Analysis of alternatives methodology for large-scale information system implementation

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Article Info

ABSTRACT

According to the Presidential Decree, central and local governments must implement electronic-based government systems or *sistem pemerintahan berbasis elektronik* (SPBE). However, the independent implementations have created various similar applications to support the same field of governmental activities. The situation creates difficulties in achieving effectiveness, integration, sustainability, efficiency, accountability, interoperability, and security of governmental services. Therefore, a common application will be developed for each governmental activity to improve interoperability and data integration. On the other hand, central or local governments must consider the suitable implementation of their public service information systems. This manuscript guides the determination of alternatives using cost, benefit, and risk analysis. We use the proposed guidance for a case study because *sistem pengelolaan pengaduan pelayanan publik nasional-layanan aspirasi dan pengaduan online rakyat* (SP4N-LAPOR!) has been regulated as the common application for Public Service Complaints Management using PermenPANRB No. 680, 2020. The application of the proposed guidance shows that it can help the stakeholder quantitatively decide on an alternative implementation of the application for the public service complaints management system.

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1.   INTRODUCTION

Analysis of alternatives is a process of determining and analyzing multiple alternatives before making investment decisions. It has been adopted by the Office of Management and Budget and the Department of Defense [1]. On the other hand, cost-benefit analysis is a systematic and analytic process to compare the benefits and costs required from various alternative solutions [2]–[4]. It is a decision process procedure that can make informed decisions using all available resources and has been used in evaluating various government policies and projects [5]. One can consider an analysis of alternatives as a cost-benefit analysis, where both are used to support the decision-making process, using qualitative and quantitative analysis by considering various factors. The differences are in the purpose of analysis, where analysis of alternatives has a broader scope and aims to identify the best course of action among various alternatives. In comparison, cost-benefit analysis has a narrower scope and focuses primarily on monetary terms. Even though both methods have been used for various decision-making processes from social policy [6]–[11] to engineering [12]–[14]. However, there is no standardization on its application in information technology

projects, especially in large-scale governmental projects. The analysis of costs and benefits performs the qualification and quantification of the benefits obtained and the costs that could be incurred [15]. In the large-scale government service system, profits, and expenses can be obtained from within the government as service providers and from the community as service recipients.

The Indonesian Government has committed to spending billions of dollars on developing e-government systems [16]–[18]. It is followed by Presidential Decree No. 95, 2018, about the electronic-based government system or *sistem pemerintahan berbasis elektronik* (SPBE). According to that decree, information technology-based government service systems are expected to be implemented in one or more SPBE services. The implementation should have proper values (article 1), with principles of effectiveness, integration, sustainability, efficiency, accountability, interoperability, and security (section 2) [19]. Furthermore, article 63 states that several common applications will support government activities in various fields, such as planning, budgeting, procurement of government goods and services, performance accountability, monitoring and evaluation, record management, staffing, and public service complaints. As a follow-up to the regulation, *sistem pengelolaan pengaduan pelayanan publik nasional-layanan aspirasi dan pengaduan online rakyat* (SP4N-LAPOR!) has been established as the common application in managing public service complaints through the Ministry of State Apparatus Utilization and Bureaucratic Reform Regulation, PermenPANRB No. 680, 2020 concerning general applications for the management of public service complaints. Furthermore, in 2021, through the Ministry of State Apparatus Utilization and Bureaucratic Reform Regulation, PermenPANRB No. 1148, 2021, electronic procurement system or *sistem pengadaan secara elektronik* (SPSE) is decided as the common application in the procurement of government goods and services.

