THE IMPACT OF INTERNET OF THINGS (IoT) ON INTEGRATED SUSTAINABILITY ACCOUNTING MONITORING AND REPORTING

Cherilyn Harjanto[1], Clarissa[2], Nadjwa Fazira Jullyeta J[3]

School of Information System Bina Nusantara University, Jakarta, Indonesia[1*23]

Email: cherilyn.harjanto@binus.ac.id[1], clarissa005@binus.ac.id[2], nadjwa.jasmine@binus.ac.id[3]

Keywords	Abstrak
Internet of Things (IoT), Sustainability Accounting, Integrated Monitoring and Reporting	*This study aims to analyze the role of IoT in improving the accuracy and efficiency of monitoring, identifying the impact of IoT on transparency and accountability of sustainability reporting, exploring the potential of IoT in supporting real-time data-based decision-making, and evaluating the challenges and opportunities of implementing IoT in integrated sustainability accounting. This study adopts a quantitative approach with a survey method to analyze the impact of the Internet of Things (IoT) on integrated sustainability accounting monitoring and reporting. The research uses multiple linear regression for data analysis to identify significant relationships between IoT and sustainability accounting practices. To ensure the accuracy and reliability of variable measurement, the validity and reliability of the measurement instrument were rigorously tested. The findings reveal that IoT significantly enhances accuracy, efficiency, transparency, and accountability in integrated sustainability accounting monitoring and reporting, as well as supports real-time, data-driven decision-making. All hypotheses (H1 to H6) were found to be significant, confirming the positive effects of IoT on various aspects of sustainability reporting and operational effectiveness. The study is limited to examining the application of IoT in integrated sustainability accounting monitoring and reporting, focusing on the role of sensor technology and connected devices. It excludes industrial-scale applications and broader aspects of IoT-ESG integration, constrained by the resources and time available for the research.*

1. INTRODUCTION

Sustainable Technology has gained significant attention in recent years, emerging as a global issue closely tied to environmental awareness. This technology is designed and implemented to reduce the negative environmental impacts associated with the industrial sector (Sadollah et al., 2020). From an environmental perspective, companies must assess the effects of their operations on surrounding ecosystems, considering whether their business practices hinder the development of a healthy environment.

Socially, companies should prioritize the well-being of their employees, ensuring they provide adequate protection and support in line with the principles of Sustainable Technology. Economically, businesses must strike a balance between achieving financial goals and maintaining the sustainability of social and environmental conditions throughout their operations.

In Indonesia, the implementation of sustainable technology has been supported by strict regulations, which encourage companies to enhance transparency regarding their business impacts. By adhering to sustainability provisions, companies aim to create a positive working environment and achieve sustainability goals, such as reaching net zero by 2050 (Indonesia Go, 2021). In the financial sector, for example, while some companies have successfully implemented sustainable technology, many others are still struggling, either starting from scratch or transitioning from old systems to new ones. Major challenges include high implementation costs and inadequate technological infrastructure, which hinder business processes. Additionally, issues such as reporting integration—particularly in finance—remain a significant obstacle. Human error often occurs when reporting systems are not properly integrated, even when sustainable technology is fully implemented.

This is where the Internet of Things (IoT) becomes a solution. IoT is a key entity in an ecosystem that supports data and service interaction, allowing for the collection, processing, and output of information as per the desired results (Sorri et al., 2022). Within companies, IoT enables devices to exchange information and monitor assets, activities, and operations more efficiently. Its capability to track processes in real-time not only increases data accuracy but also reduces the burden of manual monitoring. Additionally, IoT contributes to better decision-making by providing early warning signals if deviations from the planned flow occur. In accounting, IoT helps streamline report processing, ensuring timely completion. It also enhances human resource performance by fostering innovation and work optimization, significantly improving overall productivity.

The objectives of the study are as follows:
A. To analyze the role of IoT in improving the accuracy and efficiency of monitoring in integrated sustainability accounting.
B. To identify the impact of using IoT technology on transparency and accountability of sustainability reporting.

C. To explore the potential of IoT in depth to determine its support in real-time data-based decision-making for companies implementing sustainability accounting.

