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DESIGN OF A DIGITAL CORRESPONDENCE AND DISPOSITION SYSTEM WITH INTEGRATED DIGITAL SIGNATURE

Kadek Rolavito Andrianto Putra[-1], Ajeng Hidayati[-2]

Informatics
Faculty of Defense Engineering and Technology
Indonesia Defense University
rolavito1234@gmail.com[-1], kadek.putra@tm.idu.ac.id [-1], ajeng.hidayati@idu.ac.id[-2]

Abstract

The administrative workflow at the Army Communication and Electronics Center (PUSKOMLEKAD) faces significant challenges due to its reliance on manual, paper-based correspondence processes. This manual system causes operational inefficiencies, difficulties in real-time disposition tracking, and critical workflow bottlenecks, particularly the dependency on the physical presence of leadership for signatures. Data for this study were collected through direct observation of the manual administrative workflow and interviews with personnel regarding user requirements. The research method used is Research and Development (R&D), applying the Rapid Application Development (RAD) model for the system's lifecycle using the PHP Laravel framework and MySQL database. The research resulted in a functional prototype that features an integrated digital archive, a multi-level disposition system for real-time tracking, and a secure PIN-based digital signature. In conclusion, the integration of digital signatures effectively solves the primary bottleneck by eliminating the need for physical presence, thus significantly enhancing operational efficiency, transparency, and accountability at PUSKOMLEKAD.

Keywords: Digital Disposition; Digital Signature; E-Government; Rapid Application Development; Digital Archive

Abstrak

Alur kerja administrasi di Pusat Komunikasi dan Elektronika Angkatan Darat (PUSKOMLEKAD) menghadapi tantangan signifikan karena ketergantungan pada proses surat-menyurat manual berbasis kertas. Sistem manual ini menyebabkan inefisiensi operasional, kesulitan dalam pelacakan status disposisi secara real-time, dan hambatan alur kerja kritis, terutama ketergantungan pada kehadiran fisik pimpinan untuk tanda tangan. Data penelitian dikumpulkan melalui observasi langsung terhadap alur kerja administrasi manual dan wawancara dengan personel terkait kebutuhan pengguna. Metode penelitian yang digunakan adalah Research and Development (R&D), dengan menerapkan model Rapid Application Development (RAD) untuk siklus hidup sistem menggunakan framework PHP Laravel dan database MySQL. Penelitian ini menghasilkan sebuah prototipe fungsional yang memiliki fitur arsip digital terintegrasi, sistem disposisi berjenjang untuk pelacakan real-time, serta tanda tangan digital berbasis PIN yang aman. Sebagai kesimpulan, integrasi tanda tangan digital ini secara efektif memecahkan hambatan utama dengan menghilangkan keharusan kehadiran fisik, sehingga secara signifikan meningkatkan efisiensi operasional, transparansi, dan akuntabilitas di PUSKOMLEKAD.

Kata kunci: Disposisi Digital; Tanda Tangan Digital; E-Government; Rapid Application Development; Arsip Digital

INTRODUCTION

Digital transformation in the public administration sector, or e-government, has become a strategic imperative to improve the efficiency and effectiveness of service delivery (Dowa & Nallien, 2022). The implementation of electronic office systems (e-office) is a fundamental component of this transformation, aiming to reduce reliance on manual, paper-based processes, accelerate workflows, and minimize operational costs(Lasmini et al., 2023). In the context of a strategic military organization like the Indonesian

Army, speed, security, and accuracy in internal communication flows are crucial.

An analysis of the current system at PUSKOMLEKAD identified significant challenges in the management of administrative and technical documents. The current system remains manual, with paper-based processes for receiving letters, creating disposition sheets, and following up. This process presents several critical problems: (1) Time inefficiency due to the circulation of physical documents; (2) Difficulty in tracking disposition status in real time, due to the lack of a centralized monitoring system(Afriansyah & Pratama, 2023); (3) Archive security risks, such as loss or damage to physical documents "stored in various work unit rooms"; and (4) Significant workflow bottlenecks, where "the disposition signature process, which requires the physical presence of the Head," can delay responses to important correspondence.

