to monitor the JBPM execution engine. The data used in the control panel is based on two tables from the engine database ; processinstancelog and bamtasksummary.

Data sources :

processinstancelog ; This table records details about process states, including start and times, status, and other relevant metrics .

bamtasksummary ; This table summarizes information about tasks,such as task status, assigned users, and completion times.

Figure 4.46 The Process Dashboard Main Screen

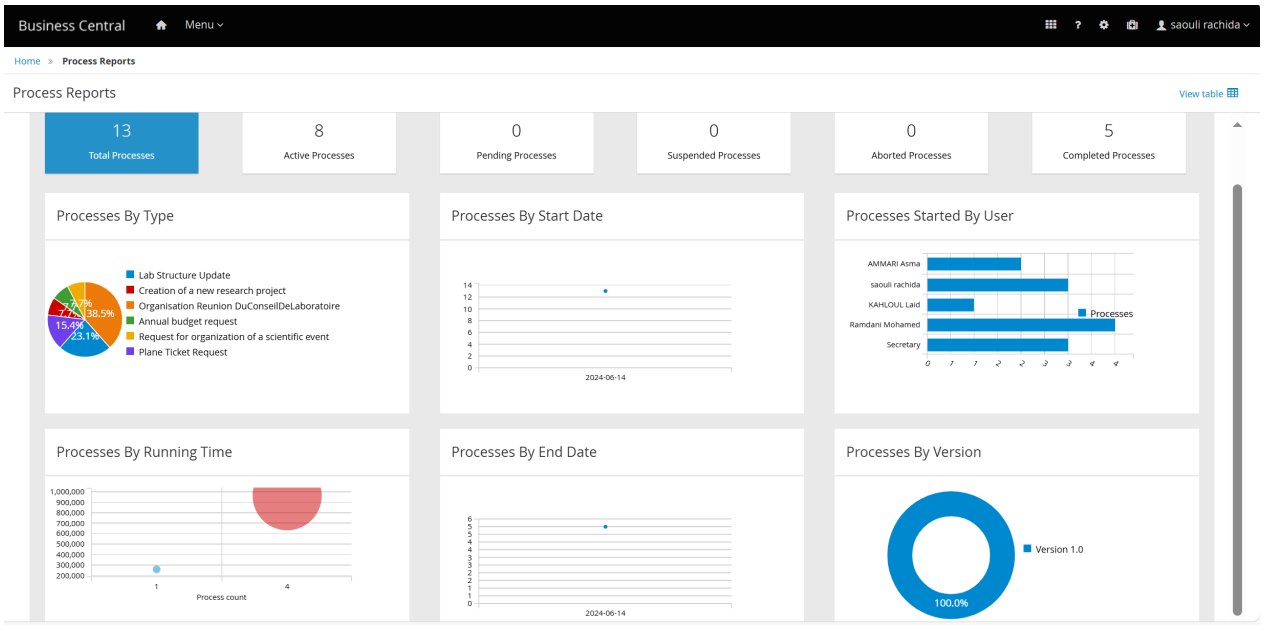


Figure 4.46: The Process Dashboard Main Screen

Figure 4.47 The Task Dashboard Main Screen

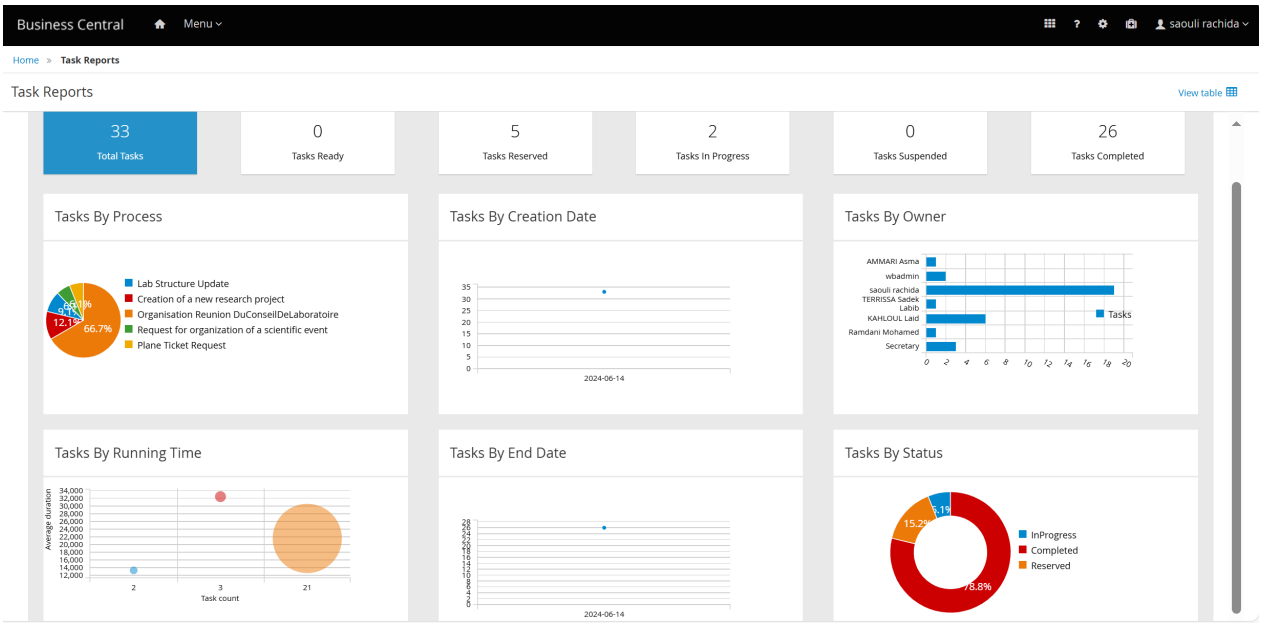


Figure 4.47: The Task Dashboard Main Screen

Can filter the data by clicking on the charts . For example,if you want to select a particular process or status, every time a filter is applied, all the indicators are automatically updated and synchronized to show the selected criteria .

The following picture 4.50 shows an example dashboard for the operations that have been completed

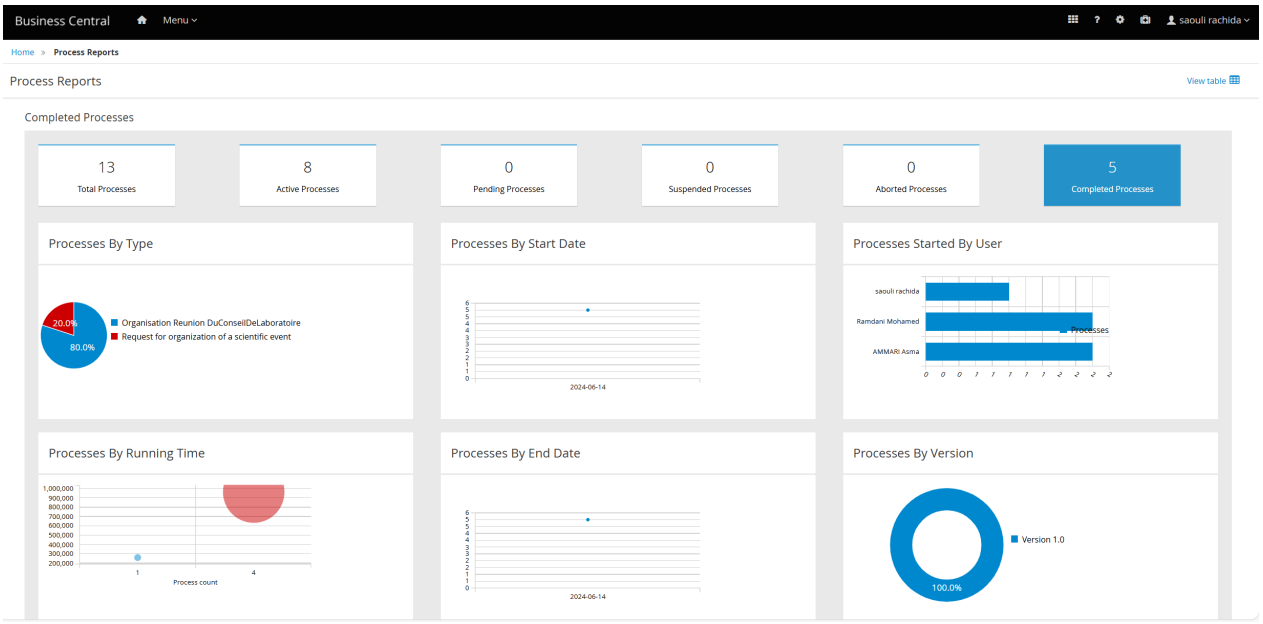


Figure 4.48: dashboard for the operations that have been completed

It is also possible to display a list of instances at any time by clicking the **View table** in the upper right hand corner of the screen . You can then switch to the original screen by clicking the **View Dashboard** .

