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Integration and Implementation of the Kanban Method in Digital Projects for Enhancing Time Efficiency

A Case Study on the Procurement of AI-Based Forensic Device Communication in a Government Security Agency

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ABSTRACT

The management of digital projects involving both physical infrastructure and artificial intelligence technology in government procurement environments presents significant challenges due to rigid sequential workflows and strict regulatory requirements. This research examines the integration and implementation of the Kanban method in a digital project for the procurement of an AI-based Forensic Device Communication system within a government security agency, with the objective of enhancing time efficiency in project execution. An intrinsic case study approach was employed to compare the conventional 92-day linear project model with the Kanban-based execution model. Data were collected through participant observation, document analysis, and structured field documentation across 33 strategic installation locations. The Kanban system was implemented using a digital board with six workflow columns and Work-In-Progress limits to manage parallel task execution. Source triangulation through digital Kanban records, official completion reports, and field observations ensured data validity. The Kanban method reduced project duration from 92 days to 49 calendar days, achieving a 46% improvement in time efficiency. The pull system approach and transparent task visualization enabled early identification of administrative bottlenecks, including licensing delays and inter-team coordination issues, without compromising the technical quality of 22 new AI-based CCTV units integrated with 11 existing units. These findings demonstrate that agile visual management methodologies can be effectively adapted to complex government procurement projects while maintaining regulatory compliance. This study provides an empirical model for integrating Kanban within public sector frameworks. Future research may extend this model to multi-agency procurement contexts.

Keywords: *Artificial Intelligence; Forensic Communication; Project Integration; Project Management; Kanban Method*

ABSTRAK

Pengelolaan proyek digital yang melibatkan infrastruktur fisik dan teknologi kecerdasan buatan dalam lingkungan pengadaan pemerintah menghadapi tantangan signifikan akibat alur kerja sekuensial yang kaku dan regulasi yang ketat. Penelitian ini mengkaji integrasi dan implementasi metode Kanban dalam proyek digital pengadaan sistem Forensic Device Communication berbasis AI di sebuah instansi keamanan pemerintah, dengan tujuan meningkatkan efisiensi waktu pelaksanaan proyek. Pendekatan studi kasus intrinsik digunakan untuk membandingkan model proyek linear konvensional 92 hari dengan model eksekusi berbasis Kanban. Data dikumpulkan melalui observasi partisipan, analisis dokumen, dan dokumentasi lapangan terstruktur di 33 lokasi instalasi strategis. Sistem Kanban diimplementasikan menggunakan papan digital dengan enam kolom alur kerja dan pembatasan Work-In-Progress untuk mengelola eksekusi tugas secara paralel. Triangulasi sumber melalui catatan Kanban digital, laporan penyelesaian resmi, dan observasi lapangan memastikan validitas data. Metode Kanban mengurangi durasi proyek dari 92 hari menjadi 49 hari kalender, mencapai peningkatan efisiensi waktu sebesar 46%. Pendekatan pull system dan visualisasi tugas yang transparan memungkinkan identifikasi dini hambatan administratif, termasuk keterlambatan perizinan dan masalah koordinasi antar-tim, tanpa mengorbankan kualitas teknis 22-unit CCTV berbasis AI baru yang

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diintegrasikan dengan 11-unit eksisting. Temuan ini menunjukkan bahwa metodologi manajemen visual agile dapat diadaptasi secara efektif untuk proyek pengadaan pemerintah yang kompleks dengan tetap mematuhi regulasi. Penelitian ini menyediakan model empiris untuk mengintegrasikan Kanban dalam kerangka sektor publik. Penelitian selanjutnya dapat memperluas model ini ke konteks pengadaan multi-instansi.
Keywords: *Kecerdasan Buatan; Komunikasi Forensik; Integrasi Proyek; Manajemen Proyek; Metode Kanban*

INTRODUCTION

1.1 Research Background

The global acceleration of digital transformation has fundamentally reshaped the project management landscape, particularly within strategic technology sectors that demand high operational efficiency. Contemporary digital projects are characterized by significant complexity, multi-layered system integration, and evolving technical uncertainties. Conventional management approaches, which are often linear and rigid, are increasingly viewed as inadequate for addressing rapidly changing requirements. Consequently, organizations require a new, more flexible, and adaptive paradigm to manage every phase of the work effectively (Kerzner, 2022).

