

AN ANALYSIS OF THE COST BENEFITS OF ESTABLISHING A REGIONAL MAINTENANCE CENTER FOR HEALTH SERVICES

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ABSTRACT

OBJECTIVE:

The limitations of the District Health Office in managing medical equipment management programs are compared to the management of medical equipment in hospitals, as are the efficiency of the resources needed by the Regional Maintenance Center in assisting the Health Office to carry out the program. An analysis is needed to see what the resultant costs and benefits are.

METHOD:

The research is accompanied by observations and observations of documents related to medical device maintenance and calibration analysis of equipment using cost-benefit analysis. The study was carried out in 2021 at the Pasuruan District Health Office in East Java Province, Indonesia.

RESULTS:

It was found that in respect to financial aspects, when viewed from the NPV, the IRR value is found to be 2.34%, the BCR is greater than one, which is 6.95%, and the PI is 8.5. The Regional Maintenance Center at the district health office is feasible to establish and develop in terms of both financial and effectiveness.

CONCLUSION:

It is believed that the Regional Maintenance Center can run well if all parties support it, starting from the regional leadership, then support from human resources, financial resources, staff competence, infrastructure and management information systems. so that health services can be provided both in quantity and quality. It is hoped that the Ministry of Health can support it with various regulations for these matters.

KEYWORDS

Maintenance, medical devices, cost-benefit analysis, medical equipment, health service

INTRODUCTION

During the COVID-19 pandemic the demand for health services and facilities was very high. Asset management, risk management, and maintenance are three types of management that are closely related to each other all

over the world. It is possible to ensure the safety and security of patients.

Maintenance management has developed as a science over time, but in decision-making for strategic purposes, it

is still not an important concern for stakeholders. According to research from the WHO, up to 50% of existing medical equipment in developing countries cannot be used, among other things, due to improper planning, poor maintenance, and a lack of resources [2].

Equipment maintenance management in each country uses a different model with a view that exists in that country. In Jordan, designing a simulation model based on the failure data to be represented maintenance policies with the aim of maximizing utilization and reducing downtime thereby providing maximum utilization value [4], and in India, using the maintenance management model *Failure Mode and Analysis Effect* [5].

In Indonesia, the policy for maintaining medical devices determined by the ministry of health requires health facilities to meet service standards, quality requirements, safety and usability requirements. Equipment maintenance must be documented and carried out periodically, as is the case with experiments [6, 7, 8, 9, 10].

The limitations of the district health office in carrying out the requirements of the ministry of health to carry out maintenance are thought to be more difficult than carrying out replacements in the event of a malfunction, which is one of the reasons for not paying attention to maintenance at public health centers.

Community health centres, under the control of the district Health Office, are the first level of the Indonesian care system, providing a wide range of health services of which promotive, preventive, curative, rehabilitative, midwifery and support services are components of overall health. service coverage for people living in rural, suburban, and hard-to-reach areas. The Health Office and the Puskesmas do not yet have a section that specifically manages the alkes management program.

Resource efficiency was the rationale for setting up a regional maintenance center to manage medical equipment under the district Health Office. researchers found that most of the maintenance units were in hospitals. so that public health centers have to repair their medical devices in private maintenance units.

According to Prof. Tohisiro OKA, cost analysis is a method that uses models, theories, and data to examine goods, shopping, and businesses that have targets and solutions that are in accordance with the organization's vision and

mission [11]. Cost-benefit analysis is a theory for recommending policies with total costs in the form of money. In the cost-benefit analysis, there are two components, namely: (1) costs starting from preparation, investment, operation, and maintenance; and (2) benefits that are either direct, indirect, or related.

The purpose of this study is to analyze the cost benefits in optimizing equipment maintenance management with the existence of a regional maintenance center and as a basis for decision making by the Health Service. A regional maintenance center is said to be feasible if the CBA number is more than one (26). With this research, it is hoped that medical equipment management, including medical device maintenance and calibration, will not only be recognized as important when it comes to health center accreditation, but will also be carried out in a planned and sustainable manner to support the governance of medical devices in community health centers and their networks.

METHOD

DESIGN

Descriptive research with quantitative methods is the type of research used in this study. in an observational study conducted in 2021 at the Pasuruan district health office. The results of the cost-benefit analysis were evaluated by examining the records of costs incurred for establishing a regional maintenance center. The costs and benefits of the regional maintenance center from a maintenance point of view in one year are calculated.

PROCESS

The first stage in this research is to analyze the cost components of the establishment of the regional maintenance center, which can be seen in Table 1.

