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ENHANCING PROJECT MANAGEMENT EFFICIENCY IN THE DEVELOPMENT OF PUBLIC SERVICE COMPLAINT APPLICATIONS

Indah Dwijayanthi Nirmala[1]*, Ade Tamin[2]
Universitas Budi Luhur, Indonesia[1,2]
E-mail: 2211602392@student.budiluhur.ac.id[1]*, 2211600651@student.budiluhur.ac.id[2]

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Abstract

This study investigates how project management optimization can improve the development of an information-technology-based public complaint application. Grounded in the PMBOK framework and employing a Waterfall development approach, the research assesses how project planning, execution, monitoring, and closure contribute to efficiency, cost control, and product quality. Results reveal that structured project management strengthens stakeholder coordination, mitigates risks, and facilitates timely, budget-compliant delivery. The study recommends enhanced monitoring practices and capacity-building for project teams to sustain long-term benefits.

Keywords: ***project management; complaint application; PMBOK; Waterfall; public service;***

INTRODUCTION

The rapid advancement of information technology has profoundly transformed various aspects of modern life, driving the demand for faster, more transparent, and accountable public services. Within this digital transformation, public complaints have become a vital mechanism for assessing the performance of government services, as they provide direct feedback from citizens regarding service shortcomings and areas requiring improvement. Nevertheless, traditional manual complaint management systems often encounter limitations such as restricted accessibility, delayed responses, and a lack of transparency, which hinder effective public engagement and service improvement. To address these challenges, the adoption of digital-based complaint applications has emerged as a strategic innovation to enhance service efficiency and accountability. The success of such application development, however, relies heavily on the implementation of effective project management practices. Comprehensive planning, efficient resource utilization, proactive risk control are essential to ensuring that project outcomes meet the expected standards of time, cost, quality (Project Management Institute 2021). Empirical studies have emphasized that the systematic application of project management methodologies significantly improves organizational performance and increases public satisfaction with service delivery (Mulyapradana et al. 2022). Building upon this foundation, the present study aims to explore how project management optimization—based on the Project Management Body of Knowledge (PMBOK) framework—can support the effective and sustainable development of public service complaint applications in the digital era.

LITERATURE REVIEW

Information technology–based complaint systems have been widely developed to improve the efficiency, transparency, and accountability of public services. (Mahdias, Aryadita, and Wicaksono 2019) found that Android-based complaint applications accelerate reporting and management processes, though limited digital literacy remains a challenge. Likewise, (Sucinta, Dedi, and Handika 2024) and (Komarudin and Nurmiati 2022) confirmed the effectiveness of Waterfall-based and web-based systems, but noted the need for sustainability and feature optimization. Government platforms such as LAPOR! and SP4N-LAPOR! have improved service responsiveness (Nurulhikmah and Abdi 2024; Wulandari 2023), yet infrastructure disparities persist. Methodological approaches such as UML, Rapid Application Development, and usability testing also enhance system quality and user satisfaction (Hayati, Rusdianto, and Amalia 2019; Kemendikbud et al. 2022; Nugroho, Taufiq, and Alfarizi 2021). Moreover, applying Work Breakdown Structure (WBS) methods supports better project efficiency in time and cost management (Herzanita n.d.; Maddeppungeng, Suryani, and Iskandar 2015; Padma Arianie and Budi Puspitasari 2017). In summary, previous studies confirm that digital complaint systems can strengthen public service

performance and citizen satisfaction. However, issues of user adaptation, system sustainability, and infrastructure readiness remain key research gaps to be addressed in future studies.

METHOD

This study employed a mixed-methods approach, integrating both qualitative and quantitative techniques to obtain a comprehensive understanding of the research context. Data were collected through field observations, in-depth interviews with project stakeholders, literature reviews, and project documentation used as secondary sources. In implementing project management, the research followed the five main phases of the *Project Management Body of Knowledge* (PMBOK): initiation, planning, execution, monitoring and controlling, and closure. Technically, the application development process adopted the *Waterfall* model, consisting of requirement analysis, system design, software construction, testing (including *black-box testing*), and user training and installation. Qualitative data were analyzed through synthesis of interview findings and documentation, while quantitative data—including schedule metrics, cost performance, and testing results—were analyzed descriptively to evaluate the project's achievement of time, cost, and quality objectives (A.S. and Shalahudin 2015; inc 2013).

RESULTS AND DISCUSSION

This section presents the results of the development of a public service complaint application along with its project management analysis. The system was developed with core features, including public complaint submission, report status tracking, a government agency dashboard, and automated notifications. The implementation utilized PHP and MySQL, and *black-box testing* was conducted to ensure that all functions operated correctly. The findings revealed that the application of PMBOK principles enhanced team coordination, accelerated project completion, and minimized the risk of technical errors. The quality testing results indicated that 95% of the test cases were executed successfully without errors, confirming that the system is stable and ready for deployment. Moreover, project cost analysis demonstrated efficient resource utilization and achievement of budget targets as planned (Komarudin and Nurmiati 2022; Maddeppungeng et al. 2015). In terms of risk management, the project team implemented a preventive approach by identifying potential obstacles such as delays in system integration, database errors, and changes in user requirements. Each potential risk was mitigated through pre-defined management strategies aligned with the *Risk Management* principles of the PMBOK framework (Project Management Institute, 2021). The evaluation results further indicated that effective communication among project stakeholders played a crucial role in maintaining smooth system implementation (Nurulhikmah and Abdi 2024).

Initiation

The initiation phase of the public service complaint information system project involved identifying analyzing system requirements to ensure that the project aligns with stakeholder needs & operational goals.

Project Description and Feasibility

This project focused on developing a digital complaint management application designed to enhance efficiency, effectiveness, and transparency in handling citizen reports. The system enables users to submit complaints, track handling progress, and ensures government accountability in responding to public feedback. The project was initiated due to the inefficiencies of manual complaint mechanisms, which often lacked speed, transparency, and accessibility (Wulandari 2023).The feasibility study confirmed that the project is viable across three key dimensions:

1. Technical: The system is built on web and mobile platforms with robust security and scalability.
2. Economic: The development utilizes internal resources efficiently, minimizing external costs.
3. Operational: The digital system replaces manual processes with faster, automated procedures that save time and reduce administrative burdens (Komarudin and Nurmiati 2022).

The main objective of this project was to deliver a responsive, user-friendly complaint platform that accelerates government response times, enhances transparency, and facilitates internal monitoring and evaluation. The project scope includes the development of key modules such as a complaint form, status tracking feature, monitoring dashboard, and automated notification system. Further integration with external systems is planned for future phases to ensure a focused and measurable initial implementation (Sucinta et al. 2024).

The project was carried out by a multidisciplinary team with clearly defined roles and responsibilities. The *Project Manager* oversaw the overall execution, supported by a system analyst, software developers, UI/UX designers, and a testing and technical support team. Additionally, stakeholders and IT consultants played an essential

role in ensuring the system's alignment with organizational objectives and user requirements. This cross-functional collaboration was a key success factor in ensuring the project's comprehensive performance and sustainability (Padma Arianie and Budi Puspitasari 2017; Project Management Institute 2021).

