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Optimization of IS/IT Investment Using The Cost-Benefit Analysis (CBA) Method in Government Agencies

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ABSTRACT

In improving its services to the public, Badan Pengelolaan Keuangan dan Pajak Daerah (BPKPD) requires investment in information systems (IS) and information technology (IT) to support the governance. Therefore, IT investment must be implemented well and with full consideration, because IS/IT investments, if allocated appropriately, can support the organization in implementing its business strategy. Based on problems experienced by BPKPD such as IT investment that is not in accordance with business needs and project management that is not well managed, then BPKPD must be observant in determining the feasibility of a project before investing. Researchers use two methods, Ward and Peppard to analyze strategic planning that produces what investments are needed and using Cost-Benefit Analysis (CBA) to find out whether investments are profitable or detrimental and to choose which investments are worth prioritizing. The results of this study are to produce an investment proposal consist of: 5 IS proposals, 1 IT proposal and 2 IS/IT Management proposals. Eight investment proposals obtained from the Ward and Peppard analysis, after analyzing their feasibility using the CBA method, it produced 1 IT investment proposal that was unfeasible.

Keywords: BPKPD; Cost-Benefit Analysis; IS/IT investment; Ward and Peppard

ABSTRAK

Dalam meningkatkan layanannya kepada publik, Badan Pengelolaan Keuangan dan Pajak Daerah (BPKPD) membutuhkan investasi dalam sistem informasi (SI) dan teknologi informasi (TI) untuk mendukung tata kelola organisasi. Oleh karena itu, investasi TI harus diterapkan dengan baik dan penuh pertimbangan, karena investasi SI/TI jika dialokasikan dengan tepat, dapat mendukung organisasi dalam menerapkan strategi bisnisnya. Berdasarkan permasalahan yang dialami BPKPD seperti investasi TI yang tidak sesuai dengan kebutuhan bisnis dan manajemen proyek yang tidak dikelola dengan baik, BPKPD harus jeli dalam menentukan kelayakan suatu proyek sebelum berinvestasi. Peneliti menggunakan dua metode, Ward and Peppard untuk menganalisis perencanaan strategis yang menghasilkan investasi apa yang diperlukan dan Cost-Benefit Analysis (CBA) untuk mengetahui apakah investasi menguntungkan atau merugikan serta untuk memilih investasi mana yang layak diprioritaskan. Penelitian ini menghasilkan usulan investasi yang terdiri dari: 5 usulan SI, 1 usulan TI, dan 2 usulan Manajemen SI/TI. Delapan usulan investasi yang diperoleh dari analisis Ward and Peppard selanjutnya dianalisis kelayakannya menggunakan metode CBA dan menghasilkan 1 usulan investasi TI yang tidak layak.

Kata kunci: BPKPD; Cost-Benefit Analysis; Investasi SI/TI; Ward and Peppard.

PENDAHULUAN

The Surabaya City Government has made information technology one of the visions that must be achieved. To ensure that the use of information technology truly supports the objectives of governance, it must pay attention to the efficient use of resources and risk management. Information

technology (IT) investment, if allocated appropriately, can support an organization in executing its business strategy and increase competitive advantage. On the other hand, IT investment is a waste of time for the organization because once it is made, it is underused or maybe it is not needed by the organization, even it has the potential to cause new problems.

Badan Pengelolaan Keuangan dan Pajak Daerah (BPKPD) is an agency that functions to manage regional income from the tax sector and manage regional finances in the city of Surabaya [1]. Local taxes are mandatory contributions to regions that are owed by individuals/entities that are compelling based on laws for regional needs and the prosperity of the people [2]. BPKPD manages local taxes which are classified into restaurant tax, hotel tax, entertainment tax, advertisement tax, street lighting tax, parking tax, groundwater tax, land building tax (PBB), and land and building rights acquisition tax (BPHTB) [3]. To support its service activities, an organization must be supported by IS/IT [4]. BPKPD has various information technology (IT) assets managed by the IT division which is formed in an IT management team. Besides, the IT division is also in charge of implementing budgeted work programs and handling IT investment problems that occur at BPKPD. Problems related to IT investment experienced by BPKPD include: (1) IT investment is not in line with business needs, for example, BPKPD incurs large costs to follow trends in the use of certain systems or software regardless of whether the investment is appropriate or not with BPKPD's specific needs or conditions; and (2) Project management is not well managed, for example, IT initiatives are realized with IT projects, but these projects are not managed adequately so that IT projects often exceed the budget and/or exceed the predetermined completion schedule.

