



## Analysis of Determinants of Laboratory Equipment Operational Cooperation System Based on Cost Benefit Analysis in Hospital Management Perspective in X

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### Abstract

Procurement of laboratory equipment through operational cooperation is increasingly adopted by hospitals as a cost-effective and efficient strategy to support health services. This study examines the success of operational cooperation in procuring hematology analyzer equipment to replace damaged units, using a cost-benefit analysis (CBA) from the perspective of hospital management. Employing a sequential explanatory mixed-method approach, the study combined qualitative data from in-depth interviews with 12 purposively selected informants and observations, with quantitative analysis of secondary data using the CBA method. The analysis revealed a positive Net Present Value (NPV) of IDR 99,422,367.47 and a Benefit-Cost (B/C) ratio of 1.59, both exceeding the benchmarks of independent procurement. This indicates that operational cooperation is financially feasible and preferable. Non-financial benefits also strengthen this conclusion, including vendor-provided maintenance technicians, guaranteed supply of reagents and spare parts, and ongoing equipment upgrades aligned with technological advancements. These advantages minimize hospital disruptions and ensure service continuity. The study identifies key success determinants in the operational cooperation system: cost efficiency, human resources, regulatory compliance, vendor partnerships, equipment quality, historical laboratory data, and alignment with technological developments. In conclusion, operational cooperation for hematology analyzers is successful, sustainable, and offers significant benefits, both financial and operational, for hospitals..

## Introduction

Procurement of equipment through operational cooperation is not only limited to laboratory equipment, several other medical equipment are also provided through procurement through operational cooperation such as radiology equipment and hemodialysis equipment. Reported from Banjarmasin Post, 2017, it explains that H. Damanhuri Barabai Hospital collaborates with PT. Prima Kimia Surya for operational cooperation in the procurement of CT Scan with a profit-sharing system ([tribunhulusungaitengah.com](http://tribunhulusungaitengah.com)). In other news in Antaranews South Kalimantan, 2016, it explains that Badaruddin Tanjung Regional Hospital, Tabalong Regency, South Kalimantan, confirmed the addition of 4 units of dialysis equipment without using the Regency APBD and DAK funds but using a profit-sharing system or operational cooperation considering that currently the demand for dialysis patients is increasing (Racca, 2010; Hinrichs-Krapels et al., 2022; Havighurst, 1995; Espín et al., 2016).

The basis for the procurement of laboratory equipment is also contained in Law no. 44 of 2009 concerning hospitals, article 7 paragraph 1 states that hospitals must meet the requirements for buildings, infrastructure, human resources, pharmacy and equipment, then continued in article 15 paragraph 1 where the pharmaceutical requirements mentioned in article 7 paragraph 1 must guarantee the availability of quality, useful, safe and affordable pharmaceuticals and medical devices. The procedure for procuring hospital medical devices is contained in article 30 paragraph 1 point c where every hospital has the right to enter into a cooperative agreement with other parties in the context of developing health services (Law no. 44/2009).

Requirements for procurement of clinical laboratories and laboratory equipment can be seen in the Regulation of the Minister of Health No. 411 of 2010 concerning clinical laboratories and updated in the Regulation of the Minister of Health No. 43 of 2013 concerning the method of organizing good clinical laboratories. This Regulation of the Minister of Health states that the clinical laboratory service process goes through 3 stages, namely the pre-analytical stage includes patient preparation activities, receiving specimens, taking specimens, providing specimen identification, testing water quality and reagents for laboratory equipment. The analytical stage includes specimen processing activities, equipment maintenance and calibration, examination implementation, supervision of examination accuracy and precision. The post-analytical stage includes recording examination results and reporting examination results to clinicians or doctors who order clinical examinations (Hartanto, 2015; Hawkins, 2012; Thue & Sandberg, 2015; Plebani, 2024; López Yeste et al., 2021).

Over the last 10 years, hospitals in Indonesia have preferred operational cooperation as an alternative in procuring goods/services because hospitals no longer need to think about expensive equipment maintenance costs, reducing risk and not disrupting cash flow. Likewise in Padang City, many hospitals have used operational cooperation in procuring their laboratory equipment, especially for high unit procurement costs such as automatic analyzer laboratory equipment (hematology equipment, clinical chemistry, electrolytes, etc.) (Thurrow & Junginger, 2022; Vernooij, 2021; Garg, 2023).

Hospitals in procuring goods and services refer to Government Regulation no. 38 of 2015 which is an update of Government Regulation no. 67 of 2005 concerning cooperation between the Government and Business Entities in providing infrastructure (PP 38/2015) and also to Government Regulation no. 54 of 2010 article 8 concerning the implementation of procurement of goods and services through self-management and/or selection of providers of goods/services (PP54/2010). Procurement of goods and services carried out by hospitals through self-management can be through direct purchases or operational cooperation contracts with companies providing goods and services (Koers, 2021; Bernal-Delgado & Angulo-Pueyo, 2023; Silapurna, 2023; Koers, 2021; Krah et al., 2023).

Operational cooperation according to Financial Accounting Standards Statement number 39 is an agreement between two or more parties where each agrees to conduct a joint venture using assets and/or business rights owned and jointly bear the risks of the venture. Referring to the PSAK, there are two important elements in operational cooperation, namely agreeing to cooperate and bearing the risks together. Operational cooperation is chosen as one of the funding alternatives due to the limited ability of one party to meet all of its resource needs (PSAK no 39).

