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Operationalising Social Return on Investment (SROI) in flood mitigation: Applying the Sungai Muda model to Shah Alam

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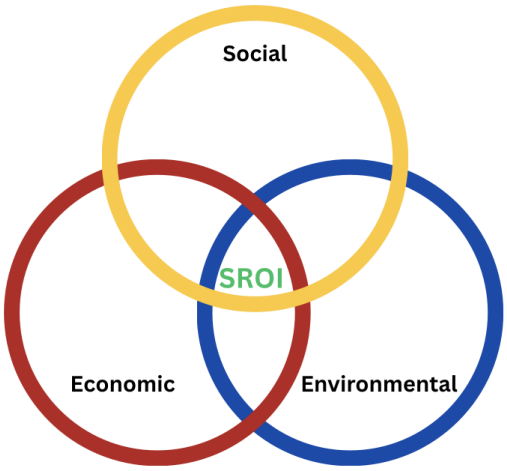
Abstract

The 2030 Agenda for Sustainable Development mandates the implementation of public financing models that balance economic advancement, social well-being, and environmental sustainability. However, in flood disaster management, funding justification remains challenging due to difficulties in quantifying the intangible social and environmental outcomes generated by mitigation projects. This study operationalises the Social Return on Investment (SROI) framework by integrating empirical evaluation with predictive forecasting to assess the broader societal value of flood mitigation projects in Malaysia. Using the completed Sungai Muda Flood Mitigation Project as the empirical baseline case to evaluate actual social return outcomes and forecast the potential social value of future flood mitigation initiatives, including the Shah Alam Flood Mitigation Project. The methodology translates social, environmental, and economic impacts into measurable financial proxies using stakeholder-informed valuation and comparative forecasting predictions derived from historical project performance. The findings reveal that the Sungai Muda Flood Mitigation Project generated a total social return value of RM4,892,641,540.00, indicating that every RM1 invested yields approximately RM4.88 in shared values of social, economic, and environmental benefits. These empirical findings subsequently serve as the baseline reference for forecasting and exemplifying the potential social return outcomes of the Shah Alam Flood Mitigation Project within the comparative SROI framework. The study further demonstrates that integrating predictive forecasting with empirical SROI assessment strengthens the framework's capacity to estimate future social value creation under conditions of uncertainty and resource scarcity. The findings imply that the operationalised SROI framework provides government agencies, investors, policymakers, and project managers with a strategic evidence-based tool to justify funding allocation, optimise resource utilisation, and enhance the long-term sustainability and resilience of public investments in line with the Sustainable Development Goals (SDGs).

Keywords: Flood mitigation project, social investment, Social Return on Investment (SROI), Sustainable Development Goals (SDGs)

Introduction

The global economic landscape is increasingly characterised by uncertainty, climate change related risks, and growing demands for sustainable and resilient development. Within Malaysia's economic structure, strategic planning is being intensified to achieve inclusive growth, aligning with the SDGs. Operationalising SROI has emerged as a significant approach for evaluating the broader societal value created by such investments. SROI comprises a set of principles that guide thought processes and develop standards for behaviour in social investment contexts (Bahri et al., 2024; United Nations, 2016). Recent scholarship demonstrates that SROI operationalises these principles by systematically monetising social and environmental outcomes, enabling organisations to capture value creation beyond financial returns (Ashton et al., 2024; Lee et al., 2025). This capability is vital specifically in flood mitigation projects, where many long-term benefits including community resilience, environmental preservation, improved public well-being, and avoided disaster losses are often intangible and insufficiently reflected in traditional cost-benefit analyses. In line with the study's objective of bridging empirical evaluation and predictive forecasting in Malaysian flood mitigation projects, the SROI framework provides a strategic mechanism for translating both observed and forecasted impacts into measurable financial proxies. By integrating empirical evidence from completed projects with predictive forecasting for future initiatives, SROI supports evidence-based investment planning under conditions of uncertainty and resource scarcity. The interdependent nature of sustainable development is underscored by a three pillars of sustainability framework comprising social, economic, and environmental elements (Kusmendar et al., 2025; Meyer, 2023; Purvis et al., 2019). Visually represented in Figure 1 as intersecting circles, this model reinforces the overall framework by positioning core sustainability at the point where all three dimensions meet.



Source: Own elaboration based on Purvis et al., 2019; Meyer, 2023; Kusmendar et al., 2025

Figure 1. Intersecting circles of SROI

Recent scholarship further emphasizes that the tripartite model remains a dominant and evolving framework, widely utilised across sectors to operationalise sustainability strategies and integrate policy, governance, and technological dimensions in addressing complex global challenges (Kusmendar et al., 2025; Yenita & Soegiarso, 2024). Current literature notes that the

tripartite framework excels at illustrating how the three pillars depend on one another. This allows for a more comprehensive, systems-based approach to achieving sustainability. In the contemporary landscape, characterized by a heightened focus on flood mitigation projects, The SROI framework serves as a thoroughly integrated method for illustrating impact and value creation, aligning closely with the principles of the SDGs and the foundational three pillars of sustainability. To harmonise economic expansion with pressing ecological and social demands, these goals offer a highly integrated structure (Garg et al., 2022; Smith et al., 2021).