In order to enforce the implementation of SPBE regulation, there will be other common applications in other SPBE fields. Hence, it is necessary to have a framework for analyzing the costs, risks, and benefits of various alternatives for the implementation of an appropriate system. Therefore, it is essential to study how to implement a cost, benefit, and risk analysis in an integrated methodological framework and use the SP4N-LAPOR! application as the case study. This manuscript is expected to be used as a guideline for conducting decision-making studies using cost, benefit, and risk analysis to choose the implementation techniques from alternative approaches, such as using a common application system or developing other similar applications. This paper is organized by explaining the differences between common and similar applications in the context of SPBE, followed by the general method of cost, benefit, and risk analysis as the methodological framework for the analysis of alternatives. The proposed method is explained in detail using a case study of analysis of alternatives for the implementation of public complaints management system. Lastly, we present the conclusion and future work in improving the framework and guidelines for using the framework for different implementations of SPBE applications.

2.   COMMON AND SIMILAR APPLICATIONS

The concept of a common application in the context of SPBE represents a unified approach to digital governance. These applications are characterized by their standardized processes, designed to be universally applicable across various branches of government. This standardization ensures that whether an application is being used by central agencies or local governments, its functionality and processes remain consistent. Such a system facilitates ease of use and interoperability, allowing for a more streamlined sharing of information and resources among different governmental entities. The goal is to create an integrated digital environment that supports efficient public service delivery.

On the other hand, similar applications refer to information system applications that are developed independently by state agencies, central agencies, or local governments. Unlike common applications, these similar applications are managed separately, each with its own set of rules and protocols. However, they are designed to fulfill comparable functions and processes within the government's digital infrastructure. The existence of similar applications across different governmental levels indicates a move towards digitalization, albeit with a more decentralized approach. Each agency or government unit tailors its information system to meet specific needs while still aligning with the broader goals of public service and governance.

The distinction between common and similar applications lies in their development and management approach. Common applications emphasize uniformity and shared use across the government spectrum, promoting a cohesive digital governance framework. In contrast, similar applications showcase the diversity in digital solutions adopted by various government entities, reflecting a more tailored approach to specific operational needs. Despite their differences, both types of applications play crucial roles in the digital transformation of government services, aiming to enhance efficiency, transparency, and accessibility in public service delivery.

3.   METHOD

Cost-benefit analysis is a method that quantifies the value of implementing a policy or applying technology to stakeholders [15]. In a government system, stakeholders are the government as the service provider and the community as the service recipient. In general, cost-benefit analysis calculates net benefit (NB) as the difference between benefit (B) and cost (C).

$$NB = B - C \qquad (1)$$

Another parameter, such as risk (R), can also be added as a threat to policy or technology implementation. Risks should be assessed and managed [20], [21] as if they might affect the NB. Thus, (1) might be modified as (2) accordingly:

$$NB = xB - yC - zR \qquad (2)$$

where B is the total benefit, C is the total cost, and R is the total risk, while x, y, and z are adjustable weights of those values.

For the implementation of new technology or adaptation of a new system, the analysis starts with assessing the existing condition and predicts the needs that may occur in the future. Then, based on the evaluation of these needs, an analysis is carried out, starting from determining alternative solutions, carrying out qualitative and quantitative cost, benefit, and risk analysis as a basis for assessment and decision-making so that a recommendation can be produced that can be used [22]. The general analysis stages are depicted in Figure 1.
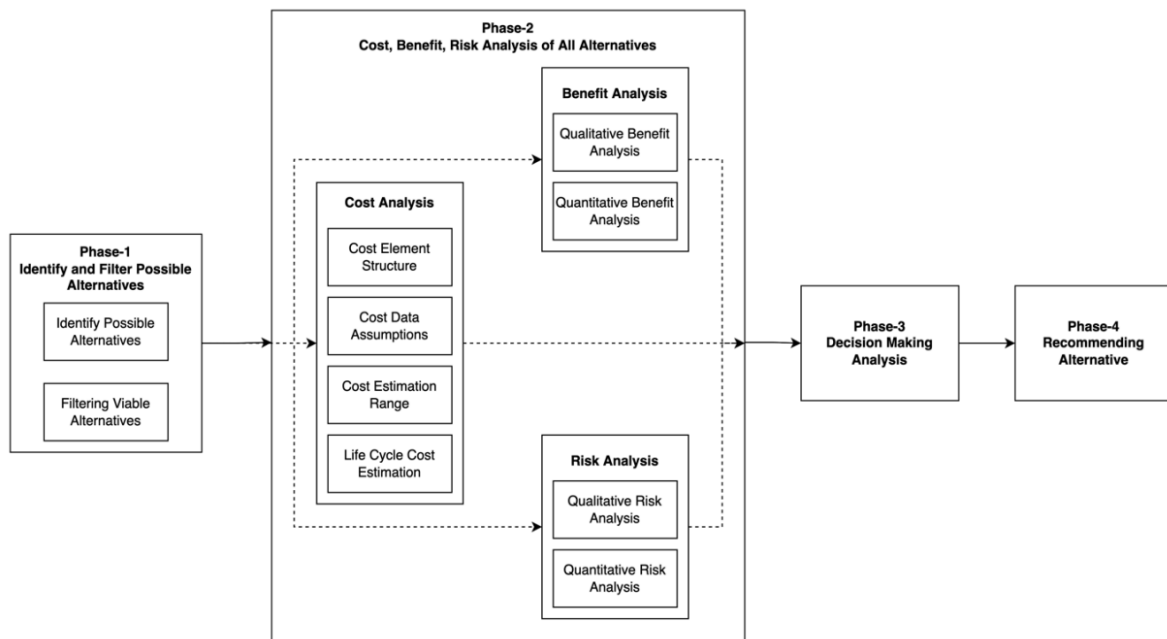

