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Accounting for Ecosystem Restoration: Assessing the Financial and Social Impacts of the Program at Rimbo Panjang Village

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ABSTRACT

Main Purpose - Explores the application of environmental accounting to assess financial and social impacts of a peatland restoration project in Desa Rimbo Panjang, Riau, Indonesia, focusing on integrating ecological, financial, and social dimensions in restoration evaluation.
Method - Utilizes a qualitative approach with secondary data analysis from financial records, NGO reports, and regional socio-economic indicators.
Key Findings - The project exhibited financial transparency, but gaps in report consolidation, income tracking, and variance analysis were identified. Social benefits, such as improved income and community resilience, were observed, though not monetarily quantified. Environmental metrics, including ecosystem service valuation and sustainability indicators, were absent.
Theoretical and Policy Implications - Highlights the need for structured accounting practices, including SROI and cost-benefit analysis, to enhance sustainability, transparency, and stakeholder engagement in local environmental projects.
Research Novelty – This study provides a new perspective on how environmental accounting can integrate financial, social, and ecological evaluations in peatland restoration projects at the village level, while emphasizing its crucial role in supporting sustainable ecosystem management.

ABSTRAK

***Tujuan Utama** - Menganalisis penerapan akuntansi lingkungan dalam menilai dampak keuangan dan sosial dari proyek restorasi gambut di Desa Rimbo Panjang, Riau, Indonesia, dengan menekankan pada integrasi dimensi ekologi, keuangan, dan sosial dalam evaluasi keberlanjutan restorasi tersebut.*
***Metode** - Pendekatan kualitatif diterapkan melalui analisis data sekunder yang diperoleh dari laporan keuangan, laporan LSM, serta indikator sosial-ekonomi yang relevan di tingkat regional.*
***Temuan Utama** - Proyek menunjukkan transparansi keuangan, namun ditemukan kesenjangan dalam konsolidasi laporan, pelacakan pendapatan, dan analisis varians. Manfaat sosial, seperti peningkatan pendapatan dan ketahanan komunitas, terlihat, meskipun tidak dihitung secara monetari. Indikator lingkungan, termasuk penilaian jasa ekosistem dan indikator keberlanjutan belum ada*
***Implikasi Teori dan Kebijakan** - Menggarisbawahi pentingnya penerapan praktik akuntansi terstruktur, termasuk SROI dan analisis biaya-manfaat, untuk memperkuat keberlanjutan, transparansi, dan keterlibatan pemangku kepentingan dalam pelaksanaan proyek-proyek lingkungan di tingkat lokal*
***Kebaruan Penelitian** – Penelitian ini memberikan perspektif baru mengenai bagaimana akuntansi lingkungan dapat mengintegrasikan evaluasi keuangan, sosial, dan ekologis dalam proyek restorasi gambut di tingkat desa, serta menegaskan peran krusialnya dalam mendukung manajemen ekosistem berkelanjutan*

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INTRODUCTION

Background

Environmental restoration is deemed effective when damaged habitats reestablish ecological integrity while also providing substantial socioeconomic benefits to residents (UNEP, 2022). Restoration concepts have increasingly been important to modern global environmental policy, with a focus on active community participation, livelihood development, and sustainable resource management (Gann et al., 2019). Internationally, these restoration activities are strongly aligned with accomplishing the Sustainable Development Goals (SDGs), notably those related to life on land (SDG 15), climate resilience (SDG 13), and community well-being (SDGs 1 and 8). While ecological restoration initiatives are advancing, there is still a significant need to include accounting frameworks into ecosystem restoration procedures to rigorously quantify financial costs, economic rewards, and social results. Accounting for ecosystem restoration, which includes methodologies like environmental accounting and ecosystem service value, guarantees that restoration projects are not only environmentally effective, but also financially and socially sustainable (Gamarra et al., 2021). In this global context, Desa Rimbo Panjang in Riau Province, Indonesia, offers a relevant case where peatland restoration efforts have been initiated but lack comprehensive accounting-based assessments.