From the investment problems that often occur, the IT division, as a manager, must improve the implementation of IT governance, both internally and externally which focuses on aligning IT with the company's business. Researchers use a Cost-Benefit Analysis (CBA) approach to analyze whether the investment that has been made is profitable or detrimental and to determine the feasibility of a program before investing. CBA emphasizes calculating the level of profit/loss of a program by considering the costs to be incurred and the benefits to be achieved. Based on the results of the CBA analysis, the BPKPD can determine the right investment options and the budget can be allocated effectively. Before applying the CBA analysis, of course, the IS/IT investment must be in line with the business objectives of the BPKPD. Therefore, it is necessary to carry out a strategic plan to support the IS/IT strategy in BPKPD. This is because the analysis process in CBA refers to the results of strategic planning in the form of investment proposals or portfolios. IS/IT strategic planning, according to Ward and Peppard [5], is divided into two elements, namely information systems (IS) and information technology (IT). The information systems strategy includes any information that must be generated for the organization, while the information technology strategy includes how information is obtained and shared. Strategic planning is carried out so that business strategies are aligned with IS/IT strategies, as well as to help improve the quality of IT planning that is flexible and in line with the environment, work culture, and organizational conditions.

LITERATURE REVIEW

Ward and Peppard Method

The Ward and Peppard method separates the IS strategy from the IT strategy. IS strategy tends to concentrate on meeting business demands and application problems, whereas IT strategy tends to focus on technology and technical problems [5]. The overall schematic of the IS/IT strategy planning model by Ward and Peppard is shown in Figure 1.

Input in the strategic planning of information systems and technology consists of: the internal business environment (the organization's business strategy); the external environment of the business (includes aspects of economic conditions, industry, and organizational competition); internal IS/IT environment (covering the IS/IT view of the business, business scope, IT contribution to the organization's business results, capabilities, resources, and infrastructure technology used); furthermore, the external environment of IS/IT (technological developments and existing opportunities, as well as information technology used by other parties, especially consumers, competitors, and suppliers).

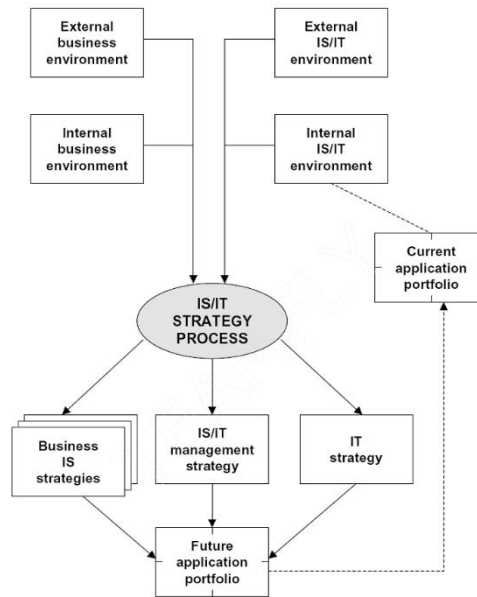


Figure 1. Ward and Peppard Method

IS/IT strategy process is the process of processing information obtained from the input and producing output. Meanwhile, the resulting output consists of business IS strategies, IS/IT management strategies and IT strategy, and strategies and policies to regulate the use of information technology in organizations. From the three outputs, it produces a *future application portfolio*, a detail that describes the proposed applications that the organization will use in the future to integrate each unit and adapt technological developments with organizational developments. Meanwhile, the current application portfolio is a breakdown of the applications that are currently in use by looking at the advantages and strengths obtained from using these applications [5].

Cost-Benefit Analysis (CBA) Method

CBA is a technique that is most commonly used to calculate costs and benefits in an information technology project. In a feasibility analysis using CBA, it is necessary to identify the costs that will be incurred and the benefits that will be obtained. Costs are divided into two types, namely direct and indirect costs. And benefits are divided into two types, namely tangible and intangible benefits. In decision making, the methods used in Cost-Benefit Analysis are Payback Period (PP), Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost Ratio (BCR) [6], [7]. The method used in the CBA is described as follows [8]:

1. Payback Period (PP)

It is the time measured at the time the investment commences until the breakeven point is reached, which indicates the length of time for the return on investment issued. The Payback Period is calculated using Equation (1).

$$\text{Payback Period} = \frac{\text{Investment Cost (Tangible dan Intangible)}}{\text{Proceed (Tangible dan Intangible)}} \times 1 \text{ Year} \quad \dots\dots\dots (1)$$

2. Net Present Value (NPV)

It is a method that compares total expenditure with overall income at a certain interest rate. The NPV is calculated using Equation (2).

$$\text{NPV} = -\text{Project Cost} + \frac{\text{Cash in Flow 1}}{(1+i)^1} + \frac{\text{Cash in Flow 2}}{(1+i)^2} + \dots + \frac{\text{Cash in Flow } n}{(1+i)^n} \quad \dots\dots\dots (2)$$

NPV is Net Present value, i is the discount rate calculated, and n is investment project life.