Figure 1. General cost, benefit, and risk analysis stages (adapted from [22])

In general, there are four phases of analytics. The first phase is identifying and filtering possible alternatives. In this phase, the analyst needs to list all possible alternatives. Then, those possible alternatives are filtered using the functional and non-functional requirements of the target system. Finally, each requirement is weighed based on the possibility of the implementation, while the cost and risk of the implementation will be deferred to the next phase. As a result, a few promising alternatives have been chosen based on the ability to fulfill the given requirements and will be taken to the next phase.

The second phase is the core cost, benefit, and risk analysis, where each alternative is evaluated on its costs, benefits, and risks. During cost analysis, the analyst creates a cost element structure, gives cost data assumptions and estimation ranges, and life cycle cost estimation on each alternative's implementation. Benefit and risk analysis deals with the anticipated benefits and potential risks during and after implementing

the viable alternatives. They can be carried out using qualitative and quantitative analysis. While quantitative analysis requires more detailed information that might not be available during the analysis phase and before the implementation, some analysis needs to be carried out using adjusted assumptions from similar implementations. Components for consideration during cost, benefit, and risk analysis are detailed in the case study. The consideration components are subject to further modification if required.

The third phase is decision-making analysis. This analysis uses decision-making weights to use cost, benefit, and risk analysis information. Espinoza *et al*. [22] provide six factors and weight values for decision-making from each alternative solution described. The six factors are:
a. Ability to meet key success factors (25%)
b. Length of time from planning to use (10%)
c. Total costs (15%)
d. Qualitative risk (30%)
e. Qualitative benefit (10%)
f. The confidence level of cost requirement (10%)
The output of the decision-making analysis becomes the chosen alternative to be recommended to the stakeholders.

4.   THE CASE STUDY (SP4N LAPOR!)
4.1. Initiation
4.1.1. Current condition assessment
SP4N-LAPOR! is a national public service complaint management application that has received 1,592,427 reports, an average of 199,053 reports annually, since 2012. With its popularity, SP4N-LAPOR! has been decided to be the common application for public service complaint management through the Ministry of State Apparatus Utilization and Bureaucratic Reform Regulation, PermenPANRB No. 680, 2020. However, with the implementation of Presidential Decree PP No. 95 In 2018, many central and local government agencies have already developed their electronic-based public complaint systems. Some of those are listed in Table 1, such as LaporGub in Central Java province, West Java quick response (*Jabar QR)* in West Java province, aspirations and complaints service in the House of Representatives or *Layanan Aspirasi dan Pengaduan DPR*, integrated system for complaints and aspirations or *sistem terintegrasi untuk pengaduan dan aspirasi* (SIGAP) in Depok City, as well as many other similar systems. Those local implementations gained popularity and met the public's expectations in their regions [23], [24], from performance to facilitation that could be given by the e-government services [25]. Nevertheless, data integration and process standardization are required with respect to the PermenPANRB regulation No. 680, 2020, which suggests using SP4N-LAPOR as the common application for public service complaint management.