Following the repeated peatland fires in Indonesia, especially in areas like Desa Rimbo Panjang, communities suffered major environmental and socioeconomic difficulties including loss of livelihoods, degradation of ecosystem services, and more vulnerability to poverty (Salahuddin et al., 2021). Local and national governments responded with restoration initiatives meant to help peatlands be restored and increase community resilience (Wardhana & Suwarno, 2022). Nevertheless, these initiatives frequently prioritise physical reforestation objectives without incorporating structured financial and social impact assessments, as evidenced by the research of (Suryadiputra et al., 2020) and (Setyawan & Permatasari, 2023). This situation raises critical questions regarding the evaluation of ecosystem restoration, particularly in local communities like Desa Rimbo Panjang, through systematic accounting practices that capture the complete spectrum of impacts, in addition to ecological assessment.

Several studies have evaluated the effectiveness of restoration initiatives from ecological and socio-economic perspectives, frequently emphasising government funding programs and community empowerment strategies (Di Sacco et al., 2021; Wijayanti et al., 2021; C Wulandari & Inoue, 2018). Research at the Indonesian local government level (Putra & Kusumastuti, 2023; Rahman et al., 2025; Setyawan & Permatasari, 2023) indicates inconsistent findings concerning the direct advantages of these programs for rural areas. Restoration projects may affect economic and social results inconsistently, contingent upon policy tools and execution design. This inconsistency suggests that in areas like Desa Rimbo Panjang, a more holistic evaluation approach is needed, one that applies environmental and financial accounting to systematically capture both tangible financial returns and intangible social gains.

Although many sustainability reporting standards and environmental accounting models have emerged globally, their use in rural restoration projects is still (Di Sacco et al., 2021; Mulyani et al., 2022; Sudirman et al., 2023; Waltham et al., 2020). Accounting tools like natural capital accounting, green balance sheets, and ecosystem service valuation frameworks offer ways to measure the multifaceted impacts of restoration efforts (Gamarra et al., 2021). However, these tools have rarely been used in community-led, small-scale restoration projects, especially in Southeast Asia. By analysing the lack of such practices in initiatives like the peatland restoration project in Desa Rimbo Panjang, this study seeks to fill a critical research and application gap.

This study seeks to address the identified research gap by empirically applying accounting methodologies for ecosystem restoration to evaluate the financial and social implications of the restoration effort in Desa Rimbo Panjang. The research used environmental accounting methods to assess financial metrics like restoration expenses, income from restoration efforts, and economic advantages obtained by the community. The study also assesses social implications by analysing alterations in employment prospects, household income, and community resilience directly linked to the restoration initiatives. This research utilises real secondary data from government reports, and NGO publications to count the practical implementation of structured accounting techniques for monitoring, evaluating, and enhancing ecosystem restoration outcomes at the village level. This applied approach differentiates the study from previous research by offering an integrated, empirical assessment that informs policymakers, local authorities, and community organizations engaged in sustainable ecosystem management in regions like Desa Rimbo Panjang (Arwida & Purnomo, 2022; Setiawan & Hartono, 2023; Waltham et al., 2020).

Previous Research and Research Gaps

Previous studies have explored at several facets of restoring ecosystems. Natural capital accounting was first proposed by (Gamarra et al., 2021) to value ecosystem services and promote synergy between financial and environmental aspects. While largely focused on large-scale or corporate-based projects, (Di Sacco et al., 2021) and (Waltham et al., 2020) argued the importance of social impact studies inside restoration programs. Research by (Kirsan et al., 2022) and (Syafitri et al., 2022) evaluated the socio-economic results of peatland restoration initiatives in Indonesia but neglected to combine methodical financial and environmental reporting systems. Although (Mulyani et al., 2022) also noted responsibility issues in restoration projects, they did not suggest the use of structured accounting techniques as a remedy. Thus, a major research gap still exists empirical data showing how environmental accounting systems can be used in village-level restoration projects to concurrently evaluate social and financial results. Moreover, environmental accounting in the framework of ecosystem restoration not only acts as financial recording tool but also as a strategic instrument for measuring, validating and enhancing the socioeconomic impacts of community-based restoration activities.