Figure 4.49 show the Process Instances List

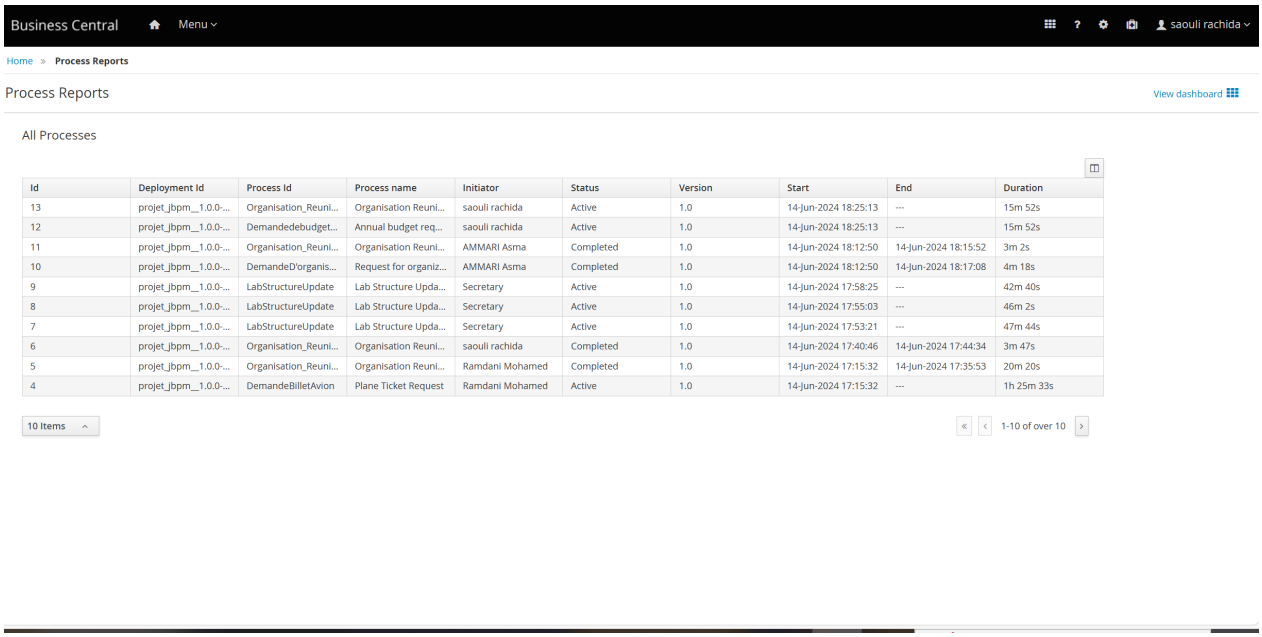


Figure 4.49: Process Instances List

Figure4.36 show the Task Instances List

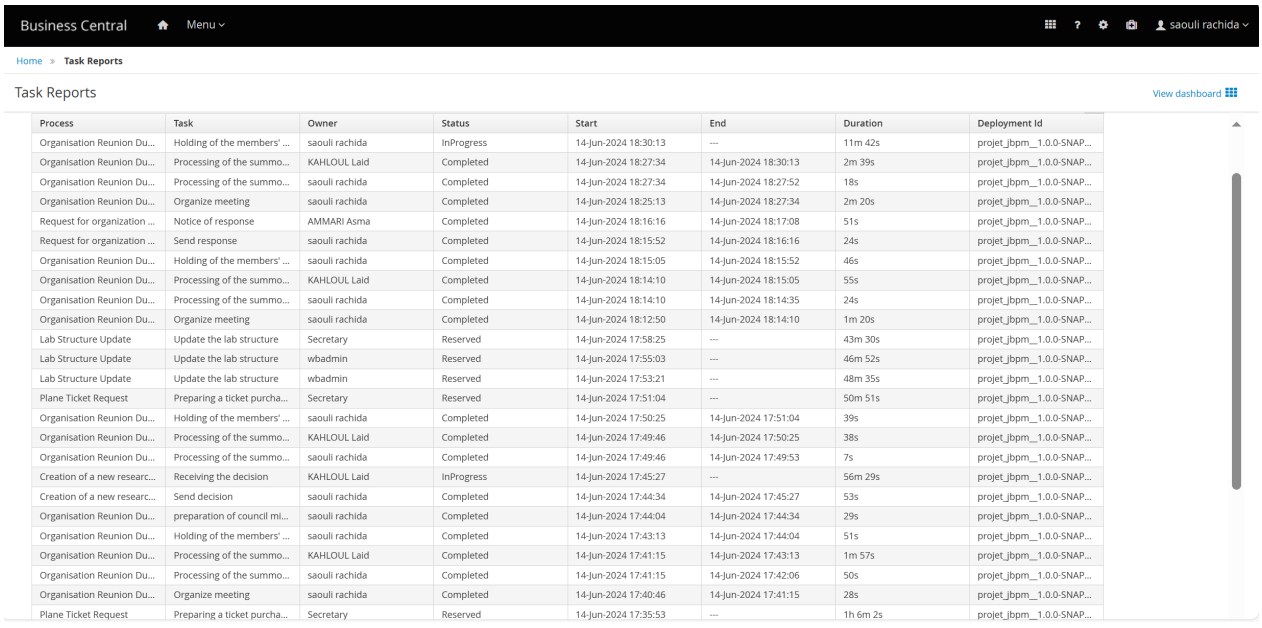


Figure 4.50: Task Instances List

Using dashboards, organizations can get instant , in-depth insights into the performance of their operations and key performance indicators. these tools provide the ability to monitor operations in real time and make strategic decisions based on accurate data. With high customization and the ability to integrate with multiple data sources,dashboards enhance operational efficiency and contribute to improved overall business performance .

4.4 Conclusion

This section has empowered us to not only develop our application but also to grasp the intricate phases involved in crafting a workflow application within the JBPM development ecosystem. This newfound comprehension has paved the way for us to seamlessly advance towards its actualization.

Chapter 5

Conclusion and Perspectives

The work carried out in this end-of-studies project aimed to design and create a workflow application for the "*Digitization of L'INFI laboratory processes*." This project has been divided into two main parts.

Firstly, we delved into the theoretical studies on workflow and business process modeling. This part provided a solid foundation in understanding the core concepts and methodologies involved in workflow management and business process modeling. It emphasized the importance of structured and efficient processes in achieving organizational goals.

Secondly, we focused on the practical implementation, presenting the process modeling method using BPMN (Business Process Model and Notation) on the JBPM open-source platform. This part demonstrated the application of theoretical knowledge to a real-world scenario, showcasing how BPMN and JBPM can be leveraged to create a workflow application that meets our set objectives.

This project has significantly enhanced our understanding of business processes and workflows. We gained a comprehensive insight into the principles of workflow management and became proficient with groupware technologies and tools, specifically JBPM as a workflow engine. Through this journey, we have not only deepened our knowledge of theoretical concepts but also acquired practical skills in process modeling and workflow application development.

Perspectives

Moving forward, several perspectives can be considered to further enhance and expand the scope of this project:

1. Integration with Other Systems: Exploring ways to integrate the workflow application with other existing systems within the laboratory to create a more cohesive and interconnected digital ecosystem.

2. Advanced Analytics: Incorporating advanced analytics and reporting features to provide deeper insights into the performance of various processes, helping to identify bottlenecks and areas for improvement.

3. Scalability and Adaptability: Ensuring the application is scalable to handle increased workload and adaptable to evolving business requirements, enabling the laboratory to maintain efficiency and productivity as it grows.