Table 1. Common application and similar applications for public service complaint management application

Common applications	Similar applications
Ministry of State Apparatus Utilization and Bureaucratic Reform: SP4N-LAPOR! (https://www.lapor.go.id/)	Central Java Province Government: LaporGub (https://laporgub.jatengprov.go.id/) West Java Province Government: JabarQR (https://web.archive.org/web/20240101085119/https://jabarqr.id/) House of Representatives: *Layanan Aspirasi dan Pengaduan DPR* (https://pengaduan.dpr.go.id/) Depok City Government: SIGAP (https://play.google.com/store/apps/details?id=com.depok.sigap)

4.1.2. Determining future requirements
SPBE requires integrating and consolidating data from existing similar applications or even with a common application. Data integration or consolidation is necessary to realize an integrated development planning, implementation, evaluation, and control supported by accurate, up-to-date, integrated, accountable, easily accessible, and shared carefully managed, integrated, and sustainable data [26]. Therefore, one data Indonesia was formed through Presidential Decree no. 39 of 2019.

The increasing number of Internet and mobile users in the Indonesian community allows people to report their public services using online systems. The system requires better infrastructure tools for data management, and data security is also needed with the increasingly available technology used and the access provided to the public. This need can be met by improving the management and security of data in the system

and data center through a comprehensive system evaluation. The public service complaint management system has a strategic aspect for evaluating the implementation of services to the community to be used as the basis for development planning. Stakeholders in this system include:

− The Central Government, in this case, the Ministry of State Apparatus Empowerment and Bureaucratic Reform, to evaluate the public services provided by the State Apparatus.
− The Local Government evaluates the public services offered by the local civil servants.
− Ministry of Information and Communication.
− Public Agencies.
− The community controls public services provided by the central government or local governments.

The future application requirements for SPBE can be summarized in Table 2.

Table 2. Future application requirements

Requirements	Implementation techniques	Supporting regulations
Integration of development planning, implementation, evaluation, and control	Integration and consolidation of data from similar applications and common applications	Indonesian One Data (*Satu Data Indonesia*) through the Presidential Decree No. 39, 2019
An increase in service users in the form of the number of users and the number of reports	Addition of computing infrastructure and data center	National Data Center (*Pusat Data Nasional*)
Application data management and security	Improved data management and security in systems and data centers	Guidelines for Evaluation of SPBE through Ministry of State Apparatus Utilization and Bureaucratic Reform Regulation, PermenPANRB No. 5, 2018)

4.2. Analysis of alternatives
4.2.1. Identify and filter possible alternatives

The implementation of the public complaint application system for public services in government agencies can be achieved in various ways:

a. Using existing reporting application system products (off-the-shelf).
b. Creating a new similar reporting application system similar to existing similar applications.
c. Creating a similar application system that refers to general applications.
d. Using conventional approaches such as telephone, SMS, or other messaging applications.
e. Use common applications.

The various alternative solutions are selected as the best solutions according to the criteria for meeting the primary requirements and implementation needs. The public complaint application system for public services is needed to realize the quality and reliability of public services in central and local government agencies. In addition, this system is a channel for the community as recipients of public services for the services provided. It can be used as a clean, effective, transparent, and accountable governance control.

Therefore, in general, the public complaint application system has the following functional requirements:

F-1. Can receive reports of complaints from the public against one part of a particular central institution or local government.
F-2. Can forward the complaint report to the person in charge of a specific central institution or local government.
F-3. Can display the status of complaints reports that the public has submitted.
F-4. Can receive satisfaction surveys from the public on complaints reports that have been made and processed.
F-5. Can provide performance evaluations of certain central institutions or local governments based on public service complaints reports from the community.