The persistence of these manual bottlenecks creates a critical operational vulnerability. In a high-stakes environment like PUSKOMLEKAD, delays in processing dispositions due to the leadership's physical absence can hinder rapid decision-making and compromise operational readiness. Therefore, transitioning to a digital system is not merely a modernization effort but an urgent requirement to ensure organizational agility and responsiveness.

In response to these challenges, this study proposes the design and development of a web-based internal digital correspondence and disposition information system. Previous research has demonstrated the effectiveness of web-based correspondence management systems in increasing efficiency and transparency (Dres & Rabut, 2025; Rhomadhoan et al., 2024). Additionally, studies on integrated archive systems have shown improvements in document retrieval speed (Pamungkas & Rahardja, 2025; Sari et al., 2022; Setiadi et al., 2025).

However, a significant research gap remains in the existing literature. Most developed systems focus primarily on digitizing the document flow and storage (e-archives) but often overlook the integration of secure authentication mechanisms within the hierarchical disposition process itself. Few studies have addressed how to legally and technically validate dispositions without physical signatures while maintaining a multi-level command structure.

To bridge this gap, the main distinguishing feature and core innovation of the proposed system is the integration of digital signatures directly into the disposition workflow. Authentication, legal validity, and non-repudiation are essential in government administration. Implementing digital signatures is a crucial component of modern e-government, not only securing document integrity but also providing legal validity as stipulated by national regulations (Izzah & Sugandha, 2021). This research fills the identified gap by developing a system that combines a multi-level disposition mechanism with PIN-based digital signatures. This system is designed to provide a secure technical framework for electronic authentication, addressing the legal and security challenges often encountered in the adoption of electronic signatures by public officials (Dowa & Nallien, 2022).

Based on this background, this research aims to: (1) Develop a user-friendly and efficient web-based application for internal digital correspondence and disposition to accelerate the administrative workflow at PUSKOMLEKAD; (2) Implement digital signature technology to provide security, authenticity, and legal validity for every document processed; and (3) Creating a centralized and integrated digital archiving system to facilitate the management and retrieval of correspondence documents and their disposition.

RESEARCH METHODS

Types of research

This study uses a Research and Development (R&D) approach. This approach was chosen because the main objective of the study is "Design and Build," namely to produce specific technological artifacts (application software) designed to solve practical problems in the PUSKOMLEKAD environment. This R&D approach is consistent with similar studies in the development of information systems and e-archives, where the focus is on the design, implementation, and evaluation of new technological solutions (Pamungkas & Rahardja, 2025; Setiadi et al., 2025).

Time and Place of Research

Data collection, needs analysis, design, and system development were conducted at the case study site, the Army Communications and Electronics Center (PUSKOMLEKAD). The research activities took place within a structured timeframe, starting from August 4, 2025, to October 31, 2025.

Research Target / Subject

The subject of the research is the existing administrative business process at PUSKOMLEKAD,

particularly those related to the incoming mail workflow and manual management disposition procedures. The target (potential users) of the developed system include personnel at various levels of the organizational hierarchy, which in this system are categorized into functional roles: Admin, TU Staff, Head of TU Section, Leader (Head of Center/Deputy Head of Center), Superior (Head of Section/Head of Subsection), and Executive Staff.

Procedure

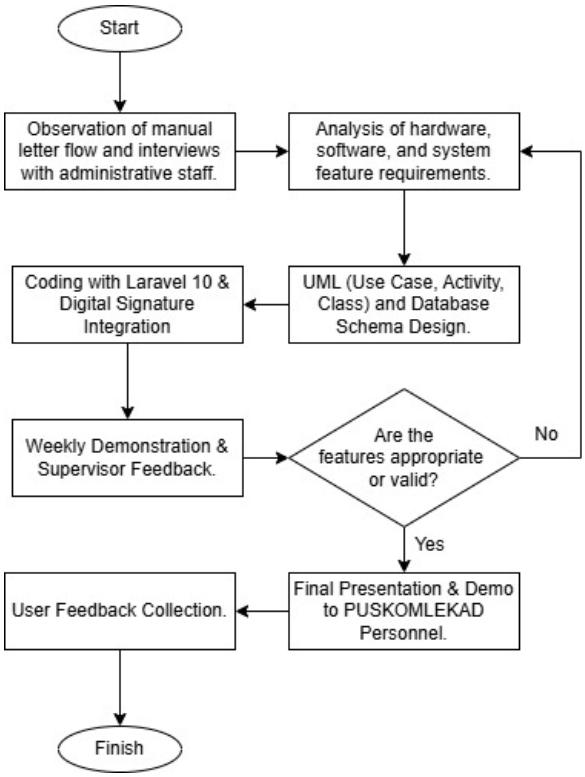

Figure 1. Research Flowchart

The research procedure adopts the Rapid Application Development (RAD) methodology to ensure efficient system delivery within the limited timeframe. The complete research flow, consisting of three main phases, is illustrated in Figure 1.

