

Intelligent Agents for Archival Processing in Electronic Record Archiving: Application Dilemmas and Implementation Pathways

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Abstract: Digital transformation is reshaping the archival field, and this study focuses on the practical challenges of using intelligent agents for electronic records filing. It clarifies the concept and application scope of intelligent agents for archival processing, identifies the difficulties encountered in practice, and proposes implementation pathways to support single-copy management in archival work. Drawing on the Technology-Organization-Environment (TOE) framework and using the Technology Acceptance Model (TAM) to explain archivists' acceptance of the technology, the study analyzes the barriers to the adoption of intelligent agents. The findings indicate that such agents can lighten the burden of routine archival work, then formalize and standardize tacit archival rules. This, in turn, helps advance the shift toward human-AI collaborative archiving. The study found that the core value of intelligent archiving agents is to automate repetitive labour, make implicit rules explicit, and promote archiving work towards human-computer collaboration mode. To break through the application dilemma, it is necessary to cooperate with internal and external subjects and take measures from the three levels of technology, organization and environment to truly realize the implementation of intelligent agents in electronic document filing.

Keywords: Artificial Intelligence; Intelligent Agents for Archival Processing; Electronic Records Archiving; Single-Copy Management; TOE Framework; Technology Acceptance Model

1. Background

In this study, an intelligent agent for archival processing refers to an AI-enabled system that supports the archiving of electronic records. It

can autonomously identify record attributes, determine whether records fall within the archival scope, and recommend appropriate retention periods. As specified in Article 37 of the Archives Law of the People's Republic of China, electronic archives must be derived from reliable sources, follow standardized procedures, and include elements that comply with applicable regulatory rules. The article also makes clear that electronic archives carry the same legal validity as traditional archives and can be used as official evidence. These legal requirements set strict quality standards for electronic records filing.

Under the background of 'artificial intelligence + archiving', domestic studies have verified the technical feasibility of relevant capabilities from the perspective of intelligent perception and automatic classification [1,2]. However, the development of 'hardware' is only the starting point for promoting archiving intelligence, and 'software' such as updating relevant management concepts and reforming standards and norms is indispensable. Therefore, we should not only focus on whether it is technically feasible, but also consider whether it is practiced in organizational management and whether it is implemented in terms of normative standards.

2. Theoretical Foundation and Analytical Perspective

Studying intelligent agents for filing cuts across disciplines. It's technical, organizational, and ultimately about how people behave. We use the TOE framework to get three angles: technological, organizational, environmental. We also bring in TAM. It helps explain archivists' acceptance of, and resistance to, intelligent agents.

2.1 Existing Research Progress

Prior research on the transition to single-copy

management has clarified its key concepts. In particular, scholars have distinguished among such terms as ‘track’, ‘set’, and ‘portion’, and have specified the conditions under which the single-copy model is applicable [3]. Some researchers further argue that the end-to-end electronic management and preservation of records is not merely a technical option, but an inevitable direction of archival development. However, the transition from paper-based to electronic archiving requires more than a change in storage medium or policy intent. It needs law, policy, and management to line up [4]. The latest industry reports suggest these pieces are coming together. The standards, theories, and technical pathways for single-track archiving and single-copy management are moving toward maturity [5].

Some scholars have started to explore AI applications in the archiving stage. Some studies have proposed intelligent perception and automatic classification methods for electronic document archiving, and have tried to build an intelligent mechanism for automatic feature extraction, value evaluation, and content verification [1]. Another team developed an intelligent review system for archival materials using deep learning [2]. Others have looked at intelligent archiving for audio-visual records, and at combining large models with RPA for automated collection [6]. Across these studies, intelligent perception, automated classification, and value appraisal all appear technically feasible. All these point to technical feasibility—but in isolation. What remains unclear is how to join them up.

Research on this topic has advanced—on concepts, institutions, and technical details. Yet most work remains at either the macro level of single-copy transformation or the micro level of verifying individual techniques. What we still lack is a systemic view: how do these scattered capabilities integrate into something functional—an intelligent agent for archiving? Few studies address the information-service dimension of archiving, or how users actually accept these new tools. These are precisely the questions that keep the intelligent agent confined to experimental settings rather than real-world practice.