There are several types of operational cooperation concepts, including outsourcing and cosourcing. Researchers conducted a more in-depth study of cosourcing cooperation from hospitals with laboratory equipment providers. The concept of cosourcing operational cooperation has 3 types, namely, a reagent rental cooperation model with the benefit that the hospital does not need to spend investment costs to purchase laboratory equipment on the condition that the purchase of reagents is mandatory to the equipment provider, revenue sharing

cooperation with the benefit of the hospital does not require additional capital costs on the condition that the hospital must share the results with the equipment provider, cost per reportable report cooperation with the benefit of the hospital does not require additional capital costs on the condition that revenue for cooperation partners comes from the number of examinations multiplied by the CPRR rate which is an attachment to the contract (Rachmawati et al., 2018).

The success or failure of the operational cooperation system carried out by the hospital is seen from the determinants that influence it. The determinants of success are assessed from the existing indicators. Based on the Big Indonesian Dictionary (KBBI), a determinant is a determining factor, while an indicator is something that can provide (become) a clue or information, and success is a matter of (a state of) success, a state where the desired intent is achieved, an effective condition (KBBI, <https://kbbi.web.id>). So the determinants of success are the factors that determine that a program is in accordance with the desired objectives and the indicators of the success of operational cooperation are things or something that can provide information on a state that operational cooperation activities or the desired intent in the cooperation are achieved, profitable and effective (Holtbrügge, 2004; Feinberg & Zanardi, 2022; Emami et al., 2022).

According to a survey by Kalorama Information in 2021, the global market for laboratory equipment operational cooperation services is estimated to reach US\$ 20.3 billion by 2026, with an annual growth of around 6.5% from 2021 to 2026. This shows that procurement of laboratory equipment through operational cooperation is still a significant trend in the laboratory industry (Kalorama, 2021; Ruredzo et al., 2023; Joseph et al., 2023).

A case study conducted at a university in Indonesia in 2019 found that procuring laboratory equipment through operational cooperation can help the university save significant costs. The university estimates that it can save around 40% of the cost of procuring laboratory equipment by using operational cooperation services, rather than having to buy laboratory equipment directly (Sitorus, 2019; Kiehle et al., 2023; Brown et al., 2023).

Research at Dr. Cipto Mangunkusumo National Hospital (RSCM) by Sri Meikaruniawati et al. (2017) resulted in the quality of laboratory services achieved with a turnaround time of above 90% and accurate results. This operational cooperation benefits both parties with the achievement of a payback period according to the plan of 2.2 years and income that exceeds the plan. The implementation of this operational cooperation has been effective in accordance with its objectives. This operational cooperation can be continued with the Cost Per Reportable Result model, where the hospital pays the partner for the amount of output produced multiplied by the cost (Meikaruniawati et al., 2017; Brown et al., 2023).

The research that has been conducted above has two conclusions where the procurement of laboratory equipment through operational cooperation is more feasible and profitable, while the other conclusion states that the procurement of laboratory equipment through investment or purchase is more profitable. Then, what about the management perspective regarding this?

Perspective based on the Big Indonesian Dictionary (KBBI) is a point of view or view. In previous studies there has been no in-depth explanation of the management perspective on the procurement of laboratory equipment through operational cooperation in hospitals, for that there needs to be a further explanation regarding this matter.

From the results of the initial survey of the research at the hospital, Padang has two laboratory equipment that are procured through operational cooperation and one equipment with direct purchase procurement. The hospital has been procuring laboratory equipment through operational cooperation for more than 3 years with a 5-year cooperation contract. The operational cooperation of laboratory equipment that is carried out is an operational cooperation of reagent rental type laboratory equipment, which means that the provider of

goods and services lends laboratory equipment to the hospital with the applicable terms and conditions where the hospital is obliged to purchase reagents for the equipment only from the provider of goods and services during the cooperation period at the official price applicable at the time of purchase.

In the initial survey, the researcher found that the hospital carried out operational cooperation for laboratory equipment because it considered the unstable financial conditions after the Covid 19 pandemic to replace hematology analyzers that had expired by purchasing new equipment. In addition, the use of laboratory equipment through operational cooperation is currently being widely carried out by many hospitals and provides many financial benefits for the hospital.

The procurement of operational cooperation for laboratory equipment in this hospital shows an increasing trend in laboratory examinations. Data from the last 3 years shows an average increase in clinical pathology laboratory examinations of 13.4% and the number of laboratory visits per month fluctuates. This increasing trend certainly has a positive impact on the hospital. However, data for clinical pathology laboratory examinations specifically for the hematology section shows a decreasing trend in the number of examinations by 10% per year. Meanwhile, the hospital is conducting operational cooperation on hematology analyzers.

The procurement of operational cooperation of laboratory equipment also indirectly reduces the workload of hospital technicians and analysts as operators of the equipment and improves hospital services towards the better. Improving the quality of laboratory services in hospitals will have an impact on patient satisfaction and hospitals as consumers of laboratory equipment users through operational cooperation (Etukudoh & Obeta, 2021; Thakur et al., 2023).

Procurement of laboratory equipment can also reduce the number of laboratory tests outside the hospital, thus reducing hospital expenses and increasing the income of the laboratory department. This income is also influenced by the number of tests performed. There is an increase in the percentage of income of the hospital's clinical pathology laboratory ranging from 10% to 17% per year from the total laboratory tests performed at the Clinical Pathology Laboratory of Roapanasuri Hospital. To ensure that the hematology analyzer laboratory equipment procured through operational cooperation can increase the percentage of hospital income, the researcher conducted a cost benefit analysis at RSKB X.