3. Internal Rate of Return (IRR)

This method calculates the interest rate, which is the exact interest rate for an investment with a break-even value, that is, neither profitable nor detrimental. By knowing the break-even interest rate, it can be compared with the desired rate of return. If it is bigger, the investment is profitable and vice versa (the investment is not profitable). The IRR is calculated using Equation (3).

$$IRR = i1 + \frac{(i2-i1) \times NPV1}{NPV1-NPV2} \quad \dots\dots\dots (3)$$

$i1$ is the first interest rate that causes a positive NPV, $i2$ is the second interest rate that causes the NPV to be negative, NPV1 is NPV positive with an interest rate of $i1$, and NPV2 is NPV positive with an interest rate of $i2$.

4. Benefit-Cost Ratio (BCR)

It is a comparison between all benefit values against all cost values. The BCR method is done by comparing the total benefits that have been identified during the planned investment life with the total costs which are all stated in year 0 (present value). The BCR is calculated using Equation (4).

$$BCR = \frac{\text{Present Value (Benefit)}}{\text{Present Value (Cost)}} \quad \dots\dots\dots (4)$$

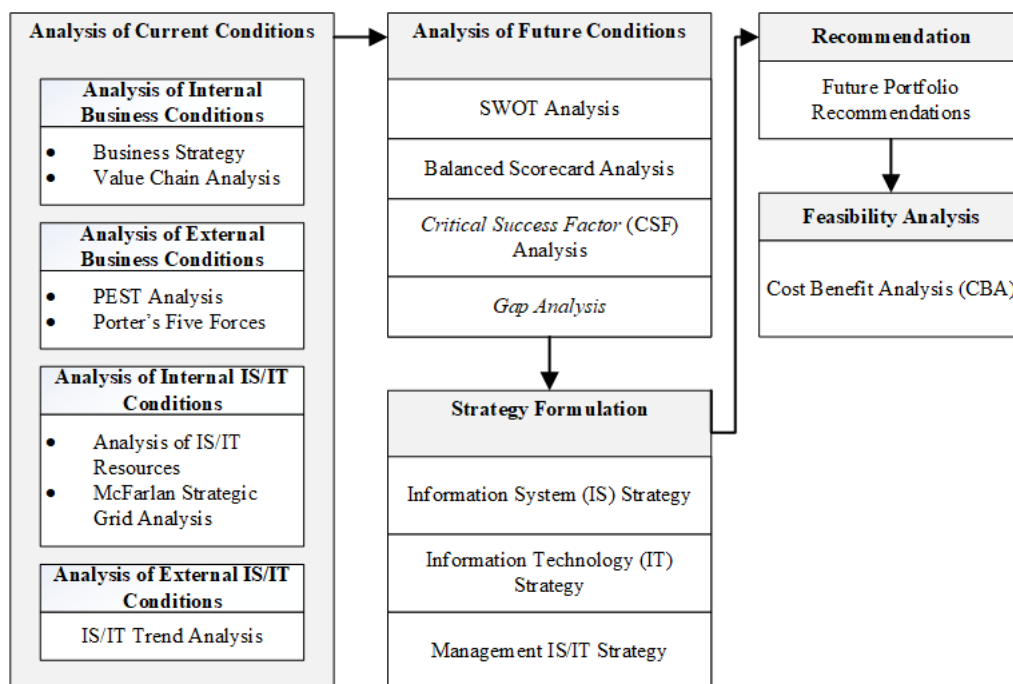
We can calculate this present value (PV) using Equation (5).

$$PV = \frac{Fn}{(1+r)^n} \quad \dots\dots\dots (5)$$

Fn is future value (value at the end of year n), PV is the present value (value in year 0), r is the interest rate, and n is the total time (years).

METHOD

The research method consists of several stages, namely the analysis stage of current conditions, future conditions, formulation of strategies, recommendation stage, and feasibility analysis. The outline is shown in Figure 2.