4. User Training and Support: Developing comprehensive training programs and support materials to assist users in effectively utilizing the workflow application, ensuring smooth adoption and maximizing the benefits of digitization.

5. Continuous Improvement: Establishing a feedback loop for continuous improvement, where user feedback and performance metrics are regularly reviewed to make iterative enhancements to the workflow application.

By addressing these perspectives, we can ensure that the workflow application not only meets the current needs of the laboratory but also evolves to accommodate future challenges and opportunities. This approach will contribute to the ongoing success and efficiency of the laboratory's operations, aligning with the broader goals of digital transformation and innovation.

the annex here

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الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

جامعة محمد خيضر بسكرة

عنوان المشروع:

استخدام (JBPM) للنمذجة السريعة للعمليات

مشروع لنيل شهادة مؤسسة ناشئة في اطار القرار الوزاري 1275

صورة العلامة التجارية

الاسم التجاري

SkillPro

السنة الجامعية

2024 _ 2023

بطاقة معلومات:

حول فريق الاشراف وفريق العمل

1- فريق الاشراف:

فريق الاشراف	
المشرف الرئيسي (01): محمد رمضاني	التخصص: اعلام الي
المشرف الرئيسي (01):	التخصص: .....
المشرف المساعد:	التخصص: .....

2- فريق العمل:

فريق المشروع	التخصص	الكلية
الطالب: رقية روبي	هندسة برمجيات والأنظمة الموزعة	العلوم الدقيقة وعلوم الطبيعة والحياة
الطالب: مسعودة شبيرة	هندسة برمجيات والأنظمة الموزعة	العلوم الدقيقة وعلوم الطبيعة والحياة

فهرس المحتويات

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المحور الثاني: الجوانب الابتكارية

المحور الثالث: التحليل الاستراتيجي للسوق

المحور الرابع: خطة الإنتاج والتنظيم

المحور الخامس: الخطة المالية

المحور السادس: النموذج الاولي التجريبي

المحور الأول: تقديم المشروع

لاحظنا الكثير من الشركات ومختبرات البحث العلمي مثل مختبر الاعلام الالي الذكي لبسكرة أنها تعتمد في إدارة مهامها على نظام وأساليب تقليدية بعضها معقد ويستغرق وقتا طويلا وهذا ما ينعكس سلبا على بعض الاعمال من حيث الكفاءة وزيادة احتمالية الأخطاء وعدم التنظيم والكثير من الوقت والجهد، فالعمل اليدوي مع الاحتياج الى بيانات كثيرة والتعاون الفرق مع بعضهم يعرقل في إنتاجيتهم وكفاءتهم في العمل.

ونقترح لتحقيق الكفاءة للإدارات وخاصة مخابر البحث العلمي الاستخدام الاستراتيجي للأدوات والمنهجيات المتقدمة مثل (BPMN) كتمثيل رسومي موحد يعطي صورة واضحة للعمليات التجارية المعقدة بحيث نعمل على منصة (JBPM) واستغلال امكانياتها في تبسيط العمليات التجارية وتعزيز الإنتاجية وتمكن الإدارات من الدخول في مجال رقمنة سير اعمالها من خلال ادواتها ووظائفها.

1. فكرة المشروع (الحل المقترح)

فكرة مشرعنا تتمثل في استخدام منهجيات إدارة عمليات الاعمال في تطوير تطبيقات سير العمل للمؤسسات و لمختبرات البحث العلمي وذلك باستخدام منصة (JBPM) لتحسين أداء المهام داخلها لتحقيق الكفاءة وتقليل الوقت والجهد في أداء المهام اليدوية.

2. القيم المقترحة

1-تحسين الكفاءة للعمليات وكذلك جودة العمل.

2-التقليل من الأخطاء اليدوية والحفاظ على سلامة البيانات ودقتها.

3-التنظيم وتعزيز التعاون بين الفرق والعمال والتنسيق بينهم.

4-تقليل التكاليف وحسن استغال الموارد وتخفيف الأعباء الناتجة عن الأسلوب التقليدي في سير الاعمال.

5- المرونة في تحديث العمليات وتحسينها والقدرة على التكيف مع متطلبات العمل.

6-توفير الوقت والجهد المبذول في الأنشطة الروتينية والتركيز على المهام الاستراتيجية.

7-اتاحةاستغلال تقنيات الذكاء الاصطناعي في العمل وتحليل البيانات واتخاذ القرارات وتحسينها.

8-دقة المعطيات والارشفة وتخزين البيانات.

3. فريق العمل

تكون فريق العمل من عضوين تتمثل سيرتهم الذاتية في هذا النموذج:

MESSAOUDA CHABIRA

Student

PROFILE

A student of software engineering
I consider myself to be a responsible and orderly person.
I am looking forward to my first work experience.

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Lioua Biskra

EDUCATION

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Software development career, in progress

FACULTY OF FSESNV, DEPARTMENT OF COMPUTER SCIENCE
2019-2024

LANGUAGE

Arabic
French
English

SKILLS

programing language(java).
Networking concepts(Protocols and network layers).
Databases(SQL).
Web development(Html/Css/Js).

EXPERIENCE

I have never worked before and my skills are under development.

REGUIA ROUBI

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PROFILE

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Tolga Biskra

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FACULTY OF FSESNV, DEPARTMENT OF COMPUTER SCIENCE

LANGUAGE

Arabic.
French.
English.

SKILLS

programing language(java).
Databases(SQL).
Networking concepts(Protocols and network layers).
Web development(Html/Css/Js).

EXPERIENCE

I have never worked before and my skills are under development

4. أهداف المشروع

نهدف في مشروعنا الى تطوير تطبيق سير العمل لمختبر البحث العلمي بكفاءة عالية وكذلك العمل على التطبيقات الإدارية وتحسين جودتها وتعزيز جودة الخدمات.

جدول زمني لتحقيق المشروع:

هنا التسلسل الزمني للعمل على المشروع:

الرقم	المرحلة	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	الدراسات الاولية																
2	توفير الأدوات وبيئة العمل																
3	تحليل البيانات والمعطيات																
4	الإنتاج والبدء في تطبيق																
5	البيع																

الجدول(01): جدول زمني لتحقيق المشروع

1-الدراسات الأولية:

-الأسبوع 1-2: اجراء دراسة للسوق.

الأسبوع 2-4: تحليل متطلبات المشروع.

2-توفير الأدوات وبيئة العمل:

-الأسبوع 1: اقتناء الحواسيب والخادم.

-الأسبوع 2-4: البحث على محل في مكان مناسب.

-الأسبوع5: توفير معدات المحل.

3- تحليل البيانات والمعطيات:

-الأسبوع 6-7: تحليل المعطيات ووضع الاحتياجات حول المشروع.

-الأسبوع 8: دراسة حول نمذجة العمليات.

4- الإنتاج والبدء في التطبيق:

-الأسبوع 9-10: نمذجة العمليات.

-الأسبوع 11-15: التطبيق وربط مع قاعدة البيانات.