In addition, the public complaint application system also has non-functional requirements, including:

NF-1. Can guarantee that the complaints are made by trusted complainants.
NF-2. Can guarantee the confidentiality of the complainant.
NF-3. Can receive many complaints and be forwarded to various persons in charge of certain central institutions or regional governments.
NF-4. Can guarantee the availability of complaint services.
NF-5. Can guarantee the confidentiality and ownership of data in the authorized agency.

The functional and non-functional requirements are mapped to each identified alternative solution. The mapping results are shown in Table 3.

Table 3. Analysis of public complaint application system needs on various alternative implementation solutions

Requirements	a	b	c	d	e
F-1. Can receive reports of complaints from the public against one part of a particular central institution or local government.	x	x	x	x	x
F-2. Can forward the complaint report to the person in charge of a specific central institution or local government.	+	x	x	o	x
F-3. Can display the status of complaints reports that have been submitted by the public.	+	x	x	o	x
F-4. Can receive satisfaction surveys from the public on complaints reports that have been made and processed.	+	x	x	o	x
F-5. Can provide performance evaluations of certain central institutions or local governments based on public service complaints reports from the community.	o	+	x	o	x
NF-1. Can guarantee that the complaints are made by trusted complainants.	+	x	x	x	x
NF-2. Can guarantee the complainant's confidentiality.	o	x	x	o	x
NF-3. Can receive many complaints and be forwarded to various persons in charge of certain central institutions or regional governments.	o	x	x	o	x
NF-4. Can guarantee the availability of complaint services.	x	x	x	o	x
NF-5. Can guarantee the confidentiality and ownership of data in the authorized agency.	o	x	x	o	x
Total	4	9.5	10	2	10

Notes:
a. Using existing reporting application system products (off-the-shelf),
b. Creating a new reporting application system similar to existing similar applications,
c. Creating a similar application system that refers to the common application,
d. Using conventional systems such as telephone, SMS, or other messaging applications,
e. Use common applications.
o. Not available (=0)
+. Available after doing additional development (=0.5)
x. Available (=1)

Based on the preliminary analysis, three alternative solutions can be considered to meet the needs of the public complaint application system, namely: new application development refers to existing similar applications, new application development that is similar to the common application and using the common application. The three alternative solutions can be reduced to two: developing a new similar application or using the common application. In the following section, we explain those alternatives and then assess them by analyzing costs, benefits, and risks.

4.2.2. Cost, benefit, and risk analysis of all alternatives

Cost analysis relates to the estimated costs required to implement the alternative solutions obtained in section 4.2.1. Cost analysis is carried out by defining the cost element structure for the implementation of each alternative solution. That includes procurement, operation, and maintenance costs, transition costs, and other costs. In addition, it is also necessary to define the required cost assumptions, such as the costs required to improve performance (performance scalability), inflation, and so on, as well as determine the range of possible expenses to occur. Costs are categorized as "best", "worst", and "most-likely", where "best" for the lowest cost; "worst" for the highest cost; and "most-likely" for the least possible cost. Cost information also needs to be collected as a quantitative parameter of the cost analysis.

Cost components that can be measured include:
C-1. System implementation or development is the cost required to develop similar applications or the application of general applications according to the needs of certain agencies.
C-2. Duration of system implementation or development is the time required to develop similar applications or general application applications according to the needs of certain agencies.
C-3. Provision of computing infrastructure that must be owned by the agency that will use the public complaint application system, either in the form of a computer in its data center or using other data centers.
C-4. Manager training is needed to prepare application system managers to use application systems and solve problems that may exist. Management training costs are also related to the provision of management staff (C-9).
C-5. Maintenance of equipment and infrastructure is a cost that must be allocated to ensure the availability of application system services. It is required because the system can be damaged and must be repaired.
C-6. Service advertisement is the cost required to advertise services to the public, provide information or even provide public training to use the application systems.
C-7. Transition time is the cost of time that must be spent waiting for the system to be available and usable.