2.2 Construction of the Analytical Framework

To better understand the roots of these

difficulties, we turn to the Technology-Organization-Environment (TOE) framework proposed by Tornatzky and Fleischer [7]. This framework has already been used in studies on the digital transformation of archival work and the construction of smart archives [8]. According to TOE, three sets of factors shape whether an intelligent agent moves from a technical blueprint into real-world use. Among them, technical factors include the reliability of judgement, system stability, and interpretability of intelligent agents; organizational factors involve the top-level design of the organization, cross-departmental coordination mechanisms, digital literacy cultivation, etc.; environmental factors pay attention to the recognition of the effectiveness of electronic document certificates, the perfection of industry standards, etc. The application of archiving intelligence is the organizational adoption behavior of an emerging technological innovation by the institution. It is also a profound organizational process change and management model transformation, which is suitable for using the TOE framework analysis.

On this basis, this paper introduces the technical acceptance model as a supplementary interpretation tool. The model was proposed by Davis in 1989 and is an important theoretical framework for explaining and predicting the degree of user acceptance of information technology. Its core view is that the user's acceptance of a new technology depends on the two core variables of perceived usefulness and perceived usability [9]. Studies have applied this model to archive website service optimization and digital archive user experience analysis [10,11], proving that it is suitable for archive scenarios. This perspective helps to explain the difference in the attitude of archivists in the face of intelligent archiving agents, and supplements the explanatory power of the TOE framework at the micro level.

3. Application Dilemmas

At present, some institutions have deployed intelligent archiving agents, but more than half of the institutions that have deployed agents are still based on manual review. From the perspective of the TOE framework, it is difficult to implement intelligent archiving agents. In addition to technical maturity, there are also multiple obstacles to the organization and environment.

3.1 Technological Barriers

When confronted with intelligent archiving agents, the doubts of the archive personnel are concentrated in three specific business issues: whether the archiving scope judgment is accurate and reliable, whether there are differences in preference in algorithmic decision-making, and how to define responsibility in case of errors. If these problems are not solved, it will be difficult for archivists to establish trust in the intelligent archiving agents.

A study of AI-assisted appraisal of electronic records notes that, although manual appraisal is constrained by efficiency limitations, AI can support appraisal only when its decision-making process is sufficiently explainable and its outputs are demonstrably reliable [12]. However, the opacity of many AI systems makes it difficult for archivists to review the basis of an agent's decisions, thereby limiting their willingness to rely on them. From the perspective of TAM, limited explainability may reduce perceived usefulness because archivists cannot readily assess whether an agent's decisions are appropriate. It may also undermine perceived ease of use, as archivists may lack clear procedures for operating, verifying, or correcting the system.

At one pilot site, archivists continued to review all system outputs manually two months after the system had been deployed. This case suggests that technical deployment alone does not amount to the effective integration of intelligent agents into archival practice.

3.2 Organizational Dilemmas

Electronic records archiving requires coordination among multiple departments. In many organizations, however, information technology planning remains fragmented and lacks systematic process design. Archiving requirements are often considered only after business systems have been deployed. As a result, file formats may be inconsistent, metadata standards may be incompatible, and systems may lack interoperability. Retrofitting archiving functions under these conditions increases development costs and disrupts data flows.

Effective electronic records archiving requires archiving requirements to be incorporated at an earlier stage of business-system design. For

intelligent archiving agents to operate effectively, three conditions are particularly important: clearly defined archival scopes, specified retention periods, and standardized metadata schemes. If these conditions are not established during system design, intelligent agents lack an actionable basis for making archival decisions. Unified archiving rules define what should be captured, consistent metadata standards specify what information should be recorded, and interoperable interfaces enable agents to access and transfer records across systems.

Without these foundations, intelligent archiving agents can perform only fragmented tasks across disconnected systems, and their efficiency may be lower than that of manual processing. More fundamentally, the introduction of intelligent archiving agents makes the early integration of archiving requirements into business processes increasingly important. Unless top-level planning specifies when archival intervention should occur and which departments are responsible for coordinating the process, intelligent archiving agents will remain remedial tools rather than instruments for improving the efficiency and quality of archival work.