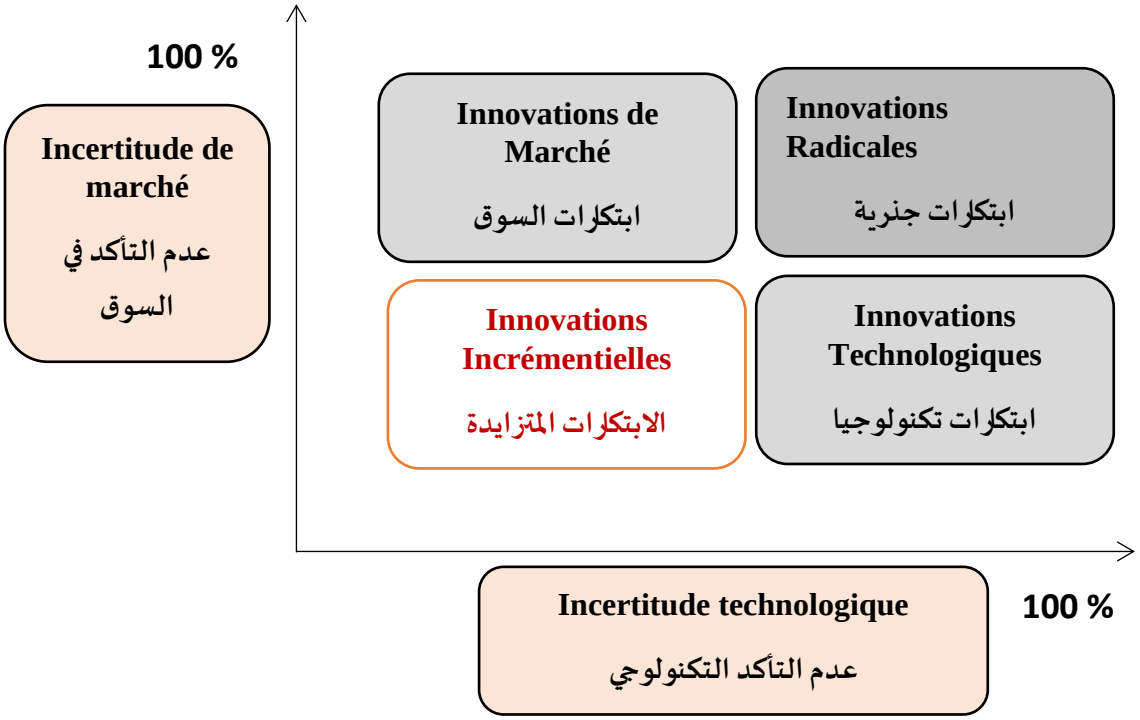
5- البيع:

-الأسبوع 16: بيع المنتج والبدء في التسويق وعمليات الدعاية.

المحور الثاني: الجوانب الابتكارية

يتمثل المشروع في تطوير تطبيق سير عمل لمخبر الاعلام الالي الذكي لبسكرة كذلك تطوير تطبيقات إدارات المؤسسات التي تسعى لدخول مجال الرقمنة وتسهيل إدارة مهامها وهذا المشروع عبارة على فكرة مبتكرة ضمن الابتكارات المتزايدة التي تقدم هذه الخدمة.

الشكل (01): تصنيف الجانب الابتكاري للمشروع



الجوانب الابتكارية للمشروع:

-تطبيقات سير مهام سهلة الاستخدام وبعيدة عن التعقيدات ودون الحاجة الى تدريبات مكثفة او مهارات برمجية متقدمة.

-التكامل مع أنظمة الشركة في جميع الفروع والاقسام بشكل سلس واسهامه في تعزيز التعاون والتنسيق بين العمليات وقواعد البيانات.

- التواصل بين الفرق والتنسيق بينها وتبادل المعلومات والبيانات والتعاون بينهم ودعم العمل الجماعي.

-تنظيم العمليات وتقليل التكاليف تعزيز استخدام الموارد بشكل أفضل.

-سرعة عملية تطوير التطبيقات بفضل خصائص أساليب التطوير التي تعتمد على أدوات بصرية سهلة الاستخدام ما يتيح من التعديل على النماذج ومواكبة السوق وتحقيق الأهداف التجارية بسرعة أكبر.

المحور الثالث: التحليل الاستراتيجي للسوق

1- تحليل PESTEL:

العوامل الخارجية		تأثير العامل
P	العوامل السياسية	-سياسة الحكومة في تشجيع مثل هذه المشاريع ودعمها. -تشريع قوانين تعزز الاقتصاد الرقمي مثل قانون التجارة الالكترونية وقانون حماية البيانات.
E	العوامل الاقتصادية	-الحاجة لتطبيقات سير العمل في المؤسسات. -دعم الاستثمار في مجال التكنولوجيا والتوجه نحو الاقتصاد الرقمي. -تأثير رقمنة الشركات واستغلال الأساليب المبتكرة على تكاليف وربحية المشروع ومقارنتها بالطريقة التقليدية.
S	العوامل الاجتماعية	-مستوى تقبل التكنولوجيا الرقمية. - التوجه نحو استخدام الخدمات الرقمية. -الحاجة للأدوات سهلة الاستخدام.
T	العوامل التكنولوجية	-التطور التكنولوجي في تطوير التطبيقات والمنصات الرقمية. -استغلال التقنيات الحديثة مثل الذكاء الاصطناعي في التطوير. -التنسيق بين مختلف تطبيقات سير العمل.
E	العوامل البيئية	-التوجه نحو الرقمنة وتوفير استخدام الموارد البيئية لأغراض أخرى.
L	العوامل القانونية	-دعم المشاريع المبتكرة مثل قانون 1275 -وضع قوانين حماية الأفكار وملكيتها وكذلك البيانات.

الجدول (2): تحليل العوامل الخارجية وتأثيرها

2- تحليل SWOT:

الشكل (02): تحليل SWOT

3- المزيج التسويقي:

1- **المنتج (Product):** تطبيق سير عمل مخصص حسب طلب واحتياج الزبون لتحسين أداء المهام داخل المؤسسات.

المنتج	الخصائص	المميزات
تطبيق ويب	-الجودة. -تحسين الأداء وسير المهام.	-التكلفة المنخفضة. -الكفاءة. -امكانية الصيانة والتعديل.

الجدول (2): المنتج خصائصه ومميزاته

2- السعر(Price) :

نقوم بحساب سعر التطبيق حسب الوظائف الموجودة في التطبيق والتصميم ودرجة تعقيد التطبيق مع عدد ساعات التطوير:

نأخذ على سبيل المثال حساب سعر تطبيق سير العمل الخاص بمخبر الاعلام الالي الذكي لجامعة بسكرة:

160ساعة × 6069 DA = 971040 دينار جزائري.

3- التوزيع(Place) : ويكون في:

- **مقر الشركة**
- **عبر الانترنت.**
- **داخل الشركات.**

4- الترويج(Promotion) :

طريقة الترويج	الوصف	الكمية	التكلفة	عدد المرات	التكلفة السنوية
الاشهار	الاشهار الشفوي	05	00 DA	05	00 DA
	مو اقع التواصل	02	10000 DA	02	20000 DA
	الاعلانات	02	10000 DA	03	30000 DA
المبيعات الترويجية	المعارض	00	00 DA	00	00 DA
المجموع		09	20000 DA	10	50000 DA

الجدول (3): طرق الترويج للمشروع

5- الافراد (People):

روبي رقية: عضوة في الفريق والمكلفة بالتطوير والتصميم.

شبيرة مسعودة: عضوة في الفريق والمكلفة بالتطوير والتصميم.

6- العملية(Process) :

تبدأ العملية بتقدم العميل الى مقر الشركة وعرض احتياج مؤسسته والذي بدوره هو ممثلا عنها فيتم عقد اجتماع يوضح فيه هيكلة المؤسسة وتنظيمها وإعطاء كل البيانات اللازمة لمباشرة عملية التطوير مع إبقاء التواصل في حال تغييرات او ضرورة الالتحاق بالمؤسسة.

بعد ذلك يتم عرض التطبيق على العميل للاختبار واستطلاع رأيه وفي حال رضاه نقوم بتثبيت التطبيق وتكوين العمال للعمل عليه وشرحه لهم مع وجود دليل مستخدم.

يتم العرض على المؤسسة المتابعة المستمرة وتوفير خدمة الصيانة المجانية والتحديثات في بداية العمل على المنصة لمدة 6 أشهر.

7- الدليل المادي(Physicalevidence) : نحتاج الى:

- أجهزة كمبيوتر ذات كفاءة.
- انترنت جيدة.
- محل بالمواصفات التالية:

-**المحل:** للإيجار.

-**المكان:** ولاية بسكرة.

-**وصف المكان:** مبنى للإيجار مساحته 50 م^2 فيه مكتبين ومكان استراحة ويتواجد في موقع استراتيجي بالقرب من جميع المرافق.

-**اختيار المكان سببه** عدم وجود منافسين في المنطقة.

- **تكاليف المحل الشهرية تقدرب: 45000** دينار جزائري.