Despite the SDGs offering a strong foundation for promoting sustainable development, traditional accounting methods face criticism for failing to significantly influence wider social and ecological systems. Existing frameworks tend to prioritize internal corporate advantages over broader systemic transformation (Bebbington et al., 2020a, b; Guthrie et al., 2010; Gray, 2006, 2010; Hsiao et al., 2022;). This gap underscores the pressing demand for sustainable transitions within resource-heavy and energy-intensive sectors, where standard financial reporting typically overlooks the external societal and environmental impacts of corporate operations (Aureli et al., 2023; Baker et al., 2023; Bebbington et al., 2020a, b). Addressing this limitation requires moving away from fragmented reporting styles toward a unified model that explicitly acknowledges the interconnectedness of social, financial, and environmental dimensions (Guthrie et al., 2010).

In response to these limitations, SROI has gained international recognition as a stakeholder-oriented and value-based evaluation methodology capable of capturing the broader societal impacts generated by public investments, including flood mitigation initiatives (Patil, 2023). Compared to conventional evaluations that focus on financial benefits, SROI offers a more comprehensive approach by integrating the assessment of social and environmental value generated from the investment (Jenkins et al., 2017; Pawley, 2023). The relevance of this approach is increasingly evident in Malaysia, where flooding has become increasingly frequent and destructive, with flood events recorded in 2024 (JPS, 2024), resulting in total flood-related losses of RM933.4 million (NADMA, 2025) and affecting approximately 123,729 people (AstroAwani, 2024).

In Selangor alone, flood-related losses in 2024 amounted to approximately RM22.6 million, involving damages to residential properties, vehicles, agriculture, and public infrastructure (The Star, 2025). Public assets and infrastructure accounted for the largest proportion of losses in Selangor at RM13.8 million, followed by residential property losses amounting to RM6.6 million, agricultural losses of RM1.9 million, and vehicle damages estimated at RM300,000 (The Star, 2025). Flood incidents in Selangor have increased significantly in recent years, particularly in densely populated and highly urbanised districts such as Shah Alam, Klang, Petaling, Hulu Langat, and Kuala Selangor. According to the Selangor State Government, a total of 119 flood hotspots were identified across the state in 2024, more than 1,200 flood victims from over 300 families were evacuated to temporary relief centres in Selangor following continuous heavy rainfall in October 2024. (Bernama, 2024). The Department of Irrigation and Drainage (DID) further reported that Selangor remains among the states with the highest frequency of flash floods due to rapid urbanisation, land-use changes, inadequate drainage systems, and extreme rainfall events (Bernama, 2024).

These statistics underscore the urgency of developing effective and sustainable flood mitigation strategies. Built upon an all-encompassing view of value, the SROI framework seeks to tackle inequalities, curb ecological damage, and improve community well-being by fully accounting for related social, environmental, and financial impacts (Hyatt et al., 2022). Despite its growing use globally, empirical applications of SROI in flood mitigation within Southeast Asia

and Malaysia remain limited. Bridging this gap, this research utilizes the SROI framework to assess the social returns of Shah Alam's flood mitigation projects.

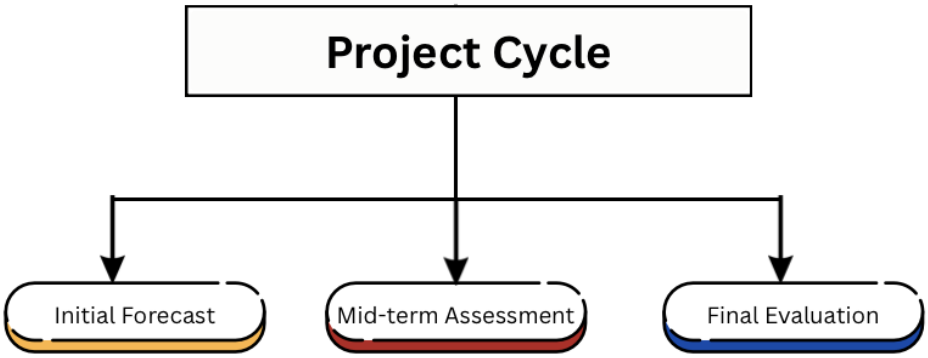
Literature review

The Social Return on Investment (SROI) methodology serves as an all-encompassing tool for measuring the impact of social investments. By blending economic, social, and environmental elements, it harmonises effectively with the SDGs. Ultimately, SROI is recognised as a framework designed to calculate and report on a much broader interpretation of value (Ashton et al., 2024; Corvo et al., 2022; Lee et al., 2025; Pastore et al., 2025; Sridan et al., 2024; Suryawati et al., 2024). Recent studies further demonstrate that SROI enhances impact measurement by monetising intangible outcomes such as well-being and social value, thereby enabling more comprehensive and comparable assessments across projects and policy contexts (Pastore et al., 2025; Ricket & Goodspeed, 2025). Moreover, contemporary applications highlight its increasing relevance in aligning corporate and public sector initiatives with the SDGs, particularly by supporting evidence-based decision-making and improving the allocation of resources toward sustainable development outcomes.