D. To evaluate the challenges and opportunities that arise from the implementation of IoT in the context of integrated sustainability accounting.

The problem formulation of the research is:

A. How is the role of IoT in improving accuracy and efficiency in Integrated Sustainability Accounting Monitoring and Reporting?

B. How does IoT support real-time decision-making in the context of sustainability accounting?

C. What is the impact of using IoT on the transparency and accountability of sustainability accounting reporting in companies that implement it?

2. LITERATURE REVIEW
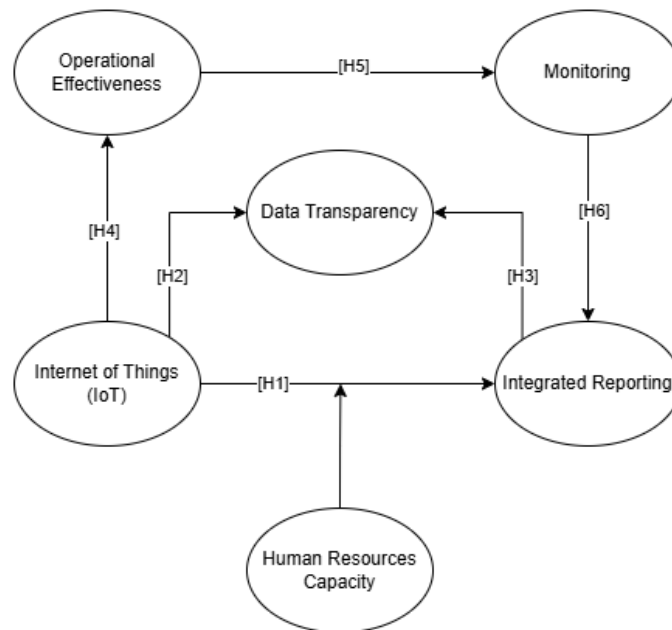
Figure 1. Research Model

A. Internet of Things (IoT)

Internet of Things is a concept where physical devices are connected to the Internet and can communicate with each other to collect, transmit, and analyze data without requiring direct human intervention. These IoT devices include various objects used daily, such as sensors, smart home devices, autonomous vehicles, and medical devices connected to the internet network (Sari, 2024). The hypothesis is as follows:

H1: Internet of Things (IoT) has a significant influence on Integrated Reporting (IR).

H2: Internet of Things (IoT) has a significant positive influence on Data Transparency (DT).

H4: Internet of Things (IoT) has a significant positive influence on Operational Effectiveness (OE).

B.   Data Transparency

Data transparency refers to the degree of openness, clarity, and accessibility of information provided by an organization or system to stakeholders, including employees, customers, business partners, and the public. In the context of management and technology, data transparency is an essential element that supports better decision-making, accountability, and better relationships between organizations and stakeholders. (Ricky & Aziz, 2022). The hypothesis is as follows:

H3: Data Transparency (DT) has a significant positive effect on Integrated Reporting (IR).

C.   Operational Effectiveness

Operational effectiveness is the extent to which an organization or process achieves its stated goals by optimally using existing resources. In other words, operational effectiveness measures how successful an organization is in producing the desired output with the given input. (Heizer & Reinder, 2019). The hypothesis is as follows:

H5: Operational Effectiveness (OE) has a significant positive effect on Monitoring (MO).

D.   Monitoring

Monitoring is a systematic and ongoing process of data collection aimed at tracking the progress of a program, project, or activity. The collected data is then analyzed and compared against predetermined objectives and performance indicators. The primary purpose of monitoring is to ensure that activities are proceeding according to plan, while also identifying issues or deviations early enough to implement corrective actions (Sulasno & Saleh, 2020). The hypothesis is as follows:

H6: Monitoring (MO) has a significant positive effect on Integrated Reporting (IR).

E.   Integrated Reporting

Integrated Reporting is an approach that combines both financial and non-financial information, offering a comprehensive view of an organization's performance, strategy, governance, and sustainability impact. The primary goal of this reporting is to provide stakeholders with a broader understanding of how the organization generates value over the short, medium, and long term within environmental, social, and economic contexts (Yurizka & Murwaningsari, 2024).