In response to these challenges, various responsive and iterative project management methodologies have been widely adopted by information technology practitioners. The successful implementation of flexible methods in project management has been demonstrated through quantitative analysis, showing a positive correlation between methodological agility and the success rates of complex projects (Damij & Damij, 2024). One prominent method is Kanban, which emphasizes workflow visualization and limiting Work-In-Progress (WIP). Through strong principles of transparency, the Kanban method enables teams to manage work capacity more equitably, minimize waiting times, and enhance responsiveness to sudden changes occurring in the field (Villanueva et al., 2025).

The implementation of this visual management method is highly relevant in managing digital projects that involve high-technology integration, such as the procurement of forensic communication devices. These projects encompass not only the provision of physical infrastructure but also involve the coordination of complex digital systems and compliance with stringent data security standards. The unique characteristics of forensic technology demand precise synchronization between technical planning, field execution, and outcome evaluation to ensure that strategic objectives are achieved without disruption (Fuentes-Del-Burgo et al., 2024). Forensic device procurement projects carry a high risk of administrative and technical delays that can impede legal investigation processes, necessitating a visual management system such as Kanban to ensure every stage is completed under strict security standards.

The utilization of Kanban boards in digital project execution provides a strategic advantage for coordination among involved teams. By visually mapping every activity stage from inception to completion, all stakeholders can monitor progress status in real time. This facilitates early identification of technical constraints or bottlenecks that could potentially disrupt the project completion schedule. The clarity of information generated by the Kanban system fosters a more transparent work culture and enhances the accountability of every team member (Pedó et al., 2022).

The significance of implementing this method also lies in its ability to optimize human resource allocation and reduce operational costs by eliminating non-value-added activities. In a competitive digital project ecosystem, the speed of delivering results or time to delivery without compromising quality is a primary key to success. This study on the integration of Kanban within the forensic device communication procurement project is expected to provide empirical evidence regarding the efficacy of visual management in enhancing the quality of system output (Marnewick & Marnewick, 2022)

Therefore, this study aims to examine in depth the integration and implementation of the Kanban method within the scope of digital project management, specifically in terms of execution time efficiency. Through a case study on the Forensic Device Communication procurement project, this research explores how lean management principles can be applied to overcome emerging technical and administrative complexities. The results of this study are expected to serve as a reference in designing project management models that are adaptive and responsive to the demands of digital transformation (Toorajipour et al., 2021). Recent studies have demonstrated that the implementation of digital systems can significantly improve operational efficiency across various sectors, including a 35% increase in healthcare service efficiency through electronic medical record implementation (Cahyaningrum et al., 2025). The use of adaptive project management is crucial in fostering digital product innovations that remain relevant to dynamic market demands (Wysocki, 2019).

1.2 State of Art

Research on the implementation of the Kanban method has been extensively documented in project management literature; however, most studies remain focused on pure software development. Research conducted by (Dahule, 2023) explains that Kanban exerts a strategic impact on enhancing data analysis efficiency in information-dense environments by mitigating bottlenecks through process visualization. That study demonstrates that integrating project management principles with the Kanban methodology can optimize project execution within complex digital ecosystems. Nevertheless, the primary focus of that research remains within the technical realm of data processing and has not yet addressed the physical infrastructure procurement aspects that support such systems.

In the broader context of digital systems (Ungern-Sternberg & Merz, 2023), explores design guidelines for digital Kanban systems integrated with Enterprise Resource Planning (ERP). This research highlights the challenges of aligning digital representations with physical inventory levels, particularly in complex multi-stage systems. These findings align with (Toorajipour et al., 2021), whose research states that the procurement process for digital products and services within organizations is significantly influenced by the readiness of the management systems in use. However, both studies place greater emphasis on manufacturing operations and inventory monitoring rather than the procurement life cycle of high-technology projects in the public sector.