4- الزبائن:

الزبائن	**مخابر البحث العلمي لجامعة بسكرة** **الشركات التي تسعى لرقمنة اعمالها.**
عددهم	**غير محدد**
مكان الشراء	**مقر الشركة**
كم مرة يقومون بالشراء	**مرة واحدة**
خصائص الزبائن	**منظمون لفرق ولديهم مهام.** **لديهم عمليات يتم تقديمها للإدارة.**

الجدول (4): معلومات عن الزبائن

-**القطاع السوقي:** تم تحديده ان المؤسسات والإدارات التي ترغب في رقمنة مهامها وتحسينها وتطوير أنظمة مرنة تتبنى تقنيات تكنولوجية حديثة.

-**السوق المحتمل:** المؤسسات والشركات المتوسطة والصغيرة في قطاع الصناعة **(المؤسسات الخاصة)** التي تسعى لرقمنة مهامها وتحسين أداء عملياتها الإدارية بكفاءة أكثر وتنظيميها تم اختيارهم أيضا لأنها تبحث عن حلول تكنولوجية لتحسين إدارة اعمالها وتطويرها.

-**السوق المستهدف:** هو مخابر البحث العلمي لجامعة بسكرة وتم اختياره لان اول مشروع وهو تطبيق سير عمل لعمليات المختبر.

الاستراتيجيات التسويقية المتبعة هي:

1- **استراتيجية القيادة بالتكلفة:** اعتمدنا على خفض تكلفة المنتج مع الاعتماد على تكنولوجيا متقدمة تختصر الجهد والوقت.

المحور الرابع: خطة الإنتاج والتنظيم

1- خطة الإنتاج:

الدراسة التقنية:

موقف المشروع حاليا:	**مشروع جديد**
مراحل عملية التطوير	**الاطلاع وجمع وتحليل البيانات.** **التصميم.** **التطوير.** **الاختبار والتحسين.** **التثبيت والتشغيل.** **الصيانة.**
عدد أيام الانجاز	**45 يوما للمنصة التي تم العمل عليها ويتغير عدد أيام الإنجاز حسب المنصة المطلوب تطويرها.**
القدرة الانتاجية	**حسب حجم المؤسسة فاذا كانت كبيرة يكون العمل المستغرق سنة او أكثر وإذا كانت مؤسسة صغيرة تكون القدرة الإنتاجية في حدود شهرين أو أقل.**

الجدول (5): الدراسة التقنية للمشروع

-عملية التطوير:

تمر عملية التطوير بالمراحل التالية:

الاطلاع وجمع وتحليل البيانات:

يتم فيها التفاعل المباشر مع العملاء لتحديد متطلباتهم امن اجل تحليلها وتحديد المشاكل التي سنقوم بحلها في التطبيق.

التصميم: وفيها يتم وضع الخطة الأولية للتطبيق وتحديد متطلباته ووظائفه الرئيسية ويتم تحديد التصميم العام لواجهة المستخدم والتفاصيل الأولية للميزات للتطبيق

التطوير: بعد انهاء التصميم يتم عملية تطوير فعلية ويتم تحويل التصميم الى برنامج قابل للتنفيذ وربطه مع قاعدة البيانات.

الاختباروالتحسين: تتم بعد الانتهاء من عملية التطوير ويتم فيها اختبار جميع جوانب التطبيق من واجهة المستخدم الى البيانات للتأكد من سلامتها وفي حال وجود أخطاء يتم تصحيحها وتحسين التطبيق.

التثبيت والتشغيل: بعد انتهاء مرحلة الاختبار والتحسين تأتي مرحلة تثبيت التطبيق على الأجهزة وتشغيله للتأكد من عمله بشكل جيد وصحيح.

الصيانة: بعد تثبيت التطبيق وتشغيله يأتي دوريا عمل الصيانة والتحديثات في حال الحاجة اليها.

موقع المشروع: ولاية بسكرة.

طبيعة الانتاج: خدمة.

الطاقة الانتاجية: المنتج عبارة عن منصة إدارية.

احتياجات المشروع: تتمثل في:

الاحتياجات	المواد	الوحدة	تكلفة الوحدة	التكلفة الكلية
الآلات	أجهزة كمبيوتر.	2	150000 DA	335000 DA
	طابعة.	1	35000 DA	
الاثاث	مكاتب	2	50000 DA	100000 DA
	كراسي مكتبية	4	10000 DA	40000 DA
	مكيفات هوائية	2	60000 DA	120000 DA
الأدوات المكتبية	اوراق			
المجموع				595000 **DA**

الجدول (6): احتياجات المشروع

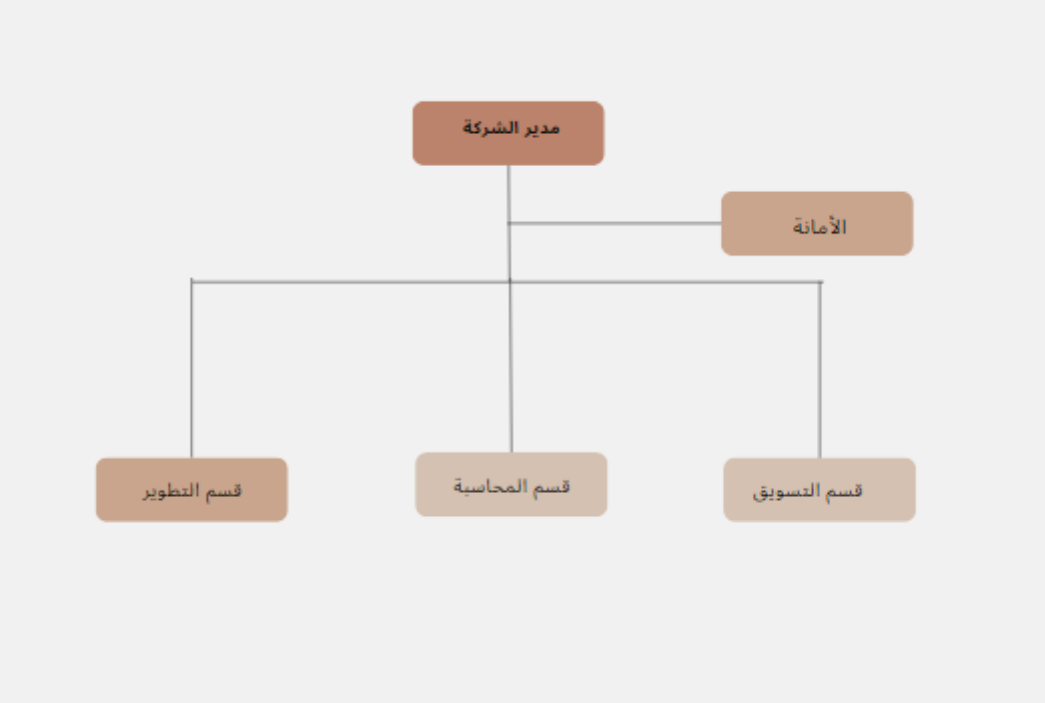
الموارد البشرية اللازمة لتنفيذ المشروع: مختصين في هندسة البرمجيات، مختص في التسويق، مختص في المحاسبة.

التنظيم الداخلي: نحتاج مبنى للكراء مساحته 50م^2 به مكتبين ومكان للاستراحة ويقع قريبا من المرافق العمومية.

2- المخطط التنظيمي:

-الهيكل التنظيمي للمشروع:

الشكل (3): الهيكل التنظيمي للمشروع



المنصب	العدد	الشهادة	أوقات العمل	الاجر
المدير العام	1	ماستر في الاعلام الالي	16:00-08:00	85000 DA
الامانة	1	ليسانس	16:00-08:00	30000 DA
التسويق	1	ليسانس في التسويق	16:00-08:00	40000 DA
المحاسب	1	ليسانس في المحاسبة	16:00-08:00	40000 DA
المطور	2	ماستر في الاعلام الالي	16:00-08:00	70000 DA
المجموع	6			335000 DA

الجدول (7): أجور العمال وأوقات العمل

المحور الخامس: الخطة المالية PLAN FINANCIER

1- تكاليف المشروع:

الأصول	التكلفة
المبنى	45000 DA
الأثاث	260000 DA
الآلات والمعدات	335000 DA
المجموع	640000 DA

الجدول (8): تكاليف المشروع

2- التكاليف التشغيلية:

الأصول	التكلفة
المواد الاولية	00 DA
الأجور	335000 DA
الهاتف والانترنت	15000 DA
الماء والكهرباء	25000 DA
المجموع	375000 DA

الجدول (9): التكاليف التشغيلية

-الهيكل التمويلي:

البيان	النسبة	القيمة
مال خاص	14.16	150000 DA
القروض	85.84	910000 DA
المجموع	100	1015000 DA

الجدول (10): الهيكل التمويلي للمشروع

كيفية استرداد الأموال:

الإيرادات الشهرية:

الاعمال	القيمة
الصيانة	100000 DA
تدريب الموظفين	150000 DA
تطوير تطبيقات للمؤسسات	450000 DA
المجموع	700000 DA

الجدول (11): مجموع الإيرادات الشهرية

الأرباح الشهرية = الإيرادات الشهرية – التكاليف التشغيلية:

700000 – 375000 = 325000 دج.

