Economic and institutional analysis for the sustainable management of Marine Protected Areas in Ujung Kulon National Park, Indonesia

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Abstract. The marine protected area of Ujung Kulon National Park, in addition to having a critical role as a buffer area for the terrestrial area of Ujung Kulon National Park, also has economic value. However, to optimize its function and its economic value, it is necessary to formulate an institutional model that not only influences aspects of efficiency and effectiveness, but also aspects of sustainability. The purpose of this study is to analyze the total economic value, the economic feasibility, and the institutional aspects of the Marine Protected Area through the Interpretative Structural Modelling (ISM) analysis. The results showed that: 1) the total economic value of the Marine Protected Area of Ujung Kulon National Park is 179690454.49 USD, consisting of mangrove ecosystems (83800377.28 USD per year), and coral reef ecosystems (95890077.21 USD per year); 2) the economic feasibility analysis shows that the net present value (NPV) is 132923470.05 USD, higher than 0, the net benefit cost ratio (Net B/C) is 19.3, higher than 1, the internal rate of return (IRR) is 39.43%, higher than 20% and higher than the minimum attractive rate of return (MARR); and 3) the ISM analysis shows that the main actors are Ujung Kulon National Park Office, the Development Planning Agency at the sub-national level of Banten Province, society, and entrepreneurs.

Key Words: economic feasibility, economic value, interpretative structural modelling, main actors, mangrove and coral reef ecosystems.

Introduction. A conservation area is an area with specific characteristics that have the primary function of preserving biodiversity, genetic species, and their ecosystem (Lazuardi 2016). The government determines conservation or protected areas based on various criteria for their interests. Water conservation efforts in Indonesia are growing in line with the development of the conservation of natural resources and the national environment, the community, and the development of world conservation with a global perspective. One form of a conservation area is a water conservation area. In the Regulation of the Minister of Maritime Affairs and Fisheries No. 31 of 2020, the purpose of the determination of a place as a marine conservation area is to unite the sustainability of marine and fishery resources with maintaining the balance of the environment, biodiversity, and aquatic ecosystems, as well as with the availability of the area management.

Establishing marine protected areas is a solution for sustainable management by protecting and restoring species and ecosystems damaged because of pressures from intensive fishing activities and human-induced marine degradation (Lancaster 1966). Polunin & Roberts (1993) added that several developed and developing countries have adopted a marine conservation model by closing fishing activities and creating marine conservation areas intended as an effort to protect and restore endangered resources and ecosystems.

The marine protected area of Ujung Kulon National Park has an area of 44,337 ha, covering the Ujung Kulon Peninsula area and 20 small islands. It is part of the terrestrial conservation area of Ujung Kulon National Park, which has a total area of 105694.46 ha. Marine habitats in the marine conservation area of Ujung Kulon National Park include rocky beaches, swamps, muddy land, and mangrove forests (with *Lumnitzera racemosa*, *Avicenna* spp, *Sonneratia alba*, *Bruguiera* spp, *Nypa fruticans*, *Acrostichum aureum* and *Rhizophora* spp.) on the coast and almost all islands in the Ujung Kulon National Park, seagrass beds and coral reefs (mostly *Acropora*, hard and soft corals species) with an extensive area in most of the waters of the Ujung Kulon Peninsula, Handeuleum Island area, Peucang Island, and Panaitan Island (UKNP 2015).

The determination of conservation areas is expected to achieve economic and social benefits, namely by providing high economic value for community welfare, regional original income, and foreign exchange through the natural resources and ecosystems in the areas. However, the current management of conservation areas has not offered significant monetary value, whereas the management of marine conservation areas is relatively dominated by conservation activities such as protection, restoration of ecosystem areas and monitoring, including area patrols for the preservation of natural resources and the environment. This condition occurs in almost all marine conservation areas, both those under the ministry's authority and under the administration of local governments. Therefore, there must be a fundamental change in the model and paradigm of conservation area management (shifting paradigm), in which the view that a conservation area that has only prioritized the protection aspect should be changed by adding sustainable use.

The marine protected area of Ujung Kulon National Park, in addition to having a significant role as a buffer area for the terrestrial area of the Ujung Kulon National Park, also has a very high economic value, seen from the potential of mangrove and coral reef ecosystems, with potential for marine tourism, but also from the presence of various species of fish with high economic value (UKNP 2015). With these roles and its high economic value, the management of the Ujung Kulon National Park water conservation area becomes strategic and critical for economic growth on the one hand and for the sustainability of resources and ecosystems on the other. For the function and economic value to be optimized, it is essential to formulate an effective, efficient, and optimal management institutional model and have full authority in its management. Institutional factors are one of the most critical aspects of leadership, affecting not only aspects of program efficiency and effectiveness, but also management sustainability (Anantanyu 2009). The purpose of this study is to analyze the total economic value, the economic feasibility, and the institutional marine protected area of Ujung Kulon National Park.