This holistic approach allows for a deeper understanding of impacts that extend beyond mere financial returns. Originating in 1996 through the Roberts Enterprise Development Foundation (REDF) in San Francisco, USA, the SROI methodology was subsequently modified by the UK's New Economics Foundation in 2008 (Banke-Thomas et al., 2015; Classen, 2015; Gutiérrez-Nieto et al., 2025; Hall et al., 2015; Mertens et al., 2015; Reupert et al., 2025). Contemporary literature underscores that SROI has developed into a powerful evaluation tool that measures social, economic, and environmental impacts concurrently. In doing so, it overcomes the constraints of standard financial accounting when evaluating multifaceted interventions (Ashton et al., 2024; Marques et al., 2025). The SROI methodology addresses limitations of traditional sustainability accounting, as noted by Baker et al. (2023) and Bebbington et al. (2020a; b). By capturing impacts across various capitals and stakeholders, it moves beyond siloed approaches. Moreover, contemporary applications highlight its growing use across sectors such as public health and integrated care, where it facilitates more comprehensive impact assessment and supports evidence-based decision-making by translating multidimensional outcomes into comparable value metrics.

While SROI is grounded in established economic evaluation frameworks such as cost–benefit analysis (Gibson et al., 2011; King, 2014; Pathak & Dattani, 2014), it distinguishes itself by adopting a more inclusive perspective that encompasses the entirety of social impacts, including multiplier effects (Ashton et al., 2024; Banke-Thomas et al., 2015; Gutiérrez-Nieto et al., 2025; Krlev et al., 2013; Pathak & Dattani, 2014; Stielke et al., 2023). Recent literature further emphasizes that, SROI goes beyond the traditional cost–benefit analysis by systematically incorporating stakeholder-defined outcomes and monetises intangible social and environmental benefits, thereby capturing indirect and long-term value creation that conventional approaches often overlook. A key benefit of SROI is its flexibility across the entire project lifespan; it functions effectively during preliminary planning, mid-way monitoring, and final evaluations. In each instance, it yields localized snapshots that document social value over specific durations (Ainuddin et al., 2024; Context, 2010; Gibbon & Dey, 2011; González-Muñoz et al., 2023; Maier et al., 2026; Stielke et al., 2023) as outlined in Figure 2. Recent studies further indicate that SROI is frequently

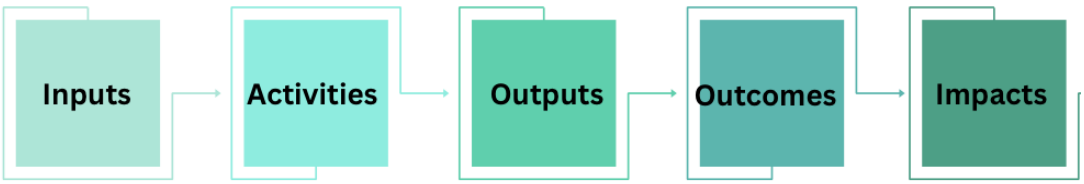
applied as an evaluative tool to monitor ongoing projects and assess their effectiveness over time, particularly in policy and development contexts where periodic measurement of outcomes is essential for ensuring sustainability and accountability.



Source: Own elaboration based on Ainuddin et al., 2024; Context, 2010; Gibbon & Dey, 2011; González-Muñoz et al., 2023; Maier et al., 2026; Stielke et al., 2023

Figure 2. The SROI project cycle

By converting social outcomes into financial proxies, SROI enables organisations to comprehensively assess the benefits derived from their investments in terms of time, money, and resources (Banke-Thomas et al., 2015). Operating across multiple tiers including the individual (micro), organizational (meso), and societal (macro) levels, SROI delivers critical insights for impact evaluation, providing essential impact data that empowers stakeholders to make well-informed resource decisions. (Corvo et al., 2022; Gutiérrez-Nieto et al., 2025; Landoni & Moratti, 2025; Lee et al., 2025; Scelles et al., 2024). Recent studies further emphasize that the monetisation of intangible outcomes such as well-being, social cohesion, and environmental improvements enhance the comparability of impacts across projects and facilitates more transparent and evidence-based decision-making processes. Underpinned by concepts such as the theory of change (see figure 3) and logic model, SROI analysis draws from traditional economic evaluations (Easterling et al., 2023; Kadel et al., 2022; Saraswati et al., 2024; Sewell et al., 2025; Stielke et al., 2024).



