

# Introducing AI-Based Techniques in the Justice Sector: A Proposal for Digital Transformation of Court Offices

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## Abstract

The digitalization of public administration has become a critical factor for the economic and social development of countries globally. Despite significant progress in implementing information technology in government services, the full potential of artificial intelligence (AI) in advancing the digital transformation of public administration has not been fully realized. Identifying and implementing AI applications which can effectively benefit citizens and society, particularly in the justice sector, is still a significant challenge. The paper represents an extended abstract of a recent work, in which these authors explore the potential of AI in public administration, with a specific focus on the justice sector. By analyzing real-world AI applications in the Court of Appeal of Naples, this paper illustrates how AI can significantly enhance the effectiveness and efficiency of justice sector operations and outlines potential future directions for AI implementation in public administration. The study's findings highlight the importance of AI in driving the digital transformation of public administration, emphasizing the opportunities for future research and development in this area.

## Keywords

Artificial Intelligence, Public Administration, E-Government

## 1. Introduction

The Digital Transformation is increasingly a priority within the political agendas of countries [1]. With the advent of new technologies and innovations, companies are looking for ways to adapt and stay ahead of the competition. The European Commission has recognized the importance of digitalization and has developed the Digital Economy and Society Index (DESI) to measure the progress of European Union member states in this area [2]. It is based on official data from the European Statistical Office (EUROSTAT) and has been compiled annually by the European Commission since 2014 to assess the level of digitization in the member states. One of the European goals is to achieve fully online provision of public services by 2030. Many studies considered information technology tools, including artificial intelligence, to achieve the set goals.

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Despite being used in many areas, the use of Artificial Intelligence in public domain is quite new [3]. The best example is the legal field, which is currently the most manually processed and the youngest application area of AI. In fact, according to [4], law differs significantly from other fields such as medicine and finance. The current courtroom process is still similar to what it looked like back in 1980, and this calls for proper digital transformation. Citizens, enterprises, and organizations are eager to change the judicial system, which is very slow. Disputants are no longer willing to pay high retainers and be billed for expensive lawyer work hours to solve their cases over extended periods [4]. Justice plays a central role in society and with its long expiration times, primarily affects the finance growth of a country. In this paper, we will discuss a recent work currently under submission. Our proposal is based on the outcomes of a significant research project that involved the Naples Court Office. This paper discusses several challenges, opportunities, and innovations that can be implemented to enhance the digital transformation of the justice sector using Artificial Intelligence and Data Analysis.

## 2. The Need and Potential Benefits of Digital Transformation in the Justice Sector

The public sector represents a specific research area that requires careful study and evaluation. The public domain is subject to various rules and boundaries that make it peculiar. One of the driving factors of digital transformation in PA is the provision of **governmental services online through AI integration**. For instance, [5] and [6] propose AI platform for supporting the improvement of government services. These contributions relate in particular to AI applications that improve government services through workflow standardization and automation [7], virtual agents, and automated task assignment. In [3], it is shown a proposal for an intelligent platform architecture that supports the development and implementation of AI applications for e-government. In particular, the functional layer of the proposed architecture aims to fulfill citizen requests in four phases using virtual agents and AI techniques. Emerging AI applications supporting e-government services aim to streamline the process of responding to citizen requests. The features they focus more on are quality, trustworthiness and speed. Another area of research for AI applications in PA that is closely related to the legal field is the identification of entities in legal documents using **Named Entity Recognition (NER)** technique. [8] uses NER to search for all legal entities in US legal documents, such as: judges, jurisdictions, and courts. The system described in [8] is based on three main tools: search tables, context rules, and statistical models. In [9], the authors propose the realization of a system dedicated to supporting the acumen of lawyers and the automatic generation of arguments related to the case. If we focus on the European and Italian context of PA, we can observe that the digitization process particularly of the legal field is evolving, certainly also driven by the pandemic. However, although the field is improving, it is still very much tied to the traditions established in the processes, mostly using manual procedures, which implies a slow evolution. Currently, the Italian judicial proceedings both in the criminal field and in the civil field, do not present a strong and full digitization. Over the years, tools were provided to support some procedures rather than others, covering only some part and tasks of the process. There are not automatic tools which allows to manage and control procedures during the legal process. In

addition, there are also technical problems related to courtrooms that are not equipped with hardware and software tools, so that the digital debate of a trial cannot be guaranteed. Through years legal field proved to be one of the most unfriendly area for AI applications. This may be due to the uniqueness of the legal systems of the various countries. In fact, legal field is strictly related to country rules and official language, which makes it difficult to define a common standard among different countries. It also emerged that most of the studies related to legal field are based on legal documents using English language, which hinders the growth of digitization of legal areas in countries with different languages.