C-8. Improving system/infrastructure performance is the cost required to improve system performance, either in the procurement of infrastructure to accommodate increased users and data or in updating application systems following the development of user needs.

C-9. Personnel provision is the cost required to provide personnel for application support if needed.

Details of the cost analysis for the community complaint application system are described in Table 4.

Table 4. Cost analysis of the public complaint application system (adjusted with assumptions)

Cost component	New application development	Using common application
Procurement		
C-1. System implementation/development	IDR 500.000.000 (most-likely)	0 (best)
C-2. Duration of system implementation/development	12 months (best)	3 months (most-likely)
C-3. Infrastructure provision	IDR 1.000.000.000 (most-likely)	0 (best)
Operation and maintenance		
C-4. Operator training	IDR 20.000.000 (most-likely)	IDR 20.000.000 (most-likely)
C-5. Equipment and infrastructure maintenance	IDR 20.000.000 (best)	0 (best)
Transition		
C-6. Service advertisement	IDR 20.000.000 (best)	IDR 20.000.000 (best)
C-7. Transition time	15 months (best)	3 months (best)
Other costs		
C-8. Improvement of system/infrastructure performance	IDR 100.000.000 (per 2 years) (best)	0 (best)
C-9. Personnel provision	5 people (best)	2 people (best)
Total cost	IDR 1.610.000.000 15 months 5 people	IDR 40.000.000 3 months 2 people

Benefit analysis is related to the qualitative and quantitative advantages obtained if alternative solutions are implemented. Benefits can be identified based on the purpose of the system used and the fulfillment of both functional and non-functional requirements of the system. Moreover, benefits can be divided into quantitative and qualitative benefits. Qualitative benefits can be measured either in the form of tangible benefits that can be directly measured, such as reduced supervision costs. On the other hand, intangible benefits cannot be directly measured, such as reducing the number of public complaint reports resulting from public control through the public complaint application system. Moreover, qualitative advantages cannot be measured by specific values, such as improving government agencies' work quality.

The profit components in the implementation of the public complaint application system can be described as follows:

B-1. Integrated management of public complaints with relevant agencies.

B-2. Increased supervision of community services.

B-3. Increased number of users and resolved community complaints.

B-4. Increasing the speed of completion of community complaints reports.

B-5. Increased community satisfaction.

B-6. Increasing the speed of the application system to be used by the public.

B-7. Improving the ability of management employees in agencies to maintain application systems.

B-8. Enhanced application development capabilities according to application needs.

B-9. Improving the quality of work in the agency.

B-10. Improving public services into the quality and reliable services.

B-11. Increasing uniformity and integration of public service management.

B-12. Improving the quality of clean, effective, transparent, and accountable governance.

However, in this case study, the benefit analysis was carried out predictively and qualitatively due to the limited available data. Details of the profit analysis for the community complaint application system are described in Table 5. Risk analysis describes the risks that may occur using existing alternative solutions. Risk analysis can be carried out using quantitative analysis and mathematical modeling, such as simulations, and by considering the possibility of risk occurrence. In addition, risk analysis can also be carried out qualitatively by assessing the likelihood of risks occurring and the magnitude of the consequences of these risks. The risks of implementing the public complaint application system can be identified as follows:

R-1. Changes in regulations related to the public complaint application system.

R-2. The unpreparedness of agencies in receiving public complaints.

R-3. Damage to the infrastructure system used by the public complaint application system.

R-4. Loss of data on the application system.

R-5. Security weaknesses in the application system.

Due to limited data and information, risk analysis is carried out predictively and qualitatively using interviews with software development teams. Details of the risk analysis for the public complaint application system are described in Table 6.