Planning

The project planning process encompassed defining the scope of work, project schedule, cost allocation, quality standards, resource management, communication strategy, risk mitigation, and procurement planning. Detailed project planning information is summarized in the following table:

No	PMBOK Area	Plan
1	**Integration Management**	Develop the Project Charter, Create an Integrated Project Management Plan, Direct and Manage Project Work, Monitor and Control Project Work, Perform Integrated Change Control, and Close the Project.
2	**Project Scope Management**	Collect Requirements, Define Scope, Create Work Breakdown Structure (WBS), Verify Scope, and Control Scope.
3	**Project Time Management**	Define Activities, Sequence Activities, Estimate Activity Resources, Estimate Activity Duration, Develop Schedule, and Control Schedule.
4	**Project Cost Management**	Estimate Costs, Determine Budget, and Control Costs.
5	**Project Quality Management**	Plan Quality Management, Perform Quality Assurance, and Perform Quality Control.
6	**Project Human Resource Management**	Develop Human Resource Plan, Acquire Project Team, Develop Project Team, and Manage Project Team.
7	**Project Communication Management**	Plan Communications Management, Manage Communications, and Control Communications.
8	**Project Risk Management**	Plan Risk Management, Identify Risks, Perform Qualitative Risk Analysis, Perform Quantitative Risk Analysis, Plan Risk Responses, and Control Risks.
9	**Project Procurement Management**	Plan Procurements, Conduct Procurements, Control Procurements, and Close Procurements.

Image: The Project Planning

Work Breakdown Structure Development (WBS)

The Work Breakdown Structure (WBS) was developed to identify and organize all activities required to complete the project management process for the public service complaint application. The WBS provides a hierarchical framework that decomposes the project into manageable components, ensuring clarity in task allocation, timeline control, and accountability across all project stages.

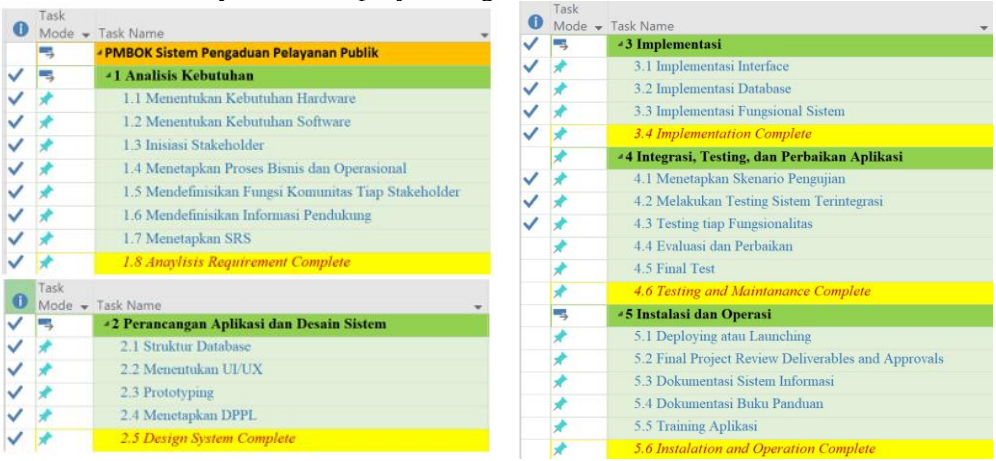


Image 2: WBS

Gantt Chart

The Gantt chart illustrates the timeline and interdependence of each project activity in the management of the public complaint information system. It visually represents the project schedule, duration of each task, and progress tracking from initiation to completion. This tool enables effective time monitoring and ensures that the development process remains aligned with the planned milestones and deliverables.

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
0		**PMBOK Sistem Pengaduan Pelayanan Publik**	**138 days**	**Thu 25/07/24**	**Mon 03/02/25**		
1		**1 Analisis Kebutuhan**	**42 days**	**Thu 25/07/24**	**Fri 20/09/24**		
2		1.1 Menentukan Kebutuhan Hardware	5 days	Thu 25/07/24	Wed 31/07/24		Consultant System;System Analyst
3		1.2 Menentukan Kebutuhan Software	5 days	Thu 01/08/24	Wed 07/08/24	2	System Analyst;Consultant System
4		1.3 Inisiasi Stakeholder	5 days	Thu 08/08/24	Wed 14/08/24	3	Administrator;Project Manager
5		1.4 Menetapkan Proses Bisnis dan Operasional	3 days	Thu 15/08/24	Mon 19/08/24	4	Business Analyst
6		1.5 Mendefinisikan Fungsi Komunitas Tiap Stakeholder	10 days	Tue 20/08/24	Mon 02/09/24	5	System Analyst;Administrator
7		1.6 Mendefinisikan Informasi Pendukung	4 days	Tue 03/09/24	Fri 06/09/24	6	System Analyst;Technical Writer
8		1.7 Menetapkan SRS	10 days	Mon 09/09/24	Fri 20/09/24	7	System Analyst
9		*1.8 Anaylisis Requirement Complete*	0 days	Fri 20/09/24	Fri 20/09/24		
10		**2 Perancangan Aplikasi dan Desain Sistem**	**27 days**	**Mon 23/09/24**	**Tue 29/10/24**		
11		2.1 Struktur Database	7 days	Mon 23/09/24	Tue 01/10/24	8	Database Administrator
12		2.2 Menentukan UI/UX	5 days	Wed 02/10/24	Tue 08/10/24	11	UI/UX Designer
13		2.3 Prototyping	10 days	Wed 09/10/24	Tue 22/10/24	12	UI/UX Designer;Developer
14		2.4 Menetapkan DPPL	5 days	Wed 23/10/24	Tue 29/10/24	13	Technical Writer
15		*2.5 Design System Complete*	0 days	Tue 29/10/24	Tue 29/10/24		
16		**3 Implementasi**	**31 days**	**Wed 30/10/24**	**Wed 11/12/24**		
17		3.1 Implementasi Interface	5 days	Wed 30/10/24	Tue 05/11/24	14	Developer
18		3.2 Implementasi Database	13 days	Wed 06/11/24	Fri 22/11/24	17	Database Administrator;Developer
19		3.3 Implementasi Fungsional Sistem	13 days	Mon 25/11/24	Wed 11/12/24	18	Developer
20		*3.4 Implementation Complete*	*0 days*	*Wed 11/12/24*	*Wed 11/12/24*		
21		**4 Integrasi, Testing, dan Perbaikan Aplikasi**	**15 days**	**Thu 12/12/24**	**Wed 01/01/25**		
22		4.1 Menetapkan Skenario Pengujian	3 days	Thu 12/12/24	Mon 16/12/24	19	Quality Assurance;Tester
23		4.2 Melakukan Testing Sistem Terintegrasi	2 days	Tue 17/12/24	Wed 18/12/24	22	Tester
24		4.3 Testing tiap Fungsionalitas	5 days	Thu 19/12/24	Wed 25/12/24	23	Tester
25		4.4 Evaluasi dan Perbaikan	3 days	Thu 26/12/24	Mon 30/12/24	24	Developer;Tester
26		4.5 Final Test	2 days	Tue 31/12/24	Wed 01/01/25	25	Quality Assurance
27		*4.6 Testing and Maintanance Complete*	*0 days*	*Wed 01/01/25*	*Wed 01/01/25*		
28		**5 Instalasi dan Operasi**	**23 days**	**Thu 02/01/25**	**Mon 03/02/25**		
29		5.1 Deploying atau Launching	2 days	Thu 02/01/25	Fri 03/01/25	26	IT Support
30		5.2 Final Project Review Deliverables and Approvals	5 days	Mon 06/01/25	Fri 10/01/25	29	Project Manager
31		5.3 Dokumentasi Sistem Informasi	5 days	Mon 13/01/25	Fri 17/01/25	30	Technical Writer
32		5.4 Dokumentasi Buku Panduan	5 days	Mon 20/01/25	Fri 24/01/25	31	Technical Writer
33		5.5 Training Aplikasi	6 days	Mon 27/01/25	Mon 03/02/25	32	Trainer
34		*5.6 Instalation and Operation Complete*	*0 days*	*Mon 03/02/25*	*Mon 03/02/25*		