### 3. Field Identification

Through the structured on-field analysis of Judicial Offices, issues and challenges are extracted. This analysis step was carried out in different time frames from September 2022 to February 2023, mainly in the Court of Appeal of Naples. In the preparatory phase, the internal processes of the Naples judicial authorities will be analyzed to identify the critical points where the use of AI can bring significant improvements. In this section we will do the analysis recognition and we will highlight the most important challenges.

#### 3.1. Analysis

Due to the peculiar research area, Agile methodology was chosen to perform the analysis and to extract challenges and software specifications. More in details, the Agile software development should start with simple and predictable approximations to the final requirement and then continue to increase the detail of these requirements throughout the project life cycle. This incremental refinement continuously improve the design, coding and testing at all stages of production activity [10]. Following the agile methodology two iterations were done, in which a series of interviews and webinars with judicial actors are carried out. In particular, the iterations are continuously refining requirements and objectives:

1. **First Iteration:** This is the most critical phase of a project, where the foundations for the entire project are laid. The initial goal is to give the project a start to find the next requirements. The first iteration started with the identification of stakeholders and the scheduling of meetings. In the first meeting general information were obtained, which helped to structure new interviews. New more precise interviews were submitted to the customers, which in our case consisted of legal stakeholders. After the meetings, we conducted a comprehensive brainstorming session with the working group. Then we defined the goals to be achieved after this first phase. After that, we designed and developed the software and solutions based on the requirements. Finally, the solutions were shown to the customers to get feedback that would be incorporated into the second iteration;
2. **Second Iteration:** this iteration is a direct result of the previous one. In the first iteration, after meeting with the customer, we received feedback and suggestions that contributed to the development of the second iteration. This iteration began with the extraction of new information from customer interviews. This information about software requirements

comes from structured interviews based on previous feedback and from analysis with stakeholders in the field. This phase is also required to examine existing data, platforms, and software solutions used in the office and confront them with alternative integration options.

The analysis phase is subject to continuous assessment as requirements change throughout the iterations of the agile cycle, ranging from information about work methods to information about software requirements. Information flows, IT systems and available resources are currently being evaluated with a view to applying new proposed solutions.

## 3.2. Challenges

At the end of the on-site analysis phase, where information on work processes and environmental characteristics has been obtained, problems and challenges are identified. The analysis, which is still ongoing, revealed critical information about the data and the working methods of the offices, which are highlighted in this section. The above challenges can be summarized as follows:

- **Data collection:** existing and available data in the offices are strictly related to private information, making it difficult to gain knowledge from it. Furthermore, there are no complete centralized databases to take information from.
- **Document digitalisation:** documents are both in digital and written format. The formal written one, which is called "act", is considered for official purposes the only one with an official value, thus the digital format is considered of secondary importance causing sometimes the lack of the digital document. Due to the necessity of information extractions, the lack of digital document is considered one of the criticism.
- **Human Resources Management:** judicial offices manage staff comprising a mix of senior legal roles. Personnel management turned out to be one of the main criticisms terms of: not scheduled working time, holidays, standard task assignments and occasional additional task assignments. Human Resources Management is done manually, without the help of Information Systems. This activity requires a lot of time, and is strictly affected by human errors. It also affects task assignment, which needs to know personnel availability (monitoring the work records and status of previously assigned tasks) and to find standard criteria for user-task matching.
- **Document Flow Management:** the high volume of documents to manage, the complexity of judicial proceedings and the need to ensure the security and integrity of information represent the major challenges for the proper functioning of judicial processes [11]. Since documents are related to the development of the final discussion folder (which is the one used in court) it is important to check in which activity phase they are, where are physically located and who is working on them, reaching a complete traceability of the document.

### 3.2.1. Data Collection

Among the challenges highlighted, the one related to "Data Collection" must be addressed before new digital solutions can be proposed. In order to overcome the problem related to **Data**

**Collection**, we choose data from different sources:

1. For classification and anonymization we use: *Legal Citation*<sup>1</sup> for the classification tool and *Decisions of the Court of Cassation*<sup>2</sup> for the anonymization tool.
2. For human resources management and workload assignment we use data extracted from the Court of Appeal of Naples which can be summarized as: *judges in charge* including personal data of magistrates with current and historical positions, *assigned staff* with personal data of secretarial and administrative staff with related functions, *sections* with details of the sections into which the Court of Appeal is divided and their composition, *offices* containing their physical data and composition, *district offices* with data relating to the offices of courts of the district, but not properly of the court of Naples.
3. For the management of the documented flows we use the relative data to the informative flows of the offices, which were analyzed and used in order to understand the flow of the documents.

The data collection is necessary to move forward to the next section, where tools and prototypes will be proposed and tested on selected data. The others highlighted challenges are faced with the tools proposed in next sections.

