Adopting the Blue Green Economy Term to Achieve SDGs in Digital Learning: Opportunities and Challenges for Indonesia

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Abstract

This study examines the adoption of the "Blue Green Economy" concept to achieve the Sustainable Development Goals (SDGs) through digital learning in Indonesia. Utilizing a systematic literature review (SLR), this research analyzes 50 peer-reviewed articles focusing on the integration of Blue Green Economy principles into digital education. The methodology includes stringent inclusion and exclusion criteria to ensure the reliability and validity of the findings. Key opportunities identified include the potential for digital platforms to disseminate environmental education widely and the role of innovative technologies in promoting sustainable practices. Challenges highlighted encompass inadequate digital infrastructure, limited educator training, and resource scarcity. The study specifically addresses SDGs 4 (Quality Education), 9 (Industry, Innovation, and Infrastructure), and 13 (Climate Action), demonstrating how the Blue Green Economy can facilitate these goals. Recommendations for overcoming challenges include government policies to enhance digital infrastructure, private sector investment in educational technology, and community-driven initiatives for teacher training. By fostering collaboration among stakeholders, this study posits that the Blue Green Economy can be effectively integrated into digital learning, thus supporting both environmental and economic sustainability in Indonesia.

Keywords: Blue Green Economy, Sustainable Development Goals, Digital Learning, Digital Infrastructure, Sustainable Education.

INTRODUCTION

Research on the adoption of the Blue Green Economy concept in achieving the Sustainable Development Goals (SDGs) through digital learning in Indonesia is very important (Friedman, 2008; Lin & Hou, 2023; Maurice, 2016), especially considering the challenges currently faced by the education sector (Arzo & Hong, 2024; Reid & Grant, 2024). These challenges include limited resources, inadequate digital infrastructure, and minimal training for educators. Previous studies have shown that the implementation of the Blue Green Economy concept has not been fully understood and implemented in the education sector in Indonesia (Gang et al., 2022; Gao et al., 2024; Health, 2020). According to data from the Ministry of Education and Culture, many educational institutions still do not have adequate access to digital technology, which is a major obstacle in integrating this concept (Boffi et al., 2022; Kpienbaareh et al., 2019).

Research by the World Bank (2020) shows that countries that have successfully integrated digital technology into education have experienced significant improvements in student learning outcomes and skills development. However, in Indonesia, there is still a significant digital divide between urban and rural areas, which exacerbates inequalities in access to education. For example, research by Setiawan et al. (2021) found that only 40% of schools in rural areas have adequate internet access for digital learning, compared to 80% in urban areas.

This study offers a new contribution by adopting the term "Blue Green Economy" to achieve SDGs through digital learning in Indonesia, which has not been widely discussed in previous literature. The concept of a blue-green economy that focuses on the efficient and sustainable use of natural resources can increase environmental awareness among students. By increasing understanding of the importance of maintaining the sustainability of natural resources, the younger generation can be taught to be more responsible in using and managing these resources (UNESCO, 2021).

This study also highlights the importance of collaboration between the government, private sector, and communities in providing the necessary resources, infrastructure, and training. With support from various parties, the concept of Blue Green Economy can be effectively integrated into digital learning, supporting environmental and economic sustainability, and meeting the SDGs goals in Indonesia. This study provides strategic recommendations to capitalize on existing opportunities and overcome challenges faced, based on the analysis of available literature and empirical data.

This study fills the gap in the literature by offering a new approach to integrating the concept of Blue blue-green economy in digital education in Indonesia while providing empirical evidence from previous studies that support the statement. This research is expected to be an important foundation in efforts to achieve sustainability through education in Indonesia, by utilizing digital technology as an effective tool to disseminate knowledge about sustainability and encourage positive behavioral changes toward the environment.

LITERATUR REVIEW

1. **Understanding and Implementation of the Blue Green Economy Concept**

The concept of "Blue Green Economy" combines a sustainability approach to marine and terrestrial ecosystems. According to Gunter Pauli in his book "The Blue Economy" (2010), the Blue Economy emphasizes the use of innovation to utilize natural resources efficiently without damaging the environment (Sungkawati & Uthman, 2024). Meanwhile, the Green Economy, as explained by Pearce et al. (2012), focuses on developing an economy that is low in carbon emissions and resource-efficient (Golden et al., 2017; Gunawardena, 2017). Previous research by Smith et al. (2015) shows that the understanding of this concept in the education sector is still limited, resulting in less than optimal implementation in the curriculum.