Material and Method. Economic value analysis was carried out using the total economic valuation (TEV) approach, which is defined as an attempt to provide a quantitative value to goods and services produced by natural resources and the environment regardless of whether market prices are available or not (Fauzi & Anna 2005). The existence and bequest value are difficult to determine through market prices. The contingent valuation method (CVM) was used to know the willingness to pay, expressed in the form of monetary value from the community for goods and services produced by natural resources and the environment, including benefits. The economic value of mangrove ecosystems and coral reefs was measured using the willingness to pay (WTP) approach. WTP measures the maximum amount a person wants to sacrifice in goods and services to obtain other goods and services. The technique used in estimating the WTP value of the marine protected area of Ujung Kulon National Park's is the CVM method. CVM is a survey method in which respondents (community) are questioned about the value or price of goods and services that do not have a market price, such as environmental goods and services. According to Fauzi (2004), the CVM approach can be carried out in two ways: experimental techniques through simulations and games and survey techniques. Economic feasibility is the total result (productivity or profit) obtained from all sources used in the project for society or the economy as a whole, regardless of who provides these resources and who is the community that receives the results of the project (the social returns from the project) (Kadariah 2001).

According to Suswarsono (2000), the economic analysis compares costs and benefits to determine whether a business will benefit during the company's life. In our case, it illustrates the benefits for managers, entrepreneurs, and the community from the existence of the Ujung Kulon National Park water conservation area. The net present value (NPV) represents the difference between cash inflows and current cash outflows at a specific period in the future. NPV estimates the present value of a business, asset, or investment based on expected future cash inflows and cash outflows adjusted for interest rates and the initial purchase price (initial investment) (Berkovitch & Israel 2004). NPV uses the initial purchase price and time value of money to calculate the value of an asset (Osborne 2010). Net benefit to cost ratio (Net B/C) is a comparison between all benefits and all cost values (Ha 2010). Net B/C shows how many times the benefits are obtained from the costs incurred in a business/project that will be carried out (Cellini & Kee 2015). In other words, net B/C in analyzing a business/project can better reflect the profit ratio. This is because the benefits received have been reduced by the costs incurred during the assumed operating life (Sen 2000). In addition, net B/C also takes into account cash flows over the life of a project/investment business. The internal rate of return (IRR) is an indicator of the feasibility of the economic aspect, which is one of the references for calculating the efficiency of a business/project investment (Harding 1998). In simple terms, the IRR calculation can determine whether an investment is worth making. An investment considered feasible must meet the criteria for an IRR value higher than the acceptable minimum rate of return or minimum attractive rate of return (MARR) (Gallo 2016). This means that if someone has funds invested in a business, the money value will be obtained by a percentage higher than the interest on money when the funds are only deposited in a bank (Psacharopoulos 1994). The MARR assumption used in this business feasibility analysis is 20%. The institutional analysis is intended to determine the role (influence and dependency) of the actor aspect, the needs and the constraints of its development using the Interpretative Structural Modeling (ISM) technique. According to Saxena et al (1992), the ISM technique is concerned with interpreting a complete object or system representation through the systematic and interactive application of graph theory. The ISM method has also been widely used especially to analyze structural elements based on their contextual relationships (Marimin 2004).

Research method. The research approach used is a survey research. The survey research is an investigation carried out to obtain facts from existing symptoms and find factual information about the social, economic, or political institutions of a group or an individual (Nazir 2011). The survey research considers the research objectives to be achieved, namely, economic valuation of natural resources and the environment, economic analysis, and analysis of institutional management. The research location is in the Marine Protected Area of Ujung Kulon National Park, Banten. The research was conducted from July to December, 2020.

Data types and sources. The type of data used in this study is primary data and secondary data. Primary data was obtained through survey and observation methods, by conducting interviews using a list of questions and without a list of questions to 160 respondents from tourists, fishermen, businessmen and the community, as well as by observing the existing conditions in the field related to the aspects of the study carried out. In contrast, secondary data was obtained through the desk study method by reviewing scientific literature, records, and reports on the economic value of natural resources and environment and regional economic analyses.

Methods of collecting data. The data collection method used in this study is based on the type and source of data. Primary data collection techniques were used to estimate the value of the economic valuation of natural resources and the environment. Regional financial analysis and institutional analysis were conducted through interviews with the help of questionnaires through purposive and accidental sampling methods, conducting focus group discussions with experts related to the field of research, and carrying out observations. Secondary data was obtained through literature research related to the economic value of natural resources and the environment, both in terms of benefit value and non-benefit value, and to other data related to regional economic analyses and sustainable institutional management.

Data analysis methods. The method of analysis is based on the research objectives, namely: 1) economic valuation of natural resources and the environment; 2) economic analysis; and 3) interpretative structural modeling analysis to identify actors in the institutional management of marine protected areas in Ujung Kulon National Park. The total economic valuation (TEV) approach was used to determine the economic value of the natural resources and the environment from the marine protected areas of Ujung Kulon National Park. Mathematically, TEV can be determined by the equation (Adrianto et al 2016):

TEV = UV+NUV

TEV = (DUV+IUV+OV) + (BV+EV)

The TEV (total economic value) of a resource or goods consumed by individuals can be categorized into use value (UV) and non-use values (NUV). UV can be interpreted as the values obtained by individuals for direct use of natural resources, where the individual is directly related to natural resources and the environment. The direct use value (DUV) refers to the direct use of resource consumption both commercially and non-commercially, such as fishing, mangrove wood, etc. Indirect use value (IUV) refers to the value that is felt indirectly on goods and services produced by resources and the environment, such as the benefits of the mangrove ecosystem as a nursery ground and prevention of abrasion. The option value (OV) refers to the value of maintaining resources and the environment, to have the option to utilize in the future. NUV is the value given to natural resources for their existence, even though they are not consumed directly. NUV is based on preference, so it is difficult to measure. The bequest value (BV) or inheritance value refers to the value given by the current generation by bequeathing resources to future generations who have not yet been born. BV measures WTP to ensure that future generations will be able to utilize the resource. The existence value (EV) or intrinsic value refers to the assessment given to the preservation of resources and the environment that has nothing to do with the use or the intrinsic value of the resource.