جدول الاسترداد:

الشهر	الأرباح المتوقعة	التكاليف المتكررة	القيمة المستردة	المبلغ المتبقي
1	325000 DA	375000 DA	100000 DA	225000 DA
2	450000 DA	375000 DA	200000 DA	250000 DA
3	600000 DA	375000 DA	200000 DA	400000 DA
4	850000 DA	375000 DA	215000 DA	635000 DA
5	1000000 DA	375000 DA	300000 DA	700000 DA

الجدول (12): الأرباح المتوقعة وحساب القيم المستردة

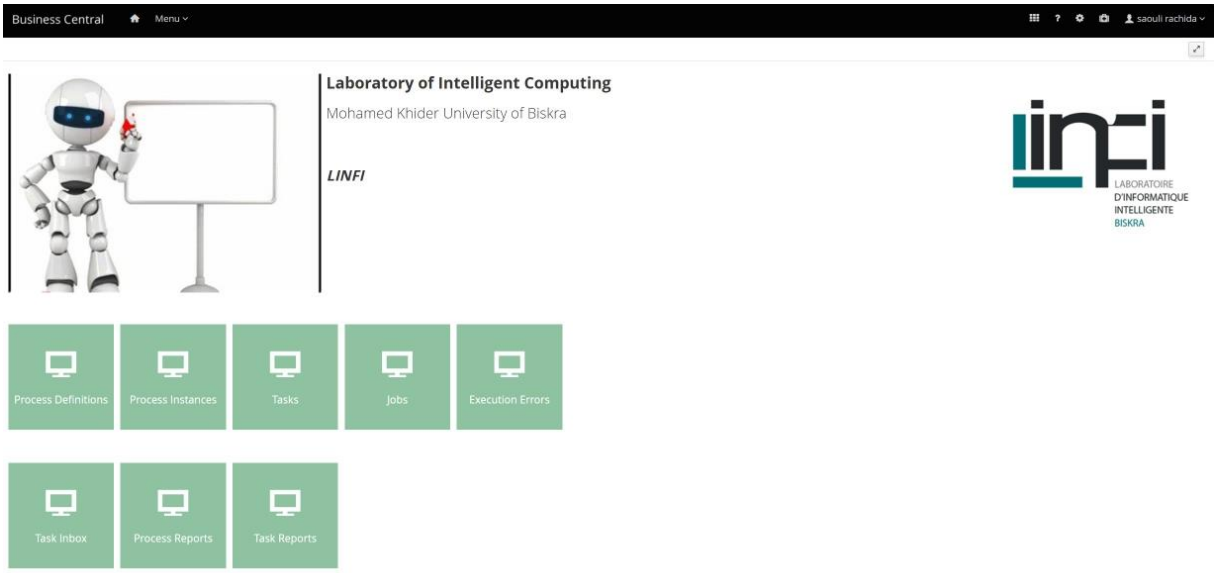
المحور السادس: النموذج الاولي التجريبي

عنوان التطبيق: منصة إدارية لمخبر الاعلام الالي الذكي

في التطبيق جميع العمليات المهمة التي تسير أعمال المختبر.

واجهة التطبيق:

الشكل (4): واجهة التطبيق



العمليات المخبرية:

في هذا التطبيق أهم العمليات التي تتم في المختبر نذكرها:

1-عملية انشاء مشروع بحثي جديد.

2-عملية دمج عضو جديد للمختبر.

3-عملية تحديث هيكل المختبر.

4- عملية طلب الميزانية السنوية.

5- عملية طلب تذكرة طائرة.

6- عملية طلب شراء معدات للمختبر.

7- عملية تنظيم حدث علمي.

8- عملية تنظيم اجتماع لمجلس المختبر.

مميزات التطبيق:

1-**التعامل بالأوراق الالكترونية:** لم تعد هناك حاجة الى التعامل بالأوراق أو التخزين الورقي اذ انه مع الاستخدام الالكتروني للوثائق يمكن من تقليص الجهد في البحث عنها والوقت وتأمين المعلومات وتبادلها بشكل أسرع.

2-**ارسال المستندات الكترونيا:** يتم ارسال الملفات والمستندات وكذلك بعض الاعلامات والاشعارات عبر البريد الالكتروني بدلا من العمل اليدوي.

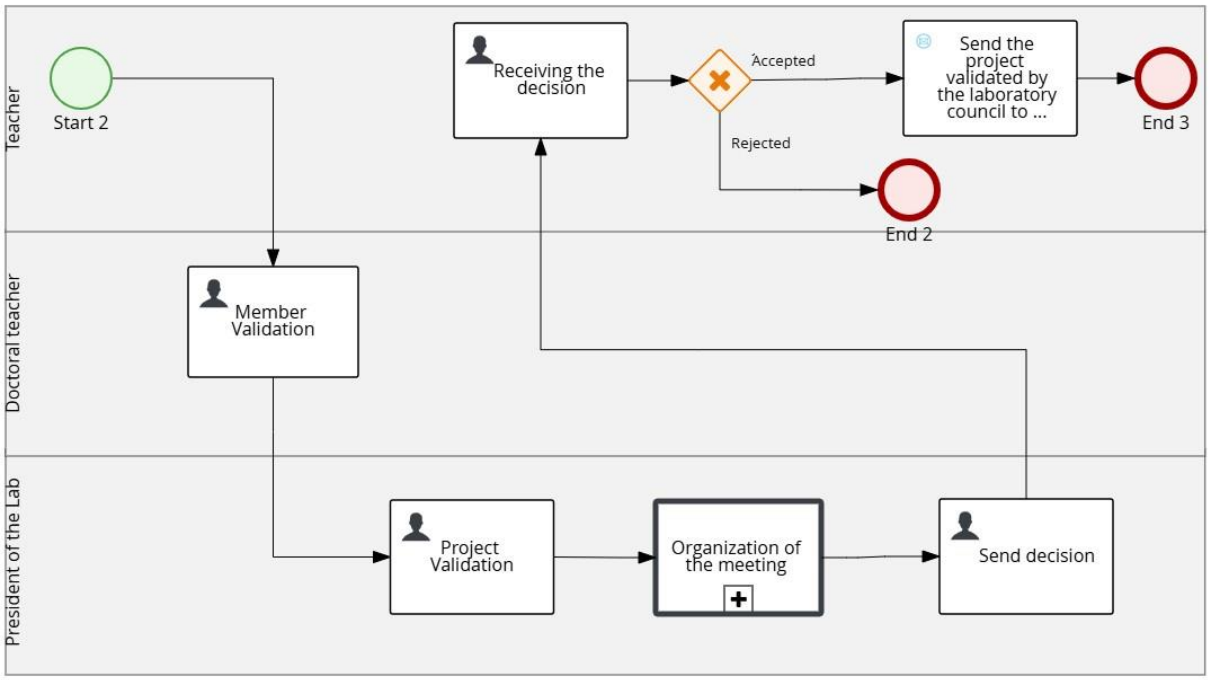
3-**التسجيل الالكتروني لجميع البيانات:** تسجيل المستخدمين للمعلومات والبيانات بشكل الكتروني يمكن من سهولة الوصول اليها وتأمينها وتخزينها بسهولة.