## 4. Proposed Digital Transformation of Court Offices

The survey phase results suggest that there are four primary areas in which the Court Office's efficiency could be enhanced: smart document classification, personnel monitoring capabilities, process and task management and document management. Building upon the findings of the reconnaissance phase, we propose a range of AI-based solutions for implementation. By implementing smart document classification, personnel monitoring capabilities, process and task management, and document management systems, we believe that the Court Office can significantly enhance its operations. Our proposed approach are:

- **Classification of Dossier:** We leverage AI techniques for text classification. Our deep learning-based classification model is DistilBERT. This choice is justified by the results of the authors [12]; in the paper DistilBERT turned out to have excellent performances on this task, obtaining better performances compared to two pre-adept models which are ELMo and BERT-base. In addition [12] highlights that even though DistilBERT is the compact version of Bert, there is no loss consciousness. DistilBERT automatically categorizes digital texts into predefined categories [13], such as affirmed, applied, approved, cited, considered, discussed, distinguished, followed, referred to, or related. The proposed AI tool can classify dossiers quickly and accurately, allowing judicial officers to focus on other critical tasks. The use of AI tools can also reduce the time required to complete the classification process, allowing for faster decision-making. The solution proposed can also provide consistent classification of dossiers, ensuring that all documents [14] are organized in the same way. The performance results are evaluated by the weighted average of the results of the classes as shown in Table 1.

<sup>1</sup>The dataset is available here: <https://www.kaggle.com/datasets/shivamb/legal-citation-text-classification>

<sup>2</sup>The dataset is available here: <https://www.italgiure.giustizia.it/sncass/>

- **Anonymization of Documents:** We use NER [15] to anonymize sensitive information, whereby associations within the text are identified and tagged. Our rules-based approach ensures actors' privacy concerns are met. Using these tools streamlines document management processes, preserving actors' privacy and reducing difficulties associated with accessing sensitive information. Proposed AI tool can provide an added layer of security to the anonymization process by ensuring that all sensitive information is removed or masked consistently and accurately. This enhanced security can help to prevent data breaches and ensure the privacy of individuals involved in legal proceedings.
- **Workflow Management System:** Due to the reasons previously discussed in Section 3, we have decided to implement a human resources management system aimed at improving the management of personnel, while ensuring flexibility, availability, and monitorability. The system provides various information on staff members, including personal data and work data. Personal data includes biographic information and work experience, while work data provides an instant picture of the office's situation, allowing views of the workforce and workers, which are distinguished as staff members who are currently working and those who are unable to carry out their daily activities due to external factors, respectively. This is important because task allocation optimization is crucial for judicial office efficiency [16]. However, due to the lack of standard criteria for task assignment, the assignment of duties is often based on subjective decisions made by the supervisor or office manager, which may lead to unfair task assignment. To avoid this problem, objective and standard criteria [17] for task assignment should be established, such as the type and complexity of tasks, the volume of work, and staff members' availability and skills. Our proposed solution is a software that supports the case manager's decisions by providing graphs and statistics on the current assignment status of tasks and the office's condition in real time. This allows for a data-driven choice, reducing the probability of errors occurring during assignment. Future work could lead to the use of optimization algorithms and artificial intelligence once a consistent and real database is obtained.
- **Document Flow Management System:** To tackle the critical issues discussed in section 3, we propose implementing a document flow management system based on digital technologies. This system aims to simplify and automate document management procedures, improve process efficiency, ensure security and information integrity, and allow for real-time monitoring [18]. The system serves as a visual tracing map for each file, streamlining the preparation phase and providing the ability to view the position and the operator working on the document. It could adopt advanced technologies for managing digital documents, and could integrate with the IT systems used in judicial offices to automate processes and ensure complete traceability of information. The proposed solution is a software that allows for the efficient and secure acquisition, processing, storing, and management of data related to documents. This process does not use any sensitive data, as all information is treated as closed systems to maintain anonymity and privacy. Advanced document processing features, such as optical document scanning, OCR, document indexing, or code readers for digital codes or QR codes, could be integrated to allow for instant localization, rapid search and retrieval of information. The document management software can be integrated with anonymization and classification algorithms to protect documents and ensure confidentiality and authenticity.