The application of lean management principles in public sector procurement has also gained attention from researchers. A study by (Xinxin et al., 2025) examines the potential for increasing public procurement efficiency through the use of lean tools and techniques to eliminate waste. This study emphasizes that transparency in the procurement process is key to achieving accountability within government institutions. While providing a strong theoretical foundation regarding administrative efficiency, the research does not specifically discuss how visual methods such as Kanban can be applied to security device procurement projects involving the integration of artificial intelligence (AI) technology. Although lean concepts have been extensively reviewed in various international journal articles, their application to forensic technology procurement in the public sector still requires further exploration (Toorajipour et al., 2021; Ugwumba, 2025).

The expansion of Kanban usage beyond the software industry is also beginning to emerge in infrastructure and construction project management. Research conducted by (Fuentes-Del-Burgo et al., 2024) reports that applying Kanban as a visual tool in construction projects has proven effective for managing workflows and reducing work variability. Research by (Pedó et al., 2022) further demonstrated that digital visual management tools effectively support coordination in infrastructure engineering design by enhancing transparency across distributed teams. Research by (Reinbold et al., 2022) identified key challenges in adopting digital visual management at construction sites, including technological readiness and user acceptance, providing important contextual considerations for the present study. However, current literature still indicates a significant research gap regarding the application of Kanban to hybrid projects, specifically those combining the procurement of specialized telecommunications hardware with the iterative implementation of AI algorithms.

The novelty of this research lies in the integration of the Kanban method within the procurement project cycle of AI-based Forensic Device Communication in a government agency environment. Unlike previous studies that tend to separate administrative procurement management from technical management, this research presents a model that unifies both into a single visual workflow. The primary focus of this study is to explore how Work-In-Progress (WIP) limits can be applied to balance the workload between the procurement team and the forensic technical team. Consequently, this research provides a unique contribution in the form of an adaptive digital project management model for organizations managing high-level cybersecurity technology. A project management approach that combines traditional, agile, and hybrid methods serves as an effective solution for addressing the challenges of multi-layered digital infrastructure integration (Wysocki, 2019).

LITERATURE REVIEW

2.1 Kanban Methodology in Digital Project Management

The Kanban method has evolved into a fundamental instrument in modern digital project management due to its ability to dynamically visualize workflows. Rooted in lean thinking principles originally applied in the manufacturing industry, Kanban is now widely adopted in the technology sector to manage high levels of uncertainty. The primary principle of this method lies in incremental evolution rather than drastic change, allowing teams to adapt without disrupting existing operational stability (Damij & Damij, 2024).

Visualization through task boards is a crucial element that distinguishes Kanban from traditional methods. By dividing work into clear activity columns, every team member can understand task status in real time. The application of Work-In-Progress (WIP) limits serves as a quality control mechanism that prevents individual workload overload. Through the implementation of Kanban, teams can practically visualize the entire work process, which facilitates the identification of waste and accelerates task flow (Villanueva et al., 2025). This directly reduces task backlogs and streamlines the workflow from the planning stage to completion (Fuentes-Del-Burgo et al., 2024).

The flexibility offered by Kanban is highly relevant for digital projects that frequently experience changing requirements mid-course. Unlike the rigid waterfall approach, Kanban allows task priorities to be adjusted at any time based on feedback or emerging technical constraints. This advantage provides significant time efficiency, as teams can focus on completing tasks that provide the greatest added value to the overall success of the project (Reinbold et al., 2022).

Beyond technical aspects, the implementation of Kanban also has a positive impact on team psychology and coordination. The transparency created through task board visualization fosters personal accountability and closer collaboration between departments. Implementing a Kanban-based management system in software development has been proven to improve workflow organization and cross-departmental coordination transparency (Ilmi et al., 2020). Project managers can identify bottlenecks more quickly and perform targeted interventions. Thus, this method not only optimizes the mechanical processes of work but also builds a more responsive work environment (Kerzner, 2022).