المراحل المتبعة للوصول الى النموذج الأولي:

نأخذ على سبيل المثال سيرورة عملية من العمليات داخل المنصة ولتكن عملية انشاء مشروع بحثي جديد:

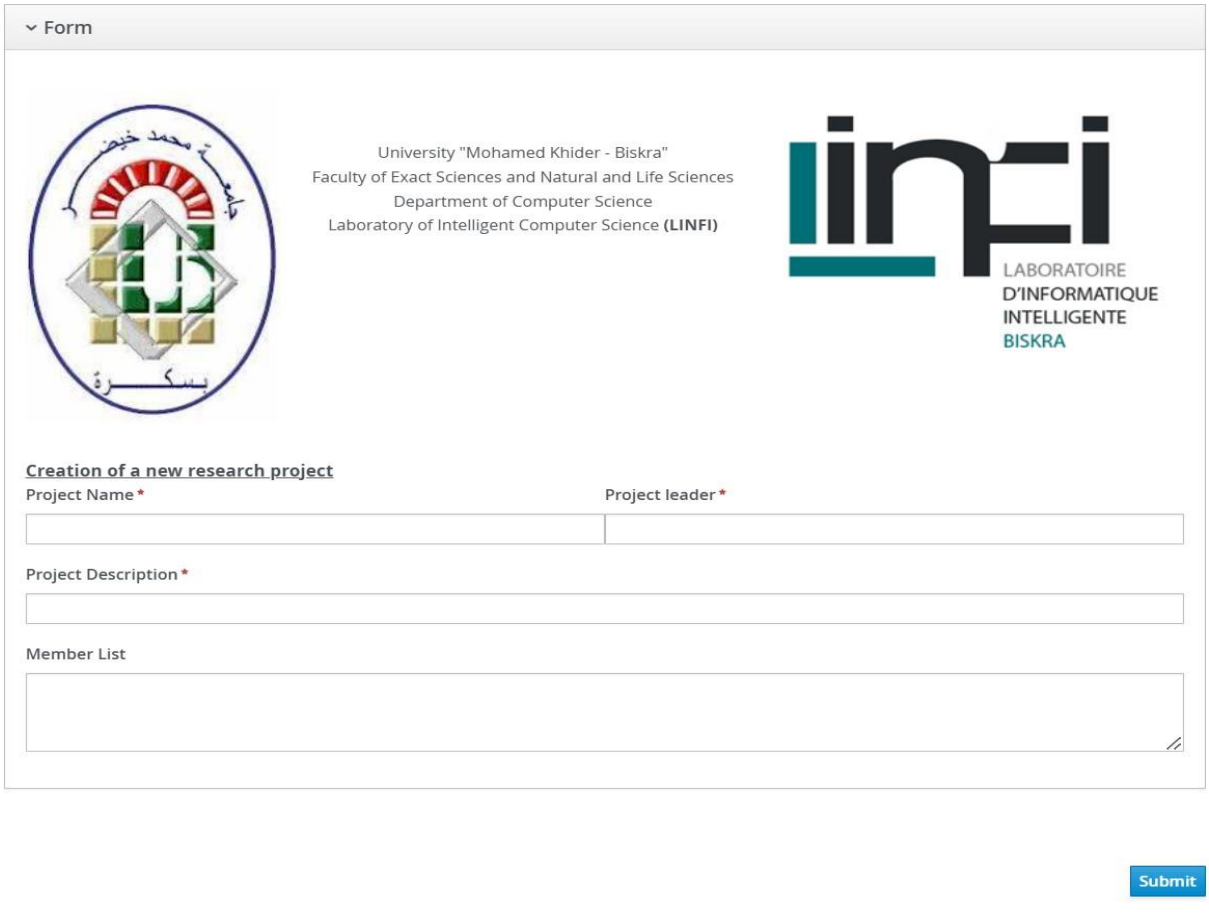
1-نبدأ بنمذجة العملية حسب ما ورد في جدول الوصف الخاص بها باستخدام نموذج عمليات الاعمال

الشكل (5): نموذج عمليات الاعمال لإنشاء مشروع بحثي جديد



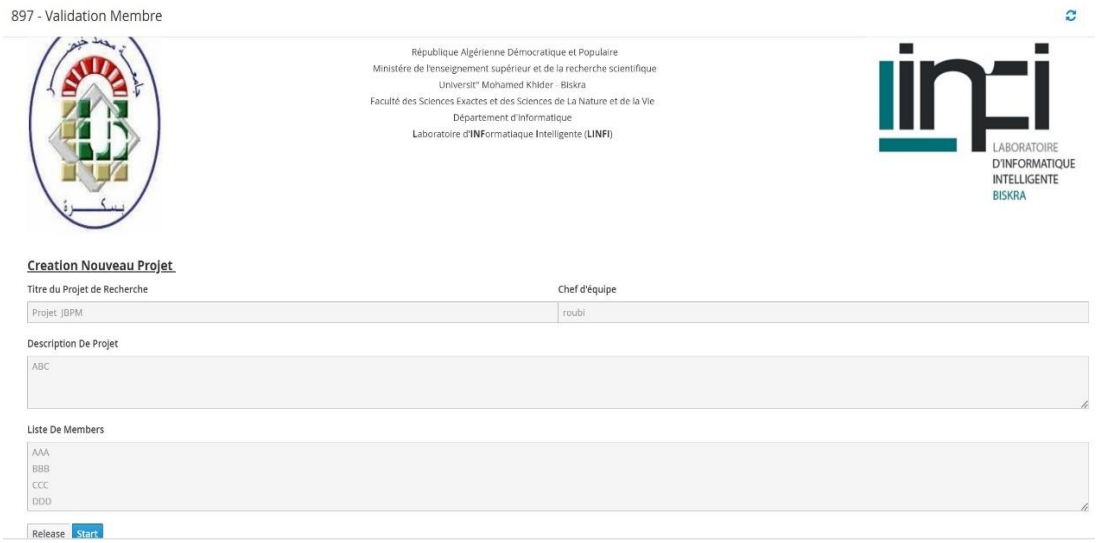
2-يجب ملء المعلومات اللازمة من اسم المشروع، رئيسه ووصفه، وكذلك أسماء الأعضاء:

الشكل (6): واجهة طلب انشاء مشروع بحثي جديد



3- يقوم الأعضاء بالمصادقة على الطلب وإعادة ارساله الى رئيس المخبر:

