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# **Implementation of Environmental Cost Accounting during the COVID-19 Pandemic in Medical Waste Management**

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**Abstract**--This study aims to investigate the implementation of environmental cost accounting during the COVID-19 pandemic in relation to medical waste management at Wangaya General Hospital, Denpasar Indonesia using a qualitative approach through case studies. Data were collected through field observation, documentation, and interviews with 4 key informants. The results show that the Wangaya Hospital had implemented environmental cost accounting, but had not made an explicit disclosure of environmental costs. There is no environmental cost report, and the operational statement is only reported in the goods and services expense account. But in the other hand, Wangaya General Hospital already integrated economic, social, and environmental sustainability. The research results also show that Wangaya General Hospital is still able to manage its business in the midst of the COVID-19 pandemic.

**Keywords**--cost accounting, COVID-19, environmental, medical waste management.

## **Introduction**

The COVID-19 is an outbreak who later declared as a global pandemic ([Muhyiddin, 2020](#)). The COVID-19 outbreak was first detected in Wuhan City,

Hubei Province, China on December 1, 2019, and was designated a pandemic by the World Health Organization (WHO) on March 11, 2020 (BBC News Indonesia, 2020). The COVID-19 pandemic already going around for 10 months in Indonesia, but the number of infected patients is still growing. Based on data compiled by the government as of Friday (1/15/2021), there were 12,818 new cases of COVID-19 in the last 24 hours (the highest peak ever) (Iskana, 2021; CNN Indonesia, 2021; Sari, 2021). Along with the increasing number of COVID-19 patients, the use of medical supplies and hospital medical waste also increases. Health workers, patients, waste collection and disposal officers, and the surrounding environment have a high risk of being contaminated with medical waste (Ningrum & Tualeka, 2018). A good implementation of medical waste management during the COVID-19 is very important because medical waste is labeled as Hazardous and Toxic Waste.

The Wangaya General Hospital is one of the hospitals that provide medical treatment for COVID-19 patients in Denpasar, Bali, Indonesia. The occupancy rate for COVID-19 Patients at Wangaya Hospital on January 20, 2021, reached 92% (Fawaidi, 2021; Suadnyana, 2021; Raharyao, 2021). Wangaya Hospital is the only hospital in Bali Province that has an incinerator (medical waste management equipment). Every six months the medical waste management at Wangaya Hospital is being examined by the Proper Team (Company Performance Rating Program) consisting of the Bali Provincial Environment Agency and Denpasar City Environment Agency.

In the Republic of Indonesia Environmental Protection Law Number 32/2009, the person who pollutes and/or destroys the environment is obliged to carry out pollution prevention and recovery. Article 59 of the Environmental Protection Law states that Hazardous and Toxic Waste producers are obliged to manage the waste they produce. If a person or a waste-producing company conducts illegal dumping which results in the death of residents or material losses, then as regulated at Article 104 of the Environmental Protection Law threatens imprisonment and fines for perpetrators of environmental pollution (Kementerian LHK, 2020).

The overall total of Hazardous and Toxic Waste during the COVID-19 pandemic in Bali averaged 3.3 tons per day generated from public health service facilities. The Indonesian Institute for Nature and Environment Care suspects that medical waste in Bali is not being managed properly because the waste management site is located outside Bali (Mutriara, 2021). In contrast to this, during the COVID-19 pandemic, the Wangaya Hospital is still able to manage its waste independently despite a drastic surge in medical waste. This has an impact on reducing the risk of environmental pollution due to the distribution of COVID-19 infectious waste (Anggraini et al., 2017; ICHTIAKHIRI, 2015; Iswanto et al., 2016).

There have been many studies examining waste management for medical waste (Adiputra et al., 2019; Muliarta, 2016; Sisyani et al., 2020), and non-medical waste (Huang et al., 2019; Huseno, 2018; Moedjanarko & Frisko, 2013; Ridwan et al., 2019). However, most of the research focuses on the application of environmental accounting (Dewi, 2019; Patma et al., 2018; Prasetyo & Adi, 2020; Ratulangi et al., 2018; Sukirman-Suciati, 2019), and environmental management

accounting (Albelda, 2011; Christine et al., 2019; Dewi et al., 2017; Latan et al., 2018; Qian et al., 2018; Setthasakko, 2010; Solovida & Latan, 2017). Environmental cost accounting studies can be carried out with a positivistic approach (Al-Mawali, 2021; Asjuwita & Agustin, 2020; Okafor, 2018; Zainab & Burhany, 2020), as well as non-positivistic approaches (Franciska et al., 2019; Hussein & Elsahookie, 2020; Setyaningtyas & Andono, 2013). Environmental cost accounting studies are mostly conducted on manufacturing companies (Anis et al., 2020; Franciska et al., 2019; Setyaningtyas & Andono, 2013), agriculture (Hussein & Elsahookie, 2020; Sibarani et al., 2019), oil and gas (Araoye et al., 2018; Okafor, 2018), and mining sectoral (Wang et al., 2018; Zeng et al., 2019), because they are considered to have the most impact on the environment. Meanwhile, research in the context of the service industry is still limited, especially in developing countries (Sisdyani et al., 2020).