1. **Requirements Planning:** This initial phase focuses on analyzing the existing system through direct observation of the manual correspondence workflow and consultations with the Administration Unit (TU) at PUSKOMLEKAD. The primary objective is to identify critical bottlenecks, map the user hierarchy, and define the specific hardware and software requirements needed for the digital transition.
2. **RAD Design Workshop:** This phase involves an iterative cycle of design and construction. Key activities include designing the database schema, modeling Unified Modeling Language (UML) diagrams (Use Case, Activity, and Class Diagrams), and coding the application using the Laravel 10 framework. Critical features, such as the PIN-based digital signature and multi-level disposition logic, are developed and refined during this stage based on weekly progress demonstrations and feedback from supervisors.
3. **Implementation:** The final phase concludes with the presentation of the functional prototype to PUSKOMLEKAD stakeholders. This session demonstrates the end-to-end workflow—from incoming mail entry to disposition completion—to validate system functionality and gather final user feedback for future development.

Data, Instruments, and Data Collection Techniques

Primary data was collected through two main techniques: (1) Observation, by directly observing the manual process of managing letters and dispositions in progress (the current system); and (2) Unstructured interviews and consultations with key personnel, including TU staff and field supervisors, to confirm the workflow and user needs. The secondary instrument used was Document Analysis, which involved reviewing internal documents such as existing disposition sheet formats, letter diary books, and PUSKOMLEKAD organizational structure charts.

Data analysis technique

Data analysis was conducted qualitatively and comparatively. The functional requirements analysis of the system was obtained by comparing the findings from the Existing System Analysis (which identified problems and weaknesses) with the Proposed System Analysis (which defined solutions). The gaps between the two became the basis for designing system features. To visualize the architecture, processes, and data structures of the proposed system, the Unified Modeling Language (UML) modeling technique was used, which included the design of Use Case Diagrams, Activity Diagrams, and Class Diagrams.

RESULTS AND DISCUSSION

This digital correspondence and disposition application system was developed as a

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web-based application running on the PUSKOMLEKAD intranet. The system was built using the PHP Laravel 10 framework, a MySQL/MariaDB relational database (Silalahi, 2022b), and the XAMPP web server. The system architecture follows a standard client-server pattern, with users accessing the application through a browser (e.g., Google Chrome).

System Architecture and Design (UML)

The system design is modeled using UML to ensure the application's structure and logical flow align with functional requirements.

The Use Case Diagram defines five main actors with distinct functionalities. Admins manage master data (users and units). Administrative staff are responsible for inputting new incoming mail. Administrative Heads review and validate incoming mail. Leaders (Head of Center/Deputy Head of Center) have the authority to create initial dispositions and perform digital signatures. Superiors (Head of Section/Head of Subsection) and staff are responsible for receiving, forwarding (advanced dispositions), and finalizing dispositions (Ramadhan et al., 2023).

Figure 2 Use Case Diagram

The Class Diagram details the data structure and relationships between entities. Key entities include User, Role, Unit, Incoming Mail, Disposition, and Digital Signature. A crucial database design lies in the Disposition entity, which has a self-join (one-to-many) relationship through the parent_disposition_id attribute. This design technically enables the implementation of a "cascading" or multi-level disposition feature, where one disposition can have multiple "child" dispositions, accurately reflecting the hierarchical command flow in PUSKOMLEKAD.

