

# Development and Optimization of Open-Source Artificial Intelligence Models for the Automation of Business Processes

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**Abstract:** Artificial intelligence is transforming traditional business models into more sustainable and adaptive operations by enabling improved resource optimization and process automation. This study investigates the potential of open-source AI models in the automation and optimization of business processes. It focuses on an Albanian company based on digital services, including website and application development, ERP and CRM systems and digital marketing solutions. Within this context, two distinct AI models are developed and trained in alignment with the organization's specific operational requirements. Our objective is the design of an AI agent capable of interpreting natural language inputs and triggering predefined automation workflows via the n8n platform. The study provides a comparative evaluation of the performance and efficiency of the selected open-source models following fine-tuning on real-world business data. The paper compares the performance and efficiency of the selected open-source models after fine-tuning with real business data, reducing manual and repetitive tasks, and increasing operational efficiency.

**Keywords:** Business Process Automation; Open-Source Artificial Intelligence; Large Linguistic Models

## 1. Introduction

This study aims to develop and demonstrate an innovative approach to business process automation using open-source Artificial Intelligence (AI) models. AI is reshaping traditional businesses into sustainable operations, so it can be used to optimize resource utilization, automate processes for improved efficiency. Focusing on a company that offers a wide range of digital services, the study develops and trains two different AI models, specific to the needs of the business. It is important to create an intelligent system that understands complex natural language commands and activates automated workflows on the n8n platform. The study serves as a practical guide for companies that want to integrate open-source AI into their operations, reducing manual and repetitive procedures and increasing efficiency. Specific objectives of the study, are:

- Analyze current business processes, especially in the areas of marketing, web development and content creation, that can be integrated with AI.
- Comparison of the performance of different open-source AI models after the fine-tuning process, in the context of business process automation.

This study includes an analysis of the theoretical concepts that support the use of open-source Artificial Intelligence (AI) models for automating processes in a business company. The focus is placed on open-source technologies, such as Llama 3 and Mistral 7B, as well as on the n8n automation platform, emphasizing their capabilities to integrate with AI-based solutions. AI has been integrated into business operation, creating new opportunities for innovation and long-term improvements. Nowadays, Large Language Models (LLMs) play a central role in process automation, thanks to their ability to understand natural language commands and generate

structured responses, which activate processes through platforms such as n8n. To adapt pre-trained LLMs to specific business needs, the Fine-tuning technique is used. This process is based on Transfer Learning, where the knowledge accumulated by a model in a broad domain is applied and adapted to a more specialized task. In this way, the models acquire the ability to interpret specific business commands and contexts, increasing their accuracy and practical relevance. This paper makes a valuable contribution to understanding AI-driven automation in modern enterprises. It combines theoretical insights with practical implications, making it useful for both academic researchers and businesses seeking to leverage AI for process improvement and competitiveness.

## **2. Literature Review**

The reviewed studies collectively suggest that Business Process Automation (BPA) is evolving from static, rule based systems toward adaptive, intelligent, and open-source-driven ecosystems powered by Artificial Intelligence (AI), Machine Learning (ML), and Robotic Process Automation (RPA). Open-source technologies emerge as a crucial enabler in this transformation, offering scalability, transparency, and customizability that align with the ethical and organizational demands of modern enterprises. Across the analysed works, a consistent theoretical pattern arises: intelligent automation systems must not only execute tasks efficiently but also interpret, learn, and collaborate within dynamic human-machine ecosystems. Such models redefine enterprise automation as a continuous co-evolution between technological intelligence and human capability, positioning open-source innovation as the foundation for sustainable and inclusive digital transformation. From 2021 to 2025, the examined studies (Abubakar, 2021; Abdelwahab & Helal, 2023; Nguyen et al., 2023; Mangal, 2023; Patrício, Varela, & Silveira, 2024; Wornow et al., 2024; Patrício et al., 2025) demonstrate a convergence between automation theory and human-centric design. Wornow et al. (2024) illustrate how foundation models (FMs) enable multimodal workflow understanding and task completion within enterprise systems, marking a new level of semantic automation. Patrício et al. (2024, 2025) extend this understanding by embedding automation within frameworks of sustainability, ethical governance, and Industry 5.0 human-machine collaboration. Similarly, Nguyen et al. (2023) and Abdelwahab & Helal (2023) show that automation research is evolving toward systems-level intelligence, where model training, data modalities, and process prioritization form the basis for adaptive enterprise ecosystems. Abubakar (2021) and Mangal (2023) further highlight the interplay between cloud infrastructure and cognitive automation, illustrating how intelligent processes can reshape decision-making, efficiency, and digital transformation. This model redefines automation not only as a tool for operational optimization but as a collaborative, evolving framework that supports organizational learning, sustainable innovation, and digital autonomy. Consequently, the integration of open-source AI-driven automation systems reflects a theoretical maturation of enterprise technology, where automation aligns with human cognition, ethical principles, and adaptive enterprise strategy to co-create resilient, intelligent, and future-ready organizations.