Intelligent archiving agents process records transferred from business departments, but problems often arise at earlier stages of record creation and circulation. In reality, most institutions lack clear provisions on the document management responsibilities of business personnel. In many cases, the document collation work is also in charge of the business department or part-time personnel. The frequent rotation of positions makes it difficult to maintain operating standards, and the lack of professional knowledge aggravates the accumulation of non-standard operations. For example, when filing on paper, the leader did not sign or even ask someone to sign on your behalf; for example, when filing electronically, the attachment is missing, and the title is incomplete. These may be 'remedy' in the double-set era, but in the single-set environment, it directly damages the integrity of the document and is difficult to trace.

3.3 Environmental Dilemmas

To promote intelligent archiving agents, the organization faces the problem of external institutional identity. Some institutions have such concerns: even if the unit implements the

single-set management of electronic documents, if the other party does not recognize the validity of the electronic document certificate when conducting business dealings with external institutions, it is still necessary to produce the paper version. This concern directly suppresses the institution's enthusiasm for promoting the intelligence of archiving.

Some studies have found that when analyzing the dilemma of the implementation of single-set filing of electronic documents, the degree of social recognition of the effectiveness of electronic document certificates is a key external factor affecting whether institutions are willing to implement single-set management [13]; some studies have also paid attention to the legal and ethical problems faced by artificial intelligence in file identification, including responsibility. In terms of attribution, algorithm transparency and interpretability of results, the degree of resolution of these problems directly affects the external acceptance environment of the intelligent archiving agents [14].

Currently, there is a lack of unified technical standards and operational specifications for the application of intelligent archiving agents, resulting in significant variations in the exploration of intelligent archiving agents by different institutions. Key issues include how the metadata scheme is mapped to the data model of intelligent agents, how system operation log meets the requirements of file audit, and how files processed by the intelligent agents prove the effectiveness of its four-property detection. These problems are customized in different systems and lack unified specifications for reference.

4. Implementation Pathways

The identification of these difficulties is also the starting point of the way out: the three levels of obstacles are interrelated, and overcoming these obstacles also require promote synchronously from the three levels of technology, organization and environment. In recent years, some regions and institutions have explored the intelligentization of electronic file archiving, which has provided empirical reference for the implementation of intelligent archiving agents.

4.1 Technological Pathway: from Single-Point Verification to System Integration

Nowadays, intelligent perception, automatic classification, storage period identification and

other links have a certain amount of technical accumulation, but they still need to be further promoted to integrate the decentralized technology into a collaborative operation system.

A feasible entry point is to establish a dual-core verification mechanism that combines the rule library and the algorithm model. The rule library inputs business requirements such as the archiving scope and the storage period table to ensure the bottom line of compliance, and the algorithm model handles complex judgements based on the large language model. In this way, the judgement logic of the rule library can be traced article by article. The output of the algorithm model needs to be supported by external evidence. This 'external basis' comes from the local archive knowledge base: through entity identification and relationship extraction technology, distributed archive resources such as text, photos, audio and video are integrated into a structured knowledge network to provide a business context for the judgement of the intelligent agents.

Judging from the existing explorations, intelligent perception, automatic classification, four-property detection and other modules run independently, and the data cannot flow automatically. Throughout every step of the data import and export process, manual oversight and intervention are needed. Therefore, filing intelligent agent is not a complete system, but has been cut into several unrelated tools.

The goal of opening the data interface is to form a data chain that runs through the whole process. After the intelligent perception module completes the extraction of file features, the results flow directly into the automatic classification module. The classification results automatically trigger the four-property detection module, and the archive information packet is automatically generated after the detection is completed. The whole process does not require manual intervention, nor does it require repeated data transfer across different systems. After the interface is opened, the intelligent body can really give full play to its value and upgrade from a tool to assist manual completion of a single link to a system platform that covers the whole process of archiving.

4.2 Organizational Pathway: from Departmental Isolation to Collaborative Governance

The technical scheme runs through, but whether the intelligent archiving agents can really be used depends on whether the organization can be connected at the organizational level.

Incorporating archiving requirements into the top-level design of information technology is the first task of the organizational path. When a business system is being built, filing needs should be considered, instead of waiting for the system to be launched before making up for them.