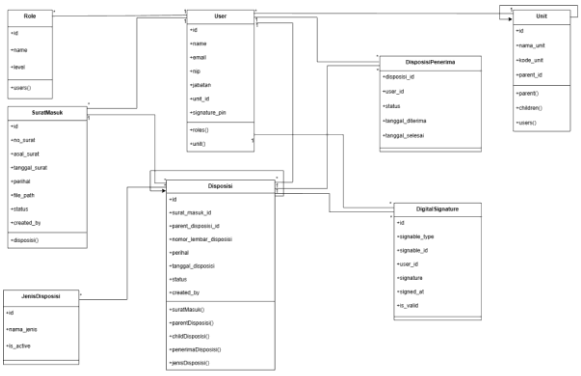

Figure 3. Digital Disposition Class Diagram

To summarize the complex workflow and Role-Based Access Control (RBAC) illustrated in the 19 Activity Diagrams, Table 1 presents a role-based function matrix of the proposed system.

Tabel 1 Role-Based Access Control Function Matrix

Role	User/Unit Management	Input Incoming Mail	Review Letters	Create Initial Dispositions	Digital Signature	Create Advance Disposition	Finish Disposition
Admin	✓	✓		✓			
Staf TU		✓					
Kabag TU			✓				
Leader				✓	✓		
Supervisor					✓	✓	✓
Staf							✓

Implementation Results and Discussion

The implementation of this research resulted in a functional web-based application system whose features directly address the issues identified in the current system analysis.

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Digital Correspondence and Archive Management

Results: The system provides a module for Administrative Staff to input incoming mail data, including the letter number, origin, subject, and upload scans of attached documents. The Head of Administrative Staff can then digitally review and approve the letter to be forwarded to the Management. All letter and attachment data is stored in a centralized database and can be accessed via the "View Incoming Mail" page.

Discussion: This feature directly digitizes the previous process of recording agenda books and physical distribution. By creating a centralized and integrated digital repository, this system effectively solves the problem of physical archives being "stored in various work unit rooms" and "prone to administrative errors." This aligns with best practices in web-based file management systems (Dres & Rabut, 2025) and the implementation of e-archives in government environments (Pamungkas & Rahardja, 2025; Sari et al., 2022; Setiadi et al., 2025), which have been shown to significantly improve data security, efficiency, and document retrieval speed.

Multi-Level Digital Disposition Workflow

Results: The disposition workflow is a core feature of this system. After a letter is reviewed by the Head of Administration, the Manager can "Create Disposition Sheet," select a recipient, and issue instructions. The recipient of the disposition (e.g., a superior) can then view the "Incoming Disposition" and take one of three actions: (1) Accept the disposition, (2) Complete the disposition (if the task is for them), or (3) Issue an "Advanced Disposition" to their subordinate staff. The system automatically records each step in the disposition timeline.

Discussion: The "Advanced Disposition" feature is a key innovation of this research. It is a technical solution to the biggest problem in the manual system: "difficulty tracking progress." In the manual system, tracking is interrupted once the document is submitted. In the proposed system, each advanced disposition is linked to its parent disposition (using the parent_disposition_id relationship discussed in the Class Diagram). This creates a complete and unbroken digital audit trail from top management to implementing staff. The “Disposition Details” page serves as a real-time tracking panel, allowing management to directly monitor which dispositions are pending, accepted, forwarded, or completed (Simanullang et al., 2024).

Integrated Digital Signature

Results: To ensure authentication and validity, every disposition (both initial and subsequent) is secured using a digital signature feature. The implementation requires authorized users (Leaders and Supervisors) to first set a secret 6-digit PIN. When saving a draft disposition, the system prompts the user to enter this PIN to authenticate and digitally "sign" the document, which then locks the disposition from further editing.

Discussion: This is a direct solution to the biggest workflow bottleneck identified in the manual system: "the disposition signature process requires the physical presence of the Leader or Supervisor." If the official is on duty outside, the manual workflow will be disrupted. With PIN-based digital signatures, approvals can be granted anytime and anywhere as long as there is access to the intranet, drastically eliminating this bottleneck. This implementation, although internal, provides three pillars of information security: Confidentiality (confidentiality via PIN), Integrity (data integrity due to document locking after signing), and Authentication (user authentication) (Silalahi, 2022a). This implementation is highly relevant in the broader e-government context (Dowa & Nallien, 2022; Izzah & Sugandha, 2021), as it provides a practical technical framework to address the legal and security challenges in the adoption of electronic signatures by public officials within an organization (Izzah & Sugandha, 2021).