2.2 Integration of Digital Technology in Forensic Device Communication Procurement Projects

High-level digital technology integration, particularly through the use of artificial intelligence, has revolutionized operational standards in the procurement of security and forensic devices. The use of intelligent algorithms allows devices to perform autonomous data analysis and provide more accurate results compared to manual monitoring methods. This transformation necessitates a management framework capable of aligning static hardware requirements with dynamic software development (Toorajipour et al., 2021).

In the context of forensic communication devices, the presence of video analytics such as facial recognition and object classification becomes a vital component for early detection systems. The utilization of artificial intelligence technology in these systems refers to modern standards that prioritize intelligent computational approaches to solve complex problems (Russell & Norvig, 2020). The integration of these systems demands a high level of reliability because the generated data is frequently used in legal investigation processes. Therefore, every stage of development and implementation must follow strict security standards to ensure that data integrity remains preserved. The synergy between sensor devices and artificial intelligence creates a more robust security ecosystem (Ugwumba, 2025).

However, the technical complexity in the procurement of advanced technology often faces challenges during the commissioning and network integration stages. The use of artificial neural networks in image processing systems requires precise optimization of computational resources so that system performance remains stable under various environmental conditions. This indicates that the success of a digital project depends not only on the sophistication of the technology itself, but also on how that technology is configured to suit the available infrastructure (Dastres & Soori, 2021).

The optimization of the procurement process for digital technology based forensic devices also requires the elimination of wasteful activities through more efficient thinking. By reducing redundancy in the workflow and focusing resources on critical stages, organizations can achieve significant cost efficiencies. This value-added approach ensures that the final project results not only meet technical specifications but also provide solutions with a broad impact on public safety (Marnewick & Marnewick, 2022). The application of data-driven optimization frameworks has further shown that systematic approaches to resource allocation and process design can yield measurable improvements in both output quality and operational sustainability across engineering disciplines (Okechukwu et al., 2025).

RESEARCH METHODS

This research utilizes a descriptive qualitative approach aimed at providing a systematic and accurate overview of the facts and characteristics of a specific population or field. The selection of a qualitative approach is based on the need to understand managerial dynamics and the adaptation process of the Kanban method within a complex digital project environment. Through this approach, researchers can explore interactions between team members, the use of visual tools, and how technical constraints are managed in real time without relying solely on statistical data (Yin, 2018).

The research design applied is an intrinsic case study, where the primary focus is directed toward an in-depth understanding of a single entity or a specific project. In this context, the forensic communication device procurement project was selected because it possesses unique characteristics that combine physical infrastructure and artificial intelligence technology. The case study design allows the researcher to maintain the holistic characteristics of real-life events, such as project management cycles and organizational decision-making processes (Kerzner, 2022).

The research design framework is illustrated in Figure 1. The study follows a five-stage process that guides the overall investigation from initial assessment to final validation. The first stage involves Baseline Mapping, where the conventional project workflow is documented and existing bottlenecks are identified through analysis of the original 92-day project plan. The second stage covers Kanban Design and Configuration, which encompasses the setup of the digital Kanban board, definition of workflow columns corresponding to six project stages, and establishment of Work-In-Progress limits for each column. The third stage is Data Collection, conducted through three techniques: participant observation, document analysis, and structured field documentation across all 33 installation locations. The fourth stage involves Comparative Analysis, where the conventional baseline timeline is compared with the actual Kanban-based execution timeline to measure efficiency gains across each project phase. The fifth and final stage is Evaluation and

Validation, achieved through source triangulation that cross-references digital Kanban board records, official completion reports (Berita Acara), and direct field observations to ensure findings are grounded in empirical evidence rather than subjective interpretation. The implementation of digital systems for improving operational efficiency has been demonstrated across various sectors (Cahyaningrum et al., 2025), and this five-stage framework adapts that principle to the specific context of public sector technology procurement.