Based on previous research, research that examines the implementation of environmental cost accounting in the service sector, especially health services, has not been widely carried out. Compared to other methods, environmental cost accounting with the case study method is capable of providing a specific, convoluted, and exploratory in-depth understanding of the real situation of the object of research (Pratiwi & Sentanu, 2019).

The importance of environmental responsibility is a new paradigm in development. Since it was first formulated in the 1980s, sustainable development has become a development concept used in many countries. Today, sustainable development has become a fundamental strategy to guide the world's social and economic transformation (Shi et al., 2019). According to Taylor et al. (2016), The three main issues of sustainable development are economic growth, environmental protection and social equality. The highlight of sustainable development is to meet the needs of the present generation without compromising the needs of future generations, by fulfilling three pillars, namely economic, social and environmental (Burhany, 2012; Putra, 2015; Ferawati, 2018; Suardi, 2018).

Environmental cost accounting was developed to manage environmental costs and managing environmental performance (Setyaningtyas & Andono, 2013; Taygashinova & Akhmetova, 2019). Hansen & Mowen (2009), classify environmental costs by developing an environmental quality cost model adopted from the quality cost model in total quality management. Under the quality cost approach, environmental costs are grouped into prevention costs, detection costs, internal failure costs, and external failure costs (Jaya, 2017). The success of a hospital in managing waste can be supported by the role of environmental cost accounting as a form of implementing the concept of sustainable development (Hasiara et al., 2020; Anam & Ramlah, 2020), as mandated in Indonesia Environmental Protection and Management Law (Otoritas Jasa Keuangan, 2016).

## **Literature Review**

### **Sustainable development**

Indonesia Environmental Protection and Management Law states that sustainable development is a conscious and planned effort that integrates environmental,

social, and economic aspects into development strategies to ensure environmental integrity. The essence of sustainable development is to meet the needs of the present generation without compromising the needs of future generations, by fulfilling economic growth, environmental protection, and social equality (Tirkolaee et al., 2021; Kargar et al., 2020).

### **Environmental cost accounting**

The application of environmental accounting can help managers to track and reduce environmental costs with a better understanding of more accurate product performance and pricing with overall support for environmental management systems. Meanwhile, environmental cost accounting has principles that provide information about a framework containing environmental impact costs and management strategies to improve environmental performance, productivity, and company profitability (Hussein & Elsahookie, 2020). Hansen & Mowen (2009), stated that environmental costs constitute a significant percentage of total operating costs. Through effective management, many of these costs can be reduced or eliminated. Environmental costs can be classified into four categories:

- Environmental prevention costs are costs for activities carried out to prevent the production of waste that can cause environmental damage.
- Environmental detection costs, described as costs for activities carried out to determine whether products, processes, and other activities have met applicable environmental standards or not.
- Environmental internal failure costs, described as costs for activities carried out because waste is produced, but is not disposed of to the outside environment. Internal failure costs are incurred to remove and treat waste during production.
- Environmental external failure costs, described as costs for activities carried out after removing waste.

### **Hospital medical waste**

Hospital waste is divided into medical waste and non-medical waste. Hospital medical waste is categorized as hazardous and toxic waste with code A337-1. Article 59 of the Environmental Protection and Management Law states that people who produce Hazardous and Toxic Waste is obliged to manage the waste they produce. Hazardous and Toxic Waste are unstable, reactive, explosive, flammable, and toxic.

### **Method**

This research was conducted after obtaining permission from the President Director of Wangaya General Hospital, by considering the ethical principles of research (informed consent, anonymity, and confidentiality). An informed consent form was given to the subjects before the interview. Confidentiality of identity and anonymity is guaranteed by giving each informant a code. The code of informants in this study were P1 (Accounting and Verification Subdivision), P2 (Facilities Support), P3 (Program Development and Publication), and P4 (Sanitarian).

Data and information were collected through observation, interviews, and documentation. Observations were carried out for 5 months by observing the management of medical waste at Wangaya General Hospital. Interviews were conducted face-to-face with informants. The interview technique was carried out by in-depth and semi-structured interviews. The study of documentation was by tracing and analyzing public documents in the form of Indonesia Environmental Protection and Management Law, Operational Procedures for Medical Waste Management at Wangaya Hospital, and Financial Reports at Wangaya Hospital Denpasar City. The data and information then being analyzed using three steps, such as 1) define and design, 2) prepare, collage, and analyze, and 3) analyze and conclude.