The data analysis method used to answer the economic feasibility of marine protected areas in Ujung Kulon National Park (UKNP) includes:

The NPV analysis, which is a method used to calculate the difference between the investment value (capital outlays) and the value of net cash receipts (present value of proceeds) both from operational cash flows and from terminal cash flows in the future (during the life of the investment) (Almeida et al 2004).

$$NPV = \sum_{t=0}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

Where: NPV - net present value (USD); Bt = total benefit in period t; Ct - total cost in period t; r - discount factor (%); t - period (years).

The Net B/C is a comparison between the level of acceptance of a business unit and the costs incurred to obtain the revenue (Basten et al 2010):

$$\text{Net B/C} = \frac{\sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+i)^t}}{\sum_{t=1}^{n} \frac{(C_t - B_t)}{(1+i)^t}}$$

Where: Bt - revenue (total benefit) in year t; Ct - cost (total cost) in period t; i - discount rate (%); t - period (years).

IRR is an indicator of the feasibility of the economic aspect, which is one of the references for calculating the efficiency of a business/project investment (Harding 1998).

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} x \, (i_1 - i_2)$$

Where: IRR - internal rate of return; i1 - discount rate that produces a positive NPV; i2 - discount rate that produces negative NPV; NPV1 - positive NPV; NPV2 - negative NPV.

ISM was used to analyze the institutional management of the water conservation area of Ujung Kulon National Park. According to Marimin (2004), the stages of the ISM methodology are: 1) the structural self-interaction matrix (SSIM); 2) the reachability matrix; 3) the level partitions; 4) the conical matrix; 5) digraphs; and 6) the ISM model. The ISM modelling stage determines the contextual relationship, which is then converted into a mathematical relationship in the form of a reachability matrix (RM). The relationship between these elements is expressed in a Cartesian multiplication. The matrix must meet reflexive and transitive properties. The contextual relationship (structural self-interaction matrix) can be converted into a mathematical relationship in the form of a reachability matrix with complete rules as presented in Table 1.

Table 1

Transformation of contextual relationships between elements into mathematical relationships

Form of contextual relationship between elements i and j (eij)	*Form of mathematical relationship between elements i and j (eij)*
V	If eij=1 and eij=0
A	If eij=0 and eij=1
X	If eij=1 and eij=1
O	If eij=0 and eij=0

Where: V - the relation from the elements Ei to Ej, but does not apply to the inverse; A - relation from elements Ej to Ei, but not vice versa; X - interrelation between Ei and Ej (valid for both directions); O - shows that Ei and Ej are unrelated.

Eriyatno (2003) states that this analysis of the institutional model basically compiles a hierarchy of each sub-element in the studied element, and makes a classification into four sectors to determine which sub-elements are included in the autonomous (Quadrant I), dependent (Quadrant II), linkage (Quadrant III), or independent (Quadrant IV) variables. Graphically, the position of each sector is presented in Figure 1. Quadrant I has weak driver-weak dependent variables (autonomous), meaning that the sub-elements included in this quadrant are generally not related to the system and may have a little relationship. Quadrant II has weak driver-strongly dependent variables (dependent), which means that the sub-elements in this quadrant are not independent. Quadrant III has strong driver-strongly dependent variables (linkage), which means that the sub-elements included in this quadrant must be studied carefully, because the relationship between the sub-elements is unstable. Quadrant IV has strong driver-weak dependent variables (independent), which means that the sub-elements included in this quadrant are the remaining part of the system, being independent variables.

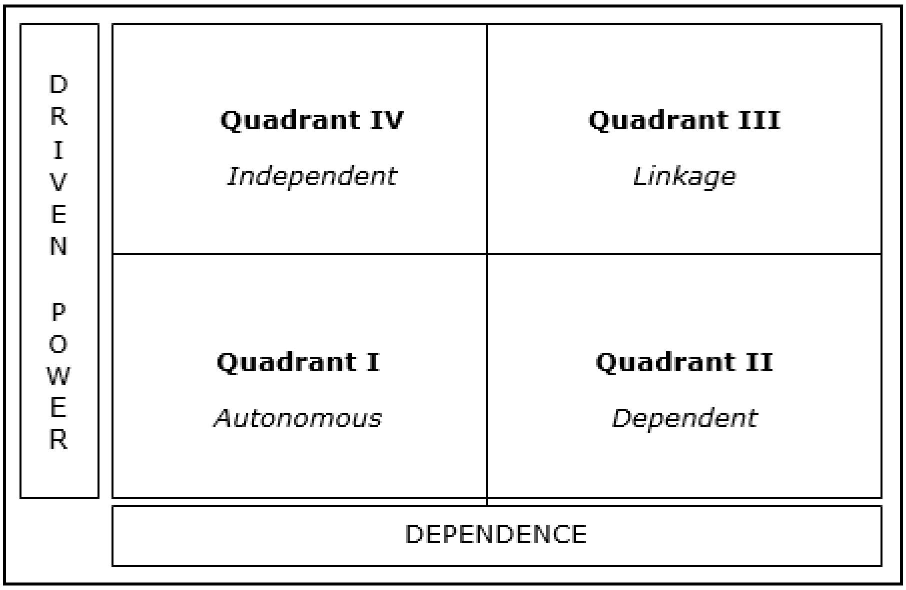

Figure 1. Interpretative Structural Modeling engineering power-dependence driver sector.