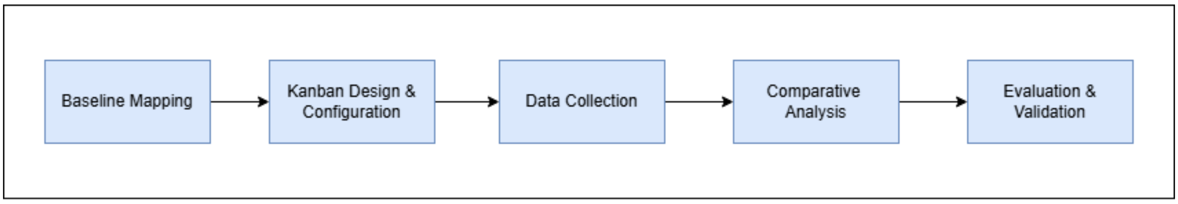

Figure 1. Digital Kanban Board as a Project Execution Guide

The research location is a government agency responsible for security fields, including intelligence and information, as well as digital and forensic investigations. The selection of this location is purposive because the agency is undergoing a transformation toward more agile work patterns to address evolving challenges, particularly in cybersecurity. The research subjects involve key stakeholders who play a crucial role in project success, with a total team of 21 people. This team includes project managers, technical teams consisting of engineers, and the procurement team managing vendor relationships, excluding the outsourced vendor teams.

The initial stage of the research begins by mapping the traditional work structures previously implemented before transitioning to the Kanban method. The researcher observes how work instructions were distributed and identifies communication bottlenecks that frequently occurred in the old or conventional models, such as the waterfall model. This is essential to provide a comparative foundation for analyzing the improvements generated after the visual management method is fully implemented within the project workflow (Kerzner, 2022).

Data collection was conducted through three primary techniques: (1) participant observation, wherein the research team was directly involved as project members throughout the entire project lifecycle, enabling first-hand documentation of workflow dynamics; (2) document analysis, encompassing project schedules, digital Kanban board logs, meeting minutes, and official procurement records; and (3) structured field documentation, including photographic evidence of each installation phase across all 33 locations.

Data validity was established through source triangulation, cross-referencing findings from the Kanban board records, official project completion reports (Berita Acara/BA), and direct field observations. The intrinsic nature of this case study ensures high contextual validity, as all data originates from the actual project environment without simulation or artificial conditions.

The observation period aligned with the actual project execution timeline of 49 calendar days under the Kanban model, with comparative baseline data drawn from the original 92-day conventional project plan documented in the initial procurement contract.

Finally, this methodological framework is structured to ensure that every finding possesses strong validity based on the field context. The research focus is not aimed at producing universal generalizations for all types of information technology projects, but rather to evaluate the practical efficacy of lean principles in future technology procurement projects. Consequently, this research design provides a deep understanding of how agile and flexible methodologies can adapt to strict administrative regulations in the public sector (Abdullah et al., 2023).

RESULTS AND DISCUSSION

This section presents the research findings derived from the implementation of the Kanban method throughout the Forensic Device Communication procurement project lifecycle. The analysis is organized into three interrelated dimensions. The first dimension examines the visualization of project workflow through the digital Kanban board and its role in facilitating real-time team coordination across 33 strategic locations. The second dimension analyzes the application and impact of Work-In-Progress limits in managing bottlenecks and maintaining construction quality during parallel execution of field activities. The third dimension presents the comparative efficiency analysis between the conventional 92-day linear model and the Kanban-based execution model that achieved project completion in 49 calendar days. Each dimension is examined through empirical evidence collected during the actual project execution period, supported by digital Kanban board records, official procurement documentation, and structured field observations. The discussion contextualizes these findings within the broader literature on agile project management, visual management in infrastructure projects, and lean principles applied to public sector procurement environments.

4.1 Workflow Visualization for the Procurement of Forensic Device Communication

This project involves the installation of 22 new AI-based CCTV units integrated with 11 existing units, forming an integrated security network across 33 strategic locations, featuring AI-based video analytics such as Face Recognition and

Vehicle Classification, which function as an early detection system. The workflow is divided into six main stages: site survey, document preparation, pole infrastructure foundation work, distribution of pole infrastructure to new points, pole erection stage, and electrical network connection.

A digital Kanban board, as shown in Figure 1, is used to visually map these stages. Each task card moves from the To-Do column to In-Progress and finally to Done. The use of this board facilitates coordination between teams working in parallel at different locations, such as the example site at Jalan Cut Mutia, Jakarta, which served as a sample for the project implementation.