Gambar 2. Research Method

Existing Condition Analysis

The research flow begins with an analysis of existing conditions or current conditions, which begins with an analysis of the internal conditions of the business. This analysis is used to determine

the internal conditions which include the vision, mission, and main duties and functions of the BPKPD. Researchers carried out internal business conditions using business strategy analysis techniques and Value Chain analysis.

Analysis of external business conditions is related to various factors outside the BPKPD that lead to opportunities and threats. At this stage, PEST and Porter's Five Forces analysis are used to complement the results of the external business environment analysis at BPKPD. PEST analysis is used to identify political, economical, social, and technological factors that influence BPKPD. Porter's Five Forces analysis is used to analyze the position of BPKPD in government. This analysis is used to determine the threat of competitors, threats from products, bargaining power of buyers, and the bargaining power of suppliers. This analysis is used to compare the current IS/IT conditions with the objectives the BPKPD wants to achieve.

The process of analyzing the internal condition of IS/IT is carried out by evaluating the current BPKPD application portfolio, information resources, infrastructure, services, and resources. The technique used in this analysis is the McFarlan Strategic Grid analysis, organizational structure, human resources, networks, IT infrastructure, BPKPD facilities, and infrastructure to complement the results of the analysis of the internal IS/IT conditions. McFarlan Strategic Grid analysis is used to analyze existing, planned, and potential information systems in BPKPD. In this analysis, there are four categories, namely strategic, key operational, support, and high potential.

The analysis of IS/IT external conditions that is carried out includes information technology trends consisting of technology trends, technology utilization, and IS/IT. The purpose of this analysis is to find out what applications will be adopted in the future [5].

Future Condition Analysis

The future condition analysis stage uses analysis techniques such as SWOT analysis, BSC (Balanced Scorecard), CSF (Critical Success Factor), and Gap analysis to complete the determination of future needs. SWOT analysis is used to analyze the factors of Strength, Weakness, Opportunity, and Threat owned by BPKPD. Then mapped in the BSC formed by a combination of systems, people, strategies, processes, and technology. BSC is used to measure the performance based on four perspectives, namely financial, internal business, customer, and innovative-and-learning perspective. The results of the BSC are used to analyze the CSF to determine the determining factors for the success of the BPKPD in achieving its goals. So that in applying CSF analysis, measurement is needed, namely the Key Performance Indicator (KPI) to see the extent to which the BPKPD's performance is in achieving the factors that have been determined in the CSF analysis. The last phase is gap analysis which is used to find out which performance should be improved. This analysis is used to determine the gap between current conditions and what actions should be taken in the future.

Strategic Formulation

At this stage, the information system, information technology, and IS/IT management strategy are carried out [8]. This strategy is implemented to improve BPKPD business processes. The results of the IS strategy recommendations at BPKPD are in the form of information system application requirements that are aligned with their business strategies. The IT strategy produces recommendations for information technology needs that support the proposed application at BPKPD. The IS/IT management strategy produces recommendations for IS/IT management requirements that support the results of recommendations for information systems and information technology.

Recommendation Stage

The recommendation stage is a stage called the results stage. This stage contains future investment proposals or portfolios. The portfolio is based on the IS business strategy and is obtained through the McFarlan Strategic Grid.

Cost-Benefit Analysis (CBA)

This stage is a calculation of the feasibility and decision making of IS/IT strategic planning in BPKPD using the CBA method by comparing the costs and benefits. Where cost reflects the investment cost of the program which consists of time, effort, cost, risk. Meanwhile, benefit reflects the return on investment in a program that can be neutral, positive, or negative (in this case is an intangible benefit). The CBA analysis phase is: (1) determining cost (tangible and intangible) and benefit (direct or indirect) and (2) calculating cost and benefit in the form of rupiah using the (PP, NPV, IRR, BCR) approach [9].

Payback Period Method

This method assesses investment projects based on how long the investment can be covered by cash inflows. This method does not include the interest factor in the calculation. The payback period method is calculated using Equation (1). From the PP calculation, results will be obtained which can be interpreted as follows

- Investment costs: all costs resulting from investment recommendations (tangible and intangible);
- Proceed/cash inflow: IT budget + intangible benefit (convert to tangible).