Image 3: Gantt Chart of the Public Service Complaint Information System Application

PERT (Program Evaluation and Review Technique)

The *Program Evaluation and Review Technique* (PERT) was employed to analyze, plan, and control the project schedule. This technique helped estimate the duration of each development phase by evaluating optimistic, pessimistic, and most likely timeframes to determine the expected project completion period.

1. Project Duration Estimation Using PERT

The PERT analysis was utilized to calculate the estimated duration of the public complaint application project by integrating time estimates across multiple activities, ensuring accurate forecasting and schedule optimization.

Duration = Optimistic : 118 days; Realistic : 138 days; Pessimistic: 158 days Proect Duration = (Optimistic + 4 × Realistic + Pessimistic) ÷ 6 = (118 + 4 × 138 + 158) ÷ 6 = **138 days**

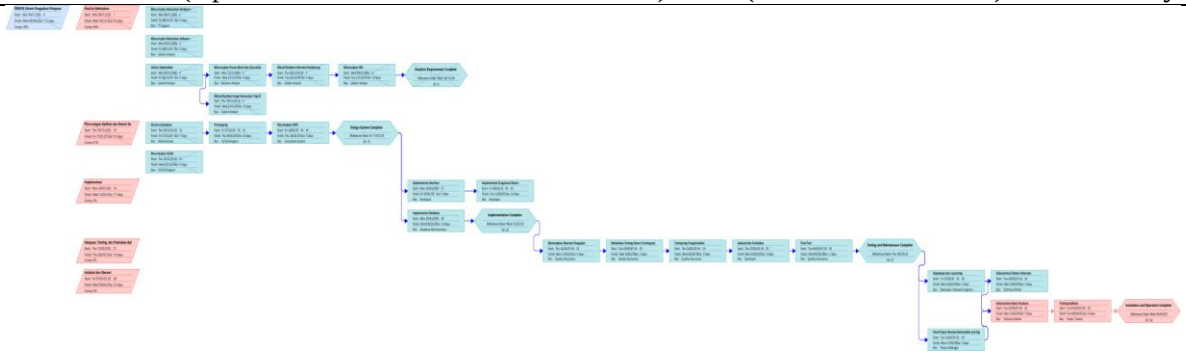


Image 4: PERT Public Service Complaint

Activity-on-arrow (AOA)

The *Activity-on-Arrow* (AOA) method was applied to identify the project's *critical path*, depicted by pink arrows connecting sequential activities from initiation to closure. The critical path includes the following stages: **A (Start)** → B (Analysis) → C (System Design) → D (Development) → E (Testing) → **F (Completion).** This sequence highlights essential tasks that directly influence the total project duration, ensuring timely completion through continuous monitoring and adjustment.

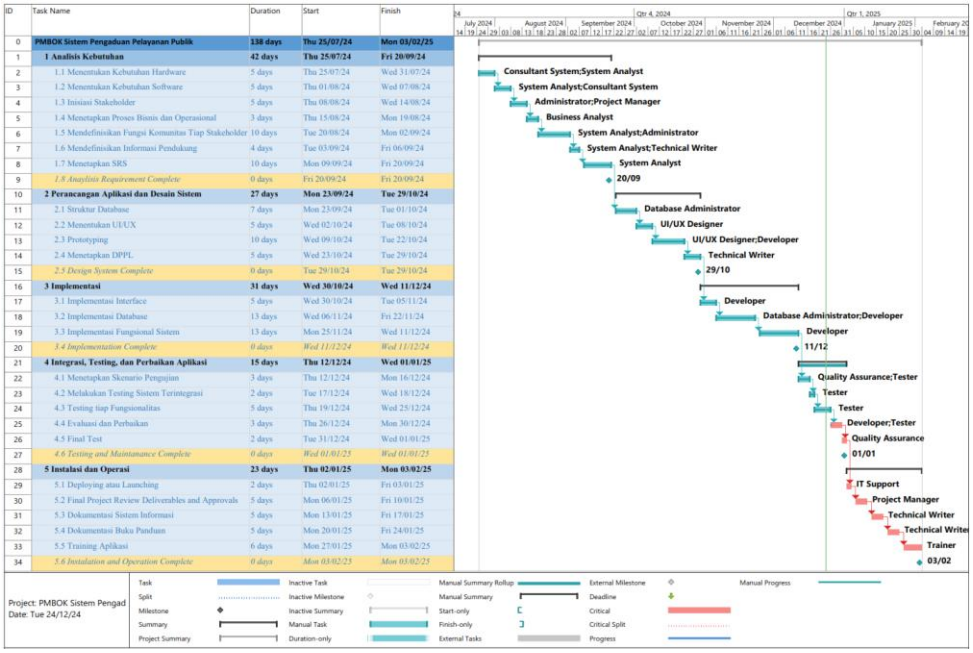


Image 5: Critical Path Activity-on-arrow (AOA)

Budget Planning (RAB)

The *Budget Plan (Cost Estimate / RAB)* in the project management of the public service complaint information system includes:

