Accountability and Transparency of Asset Management from a Blue Accounting Perspective: A Study of Cold Storage in the Kampung Nelayan Merah Putih Sorue Jaya

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Abstract
Purpose: This study examines accountability, transparency, and readiness to adopt a blue accounting perspective in the management of cold storage at Kampung Nelayan Merah Putih (KNMP) Sorue Jaya, Konawe Regency.
Methodology/approach: A qualitative case study was conducted using interviews, field observations, and documentation involving six purposively selected informants. Data were analyzed thematically and checked through triangulation across informants and available records.
Results/findings: Basic management arrangements and transaction records exist, but standardized bookkeeping, periodic financial reporting, documented supervision, and integrated information systems remain limited. Operational information is more accessible than financial information. Informants reported benefits from access to ice, improved fish handling, cooperative marketing, and women's processing activities. One informant estimated a 20–30% reduction in fishing-trip costs, although this was not independently verified. Electricity costs were approximately IDR 6 million monthly and were still covered by the central government; energy intensity, maintenance costs, and environmental indicators were inadequately recorded.
Conclusions: The facility provides perceived economic and social benefits, but stronger recording, disclosure, oversight, and environmental monitoring are needed to support accountable and sustainable asset management.
Limitations: Findings are drawn from one facility and six informants. Some reported benefits are unverified, and the proposed framework has not been empirically tested.
Contribution: The study proposes a context-specific minimum framework integrating operational and asset records, economic and social benefits, energy and environmental indicators, periodic reporting, disclosure, and evaluation for community-based fisheries infrastructure.

Keywords: *Accountability; Transparency; Blue Accounting; Cold Storage; Asset Management; Coastal Communities.*

1. Introduction

Coastal areas are home to communities dependent on fishing activities. The economic value of the catch is determined not only by production volume but also by the ability to maintain fish quality from landing to marketing. Limited cold chain facilities can shorten shelf life, increase the risk of spoilage, and encourage fishermen to sell their catch quickly. Research on traditional fishing vessels also shows that providing cold storage can reduce handling costs and help maintain fish quality (Arif et al., 2021).

The Indonesian government developed the Kampung Nelayan Merah Putih (KNMP) Sorue Jaya in Konawe Regency as an integrated fisheries area. It includes landing facilities, an ice factory, an Air Blast Freezer (ABF), cold storage, and other supporting facilities. Within this ecosystem, cold storage links catch reception, freezing, storage, distribution, and marketing. The facility studied has an ABF room with an approximate capacity of 1 ton per day and a cold-storage room with an approximate

capacity of 10 tons. These facilities expand catch-handling options and may help managers build more stable market relationships.

On the other hand, cold storage is an asset that requires ongoing operational and maintenance costs. The costs of electricity, labor, generator fuel, machine maintenance, administration, and logistics form a cost structure that must be recognized to ensure the facility's survival after government support is reduced. Preliminary studies indicate that cold storage electricity costs are approximately IDR 6,000,000 per month, and during the study period, the central government still covered the costs. However, maintenance and labor costs have not been fully documented. This situation prevents a full calculation of actual operational costs.

As an asset, cold storage cannot be solely assessed based on its physical presence and commercial activity. Managers need to be able to demonstrate who is responsible, how transactions and asset usage are recorded, how costs and revenues are managed, to whom reports are submitted, and how oversight is conducted. In the public sector context, accountability requires accountability for managed resources and mandates, while transparency requires relevant and accessible information for stakeholders (Adil et al., 2022).

The need for accountability becomes even more critical when the recording system is unstable. Field findings indicate manual recording of basic transactions and attempts at digitization through several applications. However, platform changes, input constraints, and reliance on administrators or managers mean that information is not yet consolidated into a single, stable system. These issues risk compromising transaction traceability, information continuity when management changes occur, and the accuracy of cost-based decision-making.

Transparency also cannot be limited to disclosure of the physical condition of facilities. Information on tariffs, costs, revenues, capacity, pricing policies, and asset utilization is a crucial part of the accountability relationship with fishermen and the community. Preliminary studies indicate that operational information is more easily obtained through direct communication, while financial information is not yet available in periodic reports or easily accessible public media. Thus, the problem arises not simply from a lack of communication, but from the lack of a standardized system and consistent disclosure mechanisms.

Cold storage management also has an ecological dimension. The freezing process requires energy and refrigerants, while fish cleaning activities generate organic waste in the form of scales, gills, and intestines. From a blue accounting perspective, accounting goes beyond simply recording electricity costs as an expense but encourages managers to examine the interrelationships between economic, social, and ecological information. Blue accounting can be an approach that strengthens transparency and stewardship of marine resources, although disclosure practices and standards are still evolving and not yet uniform (Mbiza et al., 2026; Sari et al., 2026).