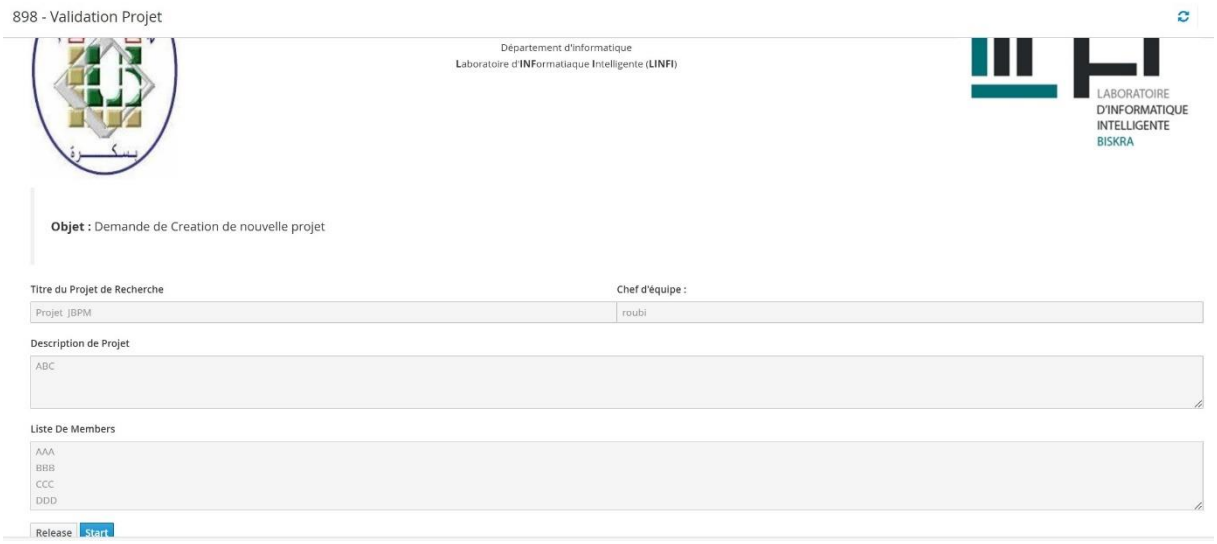
الشكل (7): واجهة المصادقة على الأعضاء



4-

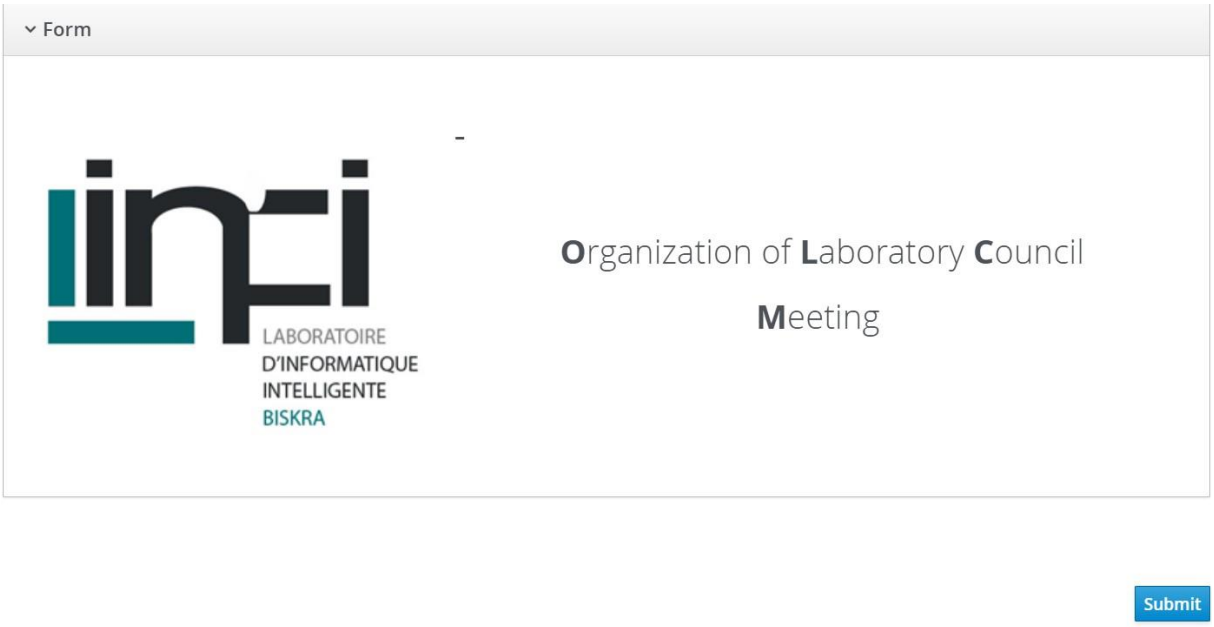
4-يقوم بعد ذلك رئيس المختبر بالمصادقة على المشروع:

الشكل (8): واجهة المصادقة على المشروع



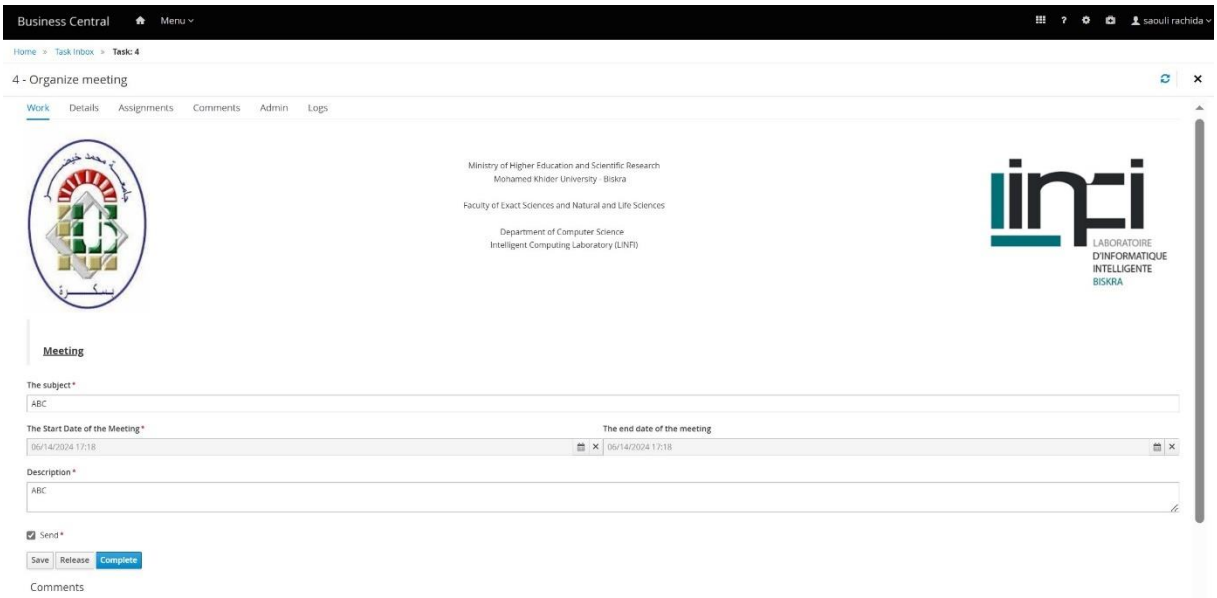
5-في داخل هذه العملية تتم عملية أخرى وهي طلب تنظيم اجتماع لمجلس المختبر:

الشكل (9): واجهة طلب عقد اجتماع



ويكون هنا هدفه مناقشة المشروع البحثي الجديد المطلوب إنشاؤه:

الشكل (10): واجهة لملء المعلومات الخاصة بالاجتماع



5- يتم بعد الاجتماع ارسال القرار من طرف رئيس المختبر الى رئيس الفريق:

الشكل (11): ارسال القرار

7-يستقبل رئيس الفريق القرار وينهي العملية في حال الرفض، اما في حال القبول فيرسل المشروع المصادق عليه الى الكلية وبهذا تنتهي العملية.

شرائح العملاء	العلاقات مع الزبائن	القيمة المقدمة	الأنشطة الرئيسية	الشركاء
-مخابر البحث العلمي للجامعات. -شركات تسعى الى تطوير تطبيق اداراتها وتنظيمها.	-العمل على تسهيل استخدام التطبيق. -العمل على توفير الاحسن من خلال التحديثات. -البحث عن الأعطال والمشاكل واصلاحها دوريا. -اخذ آراء العملاء و اقتراحاتهم.	-رقمنة العمليات وتحسين الآداء. -تعزيز الانتاجية والدقة. التنظيمي للمختبرات والإدارات. -توفير الوقت والجهد ورفع الكفاءة. -تخفيف الأعباء والتكاليف وتسهيل التعاون بين الفرق. تقليل احتمالية الأخطاء اليدوية. -تعزيز امان البيانات.	-جمع وتحليل معلومات العمليات المختبرية لفهم سير العمل وتحديد مجالات التحسين. -تصميم وتطوير التطبيق جسب حاجة الزبون. -التسويق. -تمكين توفير خدمة التكوين والاستشارة للشركات في استخدام تطبيقاتها. -تحديد احتياجات العملاء وتحليلها لتلبية توقعاتهم.	-محلات خدمات الاعلام الالي والأدوات والأجهزة المكتبية. -موفري خدمات استضافة.
	القنوات		الموارد الرئيسية	

	-استخدام إعلانات وسائل التواصل الاجتماعي لجذب العملاء. -العمل من المكتب. - التسويق والبيع مباشرة		-حواسيب جيدة وعالية الكفاءة. -محل مجهز كمقر للشركة. -موظفين للمحاسبة والتسويق. -خوادم.	

مصادر الإيرادات	التكاليف
-تكوين وتدريب موظفي الشركات. -بيع تطبيقات مباشرة. -رسوم الاستخدام ورسوم الاشتراك للعملاء.	-تكاليف الخوادم. -استئجار محل وتوفير مستلزماته وتكاليف الصيانة والإصلاحات. -رواتب الموظفين. -تكاليف التسويق.

الملحق رقم 04: نموذج العمل التجاري