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# The economic valuation of a Corporate Social Responsibility (CSR) program based on the empowerment of Scylla serrata farmers through *Silvofishery* ponds (A case study of the *Kampoeng Kepiting* Program, *Kutawaru* Subdistrict, Cilacap Regency)

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## ABSTRACT

Mangrove ecosystems have strategic ecological and economic functions, particularly for coastal communities that depend on fisheries-based livelihoods. However, the economic value of mangroves is often perceived only from direct benefits, whereas ecosystem services and non-use values remain underappreciated. This study aims to conduct an economic valuation of a Corporate Social Responsibility (CSR) program based on empowering Scylla serrata farmers through a *silvofishery* approach, using the *Kampoeng Kepiting* Program in Kutawaru Village, Cilacap Regency, as a case study. This study employed a descriptive quantitative approach using survey methods. Economic valuation was conducted using the Total Economic Value (TEV) framework, which includes direct use value, indirect use value, option value, and existence value. Data were collected through interviews with farmers and local communities, supported by secondary data and CSR program documents. The results indicate that the total economic value of the *Kampoeng Kepiting* CSR Program reached IDR 497,330,112 per year, consisting of direct use value of IDR 211,580,112 per year, indirect use value of IDR 280,000,000 per year, option value of IDR 4,650,000 per year, and existence value of IDR 1,100,000 per year. Indirect use value contributed the largest share, highlighting the critical role of mangrove ecosystem services in supporting the sustainability of the *silvofishery* system. These findings demonstrate that *the Kampoeng Kepiting* CSR Program not only enhances community income but also internalizes the economic value of mangrove ecosystems into the local economy. Therefore, mangrove management through *silvofishery*-based community empowerment is a viable CSR model that is ecologically sustainable and economically sound.

**Keywords:** economic valuation; CSR; mangrove; *silvofishery*; Scylla serrata

## 1. INTRODUCTION

Mangrove ecosystems are among the most important coastal natural resources, providing highly strategic ecological, social, and economic functions. Ecologically, mangroves serve as natural barriers against coastal abrasion, regulate seawater intrusion, sequester carbon, and function as critical habitats for a wide range of aquatic organisms. Economically, mangroves support coastal livelihoods through fisheries and aquaculture activities, particularly high-value commodities such as mud crabs (Scylla serrata). Nevertheless, in development practice, the economic value of mangroves is often reduced to direct, extractive benefits, while environmental services and long-term benefits are not fully incorporated into decision-making processes (Ridwansyah, 2023; Manullang, et al., 2025).

Numerous studies on the economic valuation of natural resources indicate that a substantial proportion of the total economic value of mangrove ecosystems is derived from indirect benefits and ecosystem services. Valuation studies conducted in various regions of Indonesia have demonstrated that services, such as coastal protection, habitat provision, and other ecological functions, often generate economic values that are comparable to or even exceed those of direct benefits from fisheries production and timber extraction (Talakua, 2015; Abbas, 2022). The inability of market mechanisms to internalize these ecosystem service values leads to the undervaluation of natural resources, which in turn accelerates mangrove degradation and undermines the long-term welfare of coastal communities (Pirngadi, et al., 2011).

In the context of coastal fisheries, Scylla serrata represents a flagship commodity with high economic value and strong ecological dependence on mangrove ecosystems. Successful mud crab production is highly contingent upon the quality of mangrove habitats, which provide natural food, shelter, and stable water conditions (Talakua, 2015; Manullang, et al., 2025). Declines in mangrove quality and extent directly affect mud crab productivity and the incomes of coastal communities that rely on this resource.

The *silvofishery* approach has emerged as an alternative coastal resource management strategy that integrates mangrove conservation with sustainable aquaculture. *Silvofishery*-based ponds enable the utilization of mangrove areas without converting or degrading the ecosystem, thereby maintaining ecological functions while simultaneously generating economic benefits for local communities (Primavera, 2000; Paruntu, et al., 2016). Several studies have shown that *silvofishery* systems can enhance aquaculture productivity, reduce production costs through the use of natural feed, and support environmental sustainability when implemented in areas with suitable biophysical conditions (Sajjad, et al., 2023).

However, the success of *silvofishery* does not occur automatically. Empirical evidence suggests that *silvofishery* may become economically unviable when applied in environmentally degraded areas or in the absence of adequate management support and technical assistance (Wijaya, et al., 2019). This indicates that *silvofishery* requires institutional intervention, capacity building for farmers, and sustained management support to generate optimal economic outcomes.