ISM consists of 3 stages, namely: 1) system identification stage, 2) analysis stage (run software), and 3) output interpretation stage. The first stage determines what elements of actors/stakeholders are involved in the management of the Ujung Kulon National Park marine conservation area. The identification results obtained several elements of actors/stakeholders (Table 2).

Table 2

Identification of actor/stakeholder elements

Symbol	*Actor/Stakeholder elements*
A1	Ujung Kulon National Park Agency
A2	Development Planning Agency at sub-national level of Banten Province
A3	University
A4	Public Works and Spatial Planning Office of Banten Province
A5	Regional Revenue Agency of Banten Province
A6	Non-governmental organizations (NGO)
A7	Tourism Office of Banten Province
A8	Directorate General of Natural Resources & Ecosystem Conservation
A9	Directorate General of Coasts and Small Islands
A10	Privates/Entrepreneurs
A11	Society (fishermen)
A12	Environment and Forestry Service of Banten Province
A13	Marine and Fisheries Service of Banten Province
A14	Directorate General of Capture Fisheries

Results and Discussion

Economic valuation of the Marine Protected Area of Ujung Kulon National Park. A reasonable economic valuation of natural resources and the environment is expected to provide optimal value, without depletion, degradation, and depreciation caused by undervaluation or overvaluation. The following results are from the economic valuation of the marine conservation area of Ujung Kulon National Park's resources.

Table 3 shows that the total economic value of the mangrove ecosystem in the marine protected area of Ujung Kulon National Park is 83800377 USD per year or 26341 USD per ha per year. Non-use value reaches 42465169 (50.67%) USD per year, which consists of and bequest value of 22558644 (26.92%) USD per year and an existence value of 19906 (23.75%) USD per year. This condition illustrates that the community has serious concerns and awareness of the existence and sustainability of the mangrove ecosystem in Ujung Kulon National Park, which is a water conservation area where ecosystem preservation is the primary goal of management. The bequest value has the highest value among other economic values, which shows public awareness about the existence of mangroves, with all their functions needed both for present and future generations. The smallest economic value is found in the indirect benefit value, namely 7819862 (9.33%) USD per year or around 2458 USD per ha per year, which in this study was only considered from the value of mangroves that function as a wave barrier.

Table 3

Economic value of mangrove ecosystem

No	*Type of economic value*	*USD/Ha/Year*	*USD/Year*	*%*
A	*Use value*	*12993*	*41335208*	*49.33*
1	Direct Use Value	5108	16248441	19.40
2	Indirect Use Value	2458	7819862	9.33
3	Option Value	5427	17266905	20.60
B	*Non-use value*	*13348*	*42465169*	*50.67*
4	Bequest Value	7091	22558644	26.92
5	Existence Value	6257	19906525	23.75
	Total economic value (A + B)	26341	83800377	100.00

Table 4 shows that the total economic value of coral reef ecosystems in the marine protected area of Ujung Kulon National Park is 95890077 USD per year or around 32636 USD per ha per year. Non-use value in the results of the total economic valuation above has the highest economic value reaching 48427751 USD (50.50%) per year. The bequest value reaches 25662854 (26.76%) USD per year and the existence value is 22764897 (23.74%) USD per year. This condition illustrates that the community has a high concern and awareness of the existence and sustainability of coral reef ecosystems in Ujung Kulon National Park. The bequest value has the highest value among other economic values, showing public awareness about the existence of coral reefs with all their functions. The smallest economic value is found in the indirect benefit value, namely 6202965 (6.47%) USD per year or around 2111 USD per ha per year, which in this study was considered from the value of coral reef ecosystems which function as carbon sinks.

Table 4

Economic value of the coral reef ecosystem

No	*Type of economic value*	*USD/Ha/Year*	*USD/Year*	*%*
A	*Use value*	*15154*	*47462326*	*49.5*
1	Direct use value	7294	21429921	22.35
2	Indirect use value	2111	6202965	6.47
3	Option value	6749	19829440	20.68
B	*Non use value*	*16482*	*48427751*	*50.5*
4	Bequest value	8734	25662854	26.76
5	Existence value	7748	22764897	23.74
	Total economic value (A + B)	32636	95890077	100

Overall, the total economic value of the marine protected area of Ujung Kulon National Park is the sum of the economic values of the mangrove and coral reef ecosystems. The details of the total economic value are presented in Table 5. Table 5 shows that the total economic value of the marine protected area resources of Ujung Kulon National Park is worth 179690454 USD per year or around 58977 USD per ha per year, consisting of the economic value of mangrove 83800377 (46.64%) USD per year or around 26341 USD per ha per year and the economic value of coral reef ecosystems, which is 95890077 (53.36%) USD per year or around 32636 USD per ha per year.

Table 5

Total economic value

No	Ecosystem type	USD/Ha/Year	USD/Year	%
1	Mangrove ecosystem	26341	83800377	46.64
2	Coral reef ecosystem	32636	95890077	53.36
	Total economic value (1 + 2)	58977	179690454	100

Overall, the non-use value category has a higher economic value than the use value for mangrove ecosystems and coral reefs. This is because the economic value measured in the non-benefit category is the existence value and bequest value. The estimated value is based on the value of the biodiversity function. Thus, the value depends on diversity: the higher the diversity index, the higher the economic value.