Table 5. Analysis of the benefits of the public complaint application system

Benefit component	New application development	Using common application
B-1. Integrated management of public complaints with relevant agencies	Can be done by carrying out additional development or granting users and access rights to related institutions (most-likely)	Can be done (most-likely)
B-2. Increased supervision of community services	Can be achieved with the participation of the community as service recipients (best)	Can be achieved with the participation of the community as service recipients (best)
B-3. Increased number of users and resolved community complaints	Can be achieved after the developed application is complete and can be used by the community (best)	Can be achieved, and the application only needs a minor adjustment on the side of the manager in the relevant agency (most-likely)
B-4. Increasing the speed of completion of community complaints reports	Can be achieved after the developed application is complete and can be used by the community and supervision of the completion of community complaints reports from system managers and authorized officials (best)	Can be achieved because the general application has been designed to provide information and reports to authorized officials on the process of resolving community complaints (most-likely)
B-5. Increased community satisfaction	Can be achieved after the application developed is complete and can be used by the community, and the community feels the benefits of the application system (best)	Can be achieved after being used by the community, and the community feels the benefits of the application system (best)
B-6. Increasing the speed of the application system to be used by the public	15 months (best)	3 months (best)
B-7. Improving the ability of management employees in agencies to maintain application systems	Management staff can use and maintain the application (best) After receiving training, management employees have not been able to use and maintain the application, so application developers are needed to run and maintain the system (worst)	The maintainer can use and maintain the application. The general application manager carries out major maintenance for the application (best)
B-8. Enhanced application development capabilities according to application needs	Application system developers can develop further applications according to their needs (most-likely)	Application capabilities are developed and adjusted according to agency needs by general application managers (best)
B-9. Improving the quality of work in the agency	The quality of work in agencies is getting better with supervision from the community (best)	The quality of work in agencies is getting better with supervision from the community (best)
B-10. Improving public services into the quality and reliable services	Public services have become quality and reliable (best)	Public services have become quality and reliable (best)
B-11. Improved uniformity and integration in the management of public service complaints	The management of public service complaints needs to be uniform according to the needs (most-likely)	The management of public service complaints is uniform (best)
B-12. Improving the quality of clean, effective, transparent, and accountable governance	Good governance, clean, effective, transparent, and accountable (best)	Good governance, clean, effective, transparent, and accountable (best)
Benefits mapping	9/8 *best* 3 *most-likely* 0/1 *worst*	9 *best* 3 *most-likely*

The decision-making analysis is then performed using collected information from cost, benefit, and risk analysis. It can be done by applying factors and weight values for each alternative solution's decision-making [22]. Those factors are:

D-1. Ability to meet key success factors (25%).
D-2. Length of time from planning to use (10%).
D-3. Total costs (15%).
D-4. Qualitative risk (30%).
D-5. Qualitative benefit (10%).
D-6. The confidence level of cost requirement (10%).

Based on the mapping of costs, benefits, and risks of developing a new application for managing public complaints against public services and using the SP4N-LAPOR! by using the decision-making form is described in Table 7.

Table 6. Analysis of the risks of the public complaint application system

Benefit component	New application development	Using common application
R-1. Changes in regulations related to the public complaint application system.	It can happen, so the new application system must be redeveloped or adjusted to the latest regulations (worst).	It can happen, but the user agency does not need to change the application system. Adjustments to regulations are carried out by the general application manager (best).
R-2. The unpreparedness of agencies in receiving public complaints.	Officials are not prepared to receive public complaints about the services provided (worst).	Officials are not prepared to receive public complaints about the services provided (worst).
R-3. Damage to the infrastructure system used by the public complaint application system.	The infrastructure system can be damaged, thereby disrupting the application system. Agencies need to prepare their handling (worst).	The infrastructure system can be damaged, but it is under the supervision of the general application manager or the national data center. The user agency does not need to be involved (best).
R-4. Loss of data on the application system.	Data can be lost, thereby disrupting the application system. Agencies need to prepare their handling (worst).	Data can be lost, but it is under the supervision of the general application manager or the national data center. The user agency does not need to be involved (best).
R-5. Security weaknesses in the application system.	The application system can have security weaknesses, especially because it is newly developed and has not been fully tested. Agencies need to prepare their handling (worst).	The application system can have security weaknesses, but it is under the supervision of the general application manager or the national data center. The user agency does not need to be involved (best).
Risks mapping	5 worst.	4 bests. 1 worst.