In this context, Corporate Social Responsibility (CSR) programs based on community empowerment represent a strategic instrument for reconciling environmental conservation objectives with the improvement of coastal livelihoods. Empowerment-based CSR positions communities as key development actors through capacity strengthening, skills enhancement, institutional development, and the promotion of economic self-reliance (Wibisono, 2007). A growing body of literature demonstrates that participatory and adaptive CSR programs are capable of generating significant and sustainable social, economic, and environmental impacts (Shodikin, et al., 2023).

The *Kampoeng Kepiting* Program in Kutawaru Subdistrict, Cilacap Regency, constitutes an example of a community empowerment–based CSR initiative that integrates Scylla serrata aquaculture, mangrove management, and local economic development through a silvofishery approach. Implemented in the coastal area of Segara Anakan, where community livelihoods are highly dependent on mangrove ecosystems as primary natural capital, the program seeks to enhance farmers' incomes while safeguarding mangrove sustainability through technical assistance, institutional strengthening, and the optimization of *silvofishery* ponds (Shodikin, et al., 2024; Shodikin, et al., 2025).

Despite reported achievements, such as increased incomes, business diversification, and environmental improvements, CSR program evaluations are generally dominated by descriptive and qualitative impact assessments. The economic value of generated benefits—including direct economic gains from mud crab aquaculture, mangrove ecosystem services, and social empowerment outcomes—has rarely been translated into measurable monetary terms. Consequently, the added value of CSR investments is often not comprehensively captured and remains difficult to compare with the scale of financial inputs provided (Nicholls, et al., 2012).

Economic valuation approaches are essential to address this gap. The Total Economic Value (TEV) framework enables a comprehensive estimation of natural resource values, encompassing direct use values, indirect use values, option values, and existence values (Ridwansyah, 2023; Abbas, 2022). In parallel, the Social Return on Investment (SROI) approach provides a framework for assessing the social and economic value of CSR programs by comparing the total benefits generated against the investments made (Nicholls et al., 2012). Integrating these two approaches allows for a more comprehensive assessment of the effectiveness and total economic value of *silvofishery*-based CSR programs.

Based on this background, the present study aims to conduct an economic valuation of the *Kampoeng Kepiting* CSR Program based on the empowerment of Scylla serrata farmers through a *silvofishery* approach in *Kutawaru* Subdistrict, Cilacap Regency. This study is expected to provide a comprehensive depiction of the economic value generated by the CSR program for communities, the environment, and the company, while strengthening the argument that natural resource management grounded in empowerment and conservation constitutes a rational and economically superior development strategy.

## 2. RESEARCH METHOD

This study was conducted in *Kutawaru* Subdistrict, Cilacap Regency, a coastal area characterized by mangrove ecosystems and serving as the implementation site of the *Kampoeng Kepiting* CSR Program, which is based on the grow-out aquaculture of Scylla serrata using *silvofishery* ponds. The study site was selected purposively, considering that *Kutawaru* Subdistrict exhibits a strong interconnection between mangrove ecosystem sustainability, coastal community economic activities, and CSR-based empowerment interventions. The research was carried out from December 2025 to January 2026, encompassing stages of field data collection, respondent interviews, as well as data processing and analysis.

This study employed a descriptive quantitative approach using a survey method. This approach was applied to identify, measure, and assess the economic benefits generated by the *Kampoeng Kepiting* CSR Program, including both direct and indirect economic benefits, as well as non-use values associated with the existence and sustainability of mangrove ecosystems. The survey method was considered effective for eliciting economic data and community perceptions from individuals who interact directly or indirectly with natural resources, particularly within the context of community-based economic valuation (Pirngadi, et al., 2011; Talakua, 2015).

The economic valuation approach adopted in this study refers to the Total Economic Value (TEV) framework, which enables a comprehensive estimation of the economic value of natural resources through the components of direct use value, indirect use value, option value, and existence value. The TEV framework has been widely applied in mangrove ecosystem valuation studies, as it is capable of capturing economic benefits that are not reflected in market mechanisms, including environmental services and the sustainability value of natural resources (Ridwansyah, 2023; Abbas, 2022; Manullang et al., 2025).

The application of the TEV framework in this study is considered particularly relevant for assessing the impacts of CSR programs based on natural resource management, as it captures economic values derived not only from community production activities but also from the ecological functions of mangroves maintained through the *silvofishery* approach. Consequently, this approach provides a robust basis for evaluating the effectiveness and economic rationality of sustainable, community empowerment-based CSR programs in coastal areas (Talakua, 2015; Ridwansyah, 2023).