Through the visualization and Work-In-Progress (WIP) limits displayed in Figure 2, the entire team and stakeholders can monitor the work status transparently and in real time. The Kanban board transforms into the primary communication instrument that facilitates dynamic collaboration and strategic adjustments, thereby enhancing team motivation and enabling the project to be completed within the agreed duration.

The Kanban board implicitly maps each stage, from Site Survey to PLN Network Connection, into activity columns. This provides the Project Manager and technical team with the ability to track progress, identify bottlenecks, and manage workloads effectively at all times. For instance, when a delay occurs in the Problem Identification and Document Preparation phase due to licensing issues, it is immediately detected on the Kanban board. This condition encourages the team to collaborate instantly to find a solution without having to delay subsequent stages that have not yet entered the execution schedule.

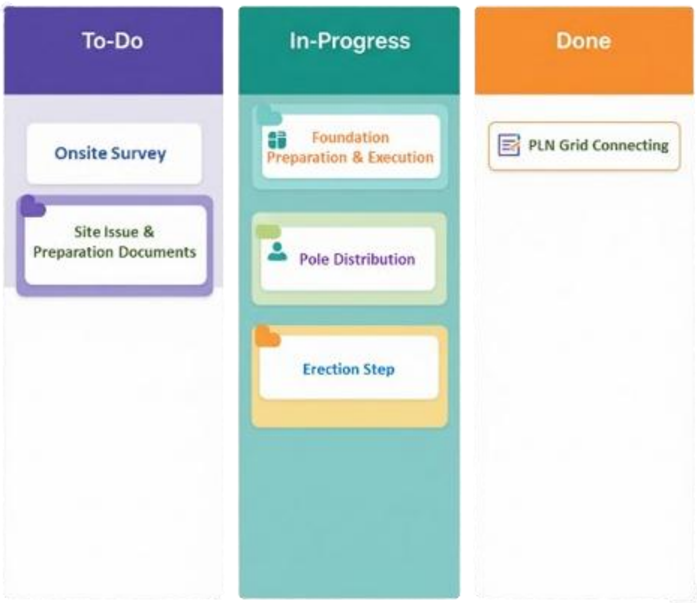

Figure 2. Digital Kanban Board as a Project Execution Guide

4.2 Analysis of WIP Limits and Bottleneck Management

One of the key elements in the success of this project is the implementation of Work-In-Progress (WIP) limits. For example, the WIP limit for the CCTV pole infrastructure foundation stage is set to a maximum of five tasks simultaneously. This forces the team to complete existing work before starting a new point, thereby preventing a backlog of tasks and maintaining construction quality, as shown in Figure 3, which illustrates the installation process stages.

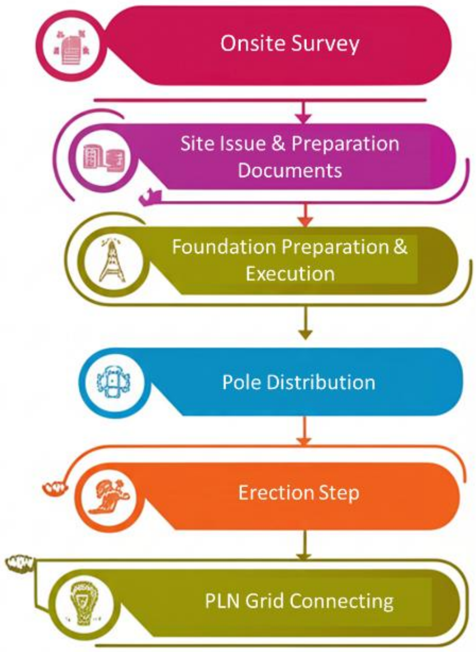

Figure 3. Installation Process Stages

The Kanban visualization shown in Figure 1 has proven effective in detecting bottlenecks. When licensing issues arise that hinder document preparation, a buildup of cards occurs in the Problem Identification column. This visual indicator triggers the team to immediately conduct a brief meeting to find solutions without halting other unaffected stages. Compared to traditional methods, this transparency allows project strategies to be adjusted dynamically and in real time.