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Cost	% Complete
0		**PMBOK Sistem Pengaduan Pelayanan Publik**	**138 days**	**Thu 25/07/24**	**Mon 03/02/25**			**Rp 1.161.200.000**	**80%**
1		**1 Analisis Kebutuhan**	**42 days**	**Thu 25/07/24**	**Fri 20/09/24**			**Rp 437.600.000**	**100%**
2		1.1 Menentukan Kebutuhan Hardware	5 days	Thu 25/07/24	Wed 31/07/24		Consultant System;System Analyst	Rp 64.000.000	100%
3		1.2 Menentukan Kebutuhan Software	5 days	Thu 01/08/24	Wed 07/08/24	2	System Analyst;Consultant System	Rp 64.000.000	100%
4		1.3 Inisiasi Stakeholder	5 days	Thu 08/08/24	Wed 14/08/24	3	Administrator;Project Manager	Rp 60.000.000	100%
5		1.4 Menetapkan Proses Bisnis dan Operasional	3 days	Thu 15/08/24	Mon 19/08/24	4	Business Analyst	Rp 19.200.000	100%
6		1.5 Mendefinisikan Fungsi Komunitas Tiap Stakeholder	10 days	Tue 20/08/24	Mon 02/09/24	5	System Analyst;Administrator	Rp 112.000.000	100%
7		1.6 Mendefinisikan Informasi Pendukung	4 days	Tue 03/09/24	Fri 06/09/24	6	System Analyst;Technical Writer	Rp 46.400.000	100%
8		1.7 Menetapkan SRS	10 days	Mon 09/09/24	Fri 20/09/24	7	System Analyst	Rp 72.000.000	100%
9		*1.8 Analylisis Requirement Complete*	0 days	Fri 20/09/24	Fri 20/09/24			Rp 0	100%
10		**2 Perancangan Aplikasi dan Desain Sistem**	**27 days**	**Mon 23/09/24**	**Tue 29/10/24**			**Rp 209.200.000**	**100%**
11		2.1 Struktur Database	7 days	Mon 23/09/24	Tue 01/10/24	8	Database Administrator	Rp 39.200.000	100%
12		2.2 Menentukan UI/UX	5 days	Wed 02/10/24	Tue 08/10/24	11	UI/UX Designer	Rp 28.000.000	100%
13		2.3 Prototyping	10 days	Wed 09/10/24	Tue 22/10/24	12	UI/UX Designer;Developer	Rp 120.000.000	100%
14		2.4 Menetapkan DPPL	5 days	Wed 23/10/24	Tue 29/10/24	13	Technical Writer	Rp 22.000.000	100%
15		*2.5 Design System Complete*	0 days	Tue 29/10/24	Tue 29/10/24			Rp 0	100%
16		**3 Implementasi**	**31 days**	**Wed 30/10/24**	**Wed 11/12/24**			**Rp 271.200.000**	**100%**
17		3.1 Implementasi Interface	5 days	Wed 30/10/24	Tue 05/11/24	14	Developer	Rp 32.000.000	100%
18		3.2 Implementasi Database	13 days	Wed 06/11/24	Fri 22/11/24	17	Database Administrator;Developer	Rp 156.000.000	100%
19		3.3 Implementasi Fungsional Sistem	13 days	Mon 25/11/24	Wed 11/12/24	18	Developer	Rp 83.200.000	100%
20		*3.4 Implementation Complete*	0 days	Wed 11/12/24	Wed 11/12/24			Rp 0	100%
21		**4 Integrasi, Testing, dan Perbaikan Aplikasi**	**15 days**	**Thu 12/12/24**	**Wed 01/01/25**			**Rp 116.000.000**	**69%**
22		4.1 Menetapkan Skenario Pengujian	3 days	Thu 12/12/24	Mon 16/12/24	19	Quality Assurance;Tester	Rp 31.200.000	100%
23		4.2 Melakukan Testing Sistem Terintegrasi	2 days	Tue 17/12/24	Wed 18/12/24	22	Tester	Rp 11.200.000	100%
24		4.3 Testing tiap Fungsionalitas	5 days	Thu 19/12/24	Wed 25/12/24	23	Tester	Rp 28.000.000	100%
25		4.4 Evaluasi dan Perbaikan	3 days	Thu 26/12/24	Mon 30/12/24	24	Developer;Tester	Rp 36.000.000	13%
26		4.5 Final Test	2 days	Tue 31/12/24	Wed 01/01/25	25	Quality Assurance	Rp 9.600.000	0%
27		*4.6 Testing and Maintanance Complete*	0 days	Wed 01/01/25	Wed 01/01/25			Rp 0	0%
28		**5 Instalasi dan Operasi**	**23 days**	**Thu 02/01/25**	**Mon 03/02/25**			**Rp 127.200.000**	**0%**
29		5.1 Deploying atau Launching	2 days	Thu 02/01/25	Fri 03/01/25	26	IT Support	Rp 9.600.000	0%
30		5.2 Final Project Review Deliverables and Approvals	5 days	Mon 06/01/25	Fri 10/01/25	29	Project Manager	Rp 40.000.000	0%
31		5.3 Dokumentasi Sistem Informasi	5 days	Mon 13/01/25	Fri 17/01/25	30	Technical Writer	Rp 22.000.000	0%
32		5.4 Dokumentasi Buku Panduan	5 days	Mon 20/01/25	Fri 24/01/25	31	Technical Writer	Rp 22.000.000	0%
33		5.5 Training Aplikasi	6 days	Mon 27/01/25	Mon 03/02/25	32	Trainer	Rp 33.600.000	0%
34		*5.6 Instalation and Operation Complete*	0 days	Mon 03/02/25	Mon 03/02/25			Rp 0	0%

Image 6: RAB

Perencanaan Anggaran/ROI

The *Budget Plan (Rencana Anggaran Biaya / RAB)* for the public service complaint information system project included financial allocation for planning, consultation, system development, and evaluation activities. A total investment of approximately Rp 1,161,200,000 was allocated to enhance operational efficiency and reduce administrative costs associated with manual complaint management.

The *Return on Investment (ROI)* analysis was conducted to assess cost-effectiveness, team performance, and the optimal utilization of technological resources. The financial planning and ROI evaluation demonstrate that the system's long-term economic benefits justify the development investment, aligning with best practices in project financial management (inc 2013; Padma Arianie and Budi Puspitasari 2017).

Table 1. Project Consultant Budget Planning

Resource Name	Rate per Hour
Project Manager	Rp 1.000.000
System Analyst	Rp 900.000
Developer, Business Analyst	Rp 800.000
UI/UX Designer, Database Administrator, Consultant System, Tester, Trainer	Rp 700.000
Quality Assurance	Rp 600.000
IT Support	Rp 600.000
Administrator (Stakeholder Admin)	Rp 500.000
Technical Writer	Rp 550.000

Table 2. Total Project Consultant Budget Planning

Resource Name	Work	Rate	Cost
Analysis Requirement Complete	0 Hours		Rp -
Design System Complete	0 Hours		Rp -
Implementation Complete	0 Hours		Rp -
Testing and Maintenance Complete	0 Hours		Rp -
Instalation and Operation Complete	0 Hours		Rp -
Project Manager	**80 Hours**	**Rp 1.000.000**	**Rp 80.000.000**
Inisiasi Stakeholder	40 Hours		
Final Project Review Deliverables and Approvals	40 Hours		
System Analyst	**272 Hours**	**Rp 900.000**	**Rp 244.800.000**
Menentukan Kebutuhan Hardware	40 Hours		
Menentukan Kebutuhan Software	40 Hours		
Mendefinisikan Fungsi Komunitas Tiap Stakeholder	80 Hours		
Mendefinisikan Informasi Pendukung	32 Hours		
Menetapkan SRS	80 Hours		
UI/UX Designer	**120 Hours**	**Rp 700.000**	**Rp 84.000.000**
Menentukan UI/UX	40 Hours		
Prototyping	80 Hours		
Technical Writer	**152 Hours**	**Rp 550.000**	**Rp 83.600.000**
Mendefinisikan Informasi Pendukung	32 Hours		
Menetapkan DPPL	40 Hours		
Dokumentasi Sistem Informasi	40 Hours		
Dokumentasi Buku Panduan	40 Hours		
Quality Assurance	**40 Hours**	**Rp 600.000**	**Rp 24.000.000**
Menetapkan Skenario Pengujian	24 Hours		
Final Test	16 Hours		
Network Engineer	0 Hours		