Data were collected through structured and semi-structured interviews with residents of *Kutawaru* Subdistrict who directly or indirectly interact with mangrove ecosystems and *the Kampoeng Kepiting* Program.

The respondents included mud crab farmers, *silvofishery* pond managers, members of community groups, and surrounding residents who experience indirect benefits from the presence of mangroves and the CSR program. The data comprised both primary and secondary data. Primary data included mud crab production and income, direct utilization of mangrove ecosystems, community perceptions and willingness to pay (WTP) for mangrove sustainability, as well as the social and economic benefits perceived from the *Kampoeng Kepiting* CSR Program. Secondary data consisted of population and household statistics, mangrove ecosystem area, CSR program documents, and relevant literature on economic valuation and *silvofishery*. The number of respondents was determined using the Slovin formula (Burhan, 2010) with an error tolerance of 10%, as follows:

$$n = \frac{N}{1 + N(e)^2}$$

where:

- $n$ = sample size,
- $N$ = population size, and
- $e$ = margin of error (10%).

Based on demographic data from *Kutawaru* Subdistrict indicating a total of 350 households, the research sample size was determined to be 60 households. Respondents were selected proportionally by considering both direct and indirect involvement in the activities of the *Kampoeng Kepiting* Program and the utilization of mangrove ecosystems. Data analysis in this study employed an economic valuation approach for natural resources using the Total Economic Value (TEV) framework. The total economic value consists of two main components, namely use value and non-use value. Direct benefits represent the economic value obtained by the community from the direct utilization of mangrove ecosystems and the *Kampoeng Kepiting* CSR Program, particularly through the grow-out aquaculture of Scylla serrata. The direct benefit value was calculated using the following formula:

$$DUV = \sum_{i=1}^{n} DUVi$$

where:

- $DUV$ = direct use value,
- $DUV_i$ = the $i$-th direct use value, and
- $i$ = type of direct benefit (1, 2, 3, …, $n$).

The option value of the mangrove ecosystem was estimated using the Benefit Transfer method by referring to the biodiversity value of mangroves. Hieriey (2009) reported that the biodiversity value of mangrove forests in Indonesia is US$15 per hectare per year. The option value was obtained by multiplying this value by the total mangrove area at the study site. This value represents the potential future benefits of the mangrove ecosystem that may be utilized over time. Existence value reflects the value perceived by the community from the mere existence of the mangrove ecosystem, regardless of its direct use. This value was calculated using the Contingent Valuation Method (CVM) through the estimation of respondents' willingness to pay (WTP), using the following formula:

$$EV = \sum_{i=1}^{n} WTP_i$$

where:

- $EV$ = existence value,
- $WTP_i$ = willingness to pay of the $i$-th respondent, and
- $i$ = respondent.

The total economic value of the mangrove ecosystem and the *Kampoeng Kepiting* CSR Program was calculated using the following equations:

$$TEV = UV + NUV$$
$$TEV = (DUV + IUV) + (OV + EV)$$

where:

- **TEV** = total economic value,
- **UV** = use value,
- **NUV** = non-use value,
- **DUV** = direct use value (direct benefits),
- **IUV** = indirect use value (indirect benefits),
- **OV** = option value, and
- **EV** = existence value.

## 3. RESULT AND DISCUSSION

### 3.1. Direct Use Value (DUV)

The assessment of direct use value (DUV) in this study was conducted through the formulation and collection of data based on direct interviews with farmers involved in the *Kampoeng Kepiting* CSR Program in *Kutawaru* Subdistrict. The interviews aimed to identify the types of commodities produced through the application of the *silvofishery* method and to obtain information on the average income received by farmers from aquaculture activities that directly utilize mangrove ecosystems. This approach is consistent with community-based economic valuation methods that position local economic practices as the primary source of direct benefit data, as applied in numerous mangrove and coastal resource valuation studies in Indonesia (Pirngadi ,et al., 2011; Talakua, 2015; Ridwansyah, 2023).

The interview results indicate that the grow-out of Scylla serrata using *silvofishery* pond systems generates not only a single primary commodity but also a range of other fisheries commodities that thrive due to the ecological functions of mangroves as nursery habitats and providers of natural feed. Mud crab represents the main commodity, with an average income of IDR 5,235,000 per month, reflecting the high economic value of this commodity and the strong linkage between mangrove sustainability and crab productivity. This income level falls within the range reported by previous studies on *silvofishery*-based mud crab aquaculture, which consistently identify mud crab as the principal contributor to the direct use value of mangrove ecosystems (Talakua, 2015; Manullang, et al., 2025).