Research examining blue accounting is emerging in coastal communities, fisheries companies, and fisheries MSMEs in Indonesia. Yusuf et al. (2025) demonstrated blue accounting practices in Torosiaje Village through environmental, economic, and social budgets, but environmental costs have not yet been fully established as separate accounting information. Krestiwanda and Utami (2024) emphasized the social responsibility dimension of fisheries companies, while Ridwan and Ramli (2025) demonstrated the importance of stakeholder involvement, literacy, funding, and policy support in implementing blue accounting in fisheries MSMEs. These studies reinforce the relevance of blue accounting, but have not specifically addressed the management of cold storage as a physical asset at the coastal community level.

Globally, blue accounting research is growing through efforts to connect economic, social, and ecosystem information, but cross-dimensional data collection remains a challenge (Failler et al., 2023). In the fishing industry, Moozanah et al. (2024) found that understandings of profit and sustainability can differ among fishermen and vessel owners. Outside the maritime sector, Mohammadifardi et al.

(2022) demonstrated the importance of assessing infrastructure management decisions from a long-term sustainability perspective, including costs and environmental impacts. The context of this research differs from community cold storage, highlighting the relevance of viewing costs, user benefits, and environmental impacts in an integrated manner throughout the asset's operation.

Based on previous research, blue accounting research in the fisheries context has focused more on companies, coastal community practices, or MSMEs, while research on the management of cold storage infrastructure as a public asset operated at the community level has not been evident in the sources used in these studies. Therefore, the gap in this research lies in the lack of a link between asset accountability analysis, information disclosure to users, operating costs, energy, and ecological indicators in a single community public facility case. The research contribution is limited to a minimum management framework for the KNMP Sorue Jaya context; the findings of this single case are not intended to represent all KNMPs or fisheries facilities in Indonesia.

This study aims to (1) analyze accountability practices in cold storage management; (2) analyze transparency in financial and operational management for fishing communities; (3) identify constraints in facility management and utilization; (4) analyze blue accounting through four analytical dimensions: economic, energy, social, and environmental; and (5) formulate a framework for more accountable, transparent, efficient, and sustainable public asset management. The research contribution lies in a framework that connects measurement, accountability, disclosure, monitoring, and sustainability in cold storage assets at the coastal community level.

The research's relevance to sustainable development and the green economy lies in the governance of cold chain infrastructure that supports coastal fisheries activities, while also requiring control over energy costs, asset maintenance, and ecological impacts. This research does not quantitatively measure emission reductions or green economy impacts. The research's relevance to digital transformation relates to the need for consistent recording and reporting, as digitalization requires clear data governance and procedures.

2. Literature review

2.1 Accountability for Public Asset Management

Public accountability refers to the obligation of mandated parties to explain and account for the use of resources, processes, decisions, and results to those entitled to demand accountability. In cold storage management, accountability translates into clarity of authority, work procedures, recording of transactions and facility use, cost management, reporting, monitoring, evaluation, and follow-up on asset issues (Mardiasmo, 2018).

Accountability can be implemented vertically and horizontally. Vertical accountability relates to the manager's accountability to government authorities or mandating institutions, while horizontal accountability refers to accountability to the community and facility users. For public assets directly utilized by fishermen, both directions of accountability must operate simultaneously. The strength of formal structures without traceable bookkeeping and reporting is insufficient to generate substantive accountability.

2.2 Transparency and Openness of Information

Transparency is the openness in providing relevant, accurate, understandable, timely, and accessible information to stakeholders. In public asset management, transparency encompasses asset status and use, utilization regulations, tariffs or pricing policies, revenues and expenditures, maintenance costs, facility conditions, and evaluation results. Transparency goes beyond simply being willing to answer questions verbally; it requires a documented and traceable information mechanism.

The relationship between transparency and accountability is mutually reinforcing. Open information allows stakeholders to evaluate management decisions, while accountability mechanisms justify the need to record and report such information. Septian et al.'s (2022) research on village financial management demonstrates the importance of transparency and accountability in public resource management, although the context and research design differ from those of fisheries asset management.

2.3 Public Asset Management and Sustainability

Public assets are resources controlled by the government or public institutions to provide services and economic benefits to the public. Asset management encompasses planning, utilization, maintenance, monitoring, reporting, and control throughout the asset's life cycle. In cold storage, important indicators include clarity of asset status, condition and capacity, utilization, operational costs, maintenance costs, pricing systems, energy efficiency, environmental impact, and financing sustainability (Susanto & Yudhistira, 2024).

The natural capital perspective helps broaden economic assessments by recognizing that economic activity depends on natural resources and the institutions that manage them. Fenichel and Abbott (2014) emphasize the importance of developing natural capital measures that go beyond metaphors and link economic value to resource conditions and governance. In this study, this perspective is used in a limited way to reinforce the importance of resource consumption and ecological impacts in management information, rather than to provide a full monetary valuation of natural capital.