Resource Name	Work	Rate	Cost
Developer	**352 Hours**	**Rp 800.000**	**Rp 281.600.000**
Prototyping	80 Hours		
Implementasi Interface	40 Hours		
Implementasi Database	104 Hours		
Implementasi Fungsional Sistem	104 Hours		
Evaluasi dan Perbaikan	24 Hours		
Business Analyst	**24 Hours**	**Rp 800.000**	**Rp 19.200.000**
Menetapkan Proses Bisnis dan Operasional	24 Hours		
Tester	**104 Hours**	**Rp 700.000**	**Rp 72.800.000**
Menetapkan Skenario Pengujian	24 Hours		
Melakukan Testing Sistem Terintegrasi	16 Hours		
Testing tiap Fungsionalitas	40 Hours		
Evaluasi dan Perbaikan	24 Hours		
Administrator	**120 Hours**	**Rp 500.000**	**Rp 60.000.000**
Inisiasi Stakeholder	40 Hours		
Mendefinisikan Fungsi Komunitas Tiap Stakeholder	80 Hours		
Database Administrator	**160 Hours**	**Rp 700.000**	**Rp 112.000.000**
Struktur Database	56 Hours		
Implementasi Database	104 Hours		
IT Support	**16 Hours**	**Rp 600.000**	**Rp 9.600.000**
Deploying atau Launching	16 Hours		
Consultant System	**80 Hours**	**Rp 700.000**	**Rp 56.000.000**
Menentukan Kebutuhan Hardware	40 Hours		
Menentukan Kebutuhan Software	40 Hours		
Trainer	**48 Hours**	**Rp 700.000**	**Rp 33.600.000**
Training Aplikasi	48 Hours		
Total Biaya Project			**Rp 1.161.200.000**

a. Estimated Project Banefits

1. Operational Efficiency

The implementation of an automated digital system reduces the dependency on manual labor, resulting in significant operational cost savings.

Table 3. Labor Cost Budget Estimation Planning

Activity (a)	Cost per Employee per Month (b)	Before The Project		After The Project		Savings (Cost per Year) (m)	Svings Over a Three-Year Period (i)
		Number of Employee (c)	Annual Cost (d)	Number of Employee (e)	Annual Cost (f)		
			(b*c)*12		(e*f)*12	d-f	g*3
Labor	Rp.10 Million	10	Rp 1,2 M	5	Rp 600 Million	Rp 600 Million	**Rp 1,8 M**

Table 4. Operational Cost Budget Estimation Planning

Activity (a)	Cost per Employee per Month (b)	Before The Project	After The Project	Savings (Cost per Year) (n)	Svings Over a Three-Year Period (j)
		Annual Cost (c)	Annual Cost (d)		
				c-d	e*3
Operational	Rp.10 Million	Rp 50 Million	Rp 10 Million	Rp 40 Million	**Rp 120 Million**

2. Increased Productivity and Revenue

The newly developed system expedites complaint resolution, enhances user satisfaction, and attracts a larger user base. Consequently, this improvement contributes to higher organizational productivity and potential revenue growth.

Tabel 5. Revenue Budget Estimation Planning

Activity (a)	Before The Project	After The Project	Annual Savings (o)	Three Year Saving (j)
	The manual system has the capacity to process 100 complaints per day	The automated system can process up to 200 complaints per day, enhancing efficiency and customer satisfaction		
	(b)	(c)	c-b	d*3
Revenue	Rp 1,5 M	Rp 1,8 M	Rp 300 Million	**Rp 900 Million**

3. Total Project Benefits

The cumulative benefits of these operational and productivity gains reinforce the project's financial and functional feasibility.

Total Annual Benefits	= m + n + o = Rp 600 Million + Rp 40 Million + Rp 300 Million
	= Rp 940.000.000 (940 Million)
Total Three-Year Benefits	= i + j + k / (Total Annual Benefits x 3) = Rp 940.000.000 x 3
	= 2.820.000.000 (2 Billion 820 Million)

b. Payback Period (PP) Analysis

The *Payback Period (PP)* method was employed to evaluate the project's investment return rate based on the time required to recover initial costs through annual economic benefits. PP serves as a key indicator in investment decision-making, reflecting both financial efficiency and risk level.

For the *Public Complaint Information System* development project, the calculated PP value was 1.24 years (approximately 1 year and 3 months), indicating a rapid and economically viable return on investment. This approach aligns with cost–benefit evaluation models described by (Project Management Institute 2021).

Formula Pay Back (PP):

$$PP = \frac{\text{Total Project Cost}}{\text{Total Annual Benefits}} = \frac{\text{Rp } 1.161.200.000}{\text{Rp } 940.000.000} = 1{,}24 \text{ years (or approximately 1 year and 3 moths)}$$

c. Return on Investment (ROI) Calculation

The *Return on Investment (ROI)* analysis was conducted to determine the efficiency and profitability of the public complaint information system project. ROI was used to evaluate project feasibility, compare investment alternatives, and assess the benefits gained relative to project costs.

Formula:

$$ROI = \frac{\text{Project Benefits} - \text{Total Project Cost}}{\text{Total Project Cost}} \times 100\% = \frac{\text{Rp } 2.820.000.000 - \text{Rp } 1.161.200.000}{\text{Rp } 1.161.200.000} \times 100\% = 142{,}9\%$$

The results showed an ROI of 142.9%, reflecting substantial profitability and confirming the project's financial viability. The high ROI value also indicates efficient resource utilization and potential for long-term improvement in public service performance. These findings are consistent with Fauzi et al. (2024), who asserted that a positive ROI exceeding 100% represents successful IT investments that generate significant organizational value.

d. Discounted Cash Flow / Net Present Value (NPV) Analysis

The Net Present Value (NPV) analysis was applied to assess the project's financial feasibility by considering the time value of money. Using a 10% annual discount rate and projected annual benefits of Rp 940,000,000, the total present value of project benefits over three years was calculated at Rp 2,337,925,026, resulting in a positive NPV of Rp 1,176,725,026. A positive NPV, coupled with an ROI of 142.9% and a PP of 1.24 years, demonstrates that the project is financially sound and delivers significant economic benefits to public service institutions. These results align with Surya Adi Darma et al. (2021), who noted that projects with positive NPV and high ROI reflect sustainable and productive investments in the public IT sector.

