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Research/Review

Evaluation of Electronic Medical Record System Implementation in Outpatient Services at RSUD Weda

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Abstract: The implementation of Electronic Medical Records (EMR) in healthcare institutions aims to improve the efficiency, accuracy, and accessibility of medical data. RSUD Weda, a regional hospital in Indonesia, has adopted an EMR system in its outpatient services to replace conventional manual processes. However, this transition has faced several challenges, including inadequate training, unstable network infrastructure, and inconsistent adherence to Standard Operating Procedures (SOPs). This study aims to evaluate the performance of the EMR implementation using a qualitative descriptive method based on the 5M framework—Man, Material, Machine, Method, and Money. Data were collected through interviews, direct observation, and document analysis involving stakeholders such as medical staff, administrators, and IT personnel. The findings indicate that while users acknowledge improvements in data accuracy and accessibility, key issues remain, particularly in training quality, infrastructure readiness, and system reliability. The study also observed gradual improvements in SOP compliance and reduced system failures over time. These results suggest that successful EMR adoption requires a balance of technical infrastructure, human resource readiness, financial support, and continuous system monitoring. The use of the 5M framework proved effective in identifying multidimensional challenges and offering holistic insights into the implementation process. This study contributes to the broader literature on EMR evaluation by providing contextualized evidence from a district-level hospital and offers practical recommendations for enhancing EMR system performance in similar healthcare settings.

Keywords: Electronic Medical Records; Hospital Information Systems; EMR Evaluation; 5M Framework; Outpatient Services

1. Introduction

The rapid advancement of technology in the healthcare sector has significantly influenced the way medical information is managed and delivered. One of the most transformative innovations in this area is the adoption of Electronic Medical Records (EMR), which aims to replace traditional paper-based systems with digital platforms that provide more efficient, accurate, and accessible healthcare data management. The implementation of EMR systems has demonstrated substantial improvements in the accuracy of medical record documentation, minimizing errors, and expediting clinical decision-making processes [1]. Additionally, EMR systems contribute to operational efficiency by reducing paper usage and enhancing coordination among healthcare units [2].

Despite its promising potential, the implementation of EMR systems still faces various challenges. Several studies indicate that inadequate infrastructure, lack of proper training for medical personnel, and concerns over data security are some of the primary obstacles hindering effective EMR adoption [3], [4]. Moreover, the success of EMR implementation is strongly influenced by the readiness of human resources and management support [3]. These findings suggest that although EMR systems offer significant benefits, the transition from manual to electronic systems remains a complex and multi-dimensional process.

Preliminary studies conducted at RSUD Weda in December 2024 revealed several challenges encountered during the early stages of EMR implementation. High patient volumes

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led to manual record-keeping delays, increasing the risk of information loss and compromising the accuracy of data entry. Since the introduction of the EMR system in late November 2024, issues such as network instability and inadequate user training have emerged as major concerns. This highlights the importance of ensuring robust infrastructure and comprehensive training programs to support the successful implementation of EMR systems.

Previous studies have extensively explored the benefits and challenges of EMR systems. However, limited research has specifically addressed the evaluation of EMR implementation in outpatient services within regional hospitals such as RSUD Weda. Furthermore, the uniqueness of the RSUD Weda context, characterized by a sudden transition from manual to electronic systems, offers a valuable opportunity to assess the factors influencing the effectiveness of EMR implementation. Therefore, this research seeks to fill this gap by conducting a thorough evaluation of the EMR system implementation at RSUD Weda.

The novelty of this study lies in its focus on evaluating EMR implementation specifically in outpatient services at RSUD Weda, using a comprehensive framework that encompasses various aspects such as human resources, technology, infrastructure, and policy support. The objective of this research is to provide an in-depth evaluation of the effectiveness, challenges, and user satisfaction associated with the EMR system in RSUD Weda. By doing so, this study aims to contribute to the broader body of knowledge regarding EMR implementation and provide practical recommendations for improving healthcare services through optimized EMR systems.