The implementation results of the main user interface, summarizing the core workflow, are presented in Figure 4 Dashboard Page, Figure 5 Create Dispositon Page, Figure 6 View Detail Disposition Page, Figure 7 Create Advance Disposition Page, and Figure 8 Mail Tracking & Disposition History Page.

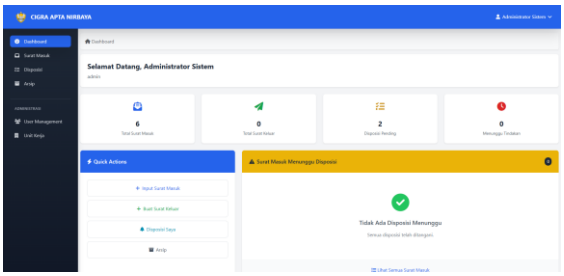

Figure 4. Dashboard Page

The dashboard serves as the central information hub for users, displaying key statistics such as the total count of incoming mail, pending dispositions, and real-time notifications. The

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content is dynamic and role-based; for instance, administrators view system-wide statistics, while leaders see items requiring immediate action. It features quick action buttons for core modules and a navigation bar with real-time alert icons to ensure efficient workflow monitoring.

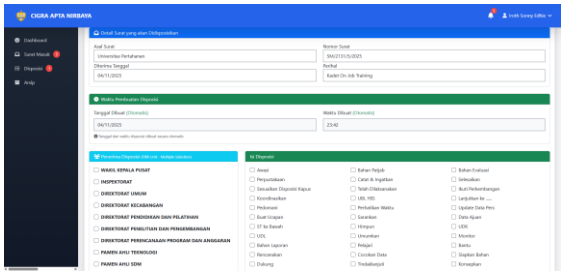

Figure 5. Create Disposition

This interface allows the Leadership (Head/Deputy Head) to initiate the disposition process. The form includes a preview of the related letter, fields for the disposition number and subject, and a multi-selection area for recipients (individuals or units) and instruction checklists. To ensure security, the system triggers a PIN-based digital signature verification modal immediately after the user saves the draft, authenticating the document before it is distributed.

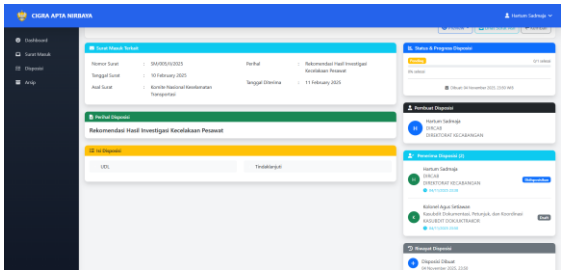

Figure 6. View Detail Disposition

This page provides a comprehensive view of a specific disposition's lifecycle, acting as a real-time tracking panel. It displays the original letter metadata, the creator's details, and a status table for all recipients, utilizing color-coded badges to indicate progress (e.g., pending, accepted, or completed). The interface also presents action buttons tailored to the user's role—such as "Sign" for creators or "Accept" for recipients—and visualizes the activity history to establish a clear digital audit trail.

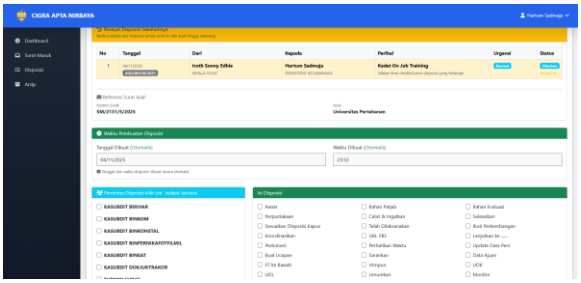

Figure 7. Create Advanced Disposition Page

This interface facilitates the multi-level disposition logic, allowing a superior to forward instructions to their subordinates. The form displays a summary of the "parent" disposition for reference and restricts recipient selection to direct subordinates based on the organizational hierarchy. Upon submission, the system generates a "child" disposition linked to the parent ID, effectively extending the disposition tree and maintaining a structured chain of command within the digital archive