Formula Present Value (PV):

$$PV = \frac{\text{Annual Project Benefits}}{(1+r)^t}$$

Description:
PV = Present Value
r = Diskonto Rate (10% = 0,10)
t = Year to-t

Present Value (PV) Calcualtion for Year 1:

$$PV_1 = \frac{\text{Rp } 940.000.000}{(1+0{,}10)^1} = \frac{\text{Rp } 940.000.000}{1{,}10} = \text{Rp } 854.545.455$$

Present Value (PV) Calcualtion for Year 2:

$$PV_2 = \frac{\text{Rp } 940.000.000}{(1+0{,}10)^2} = \frac{\text{Rp } 940.000.000}{1{,}21} = \text{Rp } 776.859.504$$

Present Value (PV) Calcualtion for Year 3:

$$PV_3 = \frac{\text{Rp } 940.000.000}{(1+0{,}10)^3} = \frac{\text{Rp } 940.000.000}{1{,}331} = \text{Rp } 706.520.067$$

Total Present Value Calcualtion (PV) = PV1 + PV2 + PV3 = Rp 854.545.455 + Rp 776.859.504 + Rp 706.520.067 = Rp 2.337.925.026

Net Present Value (NPV) Calcualtion = PVTotal – Total Project Cost = Rp 2.337.925.026 – Rp 1.161.200.000 = Rp 1.176.725.026

Implementation Phase

The implementation phase represented the execution of the project plan, encompassing system development, testing, and control activities to ensure compliance with specifications. The public service complaint application was developed as a web-based system using the Waterfall model and the PMBOK framework, enabling citizens to submit complaints, monitor their status, and access transparent public service dashboards (inc 2013; Mahdias et al. 2019). The system was designed with both functional and non-functional requirements. Functional components include complaint reporting, real-time tracking, monitoring dashboards, automated notifications, and administrative management. Non-functional aspects focus on response speed under three seconds, cross-platform accessibility, scalability, and user-friendliness (Hayati et al. 2019).

The Use Case Diagram illustrates user interactions among citizens, officers, and administrators; the Class Diagram depicts the main data structures; and the dashboard interface is designed responsively to display real-time complaint updates (Padma Arianie and Budi Puspitasari 2017; Wulandari 2023).