Table 7. Analysis of the decision making of the public complaint application system

Benefit component	New application development	Using common application
D-1. Ability to meet key success factors (25%)	70	90
D-2. Length of time from planning to use (10%)	30 (15 months)	80 (3 months)
D-3. Total costs (15%)	20 (1.610.000.000)	80 (40.000.000)
D-4. Qualitative risk (30%)	40	80
D-5. Qualitative benefit (10%)	60	80
D-6. The confidence level of cost requirement (10%)	50	50
Decision making	46.5	79.5

4.2.3. Recommending alternative

The proposed method leads to a strategic conclusion based on a comprehensive evaluation of the costs, benefits, and risks of implementing different solutions. The preferred alternative solution for adoption is the common application system, specifically SP4N-LAPOR!. It emerges as the most advantageous path for central and local government agencies. This conclusion is drawn from a detailed analysis that considers the multifaceted aspects of decision-making factors, including financial implications, operational efficiency, risk mitigation, and the potential to enhance service delivery to the public.

From a financial perspective, using SP4N-LAPOR! is anticipated to offer significant cost savings. By leveraging a shared platform, government entities can avoid the redundancies and high development costs associated with creating and maintaining bespoke applications. Furthermore, the common application framework facilitates streamlined processes and operations, leading to improved efficiency. This operational synergy not only reduces the burden on government resources but also fosters a more cohesive approach to managing public service complaints, enhancing the responsiveness and quality of services offered to citizens.

Risk mitigation also plays a pivotal role in the advocacy for SP4N-LAPOR! as the preferred alternative. Implementing a well-established, common application reduces the uncertainties and security vulnerabilities that can accompany the development of new, independent systems. Moreover, SP4N-LAPOR!'s proven track record of reliability and its comprehensive support structure provide an added layer of assurance. This, combined with its alignment with the regulatory and policy frameworks governing SPBE, underscores the strategic value of opting for SP4N-LAPOR! in advancing the digital transformation goals of government agencies, thereby ensuring a more efficient, transparent, and accessible public service delivery system.

5. CONCLUSION

The exploration of cost-benefit analysis represents a meticulous process aimed at systematically and analytically evaluating various options, relying on the breadth of information at one's disposal. This process is critical in decision-making and provides a structured framework adaptable to a wide range of studies beyond the scope of the initial research. The method deployed in this study encompasses several stages, each

designed to facilitate a comprehensive understanding of the alternatives in question, offering a blueprint that can be applied to diverse research endeavors.

Focusing on the public complaint management system, this study delves into a comparative analysis between utilizing a common application, specifically SP4N-LAPOR!, and the development of bespoke applications by central and local government agencies. The findings suggest that integrating SP4N-LAPOR! is markedly more feasible and beneficial for government entities. This conclusion is grounded in assessing various factors, including but not limited to, the ease of implementation, cost-efficiency, user accessibility, and the potential for streamlined processes across different levels of government. Nevertheless, it is imperative to acknowledge the constraints imposed by the availability of comprehensive data. The analysis, therefore, leans towards qualitative methods, supplemented by a set of adjusted assumptions to bridge the gaps in data scarcity.

While insightful, the reliance on qualitative evaluation underscores the need for a more refined quantitative analysis to substantiate the findings further. With access to additional data and information extracted from actual system implementations, a more detailed and precise quantitative analysis could be undertaken. Such an approach would enhance the robustness of the conclusions drawn and provide a more nuanced understanding of the cost, benefit, and risk implications associated with adopting SP4N-LAPOR! versus the development of similar applications. The evolution from qualitative to quantitative analysis represents a critical step in fortifying the study's foundation, enabling a more informed and accurate decision-making process for policymakers and stakeholders involved in enhancing the efficacy of public complaint management systems within government agencies.

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