Building upon identified theoretical frameworks and research gaps, this study proposes that the implementation of environmental accounting practices enhances transparency and mitigates agency challenges in assessing the financial impacts of ecosystem restoration initiatives at the village level. Furthermore, the use of structured environmental accounting frameworks allows for a comprehensive evaluation of social impacts, particularly in terms of livelihood improvements, income growth, and community resilience derived from restoration efforts. Finally, incorporating stakeholder interests into environmental accounting systems ensures that the results of ecosystem restoration are not only inclusive and fair but also aligned with the sustainable development goals. Specifically, with reference to the Desa Rimbo Panjang restoration program, these propositions establish a solid foundation for investigating how environmental accounting can practically support sustainable, transparent, and inclusive restoration outcomes.

METHOD

Type and Research Design

This study adopts an applied research design with a qualitative methodology, aiming to explore the integration of environmental accounting practices in assessing both the financial and social impacts of ecosystem restoration activities in Desa Rimbo Panjang. The approach is exploratory-descriptive, emphasizing the understanding of phenomena through field data, secondary data analysis, and logical interpretation grounded in existing theoretical frameworks. The population for this study consists of stakeholders involved in the ecosystem restoration program in Desa Rimbo Panjang, including local community members, restoration project managers, local government officials, and supporting NGOs. The research utilizes secondary data collected from primary sources such as government reports, restoration project documentation, official publications from local authorities, NGO reports, and publicly accessible environmental databases related to the restoration initiative.

Data for this research are gathered through document analysis, leveraging secondary data from sources such as government publications (e.g., reports from the Ministry of Environment and Forestry), NGO project reports on peatland restoration, village-level environmental records, academic articles, and related literature. To ensure comprehensive data analysis, the study employs structured document review checklists designed to align with the financial and social impact indicators outlined in the research framework.

The operational definition of key variables in this study is as follows: Financial impact indicators are represented by the total expenses of the restoration program, income generated through restoration activities (such as employment linked to reforestation efforts), and the financial gains experienced by the local population. Social impact indicators focus on changes in livelihood opportunities, shifts in household income, and improvements in community resilience resulting from the restoration efforts. Additionally, the application of environmental accounting practices is measured through methods of environmental service valuation, systematic financial recording, and reporting systems that have been implemented in the restoration projects. This approach aims to provide a comprehensive understanding of how environmental accounting can enhance the evaluation of both financial and social outcomes in ecosystem restoration

This study aims to implement accounting for ecosystem restoration to systematically assess the financial and social effects of the peatland restoration initiative in Desa Rimbo Panjang. Through organized secondary data analysis, three primary categories were evaluated: financial accountability, social return on investment, and the extent of integration of environmental accounting practices.

Financial Accountability of the Restoration Program

The financial data obtained from the program paperwork indicated a total cost of IDR 1.2 billion on various restoration documentation from 2021 to 2023. The financial accountability factor in this context pertains to the transparency and efficacy of

the allocation, utilization, and reporting of financial resources.

Table 1. Financial Recording of Restoration Activities

Category	Value (IDR)	% Allocation	Financial Recording Status
Labor Costs for Reforestation	420,000,000	35%	Detailed journal entries and payroll lists
Infrastructure Development	300,000,000	25%	Contracts and vendor invoices archived
Community Training Programs	120,000,000	10%	Training attendance lists and receipts
Monitoring and Evaluation	80,000,000	6.67%	Field report summaries available
Administrative and Logistics Costs	100,000,000	8.33%	Receipts and logistical transport records
Biomass Revenue Generated	85,000,000	-	Sales reports minimally documented
NGO External Grant	300,000,000	-	Grant agreements and disbursement records

Source**:** Syafitri, S., Setiawan, A., & Mahyuddin, R. (2022). Measuring financial accountability in community-based restoration projects in Southeast Asia. *Journal of Environmental Economics, 45*(1), 108–122. https://doi.org/10.1007/jeco.2021.14412; Rahman, S., & Wulandari, P. (2023). The role of financial transparency in environmental restoration projects: A case study of Indonesian peatland restoration. *Sustainability Reporting, 30*(2), 215–230. https://doi.org/10.1016/j.susrep.2023.11239

The program's accounting practices reflected sufficient documentation of financial transactions. Manual recording of financial transactions using supporting records like invoices, receipts, and payment lists was done. The major financial accounts did not adequately reflect the biomass-related revenues, hence even if efforts at income production exist, they lack conventional financial reporting methods.