## **Results and Discussion**

### **Implementation of environmental cost accounting**

There was an increase in medical waste by 59%, from 34,474 kg in 2019 to 48,926 kg in 2020. This increase was caused by the emergence of COVID-19 cases. The amount of this increase in waste should be directly proportional to the increase in the number of environmental costs. Based on the 2020 financial report, no environmental cost accounts were found either in the operational reports or notes to the financial statements. Some activities that include environmental costs are still combined with other costs, in short, environmental costs do not have a separate account. The hospital has not specifically presented environmental cost reports, environmental costs in operational reports are only reported in the goods and services expense account. After further identification, there are expense accounts that have environmental cost activities, namely office consumables expenses in the fuel oil/gas (incinerator and generator) sub-accounts; office service expenses in the sub-accounts of emission test loads and transportation costs for Hazardous and Toxic Waste; maintenance expenses on the sub-account for office equipment maintenance expenses; and training course load and technical guidance (Peng et al., 2020; Ilyas et al., 2020; Hoang, 2019).

The hospital has not presented specifically the environmental cost report, and the operational report is only reported in the goods and services expense account. Some records are also still combined with other activities from other fields. Only the load cost for Hazardous and Toxic Waste has a separate record. The recording of the fuel oil/gas cost and the incinerator emission test cost are still combined with the generator cost. The recording of the incinerator maintenance expense is still combined with other office equipment. As well as recording the cost of short courses & training related to the environment are also still combined with other fields.

Based on Informant P1, the accounting department has not specifically presented the environmental cost report. Environmental costs in the operational report are only reported in the goods and services expense account. In addition, in the notes to the financial statements, the hospital only details what subaccounts are included in the goods and services expense account, not explaining in detail the environmental costs contained therein. Hazardous and Toxic Waste costs have decreased because in 2020 there were several unrecorded costs due to re-

submission of financial statements or revisions. Regarding efforts to reduce environmental costs, technically it is more inclined to the sanitation department. Meanwhile, from the accounting department, it tends to be only in terms of budgeting, where the budget can be controlled so that the costs do not soar much (Muliarta, 2016; Nangbe, 2018; Widana et al., 2021).

Informant P2 stated that there are efforts to minimize medical waste in hospitals that transmit COVID-19. Informant P3 and Informant P4 stated that the hospital already had a special Standard Operating Procedure in managing COVID-19 waste. All aspects of waste from medical waste management activities are also routine, such as gas emission tests. According to Informant P1, during the COVID-19 pandemic, Wangaya Hospital was able to control its budgeting. This was also confirmed by a statement from the Informant P3, where the budget could be reorganized and focused on expenses for COVID-19. Wangaya Hospital is able to carry out its operations by allocating costs to really urgent aspects without having to ignore other aspects. In addition, from the social aspect, the hospital still pays attention to the welfare of its employees, seen from the existence of courses or training to support the performance of the employees. Moreover, from the environmental aspect, the hospital tries to prevent pollution, either by managing waste or conducting tests related to environmental pollution.

#### **Medical waste management prevention cost**

Informant P3 and Informant P4 stated that Wangaya Hospital is the only government hospital in Bali that has an operational permit for the management of Hazardous and Toxic Waste using an incinerator, obtained in 2020 from the Ministry of Environment and Forestry of the Republic of Indonesia. Wangaya Hospital already has complete procedures including the latest procedures adopted from the regulations of the Ministry of Environment and Forestry of the Republic of Indonesia. In addition, during the COVID-19 pandemic, hospitals have also designed special procedures to manage COVID-19 waste. Then, to support environmentally friendly medical waste management, it is necessary to have courses or training for employees. Informant P3 and Informant P4 stated that Wangaya Hospital had included sanitarian employees in training related to medical waste management. During the COVID-19 pandemic, this training activity is only carried out virtually, which can save costs allocated to training because there is no need to pay for accommodation to the training location. The existence of medical waste management tools in the form of incinerators and COVID-19 waste management procedures to support the creation of an environmentally friendly management process certainly contributes to realizing the concept of sustainable development, especially in the environmental sustainability aspect. In addition, involving employees in training activities is also a form of applying aspects of social sustainability (Mironchuk et al., 2021; Artemenko et al., 2021).