In addition to mud crab, farmers also derive income from grouper, with an average of IDR 3,456,234 per month, milkfish amounting to IDR 3,325,567 per month, and shrimp with an average monthly income of IDR 4,356,987. The presence of these commodities demonstrates that *silvofishery* systems are inherently multi-commodity in nature and capable of simultaneously optimizing mangrove ecosystem services. This finding is in line with community-based *silvofishery* studies, which emphasize that sustainably managed mangroves can support a diversity of economically valuable aquatic species without compromising ecological functions (Paruntu, et al., 2016; Sajjad, et al., 2023). Another commodity contributing to farmers' income is blood cockle (IDR 1,257,888 per month on average), which is consistent with mangrove economic valuation studies that position *molluscs* as complementary commodities within the structure of direct use benefits of mangrove ecosystems (Abbas, 2022; Manullang, et al., 2025).

Accordingly, the interview findings in this study reflect not only empirical conditions at the local level but also economic value ranges that are consistent with previous academic research. Based on these data, an aggregation of valuation results was subsequently conducted on an annual basis. See Table 1

**Table 1. Direct Use Value of the *Kampoeng Kepiting* CSR Program, Kutawaru Subdistrict, Cilacap Regency**

| No | Direct Benefits | Average Annual Value (IDR) | (%) |
|---|---|---|---|
| **1** | Direct benefit from mud crab (*Scylla serrata*) | 62,820,000 | 29.36 |
| **2** | Direct benefit from grouper | 41,474,808 | 19.39 |
| **3** | Direct benefit from milkfish | 39,906,804 | 18.65 |
| **4** | Direct benefit from shrimp | 52,283,844 | 24.44 |
| **5** | Direct benefit from blood cockle | 15,094,656 | 7.06 |
| Total Direct Use Value | | **211,580,112** | **100.00** |

**Source:** Processed research data, 2025

The table shows that the largest direct benefit from the application of the *silvofishery* method in the *Kampoeng Kepiting* CSR Program is derived from Scylla serrata, contributing 29.36% of the total annual direct use value. Shrimp and grouper also provide substantial contributions, accounting for 24.44% and 19.39%, respectively, followed by milkfish at 18.65%. Meanwhile, blood cockle contributes the smallest share at 7.06%; nevertheless, this reflects the role of the mangrove ecosystem in supporting a diversity of economically valuable fishery commodities.

### 3.2. Indirect Use Value (IUV)

The estimation of indirect use value (IUV) in this study was carried out using the shadow price approach, which assigns economic value based on replacement costs or the implicit costs required to provide functions equivalent to those generated by mangrove ecosystem services. The shadow price approach is commonly applied when the environmental services being valued do not have direct market prices, but comparable data are available in the form of actual or planned expenditures incurred by specific stakeholders (Ridwansyah, 2023; Abbas, 2022).

In this study, the determination of unit prices for indirect benefits was based on the Budget Plan (*Rencana Anggaran Biaya*/RAB) for the development of the *Kampoeng Kepiting* CSR Program prepared by the initiating company. This budget reflects tangible investments allocated to maintain, restore, and optimize mangrove ecosystem functions, as well as to support the sustainability of the *silvofishery* system for Scylla serrata grow-out. Accordingly, the costs documented in the RAB are regarded as economic proxies representing the minimum value of mangrove ecosystem services that are preserved or substituted through CSR program interventions.

The indirect benefit value associated with the nursery ground function was estimated based on RAB components related to mangrove rehabilitation activities, *silvofishery* area management, and technical support directly aimed at maintaining the sustainability of mud crab habitats and other aquatic biota. These costs represent the level of investment required to ensure that mangrove ecological functions continue to operate effectively, thereby sustaining aquaculture productivity. On this basis, an annual value of IDR 185,000,000 was considered to represent the economic value of the nursery ground services provided by mangrove ecosystems within the *silvofishery* system.

The indirect benefit value related to the biofilter function and maintenance of water quality in *silvofishery* ponds was determined using components from the Scope of Work (SOW) document associated with pond environmental quality management. This includes mangrove ecosystem maintenance, water quality control, and preventive measures against environmental degradation, which could increase the risk of crop failure. These costs represent the economic value of the natural biofilter function of mangroves, which, in the absence of such ecosystems, would need to be replaced by additional technologies or artificial management systems at relatively high costs. Therefore, an annual unit value of IDR 95,000,000 was used to estimate the replacement cost of the mangrove biofilter function.