The high existence and bequest values in mangrove and coral reef ecosystems show the great desire of the community to protect and maintain mangrove and coral reef ecosystems in the marine protected area of Ujung Kulon National Park, with all its functions and benefits. Thus, the economic value shows that sustainable management in the marine protected area of Ujung Kulon National Park is essential for people's lives.

Economic analysis of the Marine Protected Area of Ujung Kulon National Park. The economic analysis intended to estimate the feasibility of managing the marine protected area of Ujung Kulon National Park by comparing the benefits and costs. Benefits are estimated from tourist rides (canoeing, surfing, fishing, forest exploration, snorkeling, camping), research sites, boat docking costs, boat rentals, villa/cottage rentals, wildlife observation, benefits from making commercial videos, income from tickets, as well as the benefits from the existence of mangrove ecosystems and coral reefs are presented in Table 6.

Table 6

Estimated benefits of the marine protected area of Ujung Kulon National Park

No	Benefit	Amount	Unit	Price (USD)	Amount (USD)
1	Canoeing	1377	Person	1.72	2374.14
2	Surfing	18	Person	1.72	31.03
3	Fishing	165	Person	1.72	284.48
4	Ticket				
	a. Domestic tourists	22409	Person	0.72	16227.21
	b. Foreign tourists	1014	Person	10.55	10699.45
5	Adventure	3221	Person	0.34	1110.69
6	Snorkeling	731	Person	1.03	756.21
7	Ship docking fee	1079	Trip	6.90	7441.38
8	Research activities	1	Person	78.62	78.62
9	Wildlife observation	2940	Person	0.69	2027.59
10	Camping	156	Person	0.34	53.79
11	Commercial videos				
	a. Domestic tourists	1	Package	689.66	689.66
	b. Foreign tourists	2	Package	1,379.31	2758.62
12	Boat rental	1079	Trip	241.38	260448.28
13	Villa/Cottage rental	3350	Villa	51.72	173275.86
14	The benefits of coral reefs	1	Ecosystem	22,764,897.33	22764897.33
15	The benefits of mangroves	1	Ecosystem	19,906,524.57	19906524.57
		Total			43149678.9

Based on data from the Ujung Kulon National Park Office, tourism income from tourist entrance tickets totals 26926 USD per year. This value is obtained from the sale of tickets to enter the area. Accessibility and promotion are factors that cause high or low tourist visits. Accessibility is the degree of ease people achieve with an object of service or the environment. The measure of affordability or accessibility includes the ease of time, cost, and effort in moving between places or regions (Delamartha 2021). Another factor is the lack of promotion. Promotion is an activity that includes the distribution of promotional materials, like movies, slides, advertisements, brochures, booklets, leaflets, folders and others. Furthermore, Pendit (1999) states that tourism promotion is a campaign based on a regular and continuous plan or program.

The diversity of high potential ecosystems in the marine protected area of Ujung Kulon National Park provides tourism potential as well, including beach and sea tourism. Based on data from the Ujung Kulon National Park Office, tourism revenue from tourist tickets amounts to 26926 USD per year. When looking at the potential and breadth of the area as well as the various tourism potentials, the actual value of income from tourism is low. This can happen because of accessibility factors and promotion factors, which are relatively lacking.

Costs are estimated from the capital or budget spent to maintain the marine conservation area of Ujung Kulon National Park, such as investment costs, maintenance costs, operating costs, social cost (social opportunities cost), security costs, and taxes to licensing fees, are presented in Table 7. The cost value of the Ujung Kulon National Park water conservation area is shown in Table 7.

Table 7

Estimated costs of the marine protected area of Ujung Kulon National Park

No	*Costs*	*Amount*	*Unit*	*Price (USD)*	*Amount (USD)*
1	Investment costs				
	a. PT Wana Wisata Alam Hayati	1	Package	1492940	1492940
	b. Ujung Kulon National Park	1	Package	217241	217241
2	area maintenance costs				
	- Ujung Kulon National Park	1	Year	22845	22845
3	area operational costs				
	- Ujung Kulon National Park	1	Year	58894	58894
4	social costs				
	- fishermen/community	1	Year	982499	982499
5	pay tax (as an investor's expense)				
	- PT Wana Wisata Alam Hayati	1	Year	17328	17328
	- Ujung Kulon National Park	1	Year	44533	44533
6	protection costs				
	- Ujung Kulon National Park	1	Year	48588	48588
7	licensing costs and environmental documents				
	- PT Wana Wisata Alam Hayati	1	Package	44779	44779
	Total				2929617

Determining the marine protected area of Ujung Kulon National Park to become a tourist area (ecotourism and other tourisms) requires costs, such as: initial investment costs, maintenance costs, operational costs, social costs, security costs, taxes, and licensing fees.

Social costs arise from changes in the function of water areas from natural resource utilization areas to conservation areas. This change causes a loss of potential income for fishermen, who were initially able to catch fish in the area. In other words, there is a change in the natural resource management regime from an open access regime to a state province regime. The survey results show that, in general, three types of fisherman groups use the waters more, especially in catching fish, namely, the bagan fisherman group, the cantrang fisherman group, and the purse seine fisherman group. The results showed that the three groups had a potential income from the catch after deducting the cost of fishing operations amounting to 982500 USD per year. The influence of social costs in managing the marine protected area of Ujung Kulon National Park area is high. This is because the highest cost variable is the social cost. These social costs can also be called sacrificial costs or externality costs. In other words, the determination of the marine protected area of Ujung Kulon National Park has a great impact on the income of the surrounding community, especially for fishermen.