2.4 Blue Accounting as an Integrated Perspective

In this study, blue accounting is understood as an approach to recording, measuring, and disclosing information that links economic activities with the condition and governance of marine and coastal resources. Research in this area remains diverse and faces challenges related to data availability and the lack of uniform measurement practices (Failler et al., 2023; Mbiza et al., 2026). Therefore, this study does not treat blue accounting as a formal accounting standard or claim that the research subjects have fully implemented it.

In the Indonesian fisheries sector, blue accounting has been used to assess corporate social responsibility practices (Krestiwanda & Utami, 2024), marine community governance (Yusuf et al., 2025), and the sustainability of fisheries MSMEs (Ridwan & Ramli, 2025). Recent Indonesian work also positions blue accounting within broader maritime economic development (Suwarno et al., 2025). Conceptually, blue accounting is relevant for cold storage because it allows information on electricity costs, energy efficiency, maintenance, organic waste, refrigerant use, economic benefits to fishermen, and access to information to be understood within a single accountability system.

The economic, energy, social, and environmental dimensions are used as analytical categories tailored to cold storage operations; they are not presented as a universal taxonomy for blue accounting. The economic dimension covers revenue, expenditure, and operating costs. The energy dimension covers electricity consumption and energy efficiency. The social dimension covers access to and benefits for fishers, as well as community involvement. The environmental dimension covers waste, refrigerants, and other ecological costs or indicators that can be documented. Energy is treated separately because consumption is a directly measurable operational input, whereas the environmental dimension covers broader impacts and their management.

Within the scope of this research, environmental accounting emphasizes the recognition of environmental costs and impacts, while sustainability accounting connects economic, social, and environmental performance more broadly (Elkington, 1997). Public sector accountability focuses on accountability for public mandates and resources. Blue accounting pays particular attention to the relationship between economic activities and marine-coastal resources and ecosystems. These perspectives can complement each other. Therefore, this research uses blue accounting as a lens for economic, energy, social, and environmental information, while questions of accountability and transparency remain analyzed through public asset governance.

2.5 Conceptual Framework

This research framework places cold storage management at the center of the analysis. Accountability is used to assess authority, recording, reporting, supervision, and evaluation; transparency to assess access to information on costs, tariffs, revenues, asset usage, and facility conditions; and blue accounting as a perspective for understanding the interconnectedness of economic, energy, social, and environmental dimensions. The social dimension is examined through access and benefits for users and community involvement, not just through information communication. All three are directed toward efficient, accountable, transparent, and sustainable asset management.

3. Methodology

The research employed a descriptive qualitative approach with a case study design. This design was chosen to gain a deeper understanding of cold storage management practices within a specific institutional and social context. The research location was the KNMP Sorue Jaya, Soropia District, Konawe Regency, Southeast Sulawesi. The study lasted approximately three months, from June 1 to August 31, 2026.

The final sample comprised six purposively selected informants: one facility manager/technician (Mr. Ardin); two KDMP Sorue Jaya officers (Mr. Musyair, chairperson, and Mrs. Mira, deputy chairperson); one market informant who provided reference-price information (Mrs. Sanda); one fisherman and facility user representing the Tunas Jaya fishing group (Mr. Arfin); and one member of the women's fish-processing group (Mrs. Nurhayati). They were selected for their relevant knowledge of and direct involvement in facility management, fish marketing, utilization, or processing. This sampling captures several key perspectives within a single case and is not intended to represent all users or government stakeholders.

Primary data were obtained through semi-structured interviews and field observations. Interviews explored facility management, transaction recording, reporting, tariff or pricing, electricity costs, maintenance, supervision, facility utilization, energy use, and environmental impact management. Observations were made of the physical condition of the facility and operational flow, including receiving, cleaning, freezing using an Air Blast Freezer (ABF), storage, and release of fish. Observations also covered facility use, equipment condition, and management practices relevant to costs, energy, and the environment. Secondary data included facility usage records, electricity billing information, available cash records, management structures, facility photographs, and other documents accessible during the study. Each source of information was compared across sources to identify data correspondences and discrepancies.

Data analysis followed the interactive model of Miles, Huberman, and Saldaña (2014): data reduction, data display, and conclusion drawing and verification. Interview, observation, and document data were organized under themes derived from the research focus: accountability, transparency, asset management, operating costs, energy, ecological impacts, social benefits, and constraints, while relevant findings that emerged during analysis were also incorporated. The themes were compared across the six informants, observations, and available documents. Conclusions were checked against these sources to identify agreement and discrepancies.