4.3 The Impact of Kanban Method Integration on Project Efficiency

In the initial project design, infrastructure work involves multidisciplinary fields, including civil engineering. The adaptation of the Kanban method, which was originally popular in the manufacturing industry, has now shown significant effectiveness when applied to construction and physical infrastructure projects (Fuentes-Del-Burgo et al., 2024). This work plan is projected to be completed within 92 calendar days using conventional methods. This is reflected in Table 1, which presents the project implementation plan using a conventional model showing a sequential workflow. This contrasts with Table 2, which shows tasks being performed in parallel (indicated by a red √ symbol) to save 43 calendar days of project execution time.

Table 1 and Table 2 present the project timeline for the fiber optic network installation component, which served as the primary field execution workload supervised under the Kanban framework.

Table 1. Breakdown of the Project Implementation Plan using the Conventional Model

Timeline 92 Days														
Activities	Duration	Day 01-07	Day 08-14	Day 15-21	Day 22-28	Day 29-35	Day 36-42	Day 43-49	Day 50-57	Day 58-64	Day 65-71	Day 72-78	Day 79-85	Day 86-92
Project Preparation														
Survey	3 days	√												
Internal / External Administration	7 days	√												
Material Procurement	7 days		√											
Progress the Project														
Fiber Optic Cable Pulling	45 days			√	√	√	√	√	√	√				
Termination at the Handhole	7 days										√	√		
Fiber Optic Cable Pulling in the Building	7 days											√		
Core Alignment	7 days											√		
Finalize the Project														
Tidying	5 days												√	
Internal Commissioning	3 days													√
BA Submitted	1 day													√
	92 days	√	√	√	√	√	√	√	√	√	√	√	√	√

Table 2. Breakdown of Project Implementation Realization using the Kanban Model

Timeline 49 Days								
Activities	Duration	Day 01-07	Day 08-14	Day 15-21	Day 22-28	Day 29-35	Day 36-42	Day 43-49
Project Preparation								
Survey	1 day	√						
Internal / External Administration	5 days	√	√					
Material Procurement	3 days	√	√					
Progress the Project								
Fiber Optic Cable Pulling	27 days		√	√	√	√		
Termination at the Handhole	4 days					√	√	
Fiber Optic Cable Pulling in the Building	4 days					√	√	
Core Alignment	4 days					√	√	
Finalize the Project								
Tidying	1 day							√
Internal Commissioning	2 days							√
BA Submitted	1 day							√
	49 days							

The project scope managed by the procurement team encompasses two interdependent components: the direct procurement of 22 new AI-based CCTV units and the coordination of third-party contractors responsible for fiber optic network installation across all 33 strategic locations. While the CCTV hardware procurement was managed internally, the fiber optic cable pulling, which serves as the backbone connectivity infrastructure for all CCTV nodes, represents the most time-critical execution phase supervised under the Kanban framework. Therefore, Table 1 and Table 2 present the project timeline specifically for this fiber optic installation and network integration component, which constitutes the primary field execution workload monitored through the digital Kanban board.

Comparative analysis between Table 1 and Table 2 demonstrates that the Kanban method successfully reduced project duration by 46%, from 92 days to 49 calendar days, based on primary data from the project implementation.

Table 3. Comparison of Project Duration: Conventional vs. Kanban Model

Activities	Conventional Model (Days)	Kanban Model (Days)	Time Saved (Days)
Project Preparation			
Survey	3	1	2
Internal / External Administration	7	5	2
Material Procurement	7	3	4
Progress the Project			
Fiber Optic Cable Pulling	45	27	18
Termination at the Handhole	7	4	3
Fiber Optic Cable Pulling in the Building	7	4	3
Core Alignment	7	4	3
Finalize the Project			
Tidying	5	1	4
Internal Commissioning	3	2	1
BA Submitted	1	1	0
Total	**92**	**49**	**43 (46%)**

A detailed activity-by-activity comparison between the two models is presented in Table 3. The data reveals that efficiency gains were distributed across all project phases, with the most significant time reduction occurring in the Fiber Optic Cable Pulling stage, which was compressed from 45 days to 27 days, saving 18 calendar days. Parallel execution of preparation activities, namely Survey, Administration, and Material Procurement, further contributed to the overall reduction. In aggregate, the Kanban model reduced total project duration from 92 to 49 calendar days, achieving a 46% efficiency improvement and saving 43 calendar days compared to the conventional sequential approach.