All the costs mentioned above become cost variables in the economic analysis. Table 8 presents the economic analysis parameters of the marine protected area of Ujung Kulon National Park.

Table 8

Analysis of financial and economic aspects

No	*Parameters*	*Financial analysis*	*Economic analysis*	*Indicators*	*Decision*
1	NPV (USD)	135406380	132923470	>0	Feasible
2	Net B/C	2128	19.3	>1	Feasible
3	IRR (%)	39.54	39.43	>20% (MARR)	Feasible

Note: NPV - net present value; net B/C - net benefit to cost ratio; IRR - internal rate of return; MARR - minimum attractive rate of return.

The NPV value of 132923470 USD is higher than 0, so the investment is feasible. According to Brigham & Houston (2011), the eligibility criteria for investment acceptance using the NPV method is to have an NPV higher than 0. Thus, the determination of the marine conservation area of Ujung Kulon National Park can provide a reasonably high profit in the future.

The analysis results obtained a Net B/C value of 19.3, higher than 1, meaning that the designation of the marine conservation area in Ujung Kulon National Park benefits the government or the community by 19.3 times the invested capital. Therefore, the net B/C value shows that the benefits of the area are higher than the costs incurred, so the project would be feasible.

The analysis results show that the IRR value is 39.43%, higher than 20% (MARR). These results indicate that the rate of return on the minimum interest rate on venture capital invested in Ujung Kulon National Park is feasible because it is greater than the MARR value.

Observing the calculation results of the economic analysis, the values of NPV, net B/C ratio, and IRR show that the determination of the marine protected area in Ujung Kulon National Park is feasible. Sustainable management must be carried out so that the community and government can take advantage of and obtain this economic potential.

Institutional analysis of the Marine Protected Area of Ujung Kulon National Park. One of the essential aspects in managing natural resources, including the management of the marine protected area of Ujung Kulon National Park, is the stakeholders who have different interests. Stakeholders are part of the management plan. The stakeholders have an active and passive role in developing the management objectives. Based on the results of the prospective analysis, which is the result of the reachability matrix as the determination of the driven power-dependence matrix, the relationship between actors presented in Figure 2.

The power-dependence driver matrix shows that the position of actors/stakeholders is spread across all quadrants/sectors. Elements of actors included in quadrant IV are Ujung Kulon National Park Agency (A1) and Public Works and Spatial Planning Office of Banten Province (A2). In comparison, the other actor elements are in quadrants I, II, and III. Thus, it can be concluded that all elements have different levels of influence and dependence. According to Eriyatno (2003), each quadrant has a different level of influence and dependence. At the same time, the elements contained in quadrant IV have a high position of influence on the one hand and low dependence on the other. According to Yusuf et al (2020), the elements in this quadrant significantly influence the system. They are independent, so these elements can also be used as critical elements. Based on the preparation of levels (ranking), which is the stage of determining key levels or critical elements, the results obtained are presented in Figure 3.

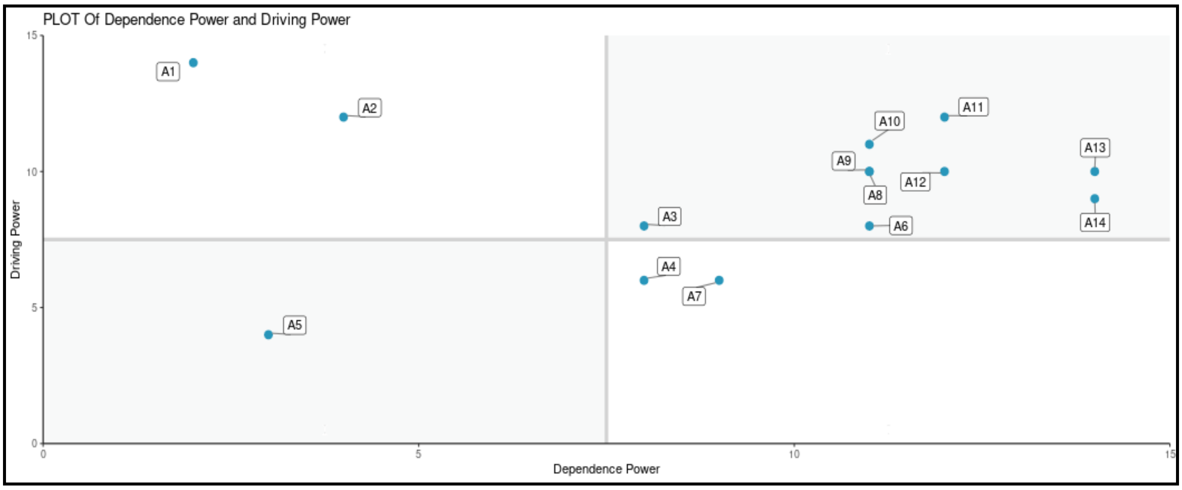

Figure 2. Power-dependence driver matrix of actor/stakeholders contextual relations.