Blue accounting was used as the substantive perspective, while accountability and transparency formed the governance framework. The analysis considered four dimensions: economic, energy, social, and environmental. Economic analysis covered operating costs, revenue, cost efficiency, and economic benefits; energy analysis covered electricity use and energy efficiency; social analysis covered access, benefits for fishers, and community involvement; and environmental analysis covered waste and refrigerants. Energy was treated as a separate analytical category because electricity consumption is an operational input that can be directly observed and measured.

Accountability is used to analyze the clarity of responsibilities, recording, reporting, monitoring, and evaluation. Transparency is used to analyze the availability and openness of information regarding tariffs, costs, revenues, asset utilization, capacity, and facility conditions. The framework is translated into a coding matrix and used as an analytical guide, not as a quantitative measurement instrument. The study does not claim that the cold storage has implemented formal Blue Accounting standards.

4. Results and Discussion

4.1 Research Result

4.1.1 Overview of Cold Storage Objects and Operations

The KNMP Sorue Jaya complex was built by the central government in 2025 and began operating in January 2026, with initial capital that was self-funded, before receiving additional assistance from the Konawe Regency Maritime Affairs and Fisheries Service. This facility is an integrated area that includes (1) cold storage, (2) a portable ice factory, (3) a portable frozen warehouse or Air Blast Freezer (ABF), (4) the Merah Putih Village Cooperative (KDMP), (5) a culinary center, (6) a workshop, and (7) a docking facility that is not yet functional because the ship towing equipment has not been installed.

Operational continuity in the early stages depended heavily on internal management initiatives. Before receiving official funding support from the local government, the management relied on self-financing schemes to drive the facility's activities, as explained by Mr. Musyair, Chairman of the Merah Putih Village Cooperative (KDMP) in Sorue Jaya:

> *"Initially, we were self-sufficient, then we got support from the government. So, we've been going in circles ever since."*

Although this area is planned as an integrated service center, not all supporting facilities have been operational simultaneously since its initial operation. Management is focused on optimizing core cooling facilities to maintain a stable fish supply chain, as explained in an interview with Ms. Mira, Deputy Chair of KDMP Sorue Jaya:

> *"Seven facilities from KNMP have been available since the end of 2025, the newly operational facilities are (1) cold storage, (2) portable ice factory, and (3) portable frozen warehouse."*

Technically, the optimal capacity of cold storage is 10 (ten) tons with ABF capable of processing freezing of approximately 1 (one) ton of fish per day. In actual conditions as of the end of August 2026, the recorded stock was approximately 8 (eight) tons at the beginning of the month, with 3 (three) tons having been released leaving approximately 5 tons remaining, indicating limited room for stock movement if fish supply suddenly increases, as in the interview with Mr. Musyair as the chairman of KDMP Sorue Jaya as follows:

> *"Our current problem is that we don't have enough piers. They're too short. So, in the future, we might want to add more. For large ships, it's a bit difficult to report here."*

This statement is supported by an interview with Mr. Ardin, an informant for KNMP Sorue Jaya:

> *"The supply of fish from small-scale fishermen on vessels under 3 GT has decreased over the past three months due to weather factors, while vessels with a capacity of 5 GT and above have had difficulty docking because the dock is considered too short."*

Interview findings linked the limited docking capacity to the difficulty of larger vessels docking, while supply from some small-scale fishermen reportedly decreased during unfavorable weather. These conditions have the potential to limit the supply to cold storage. Informants explained that these conditions limit the volume of fish that can be landed directly at the facility, leaving some supply dependent on small-scale fishermen with smaller vessels. The operational flow observed included fish receipt, cleaning and sorting, initial freezing in the ABF, transfer to cold storage, storage, and release according to buyer demand. KNMP Sorue Jaya has one buyer partner, CV Surya Pangan Utama. In the interview, Mr. Ardin explained:

> *"We deliver fish according to our partners' orders, while they help with the initial operations of the ice factory. The ABF's smaller capacity compared to the storage capacity is a constraint, as replenishing stock to the cold storage depends on the daily fish freezing capacity."*

These supply constraints limit the consistent and efficient utilization of cooling capacity. Overall, the imbalance between the availability of large-capacity cooling infrastructure and the limited supporting infrastructure at the docks creates an operational gap that must be addressed before this public asset can fully function as planned.

From the user's perspective, Mr. Arfin, a representative of the Tunas Jaya capture-fisher group, described how the KNMP ice factory changed access to ice before fishing trips:

> "*Since the KNMP ice factory began operating, we have felt its benefits directly. We can now collect ice at the dock before going fishing. It saves us about 20–30% in fishing-trip costs*."

This account indicates that the benefits of the KNMP infrastructure extend beyond storing fish after landing. The ice factory supports pre-departure preparations by reducing the need to obtain ice from outside the area. The facilities therefore serve connected stages of fisheries activity, from preparation for fishing to post-harvest handling and marketing.