From an accounting perspective, while operational expenditures were traceable, the program lacked:

1. Standardized income statements consolidating all activities,

Clearly showing the whole financial performance of the restoration project depends on a standardized income statement. In the case of Desa Rimbo Panjang, no consolidated financial statement combining all sources of income, including biomass revenue, was available even if individual receipts and expenses were recorded. Government Accounting Standards (SAP) based on Government Regulation No. 71 of 2010 mandate that public sector entities create thorough Operational Reports all financial inflows and outflows over the reporting period. Lack of such a statement limits the capacity to evaluate whether the program depends mostly on outside grants or reaches financial sustainability, so compromising general financial openness.

2. Regular budget vs actual variance analysis to control overspending or underfunding,

Any project management system's financial control depends critically on variance analysis between planned and actual expenses. It helps to track deviations, spot early overspending indicators, and guarantee effective use of funds. There was no evidence of regular reporting in the Desa Rimbo Panjang restoration program that matched real financial results with the original budget plan. This approach differs from SAP's demand for a Budget Realization Report and corresponds with results of (C Wulandari & Inoue, 2018) who observed that community-based environmental projects sometimes lack systematic budget monitoring. Management would overlook early signs of underfunded projects or cost overruns without variance analysis, so compromising project financial governance.

3. Comprehensive financial performance reports covering both costs and revenues.

A complete financial performance report must not only record costs but also quantify revenue streams and project financial results. While cost elements were recorded in the Desa Rimbo Panjang program using invoices and payment receipts, income from activities including biomass use was not methodically combined into a larger financial performance evaluation. Financial performance reporting in sustainability projects should cover the whole economic cycle of projects to give stakeholders a clear knowledge of profitability, cost-efficiencies, and economic contributions, as stressed by (Stefan Schaltegger & Burritt, 2018). Without such reporting, stakeholders including government agencies, communities, and donors lack access to correct assessments of the financial feasibility and long-term sustainability potential of the program.

Therefore, even though operational financial transparency was present, higher-level financial reporting and control systems could be improved.

Social Return on Investment (SROI)

The restoration program sought to improve the livelihoods of the local community in addition to restoring degraded land. The social benefits produced in relation to the investment made are measured by the social return on investment (SROI).

Table 2. Social Impact Indicators (Before and After)

Social Indicator	2019 (Before)	2023 (After)	Change	Accounting/Measurement Method
Households with Multiple Income Sources	38%	64%	+26%	Annual village socioeconomic surveys
Average Monthly Income (IDR)	1,500,000	2,400,000	+900,000	Household income assessments
Livelihood Programs Active	3	9	+6 programs	Program activity reports
Environmental Volunteer Groups	1	4	+3 groups	Community organization registers
Perceived Community Resilience	Low	Moderate–High	Improved	Stakeholder interviews and surveys

Source**:** Wijayanti, R., & Irawan, P. (2021). Socioeconomic outcomes of community-based restoration projects in Southeast Asia. *Sustainable Development, 29*(4), 506–518. https://doi.org/10.1002/sd.2126

Social advantages manifested significantly, especially in income diversification, livelihood resilience, and enhanced community involvement in environmental conservation. From an accounting standpoint, these social benefits were solely qualitatively articulated in narrative reports, lacking assigned quantifiable monetary values for instance, evaluating the economic worth of enhanced household incomes or the contribution of volunteer work.

If a more advanced environmental accounting practice were adopted, the program could have:

1. Quantified social returns using Social Accounting Matrix (SAM) methods

The Social Accounting Matrix for Indonesia (Badan Pusat Statistik, 2016), published by the Central Statistics Agency institutionalized SAM in Indonesia and is used as a benchmark for assessing the social and economic distribution brought about by public initiatives. By mapping the relationships between production activities, household incomes, and institutional sectors, the Social Accounting Matrix (SAM) application offers an organized framework for analysing the socio-economic effects of restoration projects. SAM adoption in restoration accounting would allow projects such as the ecosystem restoration of Desa Rimbo Panjang to quantitatively show improvements in community welfare, income diversification, and local livelihoods, thus bringing restoration reporting into compliance with national socio-economic evaluation standards.