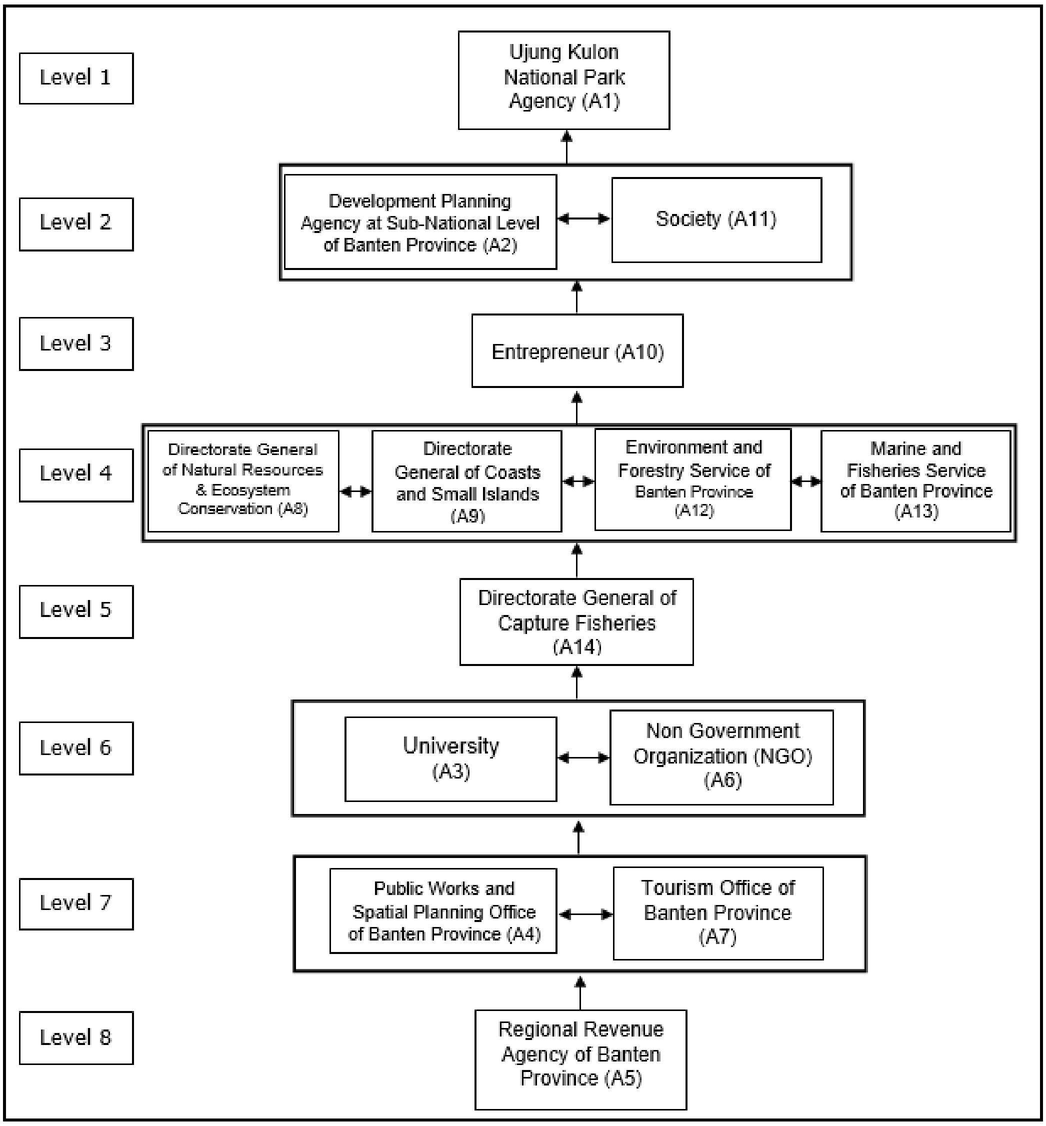

Figure 3. Actor/stakeholder elements structural model diagram.

The structural model diagram of the actor/stakeholder element, as shown in Figure 3, shows the same results as the power-dependence driver matrix, where the Ujung Kulon

National Park actor (A1) occupies level 1, while level 2 is the Development Planning Agency at Sub-National Level of Banten Province (A2) and level 3 are society (A11) and entrepreneur (A10). This shows that the institutional model for managing the water conservation area of Ujung Kulon National Park is a collaborative effort formed on a tripartite basis between the government represented by Ujung Kulon National Park and the Development Planning Agency at Sub-National Level of Banten Province, community and entrepreneurs.

The collaborative management model allows stakeholders to play a role and participate in the management of the conservation area. The government plays the role of regulator and coordinates the overall management activity plan. The role and participation of the community can be carried out when determining area zoning, utilizing zones, and maintaining area sustainability, as well as participating in rehabilitating conservation areas. The private sector (entrepreneurs) is the primary source of funding and technical management. Management that involves the private sector (entrepreneurs) will provide a professional management model where economic sustainability can be maintained.

Conclusions. The total economic value of the ecosystem of the marine protected area of Ujung Kulon National Park is 179690454 USD per year or around 58977 USD per hectare per year, consisting of the mangrove ecosystem (83800377 USD per year) and the coral reef ecosystem (95890077 USD per year). This shows that the marine protected area of Ujung Kulon National Park has a high economic value. The results of the economic feasibility analysis obtained are: NPV is 132923470 USD, higher than 0, the net B/C ratio of 19.3 is higher than 1, and the IRR of 39.43% is higher than 20% (MARR). Based on the results of the economic analysis, it can be concluded that the investment and determination of the marine conservation area of Ujung Kulon National Park are feasible. The main actors in the management of the marine protected area of Ujung Kulon National Park are: 1) Ujung Kulon National Park Agency, 2) the Development Planning Agency at the sub-national level of Banten Province, 3) the society, and 4) entrepreneurs. This shows that the institutional model for the management of marine protected areas in Ujung Kulon National Park is a collaborative effort between the government, society and entrepreneurs. The results of the three analyses show that in addition to having high economic value, the realization of the Ujung Kulon National Park marine conservation area will positively impact the economic sector of the government and society. Thus, collaborative management between the government, the society, and entrepreneurs is considered the most appropriate and effective way to carry out sustainable management of natural resources and their environment.