Net Present Value (NPV) Method

The net present value (NPV) method is a method that considers the time value of money. This method uses a discount rate that will affect the proceeds or flows of the money. NPV can be calculated from the difference in the value of the project at the beginning of the year minus the total proceeds for each year which are assessed and poured into the initial year with the discount rate. The NPV method is calculated using Equation (2). From the NPV calculation, results can be interpreted as follows:

- If $NPV > 0$, indicates that the project provides more benefits than costs and is feasible to be implemented;
- If the $NPV < 0$, indicates that the project provides fewer benefits than costs and is not feasible to implement.

Internal Rate of Return Method

The internal rate of return method is also a method that considers the time value of money. In the NPV method, the desired interest rate has been predetermined, while the internal rate of return (IRR), the interest rate will be calculated. The IRR method is calculated using Equation (3). From the calculation of IRR, results will be obtained which can be interpreted as follows:

- If $IRR > \text{Social Discount Rate}$, then the investment is feasible to be implemented;
- If the $IRR < \text{Social Discount Rate}$, then the investment is not feasible to be implemented.

Benefit-Cost Ratio (BCR)

Theoretically, the Benefit-Cost Ratio is a comparison between all benefit values against all sacrifice or cost values. The BCR method is calculated using Equation (4). From the calculation of BCR, decision making on feasibility can be determined. If $BCR \geq 1$, then it is said to be feasible, it means that the benefits of the project are greater than the sacrifices incurred. Conversely, if $BCR < 1$, it is said to be unfeasible, it means that the benefits of the project are smaller than the initial capital.

RESULTS AND DISCUSSION

Investment Feasibility Results

After analyzing using the Ward and Peppard method, this study produced eight investment proposals. Each of the eight proposals is analyzed using the CBA method to determine the feasibility of investing using the Payback Period (PP), Net Present Value (NPV), and Internal Rate Return (IRR)

approaches, as well as investment priorities using the Benefit-Cost Rate (BCR) approach to determine investment that will be applied first. In the process of calculating CBA, researchers used Microsoft Excel as a tool. The analysis resulted in an unfeasible investment proposal, namely *Building a new system for groundwater tax called E-PAT*. The results of the study are shown in Table 1.

Tabel 1. Results

Data	Investment Proposal	CBA Calculation Results				Result Analysis
		PP	BCR	NPV (IDR)	IRR (%)	
1	Adding a virtual account payment module on E-BPHTB	0.159	2.238	1,153,153,866	60	Feasible
2	Added a virtual account payment module at E-PBB	0.171	1.280	1,060,273,701	60	Feasible
3	Added virtual account payment module on E-PHR	0.320	3.400	1,164,238,494	59	Feasible
4	Building a new system for groundwater tax, called E-PAT	0.400	0.300	-	-	Unfeasible
5	Reorganize the advertisement tax service system to become E-Reklame	0.710	1.390	1,002,100,147	54	Feasible
6	Replacing an out of date PC with a more reliable PC	0.290	1.180	1,012,484,279	59	Feasible
7	Conduct an internal audit of employee compliance with SLAs in the service delivery process	0.082	2.990	1,180,623,453	61	Feasible
8	Conducting an internal audit in evaluating compliance with SOPs	0.082	3.130	1,189,140,974	61	Feasible

Note: PP is stated per month.

Investment Priority Results

The investment priorities to be applied, referring to the results of the Benefit-Cost Ratio (BCR) method, are as follows:

1. Added virtual account payment module on E-PHR,
2. Conducting internal audit in evaluating compliance with SOPs,
3. Conduct an internal audit of employee compliance with SLAs in the service delivery process,
4. Adding a virtual account payment module on E-BPHTB,
5. Reorganize the advertisement tax service system to become E-Reklame,
6. Added a virtual account payment module at E-PBB,
7. Replacing out of date PC with a more reliable PC.

CONCLUSION

Based on the results of strategic planning analysis using the Ward and Peppard method, it produces 8 investment proposals consisting of 5 SI investment proposals, 1 IT investment proposal, and 2 investment proposals. The CBA analysis using the NPV method resulted in 7 positive investment proposals (feasible) and 1 negative (unfeasible) investment proposal, namely the investment to build a new system for groundwater tax, called E-PAT.

Before the optimization is carried out, the investment determination process is carried out subjectively by the leadership. As a result, IS/IT investments are not in accordance with business needs, some procurement is ultimately not used, and some investments have even stopped. After optimization, investment determination can be done objectively using the CBA method. Future investment needs are analyzed based on current business conditions and IS/IT using the Ward and Peppard approach, then analyzed priorities and their feasibility with the CBA method. Thus, the IS/IT investment can be allocated appropriately and objectively.

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