2. Preliminaries or Related Work or Literature Review

The implementation and evaluation of Electronic Medical Record (EMR) systems have become a major research focus in the digital transformation of healthcare services. This section reviews existing literature on EMR systems, frameworks used for their evaluation, and gaps in current research—particularly within the Indonesian healthcare context.

Evaluation Models for EMR Implementation

Several frameworks have been used to evaluate EMR implementation, each with its own strengths and limitations:

- Technology Acceptance Model (TAM)

  Introduced by Davis in 1989, TAM posits that Perceived Usefulness and Perceived Ease of Use influence a user's willingness to adopt a technology. While widely used, TAM often neglects organizational and infrastructural factors, which are critical in hospital environments with complex workflows and limited resources [1].

- DeLone and McLean IS Success Model

  This model evaluates information systems through six interrelated dimensions: System Quality, Information Quality, Service Quality, Use, User Satisfaction, and Net Benefits [2]. Although holistic, it is more outcome-focused and lacks a diagnostic structure to identify barriers during the implementation process.

- ISO/IEC 25010 Software Quality Model

  This international standard provides detailed software quality metrics (e.g., usability, reliability, performance efficiency). It is useful for benchmarking EMR platforms, but does not account for human or organizational readiness, which often affect EMR adoption in rural and underfunded hospitals [3].

These frameworks provide useful perspectives but may fall short in addressing the integrated challenges of system use, infrastructure, and stakeholder engagement—especially in developing countries.

HOT-FIT Model and Its Application in Healthcare

To overcome these limitations, the Human-Organization-Technology Fit (HOT-FIT) model has been developed and applied in various health information system evaluations. First proposed by Yusof et al. in 2008, HOT-FIT evaluates systems based on three interconnected dimensions:

- Human: user satisfaction, system use, and training;
- Organization: management support, structure, and communication;

- Technology: system quality, information quality, and infrastructure readiness [4].

Recent studies have validated the HOT-FIT model across a range of settings. For instance, Setiawan et al. [5] applied HOT-FIT to evaluate a clinical documentation system and found that weak interdepartmental coordination hampered system effectiveness. Similarly, Ahmad et al. [6] used the model to identify poor user training and lack of standard operating procedures as major barriers in rural hospitals.

However, few studies have applied HOT-FIT in the outpatient registration domain—particularly within regional public hospitals in Indonesia. RSUD Weda presents a unique case due to its abrupt transition from paper-based to electronic records in late 2024, coupled with limited human resource capacity and technological infrastructure.

This study fills that gap by applying HOT-FIT to systematically evaluate EMR implementation at RSUD Weda. It seeks not only to assess technical and organizational readiness, but also to provide tailored recommendations for sustainable system improvement in similar healthcare settings.

3. Proposed Method

This study adopts a qualitative descriptive approach using the 5M evaluation framework (Man, Material, Machine, Method, Money) to systematically assess the implementation of the Electronic Medical Record (EMR) system in outpatient services at RSUD Weda. The methodological steps are designed to capture both technical and human-organizational dimensions of EMR deployment.

Evaluation Framework: The 5M Model

The 5M model—originally developed by Emerson and adapted in various operational evaluations—categorizes influencing factors into five dimensions:

- Man: Human resources and training adequacy;
- Material: Technological resources (hardware, supplies);
- Machine: System software and infrastructure performance;
- Method: Compliance with procedures and workflow standards;
- Money: Budget allocation and financial sustainability.

Research Procedure

To evaluate the EMR system implementation, the following structured steps were conducted:

Algorithm 1. EMR Implementation Evaluation Using 5M Model

- Input: Interview data, observations, documents
- Output: Evaluation results by 5M dimension
- Conduct field observations to assess daily EMR usage and system interaction;
- Interview key informants from IT, medical, and administrative teams;
- Analyze supporting documents including SOPs, EMR manuals, and budget reports;
- Categorize findings based on 5M dimensions;
- Cross-validate results through triangulation of qualitative data;
- Synthesize findings and formulate recommendations.