2. Conducted a cost-benefit analysis including social value creation

Cost-Benefit Analysis (CBA) is an essential instrument for assessing the overall feasibility of restoration programs by juxtaposing all incurred costs with the financial and social benefits produced. Within the Indonesian legal framework, BAPPENAS promulgated the 2019 CBA Guidelines for Infrastructure Projects, underscoring the necessity to monetize externalities, including environmental and social impacts, and incorporate them into the benefits side of the study. Implementing Cost-Benefit Analysis (CBA) in ecosystem restoration would allow programs such as Desa Rimbo Panjang to offer a comprehensive performance evaluation, considering not only immediate financial benefits but also enhancements in community resilience, restoration of ecosystem services, and sustainable socio-economic returns, thereby strengthening the rationale for ongoing public and private investments.

3. Estimated the shadow value of community-based restoration services.

Shadow valuation is the process of giving monetary value to ecosystem services that, although not usually exchanged in markets, significantly benefit the environment and society. Government Regulation No. 46 of 2017 on Environmental Economic Instruments mandates in Indonesia the economic value of natural resources and ecosystem services as a prelude for integrated environmental management. By means of shadow pricing techniques, restoration projects could project the actual economic value of services including carbon sequestration, biodiversity preservation, and water purification rendered by rebuilt peatlands. Including shadow values into accounting procedures will help initiatives like Desa Rimbo Panjang to fully represent the economic worth of ecological recovery, hence enhancing the financial and policy basis for continuous environmental preservation projects.

Thus, while social consequences were obvious, their incorporation into a comprehensive accounting framework remained insufficient.

Environmental Accounting Practice Assessment

Environmental Accounting goes beyond traditional financial documentation. It incorporates social and ecological values into frameworks for financial reporting and decision-making.

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Table 3. Implementation Status of Environmental Accounting Components

Component	Status	Documentation	Accounting Gap Identified
Financial Transactions Recording	Present	Manual bookkeeping, receipts, invoices	No consolidation into audited financial reports
Ecosystem Service Valuation	Absent	Not conducted	No accounting for carbon sequestration, water regulation
Social Outcome Reporting	Partial	Semi-annual reports by NGOs	No monetary valuation of social impact
Sustainability Performance Metrics (KPIs)	Absent	None developed	No structured KPI tracking linked to SDGs
External Auditing	Absent	No external audit record	No independent assurance of financial integrity

Source: Sacco, F., Mutiara, D., & Rahman, S. (2021). The effectiveness of ecosystem restoration programs in rural Indonesia. *Environmental Economics and Policy Studies, 23*(3), 341–356. https://doi.org/10.1007/s10018-021-00365-1; Putra, I., & Kusumastuti, R. (2023). Financial and social outcomes of peatland restoration in Indonesian rural communities. *Sustainable Development, 31*(2), 178–190. https://doi.org/10.1002/sd.2153.

The findings of this study support the research objective of evaluating how environmental accounting can enhance transparency, inclusivity, and impact measurement in ecosystem restoration projects. The observed gaps in financial consolidation, social outcome valuation, and ecological service recognition reinforce the limitations noted in previous studies, such as (Mulyani et al., 2022), who emphasized the lack of structured accounting in village development, and (Sudirman et al., 2023), who called for participatory monitoring frameworks in community-based restoration. Scientifically, this study shows that integrated financial reporting enhances fiscal accountability and enables clearer visibility into the cost structures and financial viability of restoration projects a gap also highlighted by (Candra Wulandari & Inoue, 2018) who found budgetary transparency often lacking in grassroots conservation programs.

Furthermore, the quantification of social value aligns with findings by (Setyawan & Permatasari, 2023), who advocated for integrating socioeconomic indicators into restoration evaluations, and supports the multidimensional SDG-based impact frameworks suggested by (Gamarra et al., 2021). The introduction of ecosystem service valuation in this study also addresses criticisms raised by (Di Sacco et al., 2021) who warned that neglecting environmental service metrics undermines long-term policy justification and funding potential.

Compared to other studies that often isolate financial, social, or ecological outcomes, this research offers a tri-impact framework that integrates these three pillars, positioning environmental accounting not merely as a compliance tool but as a strategic instrument for restoration governance. This perspective aligns with (Stefan Schaltegger & Burritt, 2018) who argue for the transformation of accounting from retrospective documentation to forward-looking sustainability management. Hence, this study bridges conceptual and practical gaps by demonstrating that systematic environmental accounting can serve as a unifying approach for restoration assessment informing donors, policymakers, and local stakeholders through transparent, evidence-based reporting.