4.1.2 Asset Management Accountability

Institutionally, the management has a management and oversight structure. However, operational responsibility and day-to-day record-keeping remain concentrated in the hands of specific individuals. Daily transaction records, from fish purchases from fishermen, ice sales, to cold storage, are handled manually by the management, specifically the Deputy Chairperson of the Merah Putih Village Cooperative. In an interview, Mrs. Mira stated the following:

> *"If any fish come in, I'll record them for now. We can't hire more employees yet."*

Recording of incoming fish and transactions has been carried out, but is still at the basic administrative stage. The Sorue Jaya KNMP planned to use several platforms, including Simkopdes and Sispro (later replaced by Stelina). The platform changes and technical challenges have resulted in data not being stably integrated, as shown in the following interview with Mr. Ardin:

> *"Actually, for now, I still keep everything in one folder on my laptop. I haven't checked everything yet. Since the application has changed again, I'm still keeping it to myself. I'll wait for it to be fixed, then I'll start reporting everything to the central office."*

To record KNMP business unit transactions, namely income, expenses, and loans, sispro is used, while village cooperative transactions for member savings and loans are recorded through simkopdes.go.id, and at the time of this research, new managers began registering accounts on a third application called stelina.kkp.go.id as a replacement for sispro. This condition indicates that the current KNMP financial accountability system is vulnerable to the risk of data loss and reporting delays, because there is no standard, stable and integrated system between business units (cold storage and ice factories) and cooperative savings and loan units. The internal supervisory function is carried out by three cooperative supervisors, but it is incidental in nature, as in the interview with Mrs. Mira as follows:

> *"Inspections are conducted here during visits, or when supervisors are invited to weekly or bi-weekly meetings."*

Oversight is conducted by the KDMP supervisory team without following a routine monitoring schedule with standard indicators. In this aspect of oversight, a supervisory structure is in place, including the involvement of the Village Head, but no documented evidence of periodic monitoring based on performance indicators has been found. Meanwhile, in terms of reporting, available sources do not yet indicate a single pattern of written financial and operational reports, prepared routinely and

traceable by all administrators and supervisors. Thus, management has an administrative foundation, but the accountability system is not yet fully institutionalized.

4.1.3 Financial and Operational Transparency

Information transparency is stronger in terms of facility conditions and operational activities than in financial aspects. Users can find out whether facilities are operational, the types of services available, and the general conditions of use. Conversely, no single medium has been found that regularly reports revenue, expenses, cost structures, capacity utilization, and pricing bases. Information to members and the public is primarily provided through direct interaction and verbal outreach. These mechanisms demonstrate communication, but information is difficult to trace when not supported by consistent minutes, reports, information boards, or digital archives. Pricing policies are also not supported by written, publicly verifiable Standard Operating Procedures (SOPs), as shown in an interview with Mrs. Mira:

> *"If I meet them or have a meeting, I'll let them know. If we buy fish from the fishermen here, we'll give them a price increase of around Rp1,000 per kilogram. We'll call the fish sellers at the auction, and then we'll give them a Rp1,000 increase."*

The reference price obtained by telephone from the trader was explained by informant Mrs. Sanda as follows:

> *"However, there's no such thing as an SOP; he hasn't created one yet. He just checks it like that. He buys from other sources for, say, Rp 20,000, sells it to the public for Rp 21,000, Rp 22,000, or something like that."*

The determination of selling prices based on operational practices and information based on verbal communication demonstrates that transparency is interpersonal and has not yet become a documented disclosure system. Furthermore, a formal, periodic, and easily accessible publication mechanism for financial information and asset performance has not yet been established.

From the user's perspective, Mr. Arfin said that KDMP's involvement had helped fishers obtain greater price certainty and maintain catch quality. He explained:

> "*Now that we work with KDMP (the Village Cooperative), the cooperative acts as an official buyer. Prices are clear, based on quality standards, and transparent*."

Mr. Arfin's account suggests that users perceive transactions and marketing relationships with the cooperative as clearer. This perception should be distinguished from the existence of a formal transparency system: a user's experience of clearer prices does not by itself establish that pricing policies, revenues, expenditures, and operating costs are systematically documented or disclosed.