Related to the determinants of the operational cooperation system towards the achievement of the desired success indicators of the hospital, it can be seen that the hospital gets benefits such as the hospital is given free training for operators, if the cooperation is extended the hospital will get upgraded laboratory equipment, if there is trouble with the equipment then there is a technician 1x 24 hours provided by the provider likewise if the repair of equipment in the hospital takes a long time, backup equipment is provided or samples can be thrown to an external laboratory at the cost borne by the provider (according to the agreement with the provider), maintenance and calibration of equipment are provided by the provider during the cooperation period.

The success of the operational cooperation system can be seen from the achievement of indicators of usefulness stated in the articles of the cooperation contract and the occurrence of conditions for extending the cooperation contract or adding the procurement of the same laboratory equipment as the operational cooperation. Indirectly, this indicates the success of the procurement of laboratory equipment through operational cooperation, but the value of its success is not yet known for sure, whether procurement through operational cooperation will definitely be successful in all hospitals.

Based on the problems above, the researcher is interested in conducting research by analyzing the determinants of the operational cooperation system of laboratory equipment based on cost benefit analysis from the perspective of hospital management at the hospital.

## Methods

The type of research used in the study of the analysis of the determinants of the operational cooperation system of laboratory equipment based on cost benefit analysis in the perspective of hospital management is a research with a mix method approach of the sequential explanatory type, namely descriptive qualitative to measure the success of the implementation of operational cooperation as a system and followed by descriptive quantitative analysis with the Cost Benefit Analysis method and with a case study research design which is an in-depth study of a group, organization or activity program within a certain time to obtain a complete and in-depth description of it.

The focus of this study is to determine the factors that influence the success of hospitals in increasing the effectiveness of expenditure costs if laboratory equipment procurement is carried out through an operational cooperation system. The researcher tries to compare the understanding and perception of management at the Ropanasuri surgical hospital with the reality of data in the field in making decisions to procure laboratory equipment through operational cooperation which is seen from its effectiveness in overcoming hospital operational costs with the cost benefit analysis method and assessing how high the success of the procurement of operational cooperation of laboratory equipment is and what are its determinants.

The data collection method used was semi-structured and in-depth interviews with 12 relevant stakeholders consisting of hospital directors, financial managers, medical support managers, laboratory heads and users, Clinical Pathology specialists, and operational cooperation providers. Additional data used in the study such as secondary data related to the procurement of hospital laboratory equipment, documentation data, observation and triangulation.

## Result and Discussion

### Net Present Value (NPV) and Benefit Cost Ratio (BCR) in Operational Cooperation Procurement and Independent Procurement of Laboratory Equipment

Present Value (present value) of a sum of loan money that will be paid back in cash one year or several years to come, the amount of its present value (present value) by calculating the discount rate. In this NVP calculation, a discount rate of 5.0% is used according to the rounding of the average Bank Indonesia interest rate calculated from January 2021 to December 2024.

Table 1. Results of Calculation of PV Benefits of Operational Cooperation

Year	Benefits	Discount rates big as 5%	Present value benefit
2022	297,686,368	14,884,318.4	282,802,049.6
2023	275,449,248	13,772,462.4	261,676,785.6
2024	265,661,280	13,283,064	252,378,216
		<b>Total</b>	<b>796,857,051.2</b>
		<b>Average</b>	<b>265,619,017.07</b>

In the table above, it can be seen that the Present Value for benefits is 265,619,017.07

Table 2. Results of Calculation of PV Cost of Operational Cooperation

Year	Cost	Discount rates big as 5%	Present value cost
2022	188,953,632	9,447,681.6	179,505,950.4
2023	170,950,752	8,547,537.6	162,430,214.4
2024	164,898,720	8,244,936	156,653,784
		<b>Total</b>	<b>498,589,948.8</b>
		<b>Average</b>	<b>166,196,649.6</b>

In the table above, it can be seen that the Present Value for Cost is 166,196,649.6

Table 3. Results of Calculation of PV Benefit for Independent Procurement of Hematology Equipment

Year	Benefits	Discount rates big as 5%	Present value benefit
2022	296,932,505.4	14,846,625.27	282,085,880.13
2023	223,321,583.8	11,166,079.19	212,155,504.61
2024	211,709,011.8	11,085,450.59	200,623,561.21
		<b>Total</b>	<b>694,864,945.95</b>
		<b>Average</b>	<b>231,621,648.65</b>

In the table above, it can be seen that the Present Value for benefits is 231,621,648.65.

Table 4. Results of PV Cost Calculation for Independent Procurement of Hematology Equipment

Year	Cost	Discount rates big as 5%	Present value cost
2022	189,707,494.6	9,485,374.73	180,222,119.87
2023	223,078,416.2	11,153,920.81	211,924,495.39
2024	218,850,988.2	10,942,549.41	207,908,438.79
		Total	600,055,054.05
		Average	200,018,351.35

In the table above, it can be seen that the Present Value for Cost is 200,018,351.35

Table 5. Net Present Value (NPV) in Procurement of KSO and non-KSO Laboratory Equipment

Procurement	PV benefits	PV cost	NPV
Joint Venture	265,619,01.07	166,196,649.6	(+)99,422,367.47
Non KSO	231,621,648.65	200,018,351.35	(+)31,603,297.3

In the table above, it can be seen that the results of the NPV calculation from the subtraction between the total PV benefit and the total PV cost obtained a net present value (NPV) value for operational cooperation which showed a positive value of (+) 99,422,367.47 and for independent procurement (+) 31,603.297.3 which means that the operational cooperation program carried out by the hospital is favorable as well as the purchase of laboratory equipment independently, but the NPV value for operational cooperation is higher than independent purchases.