Source: Own elaboration based on Easterling et al., 2023; Kadel et al., 2022; Saraswati et al., 2024; Sewell et al., 2025; Stielke et al., 2024

Figure 3. The theory of change

Recent literature further emphasises that the integration of theory of change and logic models enables SROI to systematically map causal pathways between inputs, outputs, and

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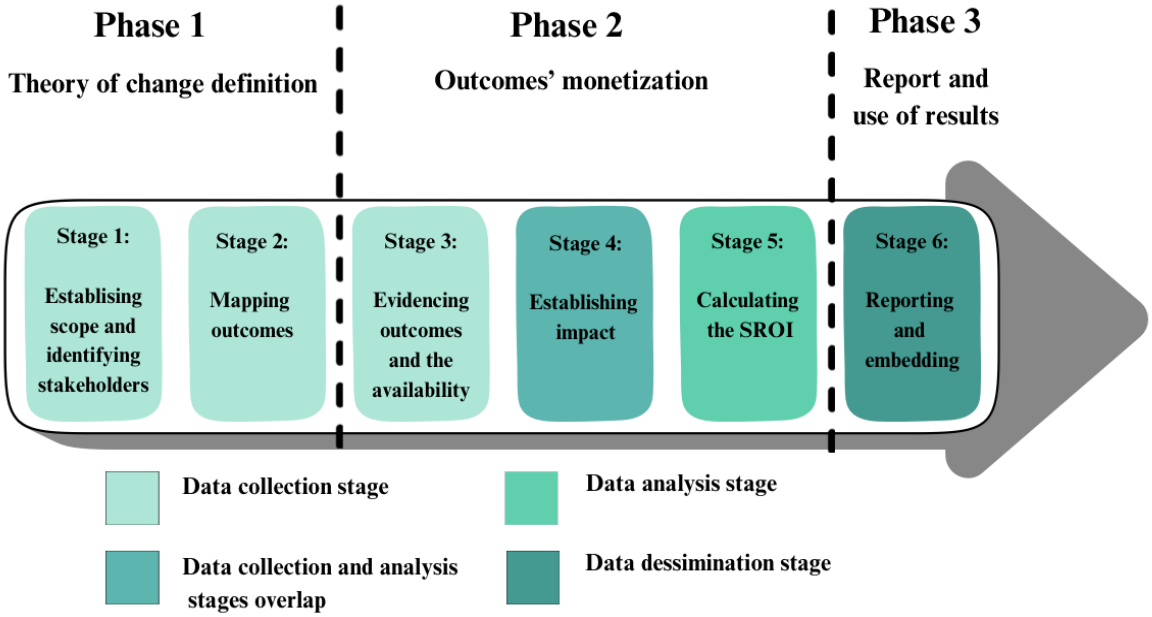
outcomes, thereby strengthening the transparency and rigor of impact evaluation processes. To understand the value generated by investments, which is heavily shaped by the involvement of both directly and indirectly affected stakeholders, an SROI analysis is conducted. This process consists of six primary stages (Bahri et al., 2024; Kadel et al., 2022) in three vital phases, as depicted in figure 4. Moreover, contemporary studies highlight that stakeholder engagement is not merely procedural but foundational, as it ensures that value attribution reflects real-world experiences and enhances the validity of outcome measurement in complex social interventions.



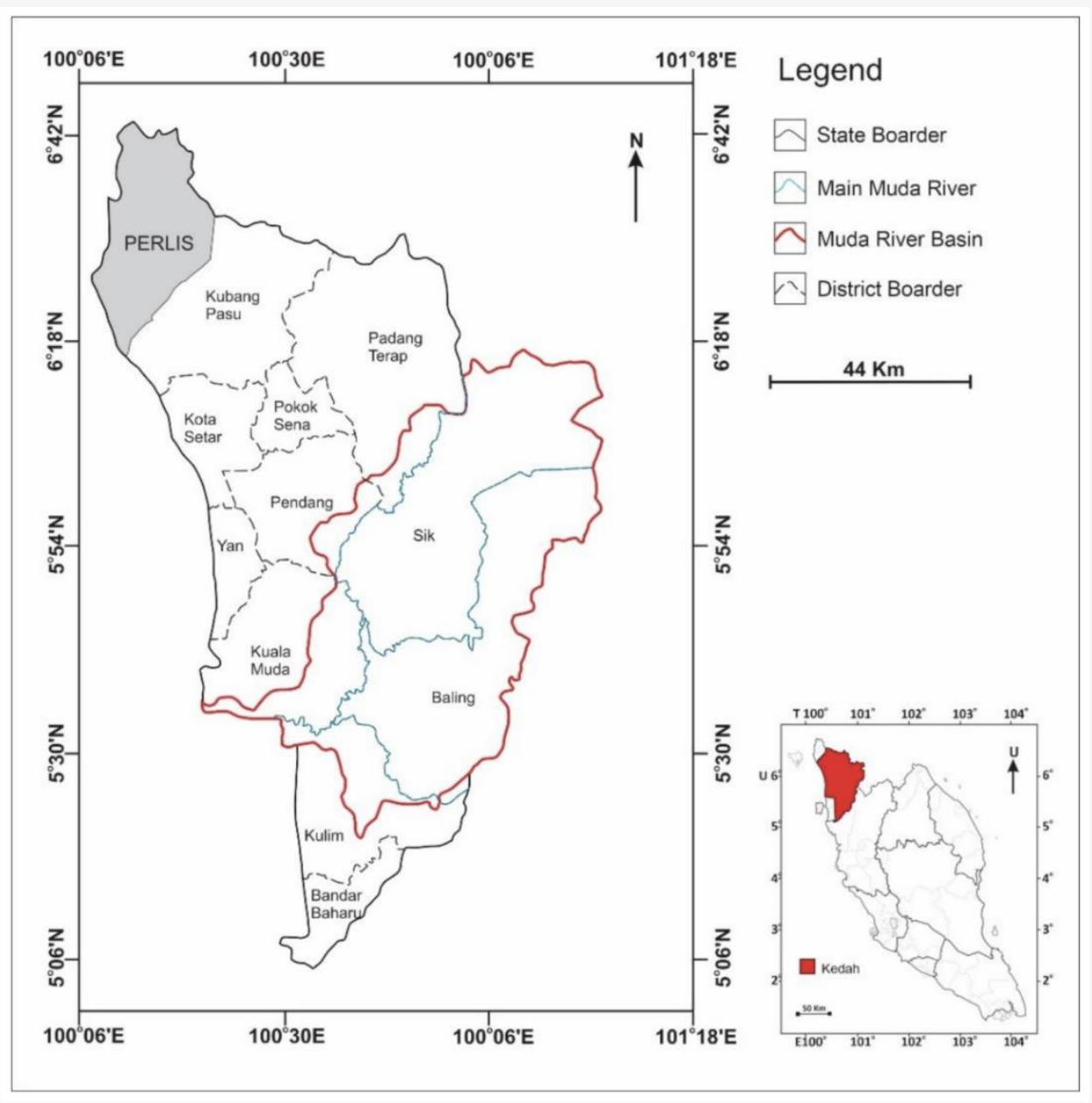
Source: Own elaboration based on Context 2010, Nicholls et al., 2009