(a) (b)

(c)

Figure 4. Project Implementation Process. (a). CCTV Pole Infrastructure Foundation Work, (b). CCTV Pole Infrastructure Erection, (c). CCTV Results and Display after Electrical Installation and Fiber Optic Network Connectivity

Visual evidence of the effectiveness of the Kanban method in managing physical infrastructure work in parallel is presented in Figure 4. This figure documents three crucial phases successfully managed without workload overlap through the WIP limit system, namely:

1. Figure 4(a) illustrates the foundation work stage of the CCTV pole infrastructure at a specific location. In the Kanban model, this civil work can commence immediately without waiting for the entire material procurement process to be completed for other locations.
2. Figure 4(b) shows the result of the pole infrastructure erection, equipped with AI-based camera units. This proves that the integration between physical components (poles) and digital components (AI cameras) can be effectively synchronized through the visual management board.

3. Figure 4(c) displays the CCTV screen capture (output) after the electrical installation and fiber optic connectivity are finalized. The clarity of the nighttime imagery demonstrates that despite the execution duration being reduced by 43 calendar days, the technical quality standards and video analytics functionality remain optimally maintained.

Furthermore, the application of the Kanban method facilitates parallel work on several key activities. This is evident in the work duration, which was successfully shortened to only 49 calendar days. This time saving of 43 days primarily stems from the optimization of the pull system, which allows the team to begin physical work stages as soon as specific document preparations are completed without waiting for all administrative tasks to be finalized.

In general, this project includes the installation of new AI-based CCTV cameras at several key and strategic points for security monitoring purposes. These CCTV cameras are integrated with artificial intelligence technology that functions as a video analytics solution, equipped with features such as face recognition, crowd estimation, people counting, and vehicle counting and classification. These installed CCTV cameras were integrated with 11 existing CCTV units belonging to an operator affiliated with the government, resulting in an integrated network of 33 strategic CCTV locations supported by fiber optic connectivity.

CONCLUSION

This research concludes that the integration of the Kanban method in the Forensic Device Communication procurement project directly addresses the fundamental challenge identified in this study, namely the inadequacy of conventional linear project management approaches in handling complex hybrid procurement that involves both physical infrastructure and artificial intelligence technology. Through a pull system approach and transparent task visualization, the Kanban method transformed the project workflow from a rigid sequential process into a dynamic parallel execution model. Administrative barriers that typically arise in conventional models, including licensing delays and inter-team coordination failures, were identified and mitigated earlier through real-time Kanban board monitoring.

The empirical findings demonstrate that the application of Kanban reduced project execution duration by 43 calendar days, from the initial 92-day baseline to 49 calendar days, representing a 46% efficiency improvement. This reduction was achieved without compromising technical quality standards, as evidenced by the successful installation and integration of 22 new AI-based CCTV units with 11 existing units across 33 strategic locations. All units maintained full video analytics functionality, including face recognition and vehicle classification capabilities. The application of data-driven optimization approaches to project execution further reinforces the value of systematic process design in achieving measurable improvements across engineering contexts.

The practical implication of this study is that the flexibility inherent in managing Work-In-Progress limits serves as the primary mechanism for navigating the dual complexity of digital technology integration and strict government procurement regulations. This finding validates the applicability of agile visual management methodologies within public sector environments, provided that the implementation framework accommodates regulatory compliance requirements. This research recommends that government organizations adopt visual management tools such as Kanban to enhance procurement transparency and operational efficiency, particularly in projects involving multi-layered technology integration. Future research should explore the scalability of this model across multi-agency procurement contexts and investigate quantitative frameworks for measuring Kanban adoption maturity in public sector settings.

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