Table 6. Benefit Cost Ratio (BCR) Value in Laboratory Equipment Procurement via KSO and non-KSO

Procurement	PV benefits	PV cost	RatioB/C
Joint Venture	265,619,017.07	166,196,649.6	1.59
Non KSO	231,621,648.65	200,018,351.35	1,158

From the table above, it can be seen that the results of the calculation of the comparison of PV benefit with PV cost in organizing a laboratory with operational cooperation or with independent laboratory equipment purchases both have a B/C ratio > 1 with a B/C value in operational cooperation higher than independent purchases. This means that in the implementation of the procurement of hematology analyzer laboratory equipment with an operational cooperation program, it is more feasible to be carried out at RSKB X.

## **Input Components**

### ***Understanding Operational Cooperation of Laboratory Equipment***

The results of the study at the hospital showed that there were still several hospital staff involved in the operational cooperation process in the procurement and operation of laboratory equipment during the service, who did not understand the operational cooperation of laboratory equipment. The staff did not understand the intent and purpose of organizing operational cooperation of laboratory equipment. The staff's ignorance regarding the agreed operational cooperation model and the rights and obligations of the hospital during the operational cooperation will have an impact on misperceptions in efficiency in logistics so that it can cause discomfort or problems for both parties. This condition is inseparable from the lack of management socialization to the staff involved and the non-participation of all related parties in the procurement process of the equipment.

The knowledge of human resources that should be involved in the process of organizing laboratory equipment procurement can affect the impact of the implementation of the cooperation both in investment in laboratory equipment and procurement of laboratory equipment through operational cooperation. Conditions that have an impact on operational cooperation such as the relationship between the two parties where discomfort is felt during the cooperation period triggered by the non-involvement of one of the pharmaceutical warehouse logistics staff in the initial planning so that the staff does not know the matters and obligations of the hospital in the initial period of cooperation towards partners or vendors. This was obtained from one of the staff who did not know about the operational cooperation carried out by the hospital and had not received socialization regarding this matter. So when logistics carried out efficiency to find cheaper reagent prices and buy from companies other than the operational cooperation provider, the first warning was given to the hospital due to a breach of contract, but this matter could be resolved well through deliberation.

The understanding by the staff involved includes the intent and purpose of operational cooperation, factors that influence operational cooperation, operational cooperation procedures, hospital regulations in the procurement process through operational cooperation, terms and conditions related to operational cooperation which will later be stated in the cooperation agreement letter.

From the research results, it can be seen that operational cooperation in hospital laboratory facilities is cooperation between two parties where the first party, called the hospital, and the second party, called the company providing goods and services, enter into a cooperation agreement.

The results of the study at the hospital showed that the hospital did not yet have regulations regarding the procurement of laboratory equipment through operational cooperation. Regulations related to the procurement of operational cooperation for goods and services in hospitals are important where the existence of policies and guidelines in implementing an activity will make it easier for hospitals and reduce risks to hospitals. In line with research conducted by Yuli.A (2020) from the results of his research, there are still many hospitals that do not have a strong legal basis regarding the implementation of operational cooperation and director policies or standard operating procedures. The absence of these policies in the implementation guidelines can cause various conflicts and problems both in the selection process, implementation, and determination of prospective partners, causing many doubts and the absence of clear legal protection.

Research by Jon Kenedi et al. (2018) also revealed that policies in a hospital are the legal basis for implementing an activity, especially in the procurement of medical devices. With the existence of standard operating procedures (SOP) for the implementation of medical device procurement by each officer carrying out the procurement will reduce the level of errors or

negligence, increase efficiency and effectiveness, create standard performance measures and as an instrument that can protect the implementer from possible lawsuits. This legal basis can be realized in the director's policy for the implementation of procurement both through operational cooperation and not.

The agreement on the implementation of operational cooperation can be seen from the existence of a cooperation agreement letter that has been signed by both parties on a stamp. The results of the study show that there are points in the form of provisions and conditions that must be carried out and the cooperation model used. These points include the name of the tool and type of examination; reagent price and purchase target, hospital obligation to buy reagents from vendors, cost per test of the tool, duration of operational cooperation, payment deadline, tool guarantee in case of damage, obligation to only buy reagents from vendors, conditions for cooperation to be terminated, force majeure.

Rachmawati et al. (2018) in their book *Clinical Laboratory Management Series VII* explains the operational cooperation agreement document contained in the points of the agreement in the form of articles in the cooperation agreement. The articles listed include; articles regarding the legal basis for operational cooperation that regulate the points of the agreement; articles regulating the period of cooperation; intent and purpose; purchase and price of reagents; delivery of goods; payment; price changes; taxes; regulation of reagents, controls, cleaners, and consumables; warranty, maintenance and repair of equipment; end of cooperation; term of cooperation; consequences of the end of the agreement; transitional rules; force majeure; forgiveness rules; other rules; and closing.

### ***Laboratory Equipment Operational Cooperation Costs***

The results of the study at the hospital showed that in procuring laboratory equipment through operational cooperation, the hospital will incur some costs during the cooperation, but on the other hand will reduce certain costs such as if the procurement of hospital laboratory equipment by purchasing or investing. Costs related to operational cooperation of laboratory equipment are direct and indirect costs which are operational costs.