## **3. Methodology and Analysis of Results**

For the implementation of AI technologies and the collection of training and testing data, we have referred to a real company in Albania that provides services to businesses. So, when developing artificial intelligence models for business process automation, several advanced open-source technologies were selected to ensure flexibility, performance, and transparency throughout model training and integration. The LLaMA 3 (8B) model was selected as one of the most powerful and high-performing open-source models, recognized for its excellent capabilities in natural language understanding the instructions. In parallel, Mistral 7B was adopted for its compact architecture, computational efficiency, and competitive performance, particularly under limited-resource conditions. The combination of these models provides a balance between computational power and resource optimization. The training and fine-tuning process relied on robust and widely adopted machine learning platforms. The Hugging Face Transformers library served as the core framework for loading, adapting, and fine-tuning LLMs. Deep learning frameworks PyTorch and TensorFlow were used for model training and

inference, allowing customized parameter optimization. To improve efficiency, the LoRA (Low-Rank Adaptation) technique was implemented through the PEFT library, enabling lightweight and memory-efficient fine-tuning. The bitsandbytes library was utilized for model quantization, significantly reducing memory requirements during training and inference. To manage business tasks and creating intelligent workflows, the open-source platform n8n was adopted. This tool offers a visual interface, high integration flexibility and extensive connectivity with external services. To bridge the AI models with the automation system, the FastAPI and Flask frameworks were employed for building RESTful APIs in Python. These frameworks enable the creation of high-performance endpoints with automatic documentation. FastAPI was particularly preferred due to its asynchronous architecture and superior execution speed. Development and experimentation were conducted primarily in Python 3.x, the standard language for AI research and application development. Google Colab and Jupyter Notebook were used for experimentation, fine-tuning, and data analysis, leveraging available GPU resources for efficient computation. Version control, team collaboration, and open-source publishing were managed through GitHub, ensuring code traceability, transparency, and continuous project improvement.

During the study, we mostly addressed customer service, how it can be improved and how automation affects the quality of services provided. During testing, we saw that: there is a faster fulfilment of deadlines, which means that clients benefit from faster project delivery; They have personalized content, so the ability to quickly generate content allows the company to create more personalized and targeted marketing and communication materials; we can do a deeper analysis with the automated collection and processing of statistics, and can provide more frequent reports on the performance of client campaigns. The developed system provides a flexible platform that can be expanded with technological developments. Overall, the automated system with AI positions the company as an innovative unit, capable of providing services with high efficiency and improved quality, emphasizing a competitive advantage in the digital services market.

The results of the conducted tests show a good performance of both AI models in business process automation. Llama 3 8B showed a higher average accuracy (91.1%) of data interpretation compared to Mistral 7B (86.8%). In terms of Parameter Extraction accuracy, Llama 3 8B (89.0%) outperformed Mistral 7B (84.6%). This suggests that Llama 3 has a better ability to capture specific details (customer names, budget figures, keywords) from a complex sentence, inserting them accurately into the JSON structure. Tasks that have more parameters or parameters pose a challenge for both technologies. Response Time to the above specified inputs, Mistral 7B had an average inference time of 1.3 seconds compared to 1.92 seconds for Llama 3 8B, so Mistral 7B is faster in response. This comes as a result of architectural optimizations such as Grouped-Query Attention (GQA) and Sliding Window Attention (SWA), which make it more efficient in processing sequences. Another comparative feature is the resource requirements that these technologies have. Mistral 7B also required less memory (VRAM), both during fine-tuning and during inference. This makes it a more attractive choice for deployment in resource-constrained environments or when minimizing hardware costs is aimed at. The implementation of automated AI systems has a significant impact on the operations of companies that offer business services, affecting efficiency, productivity and quality of services. One of the most obvious benefits is the significant reduction in time and cost that automated tasks require compared to manual and repetitive ones. If we refer to Marketing Tasks, we say that the launch of new Google Ads or Meta Ads campaigns, which previously could require 15-30 minutes of manual configuration, can now be activated with a simple command within seconds. This frees up marketing specialists to focus on deeper strategies and analysis. The intelligent system improves the overall operational efficiency of the business, where we can mention: The ability to execute commands in almost real time, Automation ensures that tasks are performed consistently and without human errors, increasing the overall quality of services, the business can manage a larger volume of tasks and clients without having to proportionally increase the number of employees, making the business more scalable, also employees are free to focus on high-value tasks, such as innovation, customer relations and the development of new strategies.

## 4. Conclusions

This study addressed the design, development and evaluation of an intelligent automated business process system, using open-source Artificial Intelligence models and the n8n platform, with a focus on companies that provide services to businesses. The main goal was to demonstrate the potential of AI to transform manual tasks into automated operations. Two different open-source AI models, Llama 3 8B and Mistral 7B, were successfully trained using a customized dataset from the business company. The integration of the trained AI models with the n8n platform was successfully realized through an API developed with FastAPI. The use of open-source models also offers the advantages of full control over the data and reducing long-term licensing costs. Compared to existing commercial solutions, the built system offers a high level of customization and flexibility, being independent. Although it requires a higher initial expertise for deployment and maintenance, the benefits in terms of data control and cost make it an attractive alternative.

This paper proves that the development and training of open-source Artificial Intelligence models for business process automation, integrated with platforms such as n8n, is a sustainable and efficient approach. It provides a practical model for companies, showing that beyond operational optimization, this approach provides measurable benefits such as reduced task execution time, reduced long-term costs through the elimination of commercial licenses, and an unparalleled flexibility in adapting solutions to specific needs, thus increasing overall business efficiency.

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