3.   RESEARCH METHODOLOGY

The study employs a quantitative approach to assess the impact of IoT implementation on integrated sustainability accounting monitoring and reporting among companies listed on the Indonesia Stock Exchange. An explanatory survey research design was chosen, as it allows for the exploration of causal relationships between variables through the collection of numerical data and statistical analysis. This method was selected for its ability to objectively test hypotheses and yield generalizable results.

The study focuses on companies that have integrated IoT into their operations, particularly those engaged in sustainability reporting. A purposive sampling technique was employed to select the sample, focusing on organizations that utilize IoT for sustainability data collection and adhere to sustainability or integrated reporting practices. The final sample size was 153 respondents, calculated using the Slovin formula with a 5% margin of error, ensuring statistically valid results and representative insights from the target population.

Data were collected using a structured questionnaire based on the key research variables, designed to assess the level of IoT adoption, the effectiveness of sustainability accounting monitoring, and the quality of integrated sustainability accounting reporting. Additionally, moderator variables such as trust in technology and organizational capabilities, along with demographic control factors, were included in the survey. The 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) was employed to allow quantitative measurement of respondents' perceptions, enhancing the robustness of the data.

Data analysis was conducted using statistical software such as SPSS and Microsoft Excel. The analysis process began with a validity test using Pearson correlation, where a result above 0.7 was required to confirm the consistency and accuracy of the

questionnaire. Following the validity test, multiple regression analysis was applied to examine the relationships between the variables and identify any significant patterns or trends.

This research methodology is designed to provide strong empirical evidence regarding the influence of IoT on integrated sustainability accounting monitoring and reporting. The findings from this study will contribute valuable insights into the role of IoT in enhancing corporate sustainability practices, offering actionable recommendations to improve transparency and accountability in corporate reporting.

4. RESULTS & DISCUSSIONS

This section of the paper presents the findings from the statistical analysis conducted to test the study's hypotheses (H1 to H6). The results provide insight into the relationships between Internet of Things (IoT), Data Transparency (DT), Operational Effectiveness (OE), Monitoring (MO), and Integrated Reporting (IR). Each hypothesis is evaluated equally for its significance in the study as summarized below in Table 1.

Table 1. Summary of Multiple Regression Analysis

Hypothesis	IV	DV	B (Unstandardized Coefficient)	Beta (Standardized Coefficient)	Std. Error	t-value	p-value	R^2 (Model Fit)
H1	IoT	IR	0.770	0.839	0.041	18.943	<0.001	0.704
H2	IoT	DT	0.801	0.865	0.038	21.160	<0.001	0.748
H3	DT	IR	0.871	0.879	0.038	22.669	<0.001	0.773
H4	IoT	OE	0.698	0.810	0.041	16.947	<0.001	0.655
H5	OE	MO	0.943	0.850	0.047	19.851	<0.0	0.723

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H6	MO	IR	0.831	0.857	0.041	20.423	<0.0 01	0.734

The data processing results, as shown in the table, indicate that all hypotheses (H1 to H6) are statistically significant, with p-values below 0.001. Notably, H3 demonstrates the strongest correlation, with a beta coefficient of 0.879, highlighting that DT has the most significant influence on IR. Additionally, the R^2 value for H3 stands at 0.773, signifying that the H3 model accounts for 77.3% of the variability in IR based on DT.

H1: IoT **significantly affects Integrated Reporting (IR)**

The study's results reveal a strong relationship between IoT and integrated reporting, confirming that IoT enables more efficient and accurate data collection. By allowing for real-time monitoring, IoT reduces the risk of delays and human errors in reporting, thereby ensuring more timely and accurate information for decision-makers. This improvement in reporting helps organizations offer a clearer picture of their sustainability efforts, financial status, and operational performance, which is essential for both internal and external stakeholders. Consequently, the positive impact of IoT on integrated reporting enhances transparency and facilitates a more holistic approach to sustainability and governance.