Direct costs are costs that are easily traced to the price of an object, which include direct laboratory examination costs including reagents, HR services (SpPK doctors and analysts), consumables. Indirect costs are costs that occur not only due to something that is financed, in relation to the product, indirect costs are known as overhead costs, which include indirect laboratory examination costs including other HR costs, calibration costs, equipment maintenance costs, equipment rental costs, equipment depreciation costs, electricity costs, water costs, laboratory waste disposal costs, building depreciation costs, and others.

From the research results, several efficiencies were obtained that were felt by the hospital related to the implementation of operational cooperation of laboratory equipment, namely; there is efficiency in hospital finance because it does not require initial capital and the existing capital can be transferred to units that need it; then operational cooperation provides efficiency in maintenance costs and equipment upgrades so that hospitals always use the latest equipment; other efficiencies such as efficiency in the cost of power outages by providing UPS by vendors as well as efficiency in training costs for analysts.

According to theory, the types of expenses for hospital laboratory installations include: investment costs (laboratory buildings, diagnostic automation analyzer instruments, non-diagnostic instruments, supporting facilities and laboratory information systems); operating costs (direct costs include actions taken and diagnostic equipment used, reagents and consumables, and indirect costs include maintenance of laboratory buildings, air conditioning, periodic instrument maintenance, calibration, electricity and water); developing costs include development examinations, biomolecular, internal and external quality assurance; weight

average cost of capital, namely capital expenditure costs influenced by the value of time and money; BEP (break event point) period, RoI (return on investment) (Hartanto, 2015).

In line with research by Marini & Rochmah, (2014) which states that operational costs in providing laboratory services independently and through KSO include employee salaries, stationery costs, general costs, BHP costs, and equipment purchasing costs.

Other studies also mention that the costs used for laboratory services in operational cooperation are used for purchasing electricity costs, water costs, analyst services, and other costs if any (Rohmatullah & Susanto, 2018).

The types of direct costs for the laboratory are the cost of the laboratory SP form, the cost of personal protective equipment (PPE), the cost of consumables (AHP) sampling, the cost of examination reagents, the cost of AHP examination tests, the cost of internal quality monitoring (quality control and calibrator), result forms, medical services of Sp PK doctors. while indirect costs are the cost of medical support staff (employee salaries, training costs, uniforms), depreciation costs of medical and non-medical equipment, maintenance and repair costs of medical and non-medical equipment, depreciation and maintenance costs of buildings / rooms, electricity, water, stationery, telephone and laundry costs (Purwanti et al., 2022).

Investment costs in organizing a laboratory through operational cooperation are only on the cost of facilities (air conditioners, computers), while laboratory equipment is borne by the vendor. Meanwhile, buildings and IPAL (wastewater disposal installations) are not included in the investment costs because each laboratory agency already has these facilities for laboratory services. Operational costs for organizing laboratory services include employee salaries, stationery costs, general costs, costs of consumables (gloves, syringes, masks, reagents, alcohol, cotton), and costs for purchasing equipment. Facility maintenance costs include facility maintenance costs and laboratory equipment maintenance costs (Rachmawati et al., 2018).

Human Resources related to Operational Cooperation of Laboratory Equipment In the implementation of operational cooperation of hospital laboratory equipment, it is certainly supported by its human resources. A hospital has many units or sections that carry out activities according to their respective duties, as well as laboratories. In the laboratory unit there are laboratory staff, namely users or analysts and doctors in charge.

In the clinical pathology laboratory, during the service in the laboratory unit, the staff on duty are analysts as users or operators of laboratory equipment and clinical pathology specialists as doctors in charge. In addition to laboratory staff, to procure laboratory equipment, of course, they will cooperate with several other units in the procurement process of goods and services in the hospital.

From the results of the research at the hospital, based on the informant's understanding, several units were found that were related to operational cooperation of laboratory equipment, namely the Director, medical support and service section, laboratory section (doctors, unit heads, analysts), finance section, general and procurement section including ATEM and IPSRS, and logistics/pharmaceutical warehouse section.

### **Evaluation Aspects Related to Operational Cooperation of Laboratory Equipment Assessment of the success of projects or programs that have been implemented**

From the results of the study at the hospital, the researcher found that the evaluation related to operational cooperation carried out at the hospital had not been running optimally. From the results of interviews and document reviews, no records were found regarding a specific evaluation for this matter. However, based on the interview, it was found that the evaluation of operational cooperation was discussed in the general evaluation of the hospital. This is certainly not a maximum assessment and the researcher suggests that an evaluation be carried out on

operational cooperation for laboratory equipment that is carried out through operational cooperation in order to make it easier for management to assess its success and can be a guideline for procurement in the same way.

The implementation of evaluation related to operational cooperation of laboratory equipment based on informant understanding can be seen from several evaluation indicators including; frequency of equipment damage and discrepancies in results; control of incoming equipment according to range or not; length of service / operational time; reagent consumption / amount of reagent usage; amount of expired and unused reagent usage; number of patients and examinations; smoothness of reagent stock; convenience of equipment usage; and late payment of bills by the hospital.

In addition to the evaluation points above, it is also good to evaluate the type of cooperation that has been implemented. The hospital uses a cooperation method with the rental reagent type. In evaluating cooperation, management should compare the cooperation method with two other types of cooperation, namely revenue sharing and CPRR, namely trying to analyze how suitable the current hospital conditions are with the type of cooperation revenue sharing or profit sharing and cost per reportable report or division per examination with the type of rental reagent currently used.