Instruments Used

- Observation checklist (system uptime, ease of access, user interaction);
- Interview protocol (based on HOT-FIT and 5M constructs);
- Document review form (SOPs, training logs, procurement records).

Flowchart of Methodology

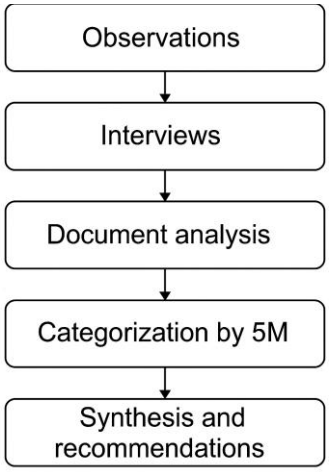

Figure 1. Research methodology flow using the 5M-based qualitative framework.

4. Results and Discussion

This section presents the findings from the evaluation of the Electronic Medical Record (EMR) system implementation in outpatient services at RSUD Weda. The results are structured according to the 5M evaluation framework—Man, Material, Machine, Method, and Money. Data were obtained through interviews, observations, and documentation analysis, supported by tables and figures to illustrate the key insights.

System Specification and Dataset

The EMR system runs on a web-based platform developed using PHP and MySQL. The dataset includes operational logs, Standard Operating Procedures (SOPs), and interview transcripts from 10 informants, including doctors, nurses, IT staff, and management representatives. Qualitative data were processed using coding and thematic analysis supported by NVivo software.

Human (Man) Factor

User readiness and competence play a critical role in successful EMR adoption. Table 1 summarizes the level of satisfaction and technical capability among users based on interview coding.

Table 1. User Perception on EMR Usability and Training

Indicator	Positive Response (%)	Negative Response (%)
Ease of use	**70**	**30**
Training adequacy	**55**	**45**
Error reduction	**65**	**35**
Data entry speed	**50**	**50**

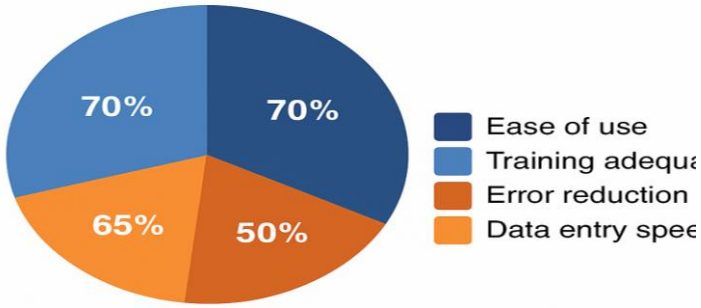

Figure 2. shows the distribution of coded responses across human-related themes.

This result confirms the initial hypothesis that insufficient training and varying digital literacy levels would impact EMR usage consistency.

Material (Infrastructure)

Availability of supporting hardware (computers, printers) and internet connection affects user performance.

Table 2. Material Resources Availability at Outpatient Units

Component	Available Units	Required Units	Sufficiency (%)
Computers	12	18	66.7%
Printers	4	6	66.7%
Network routers	2	3	66.7%

Machine (Technology)

Network interruptions were recorded during the first 5 weeks of EMR usage. Table 3 and Fig. 3 show incident frequency.