Figure 4. The Stages of SROI process

Method and study area

The Sungai Muda Flood Mitigation Project represents a shift from purely technical engineering toward a holistic social investment model. By encapsulating stakeholder viewpoints throughout the entirety of a project's lifespan, the SROI method enables an all-encompassing evaluation of social value (Kadel et al., 2022; Krlev et al., 2013). This study employs a quantitative approach, administering a survey to 380 household heads, specifically targeting farmers residing in flood-prone areas classified as high-risk and directly impacted by the project. A mix of quota and purposive sampling was deployed to ensure the representativeness of the data. Household heads engaged in agricultural activities along the Sungai Muda (figure 5) floodplain were selected from ten villages, with a 10 percent sampling proportion from each village (approximately 38 respondents per village) included in the study. The respondents shared key characteristics, including active cultivation within the floodplain area located within a 1 km radius of the riverbank, an area identified as highly vulnerable to flooding impacts and residence in similar single-storey village houses constructed from a combination of wood and concrete materials. An

objective respondent selection process was maintained by applying random number assignments within the quota for each village. This approach was implemented specifically to minimise selection bias and improve the findings' validity and representativeness.



Source: Zakaria et al., 2021

Figure 5. Sungai Muda River

Data were collected from household heads using a structured questionnaire survey designed in alignment with the study objectives. The instrument comprised demographic and socio-economic characteristics, flood experiences, damage and loss assessments, and perceptions of flood mitigation interventions. The questionnaire was organised into six sections (A–F). Section A covered demographic and socio-economic variables such as household size, farming activities,