The use of CSR program SOW documents as the basis for determining shadow prices is considered methodologically valid and relevant, as it reflects actual economic expenditures incurred to maintain ecosystem functions rather than purely theoretical or assumed values. This approach is consistent

with natural resource economic valuation practices that utilize real cost data from environmental management programs as the basis for estimating indirect benefits, particularly in CSR- and community empowerment-based case studies (Ridwansyah, 2023; Pirngadi, et al., 2011). See Table 2

**Table 2. Indirect Use Value of Mangrove Ecosystem Services in the *Kampoeng Kepiting* CSR Program, *Kutawaru* Subdistrict**

| No. | Indirect Benefit Components | Unit | Number of Units | Unit Price (IDR) | Total Value (IDR) |
|---|---|---|---|---|---|
| **1** | Nursery ground function (enhanced production of mud crab and other biota) | Year | 1 | 185,000,000 | 185,000,000 |
| **2** | Biofilter function and water quality maintenance (replacement cost of pond water management) | Year | 1 | 95,000,000 | 95,000,000 |
| Total Indirect Use Value per Year | | | | | **280,000,000** |

**Source:** Processed research data, 2025

Thus, the indirect use values applied in this study are not speculative in nature but are grounded in empirical data from the CSR program. Pertamina's corporate social responsibility (CSR) support also plays an important role in the success of the program through funding, technical assistance, and human resource capacity building. This collaboration allows for the development of derivative product innovations, such as organic fertilizers, ecoenzymes, and nutritious processed foods (Ramadhani, et al, 2025). This provides a robust and reliable basis for calculating the Total Economic Value (TEV) of the *Kampoeng Kepiting* Program in *Kutawaru* Subdistrict, Cilacap Regency.

### 3.3. Option Value (OV)

Option Value (OV) is one of the components within the Total Economic Value (TEV) framework that represents the economic value of the potential future use of natural resources, even though such benefits are not currently utilized directly. In the context of mangrove ecosystems, option value reflects the value of resource sustainability and future economic opportunities that may be optimized, whether through the development of sustainable fisheries, product diversification, or the utilization of other ecosystem services.

In this study, the option value of the mangrove ecosystem within the *Kampoeng Kepiting* CSR Program is understood as the potential value associated with the sustainability and future development of *silvofishery*-based ponds for Scylla serrata grow-out. The existence and conservation of mangroves allow communities to retain the option to further develop coastal resource-based economic activities in a sustainable manner without compromising ecological functions. Accordingly, option value is a relevant component to be assessed, as the *Kampoeng Kepiting* CSR Program explicitly aims to preserve mangroves as long-term natural capital for farmer empowerment.

The valuation approach used to estimate option value in this study is the benefit transfer method, which involves adopting economic values derived from previous academically validated studies. This method is commonly applied in natural resource economic valuation when limitations in primary data constrain direct measurement, yet the research objectives still require a rational and defensible estimation of economic value. The use of benefit transfer is also widely recommended in mangrove ecosystem valuation studies, particularly for option value components that are difficult to observe directly (Ridwansyah, 2023; Abbas, 2022).

The option value of mangrove ecosystems in this study refers to the biodiversity value of mangroves in Indonesia and subsequently compiled in various mangrove valuation studies in Indonesia, which estimate the option value of mangroves at approximately US$15 per hectare per year. This value represents the potential economic benefits that may be realized in the future through the sustainable utilization of mangrove ecosystems. Based on this reference, the valuation of option value in this study is formulated as follows: See Table 3

**Table 3. Option Value of Mangrove Ecosystem Services in the Kampoeng Kepiting CSR Program, Kutawaru Subdistrict, Cilacap Regency**

| No. | Component | Unit | Value |
|---|---|---|---|
| **1** | Mangrove biodiversity value | US$/ha/year | 15 |
| **2** | Exchange rate | IDR/US$ | 15,500 |
| **3** | Mangrove area | Hectares | 20 |
| | Option Value per Year | IDR/year | **4,650,000** |

**Source:** Processed research data, 2025

The option value was estimated using the benefit transfer method based on the biodiversity value of mangrove ecosystems. As presented in Table 3, the option value (OV) of the mangrove ecosystem within the *Kampoeng Kepiting* CSR Program in *Kutawaru* Subdistrict amounted to IDR 4,650,000 per year. This value was calculated by adopting a mangrove biodiversity value of US$15 per hectare per year, multiplied by the total mangrove area of 20 hectares, and then converted into Indonesian rupiah using the exchange rate applicable during the year of the study.