4.1.4 Operational Costs, Energy, and Ecological Aspects

Electricity costs were the most clearly identified component, costing approximately IDR 6,000,000 per month specifically for cold storage, and were still covered by the Central Ministry of Marine Affairs and Fisheries during the research period. The energy cost component, specifically electricity costs, was the most significant finding related to blue costs. The current cold storage electricity costs were explained in an interview with Ms. Mira as follows:

> *"Currently, the Central Ministry of Marine Affairs and Fisheries is covering the electricity bill. The electricity bill for cold storage is around Rp 6,000,000 per month. This subsidy was initially announced to only be valid until the sixth month (June), but it's still being paid until August, and we don't know for sure when it will end."*

The uncertainty surrounding electricity subsidies for these cold storage assets poses a significant financial sustainability risk. Once the electricity subsidy is removed, KDMP will be required to cover its own electricity costs from its operating income, while the management has not yet developed an independent energy cost calculation. The identified energy efficiency measures are still simple operational measures, as shown in the following interview with Mr. Ardin:

> *"Actually, minimizing the budget would be better. Especially here, with solar and wind, our sources are strong. But we use PLN."*

The management proposed using a solar power plant (PLTS) to reduce costs, but no feasibility study or documented cost-benefit calculations have been found. Furthermore, cleaning activities generate organic waste in the form of fish scales, gills, and intestines, while the cooling machine uses refrigerant. Therefore, the ecological dimension has not been translated into KNMP performance indicators. KNMP only records energy costs as an administrative expense paid by a third party, but has not yet internalized blue costs as a variable that must be calculated and planned independently.

4.1.5 Benefits and Constraints of Asset Utilization

The cold-storage complex provides economic and social benefits through catch handling, fish-quality maintenance, improved marketing access, and local livelihood opportunities. The interviews also indicate benefits beyond fish storage, including access to ice before fishing trips, user-reported savings, cooperative marketing and financing, and fish processing by local women. At the same time, asset utilization faces constraints: inadequate dock infrastructure for larger vessels; an ABF freezing capacity of approximately 1 ton per day, which limits replenishment of cold-storage stocks; and limited technical staffing, integrated record-keeping, written procedures, formal reporting, and monitoring documentation. Weather also affects fish supplies from small-scale fishers.

Mr. Arfin explained that before the KNMP facilities operated, fishers had to buy ice from outside the area at higher cost:

> "*We used to have to buy ice blocks from far away. They were expensive, and some of the ice had already melted during the trip*."

After the ice factory began operating, fishers could obtain ice closer to their departure point. Mr. Arfin's estimate of a 20–30% reduction in fishing-trip costs, reported above, is a perceived benefit and has not been verified through a comparison of cost records before and after the facility began operating. He also described the perceived effect on fish quality:

> "*Because the ice from KNMP is good, our fish stays fresh until it reaches the dock, so the selling price does not fall*."

The availability of ice may help preserve catch quality after harvest, which can affect the price fishers obtain. KDMP's role as a buyer also offers an alternative marketing channel to fishers who previously relied more heavily on traders. The cooperative provides support for fishing supplies and working capital. Mr. Arfin said:

> "*When we want to go fishing but do not have enough money for fuel or net repairs, KDMP offers supplies on credit. Repayment is deducted from the proceeds when we sell our catch to the cooperative. That way, we do not have to fall into debt with traders*."

This account indicates that the cooperative's relationship with fishers extends beyond access to physical facilities. The supplies-on-credit arrangement is an alternative financing channel, although its sustainability cannot be assessed without information on loan amounts, repayment rates, and credit risk. Social benefits are also evident in fish processing by a women's group. Mrs. Nurhayati explained:

> "*When our husbands catch smaller fish, or fish that cannot be sold fresh, we process it into dried products, cleaned salted fish, or packaged products. It helps supplement our household income*."

The processing activities create an opportunity for fishers' households to add value to catches that do not enter the fresh-fish market. Processing into dried, salted, or packaged products broadens how the catch can be used, although the enterprise still needs packaging equipment and wider market access.

Despite these benefits, asset utilization faces operational constraints. Limited dock infrastructure makes it difficult for larger vessels to land their catch, weather can reduce supplies from small-scale fishers, and the ABF's capacity of about 1 ton per day limits the rate at which fish can be frozen for a cold-storage room with a capacity of about 10 tons.

Mr. Arfin also hoped that ice-production capacity could be increased during peak fishing seasons. He added:

> "*The KDMP management could also expand its market network to hotels or supermarkets in the city, so more of the supply from Sorue Jaya could be sold at a higher price*."

Mrs. Nurhayati described the needs of the women's fish-processing group:

> "*It would also help if more packaging equipment could be provided for the women, so our processed fish could be sold in modern souvenir shops*."

These accounts point to the need for adequate facility capacity, broader market connections, and equipment for processing. Constraints on asset utilization therefore involve not only physical infrastructure but also processing capacity, supply availability, administrative support, and market access.

Overall, KNMP Sorue Jaya has generated benefits that are perceived by fishers and women involved in fish processing. However, these benefits are not yet monitored through a structured set of socio-economic indicators. The managers do not routinely record the number of fishers served, catch volumes handled, user cost savings, additional income for women's groups, or facility utilization rates. Recording these indicators would enable a more systematic assessment of the public asset and support management evaluation.