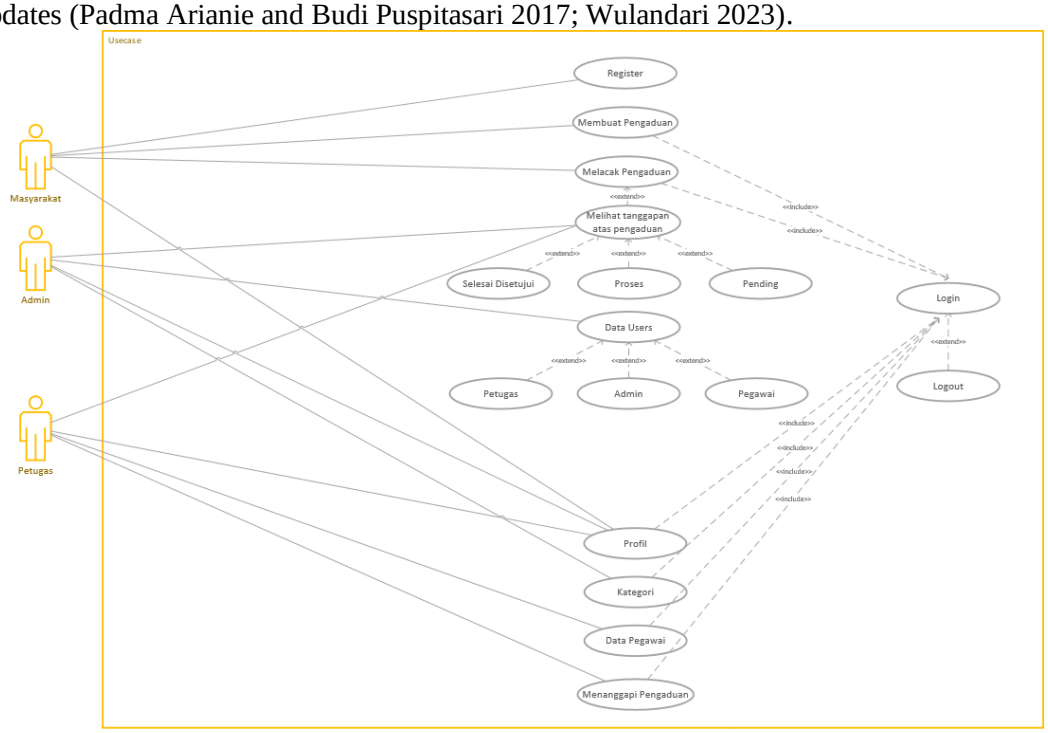


Image 7: Use Case Diagram

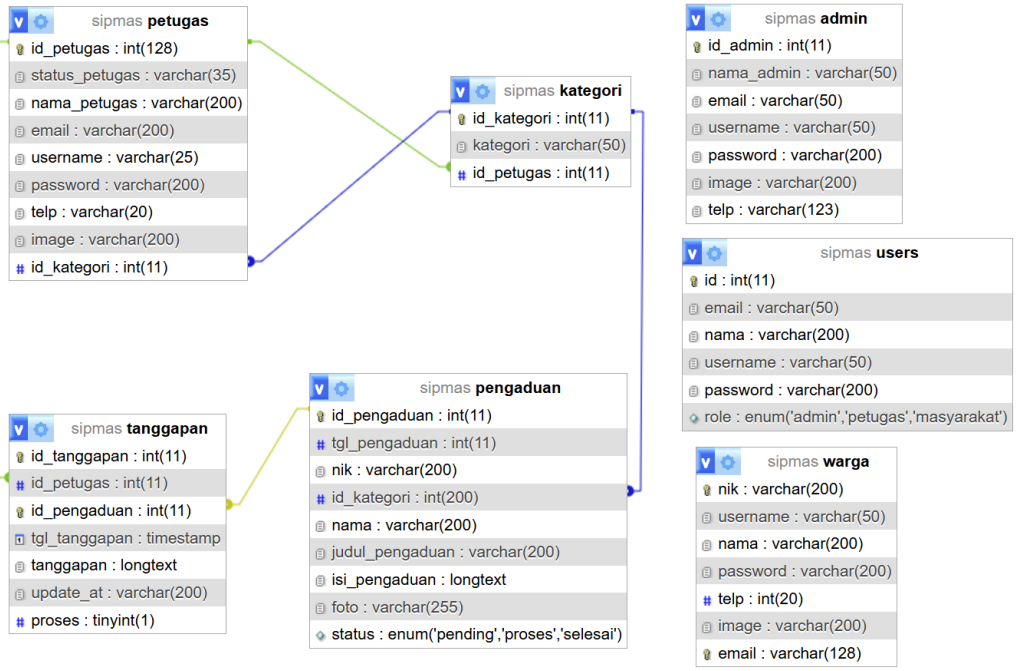


Image 8: Class Diagram

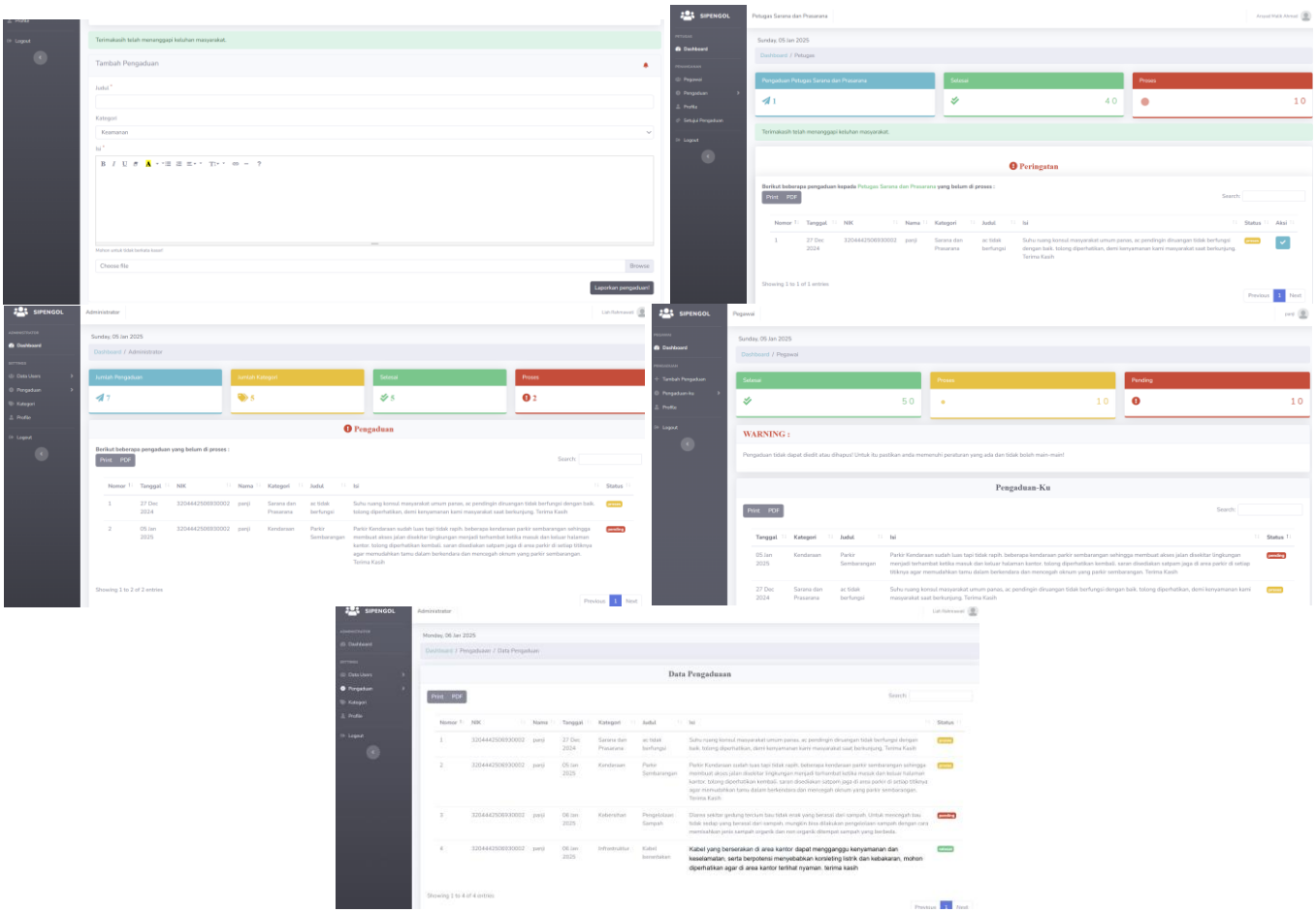


Image 9: Dashboard Interface

System quality was maintained through periodic testing of the interface, database, and code auditing using SonarQube. Evaluation was conducted based on key performance indicators (KPIs) and test documentation. Human resource management followed the RACI matrix to ensure clear role definition and accountability across the project team (Project Management Institute 2021).

Tabel 6. Matrix RACI

Source Name	Needs Analysis	Application and System Design	Implementation	Integration, Testing, and Improvement	Installation and Operation
Project Manager	A	A	A	A	A
System Analyst	R	R	C	I	I
Developer	I	C	R	R	I
UI/UX Designer	I	R	I	I	I
Business Analyst	R	I	I	C	I
Quality Assurance	I	I	I	R	I
Database Administrator	I	C	R	R	I
IT Support	I	I	I	I	R
Consultant System	I	C	I	I	I
Administrator	C	C	I	I	I
Technical Writer	I	I	I	I	R
Tester	I	I	I	R	I
Trainer	I	I	I	I	R

Description:
R: Responsibility C: Consultation

A: Accountability I: Informed

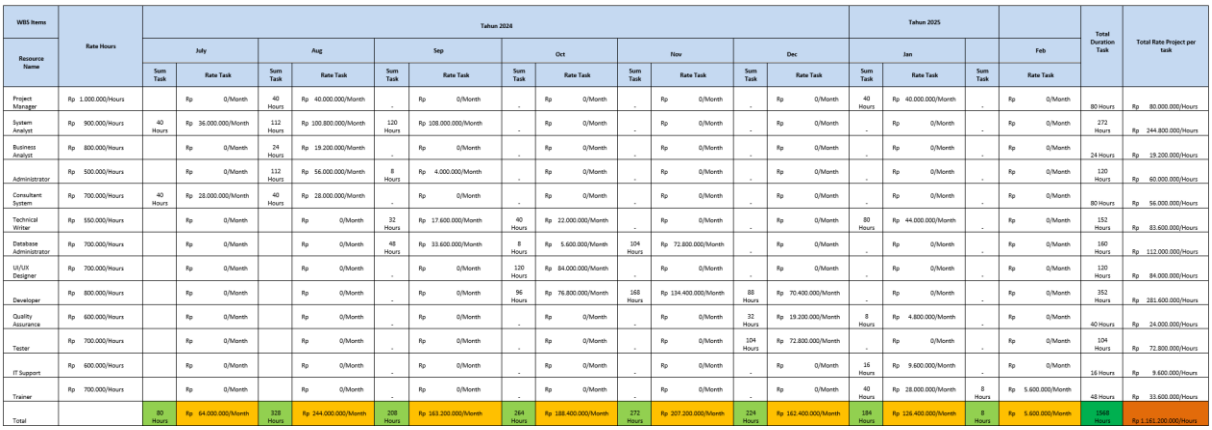
Communication management was carried out through regular meetings, project status reports, and electronic documentation. Project risks were identified according to the ten PMBOK Knowledge Areas—including integration, cost, schedule, and quality—and mitigated through schedule monitoring, contingency buffers, and periodic technical audits (Wulandari 2023). The procurement process evaluated three proposals based on four key criteria: technical approach, management approach, past performance, and price. The second proposal, scoring 43/100, was recommended as the most suitable option. Stakeholder analysis was performed using a power–interest grid to determine communication strategies and engagement methods appropriate for each stakeholder group (Padma Arianie and Budi Puspitasari 2017).

Tabel 7. Project Procurement Management

Criteria	Weight	Proposal 1		Proposal 2		Proposal 3	
		Rating	Score	Rating	Score	Rating	Score
Technical approach	30%	5	15	4	12	3	9
Management approach	30%	4	12	5	15	3	9
Past performance	20%	4	8	4	8	5	10
Price	20%	3	6	4	8	5	10
Total score	100%		41		43		38

Monitoring and Controlling Phase

This phase ensured that project activities remained consistent with planned timelines, budgets, and quality standards. Monitoring was conducted using performance reports, visual dashboards, and comparisons between actual results and project baselines to assess implementation efficiency (Project Management Institute 2021). Change control was managed through formal change request forms approved by key stakeholders. Risks were reviewed periodically, and mitigation actions were promptly implemented to maintain project stability (Hayati et al. 2019). Integration across project scope, time, cost, and quality dimensions was emphasized. Cross-functional coordination among developers, quality assurance teams, database administrators, and system consultants ensured that all deliverables met established quality standards (Mahdias et al. 2019).