This option value reflects the potential future use of the mangrove ecosystem that remains safeguarded as a result of sustainable mangrove management under the *Kampoeng Kepiting* CSR Program. The continued existence of mangroves enables local communities to retain options for developing various forms of sustainable, coastal resource-based economic activities in the future, including the expansion of *silvofishery*-based ponds for Scylla serrata grow-out, diversification of fisheries commodities, and the utilization of other ecosystem services that may generate economic benefits over time.

In nominal terms, the option value is relatively small compared with the direct and indirect benefits derived from the mangrove ecosystem. Nevertheless, within the TEV framework, this value carries strategic significance because it represents the long-term sustainability and resilience of natural resources. The option value indicates that the *Kampoeng Kepiting* CSR Program not only generates current economic benefits but also preserves future economic opportunities by maintaining the ecological functions of mangrove ecosystems as essential natural capital.

Accordingly, option value serves as an important complementary component in the economic valuation of the *Kampoeng Kepiting* CSR Program, as it incorporates aspects of sustainability and long-term economic potential into the total economic value calculation. This strengthens the argument that mangrove management based on *silvofishery* and community empowerment is not only ecologically sound but also economically relevant from a sustainability perspective.

Based on this approach, the option value was calculated by multiplying the mangrove biodiversity value per hectare per year by the total mangrove area within the *Kampoeng Kepiting* CSR Program site in *Kutawaru* Subdistrict. This value represents the economic worth of future resource-use opportunities that remain available because of the success of the CSR program in maintaining mangrove ecosystem sustainability.

### 3.4. Existence Value (EV)

The assessment of Existence Value (EV) in this study was conducted using the Contingent Valuation Method (CVM) with a Willingness to Pay (WTP) approach. This method is applied to estimate the economic value of environmental resources that do not have market prices by eliciting the community's willingness to pay for the preservation of those resources. In the context of this study, CVM was used to determine the community's willingness to pay for the existence of *silvofishery* ponds for Scylla serrata aquaculture, regardless of whether respondents were directly involved in aquaculture activities. Respondents were selected using purposive sampling, with a total of 60 respondents consisting of residents living around the *Kampoeng Kepiting* CSR Program area who possess knowledge of or concern for the existence of *silvofishery* ponds and mangrove ecosystems. The purposive approach was adopted because

WTP assessment requires respondents who understand the ecological and social benefits associated with *silvofishery* systems (Abbas, 2022; Ridwansyah, 2023).

Based on the interview results, respondents' WTP values ranged from IDR 15,000 to IDR 95,000 per *respondent* per year. This range is considered reasonable and consistent with findings from previous studies on mangrove-based *silvofishery* and mud crab aquaculture, which indicate that communities tend to express moderate WTP values for environmentally friendly, mangrove-based production systems (Talakua, 2015; Paruntu, et al., 2016; Sajjad, et al., 2023). These studies emphasize that *silvofishery*-based Scylla serrata grow-out is perceived not merely as an economic activity but also as a mangrove conservation effort that delivers long-term ecological and social benefits. The CVM analysis yielded an average willingness to pay (mean WTP) of IDR 55,000 per hectare per year. This mean value reflects the level of community concern and appreciation for the existence of *silvofishery* ponds for mud crab aquaculture as part of a sustainable mangrove management system.

Given that the total area of *silvofishery* ponds for Scylla serrata grow-out within the *Kampoeng Kepiting* CSR Program is 20 hectares, the existence value (EV) was calculated as follows:

EV = Mean WTP × *Silvofishery* pond area
EV = IDR 55,000 × 20 = IDR 1,100,000 per year

An existence value of IDR 1,100,000 per year indicates that the community assigns a positive economic value to the presence of *silvofishery*-based mud crab aquaculture, even though these benefits are not directly received in the form of cash income. This value represents community satisfaction, a sense of security, and expectations regarding the sustainability of mangrove ecosystems and environmentally friendly mud crab farming systems.

Conceptually, the presence of a positive WTP reflects social legitimacy for the *Kampoeng Kepiting* CSR Program and demonstrates that mangrove management through a *silvofishery* approach is not only economically acceptable but also socially supported by the surrounding community. Thus, existence value complements the economic evaluation of the *Kampoeng Kepiting* CSR Program by incorporating non-use values into the TEV calculation.