Archiving is not the final work undertaken by the archive department alone, but an integrated design throughout the business. Most institutions follow the logic of business priority when promoting the construction of information technology, and filing needs are often postponed until the system is completed. Moving the filing requirements forward means clarifying the archiving scope, metadata standards and interface specifications at the business system planning and design stage, instead of making up for them after the fact.

Intelligent archiving agents need to be embedded in the business process from the beginning, instead of waiting passively at the end. Judging from the existing practices, the units that take archiving needs into account in the system construction stage will face obviously less resistance when promoting intelligent archiving in the future.

The front-end is the source of archiving quality. The operation of business personnel directly affects the archiving results. No matter how strong the intelligence is, it cannot replace human control of document quality. Another focus of the organizational path is to establish a front-end constraint mechanism.

Some institutions try to cover the front-end units through platformization, so that the system can automatically complete the classification and identification in the document formation link, transform institutional constraints into technical constraints, and replace human flexibility with system rigidity. This approach is more effective than relying solely on training, and also puts forward higher requirements for the coordination between the archives department and other departments.

After the system automatically completes the classification and identification in the document formation link, the routine operation process of the business personnel has not changed, but the system has completed the work that originally

required manual judgement in the background. The operation link does not become longer, but the results are automatically generated.

From the perspective of the technical acceptance model, this design acts in two dimensions at the same time: business personnel can follow the original operating habits without additional learning, satisfying perceived ease of use; automatic verification intercepts document quality problems caused by negligence, and the documents handed over are checked at the source, and the perceived usefulness is also supported.

4.3 Environmental Pathway: from Legal Recognition to Industry Implementation

The Archives Law of the People's Republic of China has confirmed the legal validity of electronic files, but there is still a distance from legal confirmation to implementation within the industry. When it comes to the environmental path, the core problem to be solved is how to transform the recognition at the legal level into operable norms at the industry level.

Industry norms lag behind the development of technology, and different institutions operate independently in exploration. From the metadata scheme to the judgement record format and audit trail retention methods, there is a lack of unified rules.

However, in practice, the technical plans and management processes formed by some institutions in the pilot can serve as a basis for the formulation of industry standards. While standardizing follow-up, the implementation of legal validity also needs the support of cross-institutional mutual recognition mechanisms.

Although the Archives Law confirms the effectiveness of electronic files at the legal level, in actual business transactions, if external institutions do not recognize the effectiveness of electronic documents, institutions still need to produce paper versions for retention. This asymmetry weakens the willingness of the organizations to promote automation.

The deeper problem is that when there is a deviation in the archiving judgement of the intelligent archiving system, the responsibility belongs to the developer, the deployer or the auditor. At present, there is no clear statement. It is recommended to add a special clause of 'defining rights and responsibilities' to the industry standard, and clearly take 'whoever

audits shall be responsible' as the basic principle. That is, intelligent archiving agents bear the technical responsibility of auxiliary judgement, the auditor bears the professional responsibility of credit judgement, and the deployment agency assumes the management responsibility of system operation.

5. Conclusion

The practice of single-set system archiving of electronic documents shows that the archiving link is changing from manual operation to human-computer collaboration. The feasibility at the technical level has been preliminarily verified, but whether intelligent archiving agents can really embed themselves in the business process depends on whether the organization can accept them and whether the environment can tolerate them. From the three levels of technology, organization and environment, only when technology is feasible can the organization have the confidence to promote it; only when the organization is coordinated can technology be effective; only when the environment offers institutional recognition can the investment be guaranteed by the system. Archiving is no longer a 'receiving' action, but a construction process of the evidentiary value of electronic records completed in human-computer collaboration.

Starting from the TOE framework, this paper makes a structural analysis of the application dilemma and realization path of intelligent archiving agents. The effectiveness of this analysis lies in revealing common problems, but the obstacles faced by different industries and institutions of different sizes in the specific implementation have their own emphases, and the differentiated path needs to be further explored. On this basis, how to further improve the interpretability of intelligent agents' judgement and make archivists move from 'not daring to use' to 'being rest assured' is also a proposition that needs to be continuously responded to in practice. However, regardless of the differences, the core value of the archiving intelligence is not to replace human judgement, but to automate repetitive labour and make rule judgements explicit. In this context, technology is just a means. The real challenge lies in whether the organization is willing to change and whether the environment can support such a change.

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