WBS Items	Rate Hours	Tahun 2024												Tahun 2025				Total Duration Task	Total Rate Project per task
Resource Name		July		Aug		Sep		Oct		Nov		Dec		Jan			Feb		
		Sum Task	Rate Task	Sum Task	Rate Task	Sum Task	Rate Task	Sum Task	Rate Task	Sum Task	Rate Task	Sum Task	Rate Task	Sum Task	Rate Task	Sum Task	Rate Task		
Project Manager	Rp 1.000.000/Hours		Rp 0/Month	40 Hours	Rp 40.000.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	40 Hours	Rp 40.000.000/Month	-	Rp 0/Month	80 Hours	Rp 80.000.000/Hours
System Analyst	Rp 900.000/Hours	40 Hours	Rp 36.000.000/Month	112 Hours	Rp 100.800.000/Month	120 Hours	Rp 108.000.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	272 Hours	Rp 244.800.000/Hours
Business Analyst	Rp 800.000/Hours		Rp 0/Month	24 Hours	Rp 19.200.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	24 Hours	Rp 19.200.000/Hours
Administrator	Rp 500.000/Hours		Rp 0/Month	112 Hours	Rp 56.000.000/Month	8 Hours	Rp 4.000.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	120 Hours	Rp 60.000.000/Hours
Consultant System	Rp 700.000/Hours	40 Hours	Rp 28.000.000/Month	40 Hours	Rp 28.000.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	80 Hours	Rp 56.000.000/Hours
Technical Writer	Rp 550.000/Hours		Rp 0/Month		Rp 0/Month	32 Hours	Rp 17.600.000/Month	40 Hours	Rp 22.000.000/Month	-	Rp 0/Month	-	Rp 0/Month	80 Hours	Rp 44.000.000/Month	-	Rp 0/Month	152 Hours	Rp 83.600.000/Hours
Database Administrator	Rp 700.000/Hours		Rp 0/Month		Rp 0/Month	48 Hours	Rp 33.600.000/Month	8 Hours	Rp 5.600.000/Month	104 Hours	Rp 72.800.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	160 Hours	Rp 112.000.000/Hours
UI/UX Designer	Rp 700.000/Hours		Rp 0/Month		Rp 0/Month	-	Rp 0/Month	120 Hours	Rp 84.000.000/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	120 Hours	Rp 84.000.000/Hours
Developer	Rp 800.000/Hours		Rp 0/Month		Rp 0/Month	-	Rp 0/Month	96 Hours	Rp 76.800.000/Month	168 Hours	Rp 134.400.000/Month	88 Hours	Rp 70.400.000/Month	-	Rp 0/Month	-	Rp 0/Month	352 Hours	Rp 281.600.000/Hours
Quality Assurance	Rp 600.000/Hours		Rp 0/Month		Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	32 Hours	Rp 19.200.000/Month	8 Hours	Rp 4.800.000/Month	-	Rp 0/Month	40 Hours	Rp 24.000.000/Hours
Tester	Rp 700.000/Hours		Rp 0/Month		Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	104 Hours	Rp 72.800.000/Month	-	Rp 0/Month	-	Rp 0/Month	104 Hours	Rp 72.800.000/Hours
IT Support	Rp 600.000/Hours		Rp 0/Month		Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	16 Hours	Rp 9.600.000/Month	-	Rp 0/Month	16 Hours	Rp 9.600.000/Hours
Trainer	Rp 700.000/Hours		Rp 0/Month		Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	-	Rp 0/Month	40 Hours	Rp 28.000.000/Month	8 Hours	Rp 5.600.000/Month	48 Hours	Rp 33.600.000/Hours
Total		80 Hours	Rp 64.000.000/Month	328 Hours	Rp 344.000.000/Month	208 Hours	Rp 163.200.000/Month	264 Hours	Rp 188.400.000/Month	272 Hours	Rp 207.200.000/Month	224 Hours	Rp 162.400.000/Month	184 Hours	Rp 126.400.000/Month	8 Hours	Rp 5.600.000/Month	1568 Hours	Rp 1.161.200.000/Hours

Image 10: Cost Realization Matrix

Cost monitoring utilized WBS realization matrices and S-curves to compare planned versus actual expenditures. Results indicated that the project operated efficiently within the total budget of Rp 1,161,200,000, consistent with the initial estimate (Padma Arianie and Budi Puspitasari 2017).

Name	Remaining Cost	Actual Cost	Cost	ACWP	BCWP	BCWS
Analisis Kebutuhan	Rp 0	Rp 437.600.000	Rp 437.600.000	Rp 437.600.000	Rp 0	Rp 0
Perancangan Aplikasi dan Desain Sistem	Rp 0	Rp 209.200.000	Rp 209.200.000	Rp 209.200.000	Rp 0	Rp 0
Implementasi	Rp 0	Rp 271.200.000	Rp 271.200.000	Rp 271.200.000	Rp 0	Rp 0
Integrasi, Testing, dan Perbaikan Aplikasi	Rp 40.800.000	Rp 75.200.000	Rp 116.000.000	Rp 75.200.000	Rp 0	Rp 0
Instalasi dan Operasi	Rp 127.200.000	Rp 0	Rp 127.200.000	Rp 0	Rp 0	Rp 0

Image 11: WBS Realization Matrix and S-Curve

Closing Phase

The closing phase marked the completion of all project activities and the formal handover of the system to the client institution. Verification was conducted to ensure all deliverables met project scope requirements, accompanied by technical documentation and final reports (Project Management Institute 2021). End-user training sessions were conducted to ensure users could operate the system effectively. Technical writers prepared comprehensive documentation to serve as operational guides and references for future system development (Wulandari 2023). A final evaluation assessed project performance in terms of time, cost, and quality. Feedback from stakeholders was collected to identify lessons learned and enhance organizational learning. Upon achieving all project objectives, the project team was formally disbanded, and the closing report was approved by senior management (Padma Arianie and Budi Puspitasari 2017).

CONCLUSION

The development of the public service complaint application successfully produced a responsive, innovative, and citizen-oriented digital system. The project was executed with a clearly defined scope, measurable schedule, realistic budget, and well-established quality standards. Effective communication and collaboration among stakeholders contributed significantly to the smooth implementation of each project phase. Monitoring and control were carried out through key performance indicators (KPIs), periodic progress reports, and structured change management procedures. Project risks were effectively mitigated, ensuring stability and continuity throughout the implementation process. The resulting application meets user requirements by providing comprehensive functional features and an intuitive user interface. The project closing phase was efficiently executed through complete documentation, user training sessions, and the formal handover of the system to the operational team to ensure sustainability. The final evaluation indicated that the project's success was driven by thorough planning, effective risk management, and strong team synergy. This initiative serves as a practical example of good project management practices in the development of digital public service systems.

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