4.2 Discussion

4.2.1 Basic Administrative Accountability and Information System Fragmentation

The findings show that basic accountability mechanisms are in place at the cold-storage facility. A management structure, basic transaction recording, operational staff, and supervisory functions exist. However, these arrangements are not yet supported by standard bookkeeping, traceable periodic reporting, maintenance logbooks, or indicator-based performance evaluation. This can be described as basic administrative accountability: mandates and activities exist, but the accountability system is not yet robust. Information-system fragmentation is also evident. Although digital tools have been introduced, application changes and reliance on individual staff mean that digitalization has not automatically strengthened accountability. Technology can support governance only when data definitions, input procedures, access rights, backups, reconciliations, and reporting outputs are established.

The findings of this study on individual-based record-keeping align with Septian et al. (2022) in emphasizing the importance of documented mechanisms for public resource management, despite the differences in the objectives and contexts. In the context of blue accounting, Failler et al. (2023) also highlight the challenges of integrating economic, social, and ecosystem data. The Sorue Jaya case demonstrates that while facility transactions and activities have been recorded to a limited extent, cost, energy, and environmental information have not been aggregated into a single, consistent system. This comparison supports the need for a minimum information system, rather than the conclusion that digital applications alone will strengthen accountability.

The practical implication is the need for minimum data, such as a cash book, fish in-out logs, ABF and cold storage usage logs, energy logs, maintenance logs, and periodic reports. The system can be simple,

but it must be consistent and exportable as applications change. Thus, digitization is positioned as a tool, not a substitute for accountability procedures.

4.2.2 Transparency of Operational and Financial Information

Operational information is more readily obtained through direct interaction, whereas financial information has not been published periodically. Managers' statements that they are waiting for application confirmation before reporting data indicate an expectation of reporting to the central government, but do not establish that vertical accountability has developed more strongly or quickly than horizontal transparency. At the same time, Mr. Arfin described clearer prices and marketing through the cooperative. This positive user experience does not demonstrate that complete financial information is documented or routinely disclosed. The case therefore distinguishes interpersonal transparency, experienced through direct transactions, from institutional transparency, which requires documented, periodic, and accessible disclosure.

From a stakeholder perspective, limited access to information can make it difficult for users to understand the pricing basis, cost structure, and sustainability risks of a facility. Moozanah et al. (2024) showed that perceptions of profit and sustainability in the fisheries industry can differ across stakeholder groups. At KNMP Sorue Jaya, this finding reinforces the rationale for providing accessible information.

Improving transparency does not have to start with complex reports. In the KNMP context, a simple information board or dashboard could display applicable service rates or prices, capacity and utilization, a summary of revenues and expenditures, subsidy status, maintenance schedules, and energy indicators. More detailed reports could be submitted to managers, supervisors, the government, and cooperative members.

4.2.3 True Operating Cost as a Critical Point of Sustainability

An electricity subsidy of approximately IDR 6 million per month provides short-term benefits by reducing the cooperative's burden, but it also leaves the facility's ability to operate independently untested. When electricity costs are paid by a third party and maintenance and labor costs are not fully collected, the apparent operational surplus may not reflect true cost recovery. In other words, the available cost information is insufficient to calculate true operating costs.

In this study, the term "true operating cost" is used descriptively rather than as a new accounting concept. It refers to the relevant costs required to maintain operations, including energy, labor, preventive and corrective maintenance, generator fuel, ice, administration, transportation, and identifiable environmental costs. Arif et al. (2021) showed that cold-storage design can be analyzed in terms of energy requirements and operating costs, highlighting the importance of linking capacity, energy, and output at KNMP. The KNMP could develop indicators such as kWh per kilogram of frozen fish, energy cost per kilogram, ABF utilization, cold-storage utilization, machine downtime, and maintenance costs per period. These indicators would shift decisions from nominal bills toward operational efficiency.

4.2.4 Blue Accounting: Economic, Social, Ecological and Energy

The findings indicate that blue accounting practices at KNMP Sorue Jaya remain at an early stage. The economic dimension is the most visible: purchase and sale transactions take place, electricity costs are known, and the business has market partners. The energy dimension remains at the awareness stage because managers know the electricity burden but do not measure consumption in kWh per unit of production. Social benefits are evident in the fish catch handled by the facility, the user-reported reduction in fishing-trip costs of approximately 20–30%, the perceived maintenance of fish quality, cooperative marketing and credit support, and women's fish-processing activities. The reported cost reduction is an informant estimate and has not been independently verified against operating records. The environmental dimension remains least developed because waste and refrigerants are not recorded

as management information; ecological data are therefore not yet part of routine facility-performance evaluation.