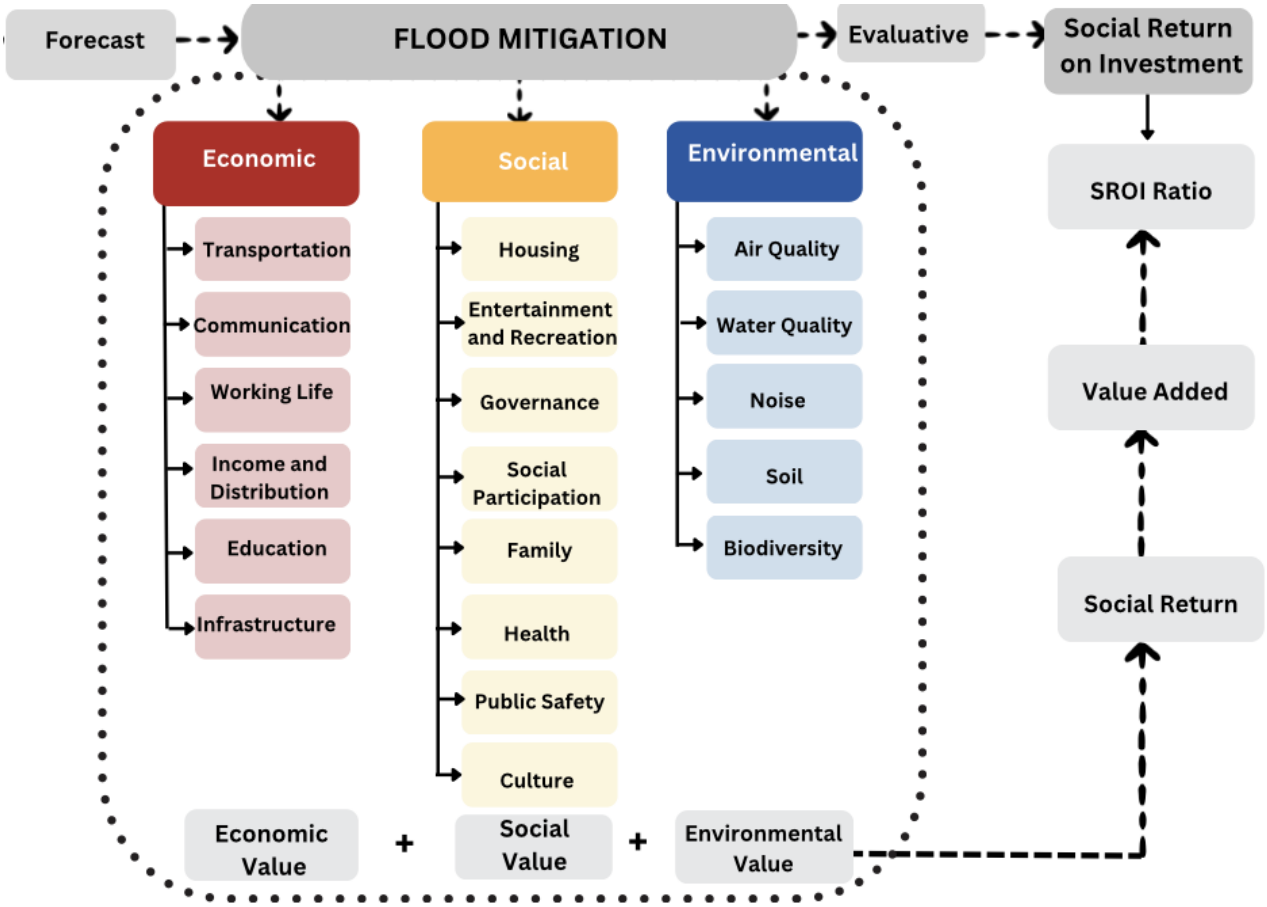
secondary occupations, income levels, and the number of school-going children. Section B examined flood experiences, including frequency, duration, causes, coping strategies, and associated impacts. Section C focused on flood damages, compensation received, and the involvement of relevant agencies. Section D explored levels of participation in flood management at individual, community, and government levels. Section E assessed perceptions of the flood mitigation projects, particularly its effects on quality of life, health, employment, income, flood frequency, and the local economy. Section F collected respondents' suggestions for future flood management and development initiatives. To ensure reliability and clarity of the instrument, a pilot test involving 30 participants was conducted, and necessary refinements were made based on feedback.

The rationale for selecting the Sungai Muda Flood Mitigation Project as the baseline case study is grounded in its high flood exposure, socio-economic significance, and representativeness of recurrent flood-prone river basins in Malaysia. The Sungai Muda region experiences almost annual flooding events, which have resulted in substantial economic losses as well as occasional loss of human life. Spanning an area of roughly 4,210 km² with a length of about 180 km, the Sungai Muda catchment is situated across the states of Kedah and Pulau Pinang. It originates at the Muda Dam and courses through the Baling, Sik, and Kuala Muda districts. As a vital water source, this river system fulfills domestic, agricultural, and industrial demands across both states, playing a strategically vital role in driving regional socio-economic growth.

Selangor's status as one of the Malaysian states most prone to severe flooding, particularly in highly urbanised areas such as Shah Alam justifies the selection of the Selangor Flood Mitigation Project as a forecasting case study. Bernama (2022) reported that eight out of nine districts in Selangor were classified as flood hotspot areas based on repeated flood occurrences, including the Petaling and Klang districts where Shah Alam is located. Shah Alam, in particular, experiences recurrent flash flood events almost annually, making it an appropriate case study for flood mitigation assessment (Leeonis et al., 2024). The frequent occurrence of floods in Shah Alam is closely associated with the overflow of the Klang River and its surrounding tributaries during periods of intense rainfall, resulting in substantial economic losses and adverse impacts on local livelihoods (Department of Irrigation and Drainage Malaysia, 2024). Fernández (2010) further asserted that flood risk is significantly higher in areas located near river networks, while the severity of flood impacts generally decreases with increasing distance from river channels. In the context of Selangor, rapid urbanisation, population growth, land-use changes, inadequate drainage infrastructure, and changing rainfall patterns have further intensified the state's susceptibility to recurring flood disasters. Recent studies by Leeonis et al. (2024) and Ahmed et al. (2024) highlighted that Shah Alam experiences frequent flash floods due to rapid urban expansion and the overflow of the Klang River during heavy rainfall events. Their findings indicated that approximately 18.9% of Shah Alam is categorised as high-risk flood zones, while 23.2% falls within moderate-risk flood areas, reflecting the city's persistent hydrological vulnerability. In addition, Bernama (2024) reported that the Selangor Department of Irrigation and Drainage identified 79 flood hotspots and 354 flood-risk areas across the state, particularly concentrated in Klang, Petaling, and Sepang districts. Empirical evidence further demonstrates the recurring impacts of flooding on local communities and infrastructure in Shah Alam. According to The Star (2024), flash floods in October 2024 affected approximately 70 houses in Shah Alam and nearby areas, including Kampung Melayu Subang, following continuous heavy rainfall. These recurring flood incidents underscore the urgent need for sustainable and effective flood mitigation strategies in Selangor, particularly in Shah Alam, where flood risks continue to threaten socio-economic

stability, infrastructure resilience, and community well-being. The Selangor Flood Mitigation Projects will replicate the core frameworks of the Sungai Muda Flood Mitigation Project to establish a baseline.