### 3.5. Total Economic Value

The Total Economic Value (TEV) represents the aggregation of all economic benefits generated by the mangrove ecosystem and the *Kampoeng Kepiting* CSR Program in Kutawaru Subdistrict, Cilacap Regency. In this study, TEV was calculated by summing the Direct Use Value (DUV), Indirect Use Value (IUV), Option Value (OV), and Existence Value (EV). This approach enables a comprehensive economic assessment, as it not only accounts for the economic benefits directly received by the community but also incorporates ecosystem services and non-use values that support the sustainability of *silvofishery*-based ponds for Scylla serrata grow-out.

Based on the calculation results, the DUV derived from multi-commodity silvofishery activities under the *Kampoeng Kepiting* CSR Program amounts to IDR 211,580,112 per year. This value reflects the tangible economic contribution received by farmers from the production of mud crabs, shrimp, fish, and other aquatic biota that directly utilize the mangrove ecosystem.

The IUV, estimated from the mangrove ecosystem's functions as a nursery ground and as a natural biofilter for maintaining water quality, is IDR 280,000,000 per year. This value indicates that the contribution of mangrove ecosystems to the sustainability and efficiency of the *silvofishery* pond system exceeds the direct cash benefits received by farmers. The ecological functions of mangroves enhance productivity while reducing production costs and business risks faced by farmers.

Meanwhile, the OV, which represents the potential future use of the mangrove ecosystem, is estimated at IDR 4,650,000 per year based on the benefit transfer method applied to a mangrove area of 20 hectares. This value signifies the preservation of long-term economic opportunities ensured by the continued existence and management of mangroves within the *Kampoeng Kepiting* CSR Program.

The EV, calculated using the CVM approach based on community WTP, amounts to IDR 1,100,000 per year. This value reflects the level of community concern and social support for the existence of *silvofishery*-based mud crab ponds and the conservation of mangrove ecosystems, regardless of direct economic utilization. This is because the current ratio only looks at the short term which is not the main factor in determining company value (Wardana, et al., 2025). See Table 4

**Table 4. Summary of Total Economic Value (TEV) of the Kampoeng Kepiting CSR Program, Kutawaru Subdistrict, Cilacap Regency**

| No. | Economic Value Component | Value (IDR/year) | Percentage (%) |
|---|---|---|---|
| **1** | Direct Use Value (DUV) | 211,580,112 | 42.55 |
| **2** | Indirect Use Value (IUV) | 280,000,000 | 56.29 |
| **3** | Option Value (OV) | 4,650,000 | 0.94 |
| **4** | Existence Value (EV) | 1,100,000 | 0.22 |
| Total Economic Value (TEV) | | **497,330,112** | **100.00** |

**Source:** Processed research data, 2025

The summary table shows that Indirect Use Value (IUV) is the largest component contributing to the Total Economic Value (TEV) of the Kampoeng Kepiting CSR Program, accounting for 56.29% of the total TEV. This finding underscores the dominant role of mangrove ecological functions—particularly as nursery grounds and natural biofilters—in supporting the sustainability and economic efficiency of *silvofishery*-based mud crab aquaculture. Direct Use Value (DUV) contributes 42.55%, indicating that *Scylla serrata* aquaculture through *silvofishery* pond systems generates substantial income for local communities. However, the larger share of IUV relative to DUV highlights that the primary economic value of mangrove ecosystems lies in environmental services that are not always immediately visible or reflected in market transactions.

Meanwhile, Option Value (OV) and Existence Value (EV) contribute relatively small proportions in nominal terms, at 0.94% and 0.22%, respectively. Nevertheless, these components carry strategic significance within a sustainability framework, as they reflect future use potential and the level of social support for mangrove conservation and the long-term continuity of the *Kampoeng Kepiting* CSR Program. Overall, the total economic value of IDR 497,330,112 per year demonstrates that the Kampoeng Kepiting CSR Program not only provides direct economic benefits to farmers but also generates greater economic value through the ecological and social functions of mangrove ecosystems. These findings reinforce the argument that mangrove management based on silvofishery and community empowerment represents a rational, effective, and economically superior CSR strategy within the context of sustainable development.

### 3.6. Economic Implications of the Kampoeng Kepiting CSR Program Based on Total Economic Value

Based on the results of the economic valuation, the *Kampoeng Kepiting* CSR Program in *Kuta*waru Subdistrict generates a Total Economic Value (TEV) of IDR 497,330,112 per year. This value represents the accumulation of direct economic benefits, indirect ecological benefits, and non-use values derived from the management of mangrove ecosystems through *silvofishery*-based ponds for Scylla serrata grow-out.