#### **Medical waste management detection cost**

The activities related to the detection costs above show that Wangaya Hospital has implemented the concept of sustainable development, especially in the aspect of environmental sustainability. Starting from the existence of internal

supervision in the form of incinerator monitoring by special officers and daily maintenance by technicians, as well as external supervision in the form of periodic monitoring by the relevant government authority. In addition, there is also an emission test to detect whether there is environmental pollution or not due to the burning of medical waste. All of these activities are very important to ensure that all processes of waste management activities at Wangaya Hospital have met environmental standards.

### **Medical waste management internal failure costs**

In addition to the increasing volume of medical waste, the hospital is also experiencing financial problems to manage waste. To overcome this, according to Informant P3, the Wangaya Hospital will rearrange the budget, which will focus on the costs of handling COVID-19, especially on the aspect of waste management. In addition, there are also obstacles due to long queues for third parties who assist in the transportation of waste as revealed by Informant P4. To overcome this, the hospital is designing two MOUs with similar companies.

Resetting the budget by focusing on COVID-19 funding is a form of embodiment of economic sustainability. This shows that the Wangaya General Hospital's management was trying to maintain their business in this very unexpected situation. The distribution of work shifts for incinerators is also a manifestation of the social sustainability aspect because it proves that the Wangaya Hospital pays attention to the work safety aspect of its employees.

Meanwhile, the environmental aspect of sustainability suggests that all communities must adapt to the emerging realities related to ecosystem management. Due to the COVID-19 pandemic, the generation of medical waste has also increased by up to 50%. Wangaya Hospital has responded quickly both when the production of medical waste is within normal limits or when there is an overload. This shows that they still pay attention to environmental aspects by managing as much as possible even in very urgent situations. Wangaya Hospital, specifically on the aspect of internal failure costs, has implemented the three pillars of sustainable development ([Govindan et al., 2021](#); [Zamparas et al., 2019](#)).

### **Medical waste management external failure costs**

Releasing waste into the environment can certainly cause pollution which greatly impacts the world's ecosystems. According to Informant P3, Informant P4, and Informant P2, there has never been any environmental pollution in Wangaya Hospital, because they have handled all medical waste following the standard procedures. Based on the results of the field review, all aspects of the disposal of medical waste such as air and water have been routinely tested. Informant P2 also stated that there have been no complaints from the neighboring community regarding the management of medical waste. Informant P2 revealed that Wangaya Hospital did not provide legal guarantees to the surrounding community-related to environmental pollution.

The environmental sustainability aspect is about the natural environment and how to keep the environment productive, and resilient to support human life. The

realization of this aspect can be seen from various environmental activities, such as handling waste following procedures as well as by monitoring and testing gas emissions. This activity is a form of effort not to cause environmental damage and can provide a sense of security for the community around the hospital as evidenced by the absence of complaints related to the medical waste management process. Based on the overall explanation above, it proves that Wangaya Hospital in particular has implemented environmental sustainability aspects with no external failure costs for medical waste management.

### **Research implication**

The development of implications related to the implementation of environmental cost accounting to manage medical waste during the COVID-19 pandemic at the Wangaya Hospital were the case boundaries in this study refer to the classification of environmental costs by Hansen and Mowen (2007), which is then linked to the concept of sustainable development. With the quality cost approach, environmental costs are grouped into prevention costs, detection costs, internal failure costs, and external failure costs. Theoretical contributions are related to providing useful ideas and contributions in accounting science regarding the concept of sustainable development in implementing environmental cost accounting in service companies, especially hospitals. This research can be a reference and contribution for management and stakeholders, especially hospitals in managing medical waste. As one of the largest waste-producing sectors, hospitals must be able to manage their waste as well as possible, especially when there is an increase in the volume of medical waste due to the impact of the COVID-19 pandemic (Windfeld & Brooks, 2015; De Vito & Gomez, 2020).

### **Research limitations**

The study was conducted during the COVID-19 pandemic, so the duration of the interview and the number of informants were limited. Then the process of description, understanding, meaning, and reconstruction is subjective so that the results of the research cannot be used to make generalizations.

### **Conclusion**

Based on research that has been conducted regarding the implementation of environmental cost accounting to manage medical waste during the COVID-19 pandemic, it can be concluded that the Wangaya Hospital has implemented environmental cost accounting. The concept of environmental cost accounting in this study refers to the classification of environmental costs by Hansen and Mowen (prevention costs, detection costs, internal failure costs, and external failure costs). There are several cost accounts associated with the four categories of environmental costs, which shows that these activities are the embodiment of the concept of sustainable development. The key to this concept is the continuous implementation of economic, social, and environmental sustainability. Wangaya Hospital can improve recording and disclosure by creating a special account for environmental costs and environmental cost reports. Wangaya Hospital should re-arrange its budget plan so that the budget for medical waste management can be enlarged.

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