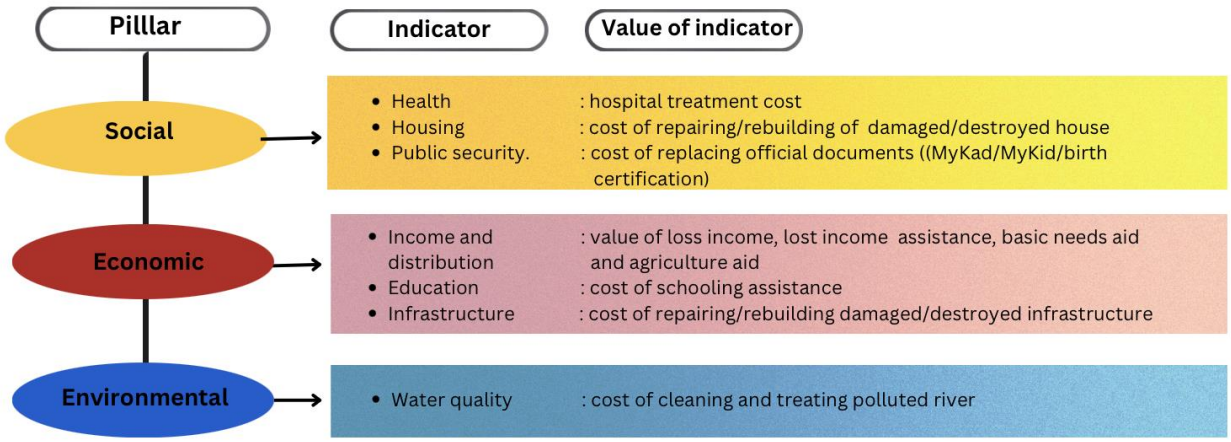
The increasing frequency and intensity of flooding have exacerbated numerous challenges, including riverbank erosion, water pollution, and the depletion of water resources. By utilising the SROI framework illustrated in Figure 6 for the Sungai Muda Flood Mitigation Project, the Selangor Flood Mitigation Project is tailored similarly through the operationalisation of the core pillars of sustainability: social indicators (housing, entertainment and recreation, governance, social participation, family, health, public safety and culture) economic indicators (transportation, communication, working life, income and distribution, education and infrastructure), and environmental indicators (air quality, water quality, water, soil and biodiversity). This adaptation enables a structured comparison between the empirical baseline case and the Selangor case study, ensuring that both observed and projected outcomes are assessed within a consistent analytical framework. The SROI instrument comprises three primary sustainability pillars and 19 indicators; however, in the case of the Sungai Muda Flood Mitigation Project, only seven indicators (health, housing, public security, income and distribution, education, infrastructure, and water quality) were selected based on their relevance to the project context, data availability, and alignment with the specific research objectives. Similarly, the Selangor Flood Mitigation Project will adapt these tripartite pillars, selecting the most relevant indicators from the original 19 indicators to suit the project's specific context. This selective approach ensures that the analysis remains focused, context-sensitive, and methodologically robust while still capturing the most significant dimensions of social value creation. For instance, within the social pillar, a health indicator was employed. The monetary value for this health indicator was determined by analyzing the cost savings associated with hospital treatments incurred by farmers.