TABLE 1. NOMINAL COMPONENTS OF COSTS AND BENEFITS

No	Cost component
1	Cost Investment
a	Cost capital
b	Cost equipment
c	Cost Support
	1) Air conditioning
	2) Exhaust
	3) Generator
2	Cost Operational permanent
a	Cost Human Resources
	1) Bachelor degree

	2) Senior high school
b	Cost office stationery
c	Cost General
	1) Electricity
	2) Air
	3) Phone / internet
	4) Ingredients burn generator
d	Cost Building Maintenance
e	Cost Maintenance tool
No Component Benefits	
1	Well-maintained tools

Source: Data from the Pasuruan District Health Office, 2021

From the results of this analysis, it can be determined how much money has been set aside or is planned to be set aside by the Pasuruan District Health Office to correct an imbalance in the form of reducing maintenance costs and improving public health services.

The second stage determines the costs and benefits of the program that will be carried out and continues to the third stage, namely analysis based on two aspects, namely determining the determination of regional development

and beginning with financial calculations such as net present value (NPV), return on investment (IRR), and benefit cost ratio (BCR), move on to benefits. from the aspect of benefits, by looking at how effective the establishment of a regional maintenance center with the Profitability Index method is with financial calculations of net present value (NPV), return on investment (IRR), and benefit cost ratio (BCR). Then, from the aspect of benefits, we can look at how effective the establishment of a regional maintenance center using the Profitability Index method is.

Ethical considerations

This article followed all ethical standards for research and has permission from the dictrict health office. This study was not conducted on human research subjects or human participants.

RESULTS

DETERMINE THE COMPONENTS OF COSTS AND BENEFITS.

From the observations of several sections of expenditure and income from the establishment of a health facility maintenance unit, as detailed in Table 2,

TABLE 2. NOMINAL COMPONENTS OF COSTS AND BENEFITS

No	Cost component	unit	Price (\$US)	Cost (\$US)
1	Cost Investment	1	104,248	104,248
a	Cost capital	1	19,635	19,635
b	Cost equipment			
c	Cost Support	7	280.14	1961
	1) Air conditioning	3	70.04	210.11
	2) Exhaust	1	10.505	10.505
	3) Generator	1	104,248	104,248
2	Cost Operational permanent			
a	Cost Human Resources			
	1) Bachelor degree	4	140.07	560.29
	2) Senior high school	3	105.05	315,16
b	Cost office stationery	1	350,18	350,18
c	Cost General			-
	1) Electricity	12	105.05	1,260.64
	2) Air	12	21.01	252.13
	3) Phone / internet	12	42.02	504.26
	4) Ingredients burn generator	12	10.51	126.06
d	Cost Building Maintenance	1	14.007	14.007
e	Cost Maintenance tool	1	700,36	700,36

No	Component Benefits
1	Well-maintained tools

28.014

Source: Data from the Pasuruan District Health Office, 2021

Data from year 0 will be reviewed for four years. component costs increased by 4% of component benefits per twelve months.

ANALYZING THE FINANCIAL ASPECT

In the analysis of the financial aspect, the net present value is calculated first. The Regional Maintenance Center uses a 4% discount factor (DF). Net present value (NPV) is the price of the current product of cash inflows less the current price of cash outflows for that period. The NPV value of the Regional Maintenance Center establishment produces positive results, and the 4%-5% Discount Factor results in a

positive NPV, which is \$US 146,078.12. This program is considered to have a high level of investment. This can be seen in Tables 3 and 4.

TABLE 3. NET PRESENT VALUE REGIONAL MAINTENANCE CENTER.

year	Cash flow (\$US)	DF	PV (\$US)
0	(18,076.76)	1	(18,076.76)
1	18,076,76	0.961538	17,381.49
2	18,076,76	1.886095	34,094.48
3	18,076,76	2.775091	50,164.65
4	18,076,76	3.629895	65,616.74
Net present value			149,180,62

Source: : Data from the Pasuruan District Health Office, 2021

TABLE 4 NET PRESENT VALUE WITH DF 4%-5%

year	cash flow	DF 4%	PV (\$US)	DF 5%	PV (\$US)
0	(18,076.76)	1	(18,076.76)	1	(18,076.76)
1	18,076,76	0.961538	17,381.49	0.952381	17,215.96
2	18,076,76	1.886095	34,094.48	1.859410	33,612.11
3	18,076,76	2.775091	50,164.65	2.723248	49,227.5
4	18,076,76	3.629895	65,616.74	3.545951	64,099.31
Net present value			149,180,62	146,078,12	

Source: : Data from the Pasuruan District Health Office, 2021

The next step was to calculate the IRR number, which is used to determine the risk of an investment. The establishment of a Regional Maintenance Center:

$$IRR = 4\% + \frac{149.180,62}{149.180,62 - 146.078,12} (5\% - 4\%)$$

$$IRR = 2.34\%$$

From the calculation using the IRR method, the formation of a health facility maintenance unit is shorter than the interest rate.