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Conflict of Interest. The authors declare that there is no conflict of interest.

References

Adrianto L., Wahyudin Y., Nurjaya I. W., Krisanti M., Yonvitner, Trihandoyo A., 2016 [PKSPL-IPB working paper: Economic valuation of damage to ecosystems of coastal and marine resources in Bontang City]. PKSPL-IPB, Bogor, Indonesia, 29 p. [In Indonesian].

Almeida H., Campello M., Weisbach M. S., 2004 The cash flow sensitivity of cash. The Journal of Finance 59(4):1777-1804.

Anantanyu S., Sumarjo, Slamet M., Tjitropranoto P., 2009 [Eficiency of farmer's

institution and their determinant factors]. Jurnal Penyuluhan 5(1):81-91. [In Indonesian].
Basten U., Biele G., Heekeren H. R., Fiebach C. J., 2010 How the brain integrates costs and benefits during decision making. PNAS 107(50):21767-21772.
Berkovitch E., Israel R., 2004 Why the NPV criterion does not maximize NPV. The Review of Financial Studies 17(1):239-255.
Brigham E. F., & Joel F. H., 2011. Dasar-dasar Manajemen Keuangan. Jakarta selatan: Salemba Empat (penerjemah Ali Akbar Yulianto).
Cellini S. R., Kee J. E., 2015 Cost-effectiveness and cost-benefit analysis. In: Handbook of practical program evaluation. 4th Edition. Newcomer K. E., Hatry H. P., Wholey J. S. (eds), Wiley, pp. 636-672.
Delamartha H. A., Yudana G., Rini F. E., 2021 [Tourism accessibility readiness in integrating tourism objects]. Jurnal Plano Buana 1(2):78-91. [In Indonesian].
Eriyatno, 2003 [Systems science: Improving management quality and effectiveness]. IPB Press, Cetakan Kedua, Bogor, Indonesia, 147 p. [In Indonesian].
Fauzi A., 2004 [Economics of natural resources and the environment: Theory and applications]. PT Gramedia Pustaka Utama, Jakarta, 224 p. [In Indonesian].
Fauzi A., Anna S., 2005 [Modeling of fisheries and marine resources]. PT Gramedia Pustaka Utama, Jakarta, 343 p. [In Indonesian].
Ha R. R., 2010 Cost-benefit analysis. In: Encyclopedia of animal behavior. Elsevier, pp. 402-405.
Harding S., 1998 MBA management models. Routledge, London, 240 p.
Kadariah, 2001 [Economic analysis project evaluation]. Fakultas Ekonomi, Universitas Indonesia, Jakarta, 184 p. [In Indonesian].
Lancaster K. J., 1966 A new approach to consumer theory. The Journal of Political Economy 74(2):132-157.
Lazuardi R. R., 2016 [Vegetation structure and composition in the Situ Patengan Nature Reserve area]. Universitas Islam Sunan Gunung Jati, Bandung, Indonesia, 149 p. [In Indonesian].
Marimin, 2004 [Multiple criteria for decision making; techniques and applications]. PT Gramedia Widiasarana, Jakarta, Indonesia, 197 p. [In Indonesian].
Nazir M., 2011 [Research methods]. Ghalia Indonesia, Jakarta, 544 p. [In Indonesian].
Osborne M. J., 2010 A resolution to the NPV-IRR debate? The Quarterly Review of Economics and Finance 50(2):234-239.
Pendit S. N., 1999 [Tourism science an introductory prime]. Pradnya Paramita, Jakarta, 321 p. [In Indonesian].
Polunin N. V. C., Roberts C. M., 1993 Greater biomass and value of target coral-reef fishes in two small Caribbean marine reserves. Marine Ecology Progress Series 100:167-176.
Psacharopoulos G., 1994 Returns to investment in education: A global update. World Development 22(9):1325-1343.
Saxena J. P., Suhil, Vrat P., 1992 Hierarchy and classification of program plan elements using interpretive structural modelling: A case study of energy conservation in the Indian cement industry. Systems Practice 5:651-670.
Sen A., 2000 The discipline of cost-benefit analysis. Journal of Legal Studies 29(S2):931-952.
Suwarsono M., 2000 [Project feasibility study. 4th Edition]. Cetakan ke-2, UPP AMP YKPN, Yogyakarta, Indonesia, 398 p. [In Indonesian].
Yusuf M., Nurhamlin, Yunianto S., Eka A. S., 2020 Decision Support System, di Era 4.0 Teori & Aplikasi Tools Analysis. IPB Press, 197 p.
*** Gallo A., 2016 A refresher on internal rate of return. Harvard Business Review. Available at: https://hbr.org/2016/03/a-refresher-on-internal-rate-of-return
*** Regulation of the Minister of Marine of Maritime Affairs and Fisheries Number 31 of 2020 concerning Conservation Areas Management.
*** Ujung Kulon National Park (UKNP), 2015 [Ujung Kulon National Park Strategic Plan 2015 – 2019]. Pandeglang, Banten Province, Indonesia. [In Indonesian].

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