Source: Own elaboration

Figure 6. Instrument of SROI

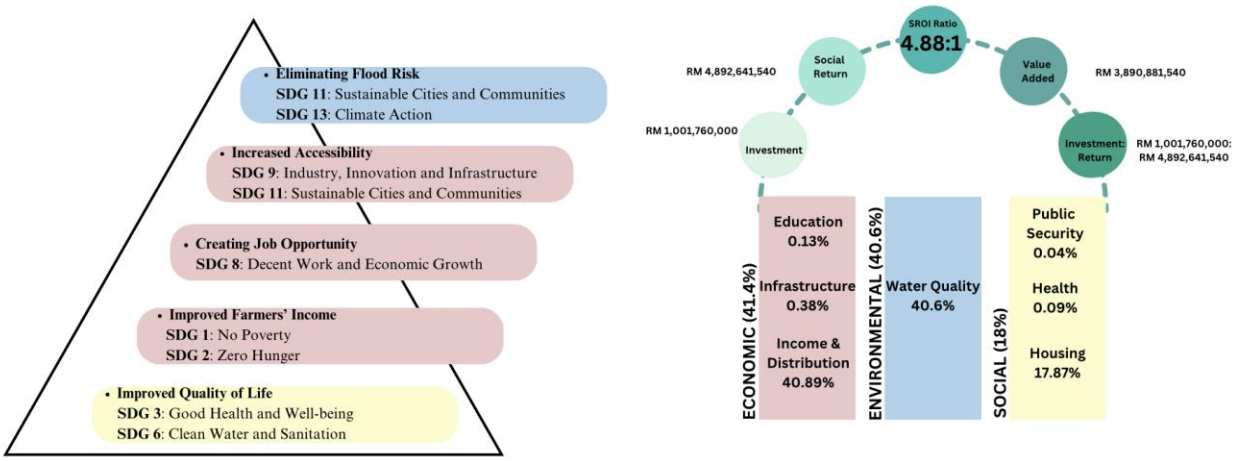
SROI analysis offers a thorough evaluation of the full theory of change continuum, measuring everything from initial inputs to eventual impacts and expressing this value through a monetised ratio (Emerson, 2003; Rotheroe & Richards, 2007; Zappala & Lyons, 2009). The social value derived from the Sungai Muda Flood Mitigation Project encompasses the interrelated social, economic, and environmental pillars, each reflecting the value derived from the indicators outlined in the Malaysia Well-being Index Report 2022 (Department of Statistics Malaysia, 2024). Subsequently, a monetary valuation is assigned to each selected indicator to quantify its contribution within the SROI assessment framework. For instance, under the social pillar, a health-related indicator is incorporated to capture the impact of flooding on community well-being. The monetary value of this health indicator is estimated based on the cost savings associated with reduced hospital visits and medical treatments incurred by affected farmers. This approach translates non-market health impacts into measurable financial proxies, enabling a more comprehensive evaluation of social outcomes. The overall value of each sustainability pillar is then derived by aggregating the monetised values of all corresponding indicators, ensuring a systematic and transparent valuation process. The relationship between indicators and their respective social pillar (health, housing and public security), economic pillar (income and distribution, education and infrastructure) and environmental pillar (water quality) is illustrated in Figure 7, which presents the structured framework used in the SROI analysis.



Source: Own elaboration

Figure 7. SROI indicator values

The findings reveal that the Sungai Muda Flood Mitigation Project positively influences shared values across these pillars: economic (41.4%), environment (40.6%), and social (18%). The application of SROI indicates that the project yielded a total net present value impact amounting to RM4,892,641,540.00. The total investment cost for the project is RM1,001,760,000.00 (JPS 2016), indicating that the flood mitigation initiative has generated a value added of RM3,890,881,540.00. The SROI ratio of 4.88:1 reflects the shared values, signifying that each ringgit invested in the project yields an additional RM3.88 in social impact value. The economic pillar contributed the largest share of social value, driven by factors such as loss of income, infrastructure repair, and agricultural support. In contrast, the social pillar generated relatively smaller benefits, reflecting costs related to hospital treatment and repairing homes. The environmental pillar accounted for the smallest proportion but remains critical, including expenses for cleaning polluted rivers. This breakdown illustrates that while economic returns represent the most of the measured impacts, social and environmental outcomes are essential for achieving a balanced and inclusive approach. Overall, the SROI ratio of 4.88:1 demonstrates that the project effectively delivers integrated economic, social, and environmental benefits, aligning strongly with the SDGs, as illustrated in figure 8. These cost savings align closely with global literature. For example, research conducted by the National Institute of Building Sciences finds $6 saved for every dollar invested in mitigation activities. When addressing river basin flooding, this return increases to a 7:1 benefit-cost ratio for proactive interventions (Lightbody & Fuchs, 2018). The SROI framework established for the Sungai Muda Flood Mitigation Project provides a transferable model for replication in the Shah Alam flood forecasting study. Although the same impact indicators and valuation approach will be employed to ensure methodological consistency, the estimated social return and SROI ratio are anticipated to vary in accordance with the differing research objectives, project scope, stakeholder profiles, and the unique socio-economic and environmental context of Shah Alam.



Source: Own elaboration

Figure 8. The shared value of the Sungai Muda flood mitigation project

Conclusion

SROI serves as an effective mechanism for converting the significant impacts of public investments into a format accessible to policymakers. For the Sungai Muda Flood Mitigation Project, the framework systematically embeds outcomes identified by stakeholders to account for both indirect and long-term value generation. By extending the analysis from the retrospective evaluation of the Sungai Muda project to the predictive modelling of the Shah Alam Flood Mitigation Project, this study demonstrates how SROI can serve as a scalable and forward-looking framework for future disaster risk management and infrastructure planning in Malaysia. By ensuring projects are relevant, balanced, and sustainable, Malaysia can move closer to realizing the vision of the 2030 Agenda, empowering stakeholders to make informed resource allocation decisions for a resilient future. The convergence of sustainability and social investment in flood mitigation projects is essential for addressing contemporary economic challenges. As a rigorous evaluation tool, SROI provides a powerful means of communicating how efficiently social investments achieve their intended impacts. Embedding SROI in policy planning can improve resource allocation, strengthen decision-making based on evidence, and ensure that future flood mitigation investments help build long-term resilience and meet sustainable development goals. This framework represents a paradigm shift in understanding value creation, ultimately supporting a more sustainable future for Malaysia.

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