The next step was to calculate the Benefit Cost Ratio (BCR) obtained from the net present value assessment for the expenditure section and the benefit section for establishing a health facility maintenance unit, calculating the Net Present Value from the use of a 4% Discount Factor. Then the BCR can be assessed as follows:

$$BCR = \frac{\text{Current Value of Benefits} / \text{Present Value of Costs}}{= (28,015.12(P/A,4\%,4) + 28,015,12(P/F,4\%,4)) / 18,076.76} = 6.95$$

Based on the BCR calculation, it was found that the establishment of a Regional Maintenance Center is greater than 1.

ANALYZING FROM THE BENEFIT ASPECT

The development of the Regional Maintenance Center in providing effectiveness can be known by calculating the value of future cash flows compared to the values that came out at the beginning of the investment period, so that a Profitability Index calculation was obtained as follows:

$$PI = \frac{149.180,62}{18.076,76} = 8.25$$

The Profitability Index value in the program is 8.25.

From this research it can be concluded that regional maintenance center development provides more benefits and worth implementing. it is based on B/C considerations the regional maintenance center construction has a value > 1 and the NPV value for regional maintenance center

construction shows positive results. Development of a regional maintenance center in 10 years PV value obtained benefit of \$US 149,180 with PV cost for \$US 146,078. The B/C ratio for the construction of a regional maintenance center is 6.35.

DISCUSSION AND CONCLUSION

Referring to research from the WHO that in developing countries, 50% of medical equipment cannot be used due to a lack of precise planning, lack of maintenance, and unavailable human resources (2), the Ministry of Health of the Republic of Indonesia developed Regional Maintenance Centers. The goal is to achieve optimal health service conditions by maintaining medical devices used in services [12, 13].

In achieving this target, the Ministry of Health of the Republic of Indonesia has carried out advocacy and outreach to the leaders of the health offices in the provinces and regions regarding the importance of maintaining medical devices in health care facilities in 2020. To find out the importance of this, this research was made with the research location at the Department of Health, Pasuruan District Health.

Based on the results of the research, from the financial aspect, the investment in the regional maintenance center is feasible to establish by looking at the NPV, which shows a positive number of \$US 146,078.12, the IRR is shorter than the interest rate, and the BCR is greater than one. According to the benefit aspect, the probability index value of 8.25 indicates that the regional maintenance center is feasible to develop because the benefits generated are very large for improving the maintenance management of medical devices.

Referring to research from the WHO sets out that in developing countries 50% of medical devices cannot be used due to improper planning, inadequate maintenance, and unavailable human resources [2], the Ministry of Health of the Republic of Indonesia developed a Regional Maintenance Center. The goal is to achieve optimal health service conditions by maintaining the medical devices used in the service. In addition to paying attention to the costs and benefits of establishing Regional Maintenance Centers, researchers also conducted a more in-depth analysis of resource fulfillment by looking at the work plan documents for establishing the Regional Maintenance

Center in 2018 and the Regional Maintenance Center Team in 2018, 2019, 2020 and 2021. However, it may not be realized until the end of 2020 because the regional leader is skeptical of that unit. So it is hoped that this research can be used as a study for regional leadership advocacy materials to establish and develop a regional maintenance center [14].

However, this research needs to be complemented by an academic study on equipment management. Regional leaders often think that maintaining medical devices is considered a burden for health providers. Hao Yu Lia developed a data-driven Markov decision process (MDP based on the discrete time Markov chain (DTMC) model) to optimize decisions and replace equipment. Medical decision-making about whether to repair or replace medical equipment is essential to managing health facility costs. [15]

Post-market management of medical equipment must be reached and properly implemented. Starting from planning, in this case, technology assessment and evaluation of existing medical equipment [16, 17],

Further research is needed on how the maintenance management system can support the operation of regional maintenance centers and how to provide adequate financial, facility, and human resources. Medical equipment maintenance programs must be carried out and managed so that health services are improved and safety is guaranteed. The development of a website-based management information system is also very important to produce data about the need for the management of available medical equipment quickly and accurately [21]. Human resource support, costs, infrastructure, and operational procedures for maintaining medical devices that conform to accreditation standards are factors that have a strong influence on the management of medical equipment [19, 20, 23, 24, 15, 26].

The cost of spare parts that are accurate and adapted to medical device technology will have an effect on overcoming financial problems in operating expenses at the regional maintenance center or clinical engineering service unit [26]. With the Regional Maintenance Center, it is expected to improve the performance of the Medical Devices and Household Health Supplies section. Lack of manpower is the reason for the less than optimal management of medical equipment in Pasuruan Regency. However, the formation of this unit also requires adequate

preparation and requires support from stakeholders and regional leaders so that the investment made in this unit can run smoothly with no obstacles.

This research can be used in other places, but the cost of building construction can adjust to local conditions.

CONCLUSION

Various regulations were issued by the Ministry of Health to develop regional maintenance centers. It is believed that the Regional Maintenance Center can run well if all parties support it, starting from the regional leadership, then human resources, financial resources, staff competency, infrastructure and management information systems. so that health services can be provided both in quantity and quality.

COMPETING INTEREST

The authors state that they have no competing interests.

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