	Precision	Recall	F1-Score
Weighted Average	0.88	0.89	0.88

**Table 1**  
DistilBERT weighted average performances

## 5. Conclusion and Future direction

In conclusion, this paper highlights the crucial role of artificial intelligence in advancing the digital transformation of PA, particularly in the justice sector in the Italian legal context. While significant progress has been made in implementing information technology in government services, there is still a considerable untapped potential for AI applications to benefit citizens and society. Through an analysis of real-world AI applications in the Court of Appeal of Naples, we propose technological solutions to support the digital transformation of PA. Our research shows that digital transformation can improve the efficiency, accessibility, and transparency of legal services, simplifying processes and reducing execution times. Our proposed technological solutions include a judgment classification system, a document anonymizer, a human resource management-workload tool and a document flow management tool. This study makes an innovative contribution to the digitalization of the Italian judicial system and emphasize the opportunities for future research and development in AI implementation in justice sector. Finally, the adoption of AI in PA can lead to more efficient, accessible, and effective government services for citizens, contributing to the economic and social development of countries globally. Future developments will focus on identifying standard metrics and parameters for the automatic assignment of resources, which will support the proposed tools. In addition, based on the results of this research it could be interesting to propose a framework for analysis, identification of challenge and digital products , and to apply the proposed solutions in other public administration offices, with a particular focus on judicial offices both in the Italian context and in other Countries with common law jurisdiction. We plan to test classification and anonymization tasks on an Italian dataset and experience the use of software in a real situation.

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## References

- [1] F. Zaoui, N. Souissi, Roadmap for digital transformation: A literature review, *Procedia Computer Science* 175 (2020) 621–628.



- [2] E. Commission, Digital Economy and Society Index (DESI) 2022, International series of monographs on physics, European Commission, keywords = Digital Economy, Society Index, 2022.
- [3] O. S. Al-Mushayt, Automating e-government services with artificial intelligence, *IEEE Access* 7 (2019) 146821–146829.
- [4] C. Rule, Online dispute resolution and the future of justice, *Annual Review of Law and Social Science* 16 (2020) 277–292.
- [5] A. H. W. Chun, An ai framework for the automatic assessment of e-government forms, *AI Magazine* 29 (2008) 52–52.
- [6] Y. Zheng, H. Yu, L. Cui, C. Miao, C. Leung, Q. Yang, Smarths: An ai platform for improving government service provision, in: *Proceedings of the AAAI Conference on Artificial Intelligence*, volume 32, 2018.
- [7] E. Masciari, Trajectory clustering via effective partitioning, in: *Flexible Query Answering Systems: 8th International Conference, FQAS 2009, Roskilde, Denmark, October 26-28, 2009. Proceedings* 8, Springer, 2009, pp. 358–370.
- [8] C. Dozier, R. Kondadadi, M. Light, A. Vachher, S. Veeramachaneni, R. Wudali, Named entity recognition and resolution in legal text (2010) 27–43.
- [9] L. Eliot, Ai and legal argumentation: Aligning the autonomous levels of ai legal reasoning (2020). URL: <https://arxiv.org/abs/2009.11180>. doi:10.48550/ARXIV.2009.11180.
- [10] G. Kumar, P. K. Bhatia, Impact of agile methodology on software development process, *International Journal of Computer Technology and Electronics Engineering (IJCTEE)* 2 (2012) 46–50.
- [11] B. I. Chimwani, M. A. Iravo, O. I. Tirimba, Factors influencing procurement performance in the kenyan public sector: case study of the state law office, *International Journal of Innovation and Applied Studies* 9 (2014) 1626.
- [12] V. Sanh, L. Debut, J. Chaumond, T. Wolf, Distilbert, a distilled version of bert: smaller, faster, cheaper and lighter (2019). URL: <https://arxiv.org/abs/1910.01108>. doi:10.48550/ARXIV.1910.01108.
- [13] G. Manco, E. Masciari, A. Tagarelli, A framework for adaptive mail classification, in: *14th IEEE International Conference on Tools with Artificial Intelligence, 2002. (ICTAI 2002). Proceedings.*, 2002, pp. 387–392. doi:10.1109/TAI.2002.1180829.
- [14] S. Flesca, G. Manco, E. Masciari, L. Pontieri, A. Pugliese, Exploiting structural similarity for effective web information extraction, *Data Knowledge Engineering* 60 (2007) 222–234. URL: <https://www.sciencedirect.com/science/article/pii/S0169023X0600022X>. doi:<https://doi.org/10.1016/j.datak.2006.01.001>, intelligent Data Mining.
- [15] A. Mansouri, L. S. Affendey, A. Mamat, Named entity recognition approaches, *International Journal of Computer Science and Network Security* 8 (2008) 339–344.
- [16] E. Biber, The importance of resource allocation in administrative law, *Admin. L. Rev.* 60 (2008) 1.
- [17] X. Deng, J. Li, E. Liu, H. Zhang, Task allocation algorithm and optimization model on edge collaboration, *Journal of Systems Architecture* 110 (2020) 101778.
- [18] H. Alshibly, R. Chiong, Y. Bao, Investigating the critical success factors for implementing electronic document management systems in governments: evidence from jordan, *Information Systems Management* 33 (2016) 287–301.