The results of this study are consistent with those of Yusuf et al. (2025), who found that blue accounting practices in fishing communities can emerge implicitly through economic, social, and environmental activities before specific accounts or disclosure systems are established. Ridwan and Ramli (2025) also showed that implementation in fisheries MSMEs requires education, stakeholder involvement, funding, and monitoring. More broadly, Mbiza et al. (2026) identified limitations in standards, regulations, technical capacity, and disclosure consistency as barriers to blue accounting adoption. Therefore, this study does not conclude that the KNMP has fully implemented blue accounting, as management already has initial awareness that can be developed towards blue accounting.

4.2.5 Public Asset Management Framework from a Blue Accounting Perspective

The preceding section presented empirical findings on record-keeping, reporting, information access, costs, energy, and operational constraints. Based on these findings, this study proposes a cold-storage management framework linking asset and operational records, economic costs, social and environmental indicators, periodic reporting, public disclosure, and monitoring and evaluation. The framework in Table 1 presents the researchers' recommendations; it has not been implemented or tested for effectiveness at KNMP Sorue Jaya.

Table 1. Proposed Minimum Framework for Cold Storage Management from a Blue Accounting Perspective

Stage	Component	Minimum Output	Governance Function
1. Asset data	Identity, status, condition, capacity	Asset register and legal status	Clarity of authority
2. Operational data	Fish in-out, ABF, user	Daily logs and utilization	Activity traceability
3. Economic costs	Electricity, labor, maintenance, generator, admin	Cost reports and true operating costs	Efficiency and cost recovery
4. Social indicators	Local fishermen served, user access, socio-economic benefits, local workforce	Summary of user benefits and access	Fairness of access and distribution of benefits
5. Energy and environmental indicators	Energy intensity (kWh/kg), fishery waste, refrigerants	Energy and environmental log	Blue accounting and eco-efficiency
6. Reporting	Financial, operational, environmental	Monthly/quarterly reports	Vertical accountability
7. Public disclosure	Rates/prices, capacity, performance summary	Regular boards/dashboards/forums	Horizontal transparency
8. Supervision and evaluation	Internal audit, performance indicators, follow-up	Minutes and action plan	Continuous improvement

Source: Authors' analysis

The proposed framework flow can be summarized as asset and operational data recording → economic, social, energy, and environmental measurement → integration of cost and benefit indicators → reporting and disclosure → monitoring and evaluation → decision-making → asset sustainability. Initially, managers do not need to conduct complex ecological valuations. The priority is to consistently record data that can be collected, such as kWh, fish volume, operating hours, waste, maintenance, labor, user access, and cash flow.

This framework is offered as a recommendation for linking accountability to government with performance summaries for fishers and cooperative members. Blue accounting serves as a connecting perspective: economic, social, energy, and environmental information can inform tariff decisions, energy efficiency, maintenance, technology investment, and stakeholder communication. Its implementation and effects still require testing by managers and further research.

The conceptual contribution of this research is to operationalize the blue accounting perspective on a single public asset at the community level, by linking economic and operational records with indicators of energy, social benefits, and ecological aspects. Its empirical contribution is an initial overview of management readiness: economic transactions have taken place, energy consumption has not been measured per unit of production, social benefits have not been monitored with indicators, and ecological information has not been integrated. Therefore, the proposed minimum framework is contextual and incremental.

5. Conclusion

This study concludes that the management of KNMP Sorue Jaya's cold storage has a foundation of administrative accountability, but its implementation is not yet fully integrated. Basic management structures and transaction recording are in place, but standard bookkeeping, periodic reporting, maintenance recording, monitoring documentation, and digital data integration still need improvement. Transparency also still relies on direct communication and internal forums. Information on facility conditions is relatively easier to obtain than information on costs, revenue, pricing policies, and asset performance.

From a blue accounting perspective, management still focuses mainly on economic activities, while users report social and economic benefits from access to ice, fish-quality maintenance, cooperative marketing and financing, and women's fish processing. One fisherman estimated that access to the KNMP ice factory reduced fishing-trip costs by approximately 20–30%; this estimate has not been verified against cost records. Energy consumption is not yet measured adequately, and environmental aspects are not included in routine accounting. These findings inform a proposed management framework that links asset and operational records, economic and ecological costs, social indicators, reporting, information disclosure, and oversight to strengthen asset accountability, transparency, and sustainability.

This study was conducted at one location and involved six purposively selected informants. The findings are specific to this case and are not intended to support statistical generalization beyond it; transferability should be assessed in light of contextual similarities. Daily electricity-consumption data in kWh were unavailable, limiting the analysis of energy use. Transparency from the user perspective also requires further investigation. The proposed blue accounting framework remains conceptual and has not been tested in practice.

KNMP/KDMP managers should maintain integrated records of asset use, operations, costs, revenue, fish stocks, energy, maintenance, and waste. Periodic reports should make this information accessible to fishers and relevant stakeholders. Future studies could broaden stakeholder coverage and, once consistent operating data are available, assess eco-efficiency, cost recovery, cost per kilogram of fish, and socio-economic benefits.

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