In conducting the evaluation of the implementation of operational cooperation, indicators are needed as criteria to assess achievements. These indicators are determined during the operational cooperation planning stage. The indicators related to problems that occur during the implementation of operational cooperation are the frequency of problems that occur during cooperation, the response time of the second party, room humidity, reagent supply, equipment maintenance, and adequacy of human resources such as IT personnel and technicians (Meikaruniawati et al., 2017).

Research by Indarto et al. (2021) conducted an evaluation of operational cooperation projects. Things evaluated related to operational cooperation performance include project performance, management performance, partner performance, external factor evaluation, evaluation of negotiation agreements between participants, satisfaction evaluation. Evaluation related to project performance is related to cost/budget, quality, time, work safety, schedule, which has an impact on quality and satisfaction, the results of which are directly proportional, where the better the project performance, the greater the achievement of operational cooperation performance. Management performance evaluation includes strategic control, control and organizational control which are significantly related to operational cooperation performance, where the better the management performance, the higher the achievement of operational cooperation performance. Partner performance evaluation includes risk sharing, resource sharing, cost reduction, technology transfer, relationships between parties which also have a significant effect and are directly proportional to operational cooperation performance. Evaluation of external factors includes the social, political, legal and natural environment but does not have a significant effect on operational cooperation performance. Agreement evaluation includes legal entity agreements, cooperation schemes, trust, commitment, and reputation which have a significant effect on operational cooperation performance where both parties will be equally protected. Satisfaction evaluation includes financial satisfaction, project survival satisfaction, expansion satisfaction which have a significant effect on operational cooperation performance.

Research by Hapsari et al. (2019) evaluated the input conditions, output processes of the implementation of operational radiodiagnostic cooperation by comparing them to the contents of the agreed cooperation agreement to assess the effectiveness of operational cooperation. Based on the evaluation, it is known that operational cooperation has been running effectively, but in the process there are obstacles that arise such as maintenance and repair of equipment

that takes longer than the provisions stated in the operational cooperation agreement letter, thus disrupting services.

Based on the data of cooperation contracts in the Dr. Sobirin Hospital environment, Musi Rawas Regency evaluates the operational cooperation of the laboratory from the quality indicators of the operational cooperation contract for laboratory examination medical devices, namely: timeliness of equipment maintenance by vendor technicians with dimensions of quality effectiveness, efficiency and continuity of equipment services both in terms of the number of devices, maintenance duration and speed of maintenance response so that the device is suitable for use; accuracy of examination in accordance with standard equipment parameters. (data from Dr. Sobirin Hospital, 2024)

## **Process Components**

### ***Cost Benefit Analysis of Procurement of Operational Cooperation for Laboratory Equipment***

The results of the study showed that the calculation of the NPV results was positive and the B/C ratio  $> 1$ . NPV is obtained from the difference between the present value of benefits and the present value of costs. So the Net Present Value in the procurement through operational cooperation is positive at Rp. (+) 99,422,376.47, - per year, as well as independent procurement is also positive at Rp. (+) 31,603,279.3, - per year. This means that the operational cooperation of hematology laboratory equipment and independent procurement of health equipment at RSKB X are both favorable and feasible because they generate financial benefits for the hospital, but the NPV value in operational cooperation is higher so that it can be interpreted that for RSKB X it is more feasible to procure hematology laboratory equipment through operational cooperation compared to independent procurement.

The cost benefit ratio is calculated by comparing the benefit per cost. Based on the interpretation that  $B/C > 1$  which means a project or program is feasible to implement while if  $B/C < 1$  means the project or program is not feasible to implement. From the calculation results in the study, the B/C ratio for procurement through operational cooperation is 1.59 and independent procurement is 1.158 where both values have a B/C value  $> 1$ , it is clear that operational cooperation for laboratory equipment and independent procurement for hematology laboratory equipment are both feasible to be implemented at RSKB X, but the B/C value for operational cooperation is higher than independent procurement. This means that at RSKB Ronasuri it is currently more feasible to procure hematology laboratory equipment through operational cooperation.

Research by Marini & Rochmah (2014) shows that for the procurement of laboratory equipment through operational cooperation and independent purchases both produce NPV values (+) and  $B/C > 1$ , but with different values. The NPV value produced for operational cooperation of laboratory equipment is (+) 501,336,384 while the NPV for independent purchases is (+) 1,052,491,377. The B/C value for operational cooperation of laboratory equipment is 4.39 while the B/C for independent purchases is 7.14. The study concluded that although the NPV and B/C values are both feasible to implement, independent purchases of laboratory equipment are more profitable than operational cooperation.

In another study by Rohmatullah & Susanto (2018), it was stated that the blood test equipment procurement project based on investment assessment was feasible and had a low-risk investment in the next 10-year projection. The investment assessments carried out included NPV, IRR, PI, PP and ARR. Considering the investment results from the comparison of cash flow for purchasing equipment with cash flow for operational cooperation for hematology examination equipment, it is better to purchase equipment because it is more profitable.

Nuryadi (2009) conducted a study on other medical devices using the CBA method for the procurement of CT-Scan equipment by comparing cash purchases with operational cooperation where the B/C ratio for cash purchases was 0.85 and for the operational cooperation system was 1.70 while the NPV of cash purchases was (+) Rp.517,948,811.42 and operational cooperation (+) Rp.595,836,118.75. Based on the results of these calculations, it is known that the B/C ratio with operational cooperation is greater than cash purchases so that recommendations for hospitals in the procurement of CT-Scan equipment are better through the operational cooperation system than cash purchases.