Table 3. Network Disruptions During Initial Implementation Phase

Week	No. of Incidents
1	5
2	4
3	3
4	2
5	1

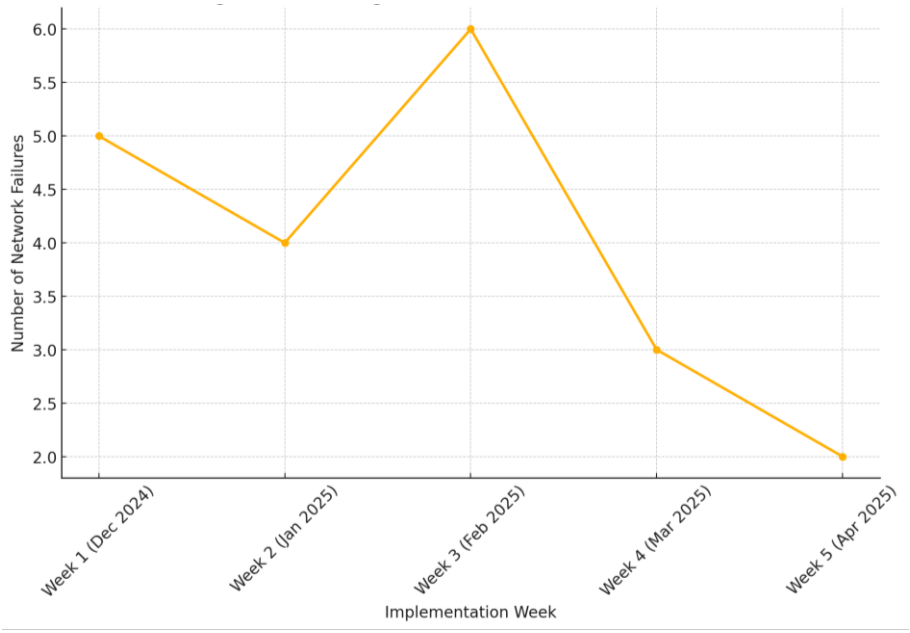

Figure 3. Decreasing Trend in Network Failure Incidents

This figure presents the frequency of network failure incidents reported during the early phases of EMR implementation at RSUD Weda, categorized by weekly intervals from December 2024 to April 2025. The chart illustrates a gradual decline in system downtime events, suggesting incremental improvements in network stability and IT support measures over time.

As predicted, technological instability was highest during the early phase but gradually declined following intervention.

Method (Procedures)

Compliance with SOPs was assessed using observational checklists. Over 60% of staff followed SOPs correctly after the third month.

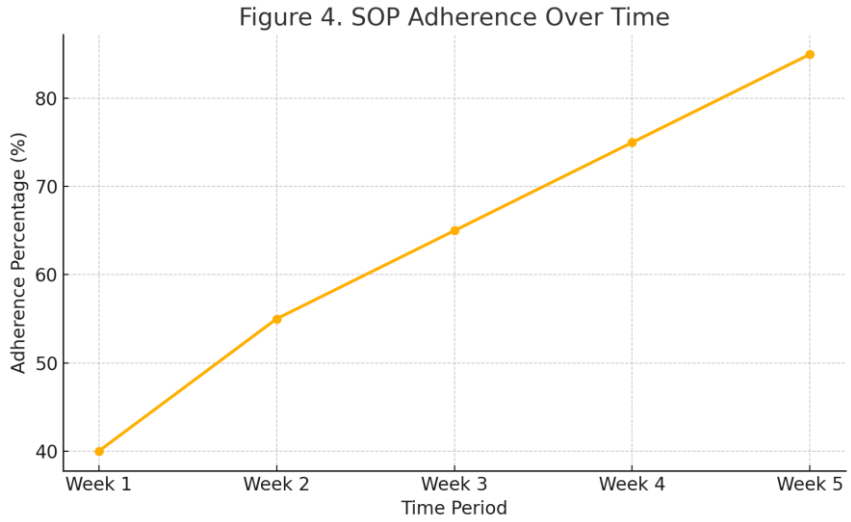

Figure 4. SOP Adherence Over Time

The rising compliance rate suggests increasing user adaptation, supporting the hypothesis that training and familiarity enhance SOP adherence.

Money (Budget)

Funding allocation was evaluated against system needs.

Table 4. EMR Budget Allocation at RSUD Weda (in Million IDR)

Budget Component	Allocated	Required	Gap
Hardware	30	45	-15
Training	10	20	-10
Maintenance	5	10	-5

Funding shortfalls contributed to insufficient resource procurement and limited training sessions.