H2: IoT has a significant positive influence on Data Transparency (DT)

The study underscores the pivotal role of IoT in fostering data transparency within organizations. As IoT enables the collection of vast amounts of real-time data, it allows organizations to provide stakeholders with a clearer, more detailed picture of their sustainability activities and outcomes. By automating data gathering and minimizing human intervention, IoT ensures the accuracy and reliability of the data presented. This increase in transparency contributes to a more accountable organization, where data is easily accessible to relevant stakeholders, promoting trust and improving decision-making.

H3: Data Transparency (DT) significantly affects Integrated Reporting (IR)

The findings support the idea that data transparency is crucial for high-quality integrated reporting. When data is accessible, clear, and reliable, organizations can more effectively communicate their performance to stakeholders through integrated

reports. Transparent data allows for better decision-making and strategic planning by providing a truthful and comprehensive account of an organization's environmental, social, and governance impacts. Moreover, the study emphasizes that the transparency provided by IoT-driven systems fosters greater stakeholder confidence, leading to more meaningful and trustworthy reports.

H4: IoT positively influences Operational Effectiveness (OE)

Operational effectiveness benefits significantly from IoT integration, as the technology facilitates automation, real-time monitoring, and predictive analytics. IoT helps organizations streamline operations by minimizing human intervention and errors, thereby optimizing resource utilization. Additionally, IoT systems can identify inefficiencies or deviations from planned operations, allowing managers to take corrective actions immediately. This not only improves productivity but also enhances the organization's ability to meet sustainability goals by ensuring resources are used more efficiently.

H5: Operational Effectiveness (OE) significantly affects Monitoring (MO)

The study finds that operational effectiveness directly influences monitoring capabilities. As operational processes become more efficient through IoT-enabled automation, monitoring systems become more robust and accurate. Real-time data allows organizations to track the progress of activities against predetermined objectives, ensuring alignment with sustainability goals. Furthermore, IoT improves monitoring by providing continuous feedback, allowing managers to make informed decisions promptly and adjust strategies when necessary.

H6: Monitoring (MO) significantly affects Integrated Reporting (IR)

Effective monitoring systems, supported by IoT, have a profound impact on integrated reporting. By ensuring that all relevant data is tracked and analyzed in real time, monitoring improves the overall quality of reports. IoT allows organizations to capture comprehensive data, offering a more accurate and up-to-date representation of their sustainability efforts. This comprehensive monitoring contributes to better management decisions, enhances reporting credibility, and strengthens the organization's position with stakeholders.

5. CONCLUSION

The conclusion of this entire study confirms that the implementation of the Internet of Things (IoT) can have a significant positive impact on its respective places

on operational efficiency, digital transformation, and information management. This has been proven by the processing of data and statements in the literature discussing IoT, therefore it is highly recommended for organizations out there that have not yet used IoT to immediately implement IoT in their organizations to achieve competitive advantage between markets and also improve decision making.

However, there are some limitations in making this paper, namely the data used is only limited to the collection of respondent-based questionnaire results, so that it can allow for subjective responses and will affect the existing results. Then the research that was made was cross-sectional so that researchers could not identify the impacts generated by IoT on organizations in the long term. And finally, this paper does not explore the differences in sectors used in the questionnaire, so there is a possibility that the sectors chosen by respondents cannot provide more in-depth information.

Future research could address these limitations by expanding the focus to include large-scale industrial applications of IoT, examining how the technology can enhance not only sustainability reporting but also overall corporate governance and accountability in diverse sectors. Further studies could explore the integration of IoT with advanced ESG metrics to evaluate its impact on comprehensive sustainability strategies. Another potential area for research is the examination of cost-benefit dynamics for small and medium enterprises (SMEs) adopting IoT, as well as the scalability of IoT solutions in different organizational contexts. Furthermore, researchers could investigate the security and privacy challenges associated with IoT in sustainability accounting, particularly concerning data protection, which is critical for maintaining trust in transparent and accountable reporting. Finally, longitudinal studies could explore the long-term impact of IoT adoption on sustainability performance and its ability to help organizations meet evolving regulatory and environmental standards.

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