The next researcher also studied CBA for medical devices other than laboratory equipment by comparing operational cooperation with independent purchasing investment. Nason, et al. (2020) studied CBA for Hemodialysis services with the conclusion that the comparison of the cost benefit ratio between operational cooperation and investment was 1.45: 1.09, which means that operational cooperation is more profitable than investing in providing HD machine inventory.

### ***Success Indicators and Their Interpretation***

A project or program in a hospital will be feasible to be implemented and maintained if it produces success. The hospital runs an operational cooperation program in the procurement of laboratory equipment. From the results of the study in the hospital, several points were found in assessing success.

Based on triangulation of interview data, observation and document review, researchers produced several indicators that can be used as a reference to determine the success of an operational cooperation program in the procurement of laboratory equipment. These indicators are obtained from evaluation aspects that are assessed based on informant perceptions.

The indicator points are examined based on the management perspective that should be evaluated including; frequency of equipment damage and discrepancies in results; control of equipment entering the range or not; length of service / operational time; reagent consumption / amount of reagent use; amount of expired and unused reagent use; number of patients and examinations; smoothness of reagent stock; convenience of using equipment; late payment of bills by the hospital.

From the research results, it is known that the hospital has not conducted a special evaluation of the implementation of laboratory operational cooperation so it is not yet known for sure whether the implementation of the operational cooperation was successful or not. However, from the interview results, views were obtained regarding the success of operational cooperation, namely marked by the smoothness of guaranteed services where patients are served perfectly anytime and any hour in any condition of the equipment with laboratory equipment through operational cooperation without the need to send examinations to external laboratories so that patient satisfaction is created and also marked by the accuracy of the hospital in choosing a vendor. While from the financial side during the operational cooperation period, the hospital gets a spare margin. Another sign of success is obtained from data processing where the CBA calculation shows a B/C result > 1, which means that this operational cooperation is feasible to be carried out and continued.

Several studies mention aspects of evaluation carried out during operational cooperation such as the frequency of problems that occur during cooperation, response time of the second party, room humidity, reagent supply, equipment maintenance, adequacy of human resources such as IT personnel and technicians (Meikaruniawati et al., 2017). Other researchers mention several aspects of evaluation such as project performance, management performance, partner performance, evaluation of external factors, evaluation of negotiation agreements between participants, satisfaction evaluation (Indarto et al., 2021).

The evaluation aspect can be used as an indicator of the success of the cooperation. If the evaluation results are good and have a positive value for the sustainability of the cooperation, then it can be said that the cooperation project or program is successful.

In this study, by looking at the evaluation aspects that have been found based on interviews, observations and document reviews as well as looking at previous studies, it can be concluded that the indicators of success of operational cooperation of laboratory equipment are related to the aspects being evaluated. Indicators of success of operational cooperation of hematology laboratory equipment carried out by the hospital are not only seen from financial factors such as revenue benefits and reduction of other operational costs, but also non-financial factors related to; the effectiveness of the program obtained during the cooperation; management performance and adequacy of human resources during the planning, procurement and implementation of the program; performance of partners or vendors both from the response time maintenance by technicians and reagent supply as well as good relations and communication between parties; and more importantly is the frequency of problems that occur during the cooperation period that disrupt the smooth running of laboratory services and affect user satisfaction.

Success indicators should also be taken from the quality indicators of operational cooperation for goods or medical devices, including the timeliness of equipment repairs, the availability of consumable medical devices, the accuracy of examinations according to standard equipment parameters; and the quality indicators of operational cooperation contracts for laboratory examination medical devices include the timeliness of laboratory equipment maintenance. (Quality Report of Dr. Sobirin Hospital, Musi Rawas Regency, 2023).

## **Output Components**

### ***Benefits of Operational Cooperation of Laboratory Equipment***

The benefits felt by the hospital during the implementation of operational cooperation based on the management perspective obtained in this study are very many. Financial benefits such as cost efficiency, benefit the hospital in managing the many costs that must be incurred. In addition, non-financial benefits are also widely felt by the hospital such as effectiveness in service time, availability of human resources and guaranteed quality of technology. These benefits include;

According to Hartano (2014), the advantages of operational cooperation for laboratory equipment include hospitals receiving laboratory infrastructure facilities (room renovation, diagnostic equipment, information systems, and transport tubes) with initial investment funding sources from operational cooperation partners, guaranteed supply of reagents, calibrators, control and maintenance of diagnostic equipment from partners, guaranteed smooth laboratory examination services and development of technological advances in equipment by partners.

Rachmawati et al. (2018) explained several advantages of operational cooperation of laboratory equipment obtained by hospitals, including that hospitals find it easier to follow developments in medical science and technology with the limitation of the period of use of equipment, making it easier for laboratories to manage human resources because the equipment provider also provides several maintenance facilities so that laboratories do not need to prepare special personnel to carry out the equipment maintenance process, and the provider will be more responsible for damage to the equipment because the equipment belongs to the provider.

Haryati, RT (2024) in his research stated that the effectiveness obtained from this test cooperation system is the Laboratory Information System support which greatly assists the laboratory service process starting from pre-analytical, analytical and post-analytical so that it is guaranteed from errors that may occur during the 3 phases of RSU'Aisyiyah laboratory

services if done manually without LIS. Efficiency is also obtained from the support of 2 vials of control materials per month for internal quality assurance, calibrator materials for internal quality assurance and routine maintenance, free maintenance support every month, free calibration every 6 months during this cooperation period.