The composition of the total economic value indicates that Indirect Use Value (IUV) constitutes the largest component of TEV, accounting for 56.29%. This finding underscores that the primary contribution of the *Kampoeng Kepiting* CSR Program lies not only in directly increasing farmers' incomes but also in its capacity to maintain and optimize the ecological functions of mangroves as nursery habitats and natural biofilters. These ecological functions play a crucial role in improving the efficiency of *silvofishery* operations by reducing production costs and minimizing the risk of crop failure.

Direct Use Value (DUV) contributes 42.55% to the total economic value. This proportion demonstrates that the *silvofishery* approach can generate substantial income for coastal communities

through a multi-commodity production system that sustainably utilizes mangrove ecosystem services. This finding suggests that silvofishery-based CSR programs are not only ecologically viable but also economically competitive compared with conventional pond systems, which tend to be more exploitative in nature.

Meanwhile, option value and existence value, although relatively small in nominal terms, play a strategic role in ensuring the long-term sustainability of mangrove management. Option value reflects the continued availability of future opportunities for utilizing mangrove resources, whereas existence value indicates social support from the community for the sustainability of silvofishery ponds and mangrove ecosystems. Together, these components strengthen the social and ecological legitimacy of the Kampoeng Kepiting CSR Program.

Overall, the economic valuation results demonstrate that the *Kampoeng Kepiting* CSR Program can internalize the value of mangrove ecosystems into the local economic system, transforming natural resource management from a perceived cost burden into a valuable economic asset. These findings reinforce the argument that CSR initiatives based on natural resource management and coastal community empowerment constitute a rational and effective strategy for supporting sustainable development.

## 4. CONCLUSION

This study aims to conduct an economic valuation of a CSR program based on the empowerment of Scylla serrata farmers through the *silvofis*hery approach, using the *Kampoeng Kepiting* Program in *Kutawaru* Subdistrict, Cilacap Regency, as a case study. The economic valuation approach applied is based on the Total Economic Value (TEV) framework, which encompasses direct use value, indirect use value, option value, and existence value, thereby providing a comprehensive depiction of the economic value generated by mangrove ecosystem management through *silvofishery*. The results indicate that the *Kampoeng Kepiting* CSR Program generates a TEV of IDR 497,330,112 per year. This value consists of a Direct Use Value (DUV) of IDR 211,580,112 per year derived from multi-commodity *silvofishery* activities, an Indirect Use Value (IUV) of IDR 280,000,000 per year originating from the ecological functions of mangroves as nursery habitats and natural biofilters, an Option Value (OV) of IDR 4,650,000 per year, and an Existence Value (EV) of IDR 1,100,000 per year.

The composition of the total economic value shows that indirect benefits constitute the largest contribution to the TEV, underscoring the critical role of mangrove ecological functions in supporting the sustainability and economic efficiency of *silvofishery*-based systems. This finding indicates that the success of the *Kampoeng Kepiting* CSR Program is not determined solely by direct increases in farmers' income but also by the program's ability to maintain and optimize mangrove ecosystem services, which are often overlooked in conventional economic assessments.

The substantial direct benefits further demonstrate that the application of *silvofishery*-based ponds is capable of generating competitive income for mud crab farmers while supporting a more environmentally friendly, multi-commodity production system. Although option and existence values are relatively small in nominal terms, they carry strategic importance in the context of long-term sustainability, as they reflect future resource use opportunities and the presence of social support for mangrove conservation and *silvofishery* management.

Overall, the results of this economic valuation confirm that the *Kampoeng K*epiting CSR Program represents an effective intervention for internalizing mangrove ecosystem values into the economic system of coastal communities. The success of the CSR program is inseparable from the good interaction between the company, the government, and the local community (Ulfa & Zhomah, 2025). The management of *silvofishery*-based ponds and the empowerment of Scylla serrata farmers are not only ecologically relevant but also economically rational and advantageous, making this program a viable model for sustainable, natural resource–based CSR initiatives.

**Ethical Approval**

Not applicable

**Informed Consent Statement**

Not applicable

**Authors' Contributions**

All authors contributed to the conception and design of the study, data collection, and economic valuation analysis using the Total Economic Value (TEV) framework. The first author led the fieldwork, data analysis, and manuscript preparation, while the co-authors contributed to methodological refinement, interpretation of results, and literature review. All authors reviewed, revised, and approved the final manuscript and take responsibility for the integrity of the study.

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No potential conflict of interest was reported by the author(s).

**Data Availability Statement**

The data presented in this study are available on request from the corresponding author due to privacy reasons.

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