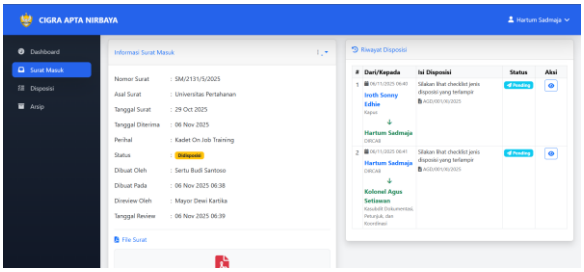

Figure 8. Mail Tracking & Disposition History Page

This page addresses the issue of disposition tracking by serving as a real-time monitoring panel. It visualizes the complete "audit trail" of a letter, displaying the hierarchical chain of dispositions (from parent to child instructions) and a timeline of activities. The interface highlights the current status of each recipient (e.g., pending, delivered, or completed), ensuring transparency and allowing leadership to trace the document's flow instantly without manual checks.

CONCLUSIONS AND SUGGESTIONS

Conclusion

This research has successfully designed and built a functional web-based digital correspondence and disposition system prototype using the Rapid Application Development (RAD) methodology within the PUSKOMLEKAD environment. The proposed system effectively addresses the efficiency, transparency, and

accountability challenges inherent in the current manual administration system. By providing centralized digital incoming mail management, the system solves the inefficient and risky physical filing problem. The implemented core features, namely a multi-level disposition flow and the integration of PIN-based digital signatures, have proven successful in addressing two key issues: (1) the inability to track disposition status in real time, and (2) the workflow's reliance on the physical presence of officials for signature authentication. This system creates a transparent digital audit trail and allows the administration and disposition process to continue without geographical or time constraints, significantly increasing the potential for operational efficiency at PUSKOMLEKAD.

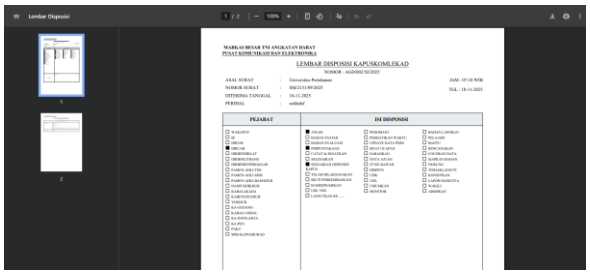

Figure 9. Generated Digital Disposition Sheet Output

To visualize the tangible result of the developed system, Figure 9 presents the final output in the form of a Digital Disposition Sheet. This document is automatically generated after the completion of the disposition process. It serves as concrete evidence of the system's ability to produce legally valid administrative documents by embedding the PIN-based digital signature and a comprehensive audit trail directly into the file. This output confirms that the system successfully eliminates the dependency on wet signatures and physical paper handling, thereby achieving the primary research objective of operational efficiency and accountability.

The implemented core features, namely a multi-level disposition flow and the integration of PIN-based digital signatures, have proven successful in addressing two key issues: (1) the inability to track disposition status in real time, and (2) the workflow's reliance on the physical presence of officials for signature authentication. This system creates a transparent digital audit trail and allows the administration and disposition process to continue without geographical or time constraints, significantly increasing the potential for operational efficiency at PUSKOMLEKAD.

Suggestion

Based on the findings of the research and system development, two categories of suggestions are proposed:

Suggestions for the Organization (PUSKOMLEKAD):

1. It is strongly recommended to conduct formal and comprehensive User Acceptance Testing (UAT) involving representatives from each user role (Admin, TU, Leaders, Supervisors, Staff) to test the system in real-world scenarios before full implementation.

2. Conduct gradual system training and socialization to all potential users, tailored to their roles and responsibilities within the system.

3. Develop clear and legally binding internal Standard Operating Procedures (SOPs) for the use of the e-mail system and the validity of PIN-based digital signatures. (Pusat Komunikasi dan Elektronika Angkatan Darat, 2020)

Suggestions for Further System Development:

1. Add an "Outgoing Mail" module to complete the organization's mail management cycle, allowing the system to manage incoming and outgoing correspondence in an integrated manner.

2. Develop a mobile application or Progressive Web App (PWA), specifically for Leaders and Supervisors, to increase mobility in granting approvals and dispositions.

3. Enhanced dashboard features with more advanced analytics to monitor workflow Key Performance Indicators (KPIs), such as average disposition completion time per work unit, to support managerial decision making.

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