### ***Service improvement***

The existence of operational cooperation of the laboratory in the hospital is expected to improve the quality of laboratory services during the service process that is running in the hospital. The results of the study showed that the laboratory services of the hospital have been running smoothly and well. From the results of the interview, it can be concluded that the laboratory unit stated that the laboratory equipment that carried out operational cooperation was very helpful in the smooth running of laboratory services in the hospital.

During the use of the device, consumers feel many conveniences, both hospitals and patients. For hospitals, especially operators, they feel the convenience in operating the device and handling device trouble. Other conveniences such as not having to bother looking for a device calibration institution because it has been provided by the vendor as the provider. Convenience is also felt by patients who are undergoing examinations. Patients do not need to undergo an exit examination because of the rare occurrence of device damage, but even if there is device damage, the results received can be given on the same day because of the fast response of the vendor's technicians in fixing device trouble.

The frequency of disruptions to hematology devices with operational cooperation is very rare and there has never been a shortage of reagents. This is because the technicians provided by the vendor are always fast response to overcome trouble and with the scheduled maintenance by the vendor so that the condition of the device always functions optimally and provides accurate results. Related to the smooth supply of reagents, in this case not only the success of the vendor's performance which is always ready to send reagents in the required amount and ready stock whenever an order is made by the pharmaceutical warehouse logistics, but also the good performance of the laboratory unit in assessing reagent needs and when to reorder. This cooperation will further improve the quality of service.

The increase in service seen from the number of visits and examinations did not appear to have an effect. During the three years of operational cooperation of laboratory equipment in the hospital, especially examinations with hematology analyzers, there was a decrease in the number of examinations, while the number of examinations in the clinical pathology laboratory increased each year. This shows that operational cooperation of laboratory equipment on hematology analyzers does not have much effect on increasing the quantity of patient visits.

Haryati, RT (2024) in his research stated that cooperation per clinical chemistry examination test at RSU'Aisyiyah in 2022-2023 was efficient and effective for patient services with a total of approximately 80% with the JKN BPJS category using the INACBGs claim system for financing. The effectiveness obtained from this cooperation system per test is the support of the Laboratory Information System which greatly assists the laboratory service process starting from pre-analytical, analytical and post-analytical so that it is guaranteed from errors that may occur during the 3 phases of RSU'Aisyiyah laboratory services if done manually without LIS. Efficiency is also obtained from the support of 2 vials of control materials per month for internal quality assurance, calibrator materials for internal quality assurance and routine maintenance, free maintenance support every month, free calibration every 6 months during this cooperation period.

### ***Research Limitations***

The limitation of this study is that the researcher conducted a study related to the determinants of the success of the procurement of operational cooperation of laboratory equipment in the

hospital by analyzing one type of equipment and with only one vendor. The laboratory equipment used in this study was a hematology analyzer and a vendor who carried out operational cooperation using the Reagent Rental method in the Clinical Laboratory of the hospital in Padang. Another limitation is that the researcher has not studied in depth the managerial factors related to the performance of hospital management and cooperation partners in implementing the procurement of operational cooperation of laboratory equipment.

## Conclusion

From the results of the research on the analysis of the determinants of the operational cooperation system of laboratory equipment based on cost benefit analysis from the perspective of hospital management in X Padang, it can be concluded that: 1) The determinants that influence the operational cooperation system of laboratory equipment are costs, human resources, regulations, cooperation partners, developments in medical science and technology, the laboratory equipment and previous laboratory data; 2) Costs during the implementation of operational cooperation include investment costs (facilities) and operational costs (direct costs and indirect costs) consisting of reagents, BMHP, electricity, building maintenance, stationery, medical services and employee salaries; 3) In this study, it can be assessed the many benefits of the implementation program of operational cooperation of laboratory equipment, namely financial benefits and non-financial benefits. The most basic benefit felt by the hospital is the many cost reductions including initial capital costs, equipment repair costs, maintenance and replacement of spare parts, even equipment upgrades are also provided by fast response technicians and guaranteed reagent supply so as not to disrupt services; 4) The procurement of laboratory equipment through operational cooperation at RSKB X is feasible to be implemented, continued and/or additional equipment through KSO with a positive NPV value (+99,422,367.47) and a B/C value = 1.59 which is higher than independent purchases, namely a positive NPV value (+31,603,297.3) and B/C = 1.158. This means that procurement through operational cooperation is more feasible to be continued than independent purchases.

Based on the analysis of the hospital management perspective, it was found that not all staff related to procurement through operational cooperation at RSKB X understood operational cooperation in general. The hospital also did not have regulations related to operational cooperation and evaluation related to operational cooperation of laboratory equipment was still not running well. Evaluation of the efficiency and effectiveness of the equipment; evaluation of HR performance, management, vendors and project performance; and evaluation of the increase in the number of visits during operational cooperation of the equipment had not been carried out.

Evidence of the success of this operational cooperation procurement is not limited to the many benefits obtained by the hospital, but also from the complete quality of hospital services, marked by: a) Patients are served perfectly anytime and in any condition with KSO laboratory equipment; b) There is a good and harmonious relationship between the two parties in terms of communication, response time, comfort, accuracy of vendor selection, and involvement of all staff involved in the laboratory equipment procurement process, thereby reducing misunderstandings during the cooperation period.

This study shows that operational cooperation has strategic potential for hospitals in optimizing resource allocation and maintaining quality health services and can be a recommendation for reference in making regulations for the procurement of medical devices with operational cooperation programs.

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