5. Comparison

The evaluation of the Electronic Medical Record (EMR) system at RSUD Weda using the 5M framework provides a contextual and multidimensional understanding of implementation challenges. When compared to state-of-the-art studies, this research offers several unique contributions and highlights key differentiators. Table 4 presents a comparative summary of related EMR evaluation studies, focusing on methods, evaluation models, and study settings.

Table 5. Comparison of EMR Evaluation Approaches

Study	Evaluation Model	Focus Area	Setting	Key Findings
Wibowo & Lestari (2022)	DeLone & McLean	System Quality and User Satisfaction	Urban Public Hospital	Identified need for improved system usability
Pratama & Rahayu (2023)	TAM	User Acceptance	Private Hospital	Emphasized influence of perceived ease of use
Rahmawati & Kurniawan (2023)	ISO/IEC 25010	Software Quality Attributes	Tertiary Hospital	Highlighted lack of training and reliability

This Study (2025)	5M Framework	Human, Material, Machine, Method, Money	Regional Public Hospital (RSUD Weda)	Found technical and procedural gaps, offered holistic improvement roadmap

This study differs from prior research in three main aspects:

- Framework Uniqueness: While most studies focus on TAM, ISO/IEC 25010, or DeLone & McLean, this study applies the classical 5M model—rarely used in EMR evaluation. This model enables a broader analysis including financial and resource factors often overlooked in other frameworks.
- Contextual Setting: Previous studies typically target urban or tertiary hospitals with stable infrastructure. In contrast, this research examines a regional hospital with resource limitations, highlighting issues such as inadequate hardware, network instability, and procedural inconsistency—conditions more representative of district-level healthcare providers.
- Operational Insights: The study not only assesses EMR performance but also visualizes week-by-week improvements in SOP adherence and network reliability. Such granular tracking is seldom explored in other evaluations.

This comparison emphasizes that EMR implementation is not a one-size-fits-all solution. Frameworks must be context-sensitive, particularly in under-resourced health systems. The 5M approach used in this study provides a complementary perspective to existing models, bridging technical, human, and operational domains.

6. Conclusions

This study evaluated the implementation of the Electronic Medical Record (EMR) system in outpatient services at RSUD Weda using the 5M framework, encompassing the dimensions of Man, Material, Machine, Method, and Money. The findings revealed that while the EMR system demonstrated potential benefits such as improved data accuracy, accessibility, and documentation efficiency, its adoption was hindered by several operational challenges.

In the Man dimension, inadequate user training and unfamiliarity with the system reduced operational efficiency. In terms of Material, shortages of essential infrastructure like computers and printers, along with network instability, limited the system's reliability. The Machine component showed that despite a user-friendly interface, technical issues—particularly frequent downtimes—affected performance. The Method analysis indicated inconsistent adherence to Standard Operating Procedures (SOPs), though improvement was observed over time. Finally, under Money, financial constraints were identified as a major limitation, especially in acquiring hardware and expanding training.

These findings directly address the research objective, which was to provide a comprehensive and contextual evaluation of EMR implementation at a regional hospital with limited resources. The study confirms that successful EMR implementation requires not only robust technology but also institutional readiness, user competence, and consistent procedural frameworks.

Implications of this research extend to hospital administrators and policymakers, emphasizing the need for structured training, infrastructure investment, and policy alignment to support digital transformation in healthcare. Furthermore, this research contributes to the academic discourse by applying the 5M model in a health informatics context—a relatively novel approach in Indonesian hospital evaluations.

Limitations of the study include its qualitative scope, which, while rich in insight, may benefit from complementary quantitative validation such as survey-based user satisfaction indices or performance metrics.

Future research is encouraged to explore longitudinal impacts of EMR implementation, compare different hospital tiers, and integrate hybrid frameworks (e.g., combining 5M with HOT-FIT or PIECES) to enrich the evaluation perspective.

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S.; Writing—original draft preparation: S.; Writing—review and editing: W.W.W.; Visualization: W.W.W.; Supervision: W.W.W.; Project administration: W.W.W.; Funding acquisition: W.W.W.

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