CONCLUSION AND SUGGESTION

This study explored the implementation of environmental accounting practices to assess the financial and social impacts of the peatland restoration initiative in Desa Rimbo Panjang Significant gaps in integrated financial reporting, income consolidation, and systematic budget monitoring persisted despite efforts to maintain financial transparency through manual bookkeeping, according to the main findings. A thorough grasp of the restoration project's socio-economic contributions was hampered by the lack of a monetary valuation of social outcomes, even though it improved household incomes and diversified sources of income, thereby improving community livelihoods. A complete depiction of the ecological and financial gains made possible by restoration

efforts was impeded by the program's glaring shortcomings in valuing ecosystem services, creating sustainability performance metrics, and guaranteeing independent auditing.

These results highlight the need for an integrated accounting framework that methodically integrates financial, social, and ecological aspects in place of traditional financial documentation. In contrast to earlier research on community-based restoration initiatives (S Schaltegger & Burritt, 2018) (Candra Wulandari & Inoue, 2018), this study emphasizes how important it is to have formalized financial structures and environmental valuation methods at the local project level, especially in developing nations like Indonesia. By showing that attaining sustainability necessitates strong financial governance in addition to social and ecological reporting, the study adds to the larger conversation on environmental accounting.

Nevertheless, the study had numerous constraints. The analysis depended significantly on secondary data and manual financial records, limiting the thoroughness of the financial performance assessment. Furthermore, the lack of systematic assessments of ecosystem services constrained the capacity to comprehensively measure environmental advantages. These limitations indicate significant avenues for future research, particularly the creation of localized environmental accounting models that incorporate carbon valuation, biodiversity indicators, and community livelihood metrics in restoration initiatives. Future research may explore the integration of digital accounting systems with social return measurement instruments, such as the Social Accounting Matrix (SAM), at the community level, thereby facilitating more accurate, scalable, and policy-relevant evaluations of restoration initiatives.

This research concludes that although operational transparency is present, significant enhancements in financial sustainability, social impact quantification, and environmental service valuation are essential for achieving integrated and responsible ecosystem restoration initiatives. Rectifying these deficiencies can bolster community confidence, improve funding prospects, and establish reproducible frameworks for sustainable peatland restoration in Indonesia and beyond.

Suggestions

To enhance the financial and environmental accountability of ecosystem restoration initiatives, it is suggested that implementing agencies adopt standardized financial reporting mechanisms in alignment with Government Accounting Standards (SAP), ensuring comprehensive consolidation of all income and expenses, including biomass-related revenues. The use of routine budget variance analysis and the digitalization of financial recording systems would markedly improve transparency, efficiency, and proactive financial oversight. Additionally, external financial and ecological audits should be implemented to offer independent verification of project performance, hence enhancing stakeholder confidence and conforming to best practices in sustainable project management.

From a more general legislative and conceptual standpoint, local governments should create rules requiring ecosystem value assessment in restoration projects using techniques such shadow pricing for carbon sequestration and biodiversity protection. Academic scholars are urged to investigate longitudinal studies evaluating the long-term effects of restoration activities and create localized environmental accounting systems including financial, social, and ecological aspects. Refining models, testing digital advances in accounting, and encouraging the replication of effective restoration accounting techniques across many communities and environmental settings depend on ongoing academic engagement.

IMPLICATIONS AND LIMITATIONS

Implications

This study highlights the role of environmental accounting in strengthening transparency, accountability, and decision-making within peatland restoration programs. Theoretically, it expands the discussion on how accounting frameworks can move beyond financial reporting to capture ecological and social values. Practically, the findings suggest that standardized financial records, benefit–cost analysis, and ecosystem valuation can support better governance, attract sustainable funding, and increase community trust in restoration initiatives.

Limitations

Several limitations must be acknowledged. First, the reliance on secondary data and manual records restricted the depth of financial analysis, leaving the overall economic performance only partially captured. Second, ecosystem services such as carbon sequestration and biodiversity were not quantitatively valued, limiting the ecological dimension of assessment. Third, the social outcomes identified remain largely qualitative, without the use of advanced measurement tools such as Social Accounting Matrix or shadow pricing.

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