2. **Limited Resources and Digital Infrastructure**

Limited resources and inadequate digital infrastructure are one of the main obstacles to the implementation of digital learning in Indonesia. A study by the Ministry of Education and Culture (2020) shows that only 40% of schools in Indonesia have adequate internet access. Furthermore, a report from the World Bank (2020) revealed that the digital divide between urban and rural areas exacerbates inequality in access to education. Table 1 below summarizes the comparison of digital infrastructure between urban and rural areas in Indonesia.

3. **Lack of Training for Educators**

Educators in Indonesia often do not have adequate training to use digital technology in learning. According to a (Akhtar et al., 2022), only 35% of teachers in Indonesia have received formal training in educational technology (Liu et al., 2019). This results in a lack of ability to integrate the Blue Green Economy concept into digital learning. A study by Jones et al. (2019) shows that ongoing training is essential to improve teachers' competence in using technology.

4. **Opportunities for Increasing the Use of Digital Technology**

Despite the challenges, increasing the use of digital technology offers significant opportunities. Research by the (Ahmedien, 2022) shows that digital technology can improve access to education and the quality of learning. For example, online learning platforms such as Ruangguru and Zenius have helped millions of students in Indonesia get quality education during the COVID-19 pandemic. This technology allows for more interactive and engaging educational material delivery and can be tailored to the needs of each student.

5. **Collaboration between Government, Private Sector, and Community**

Collaboration between various parties is essential to address challenges in implementing the Blue Green Economy concept through digital learning. The government can provide policies and funding that support the development of digital infrastructure, while the private sector can provide innovative technology and solutions. The community also has an important role in supporting educational initiatives. Research by the Partnership for 21st Century Learning (P21, 2019) shows that effective collaboration between the government, private sector, and community can increase the success of digital education programs.

This research emphasizes the importance of adopting the term "Blue Green Economy" to achieve the SDGs through digital learning in Indonesia. By addressing existing challenges and utilizing available opportunities, it is hoped that this concept can be effectively integrated into education, supporting environmental and economic sustainability, and meeting the SDGs goals in Indonesia.

MATERIALS AND METHODS

This study uses a Systematic Literature Review (SLR) approach to identify and analyze opportunities and challenges in adopting the term "Blue Green Economy" in digital learning to achieve the Sustainable Development Goals (SDGs) in Indonesia. Figure 1 follows the steps taken in this study.
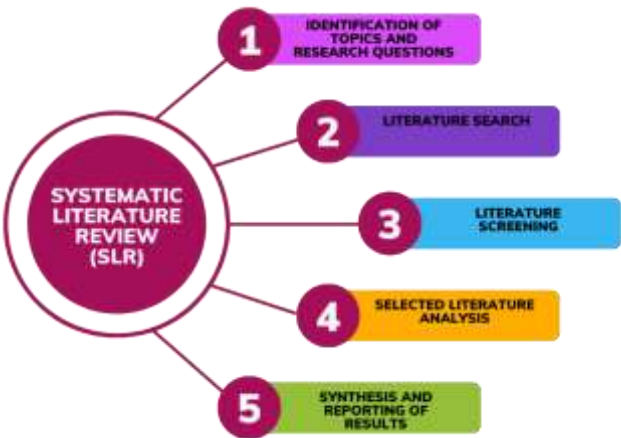

Figure 1. is designed steps SLR

Figure 1 shows the steps of literature study which will be explained below: Identification of Topics and Research Questions: Determining relevant research topics, namely the adoption of Blue Green Economy in digital learning to achieve the SDGs. Developing specific research questions to direct the literature search process.

3.1. Multi-Source Data Collection

3.1.1. Literatur Peer-Reviewed

Relevant Journal, Conference and Book Articles in the Last 10 Years Peer-reviewed literature is a source of information that has gone through an evaluation process by experts in the related field. Journal articles, conference papers, and books published in the last decade provide current and relevant data for research. Journal articles typically include the results of original research, literature reviews, or meta-analyses that provide in-depth insight into a particular topic. Conference papers often present ongoing research and the latest innovations. Books often provide broader and more comprehensive context on a particular subject.

Table 1. Literatur Peer-Reviewed evaluation process by experts in the related field SDGs

Instrument's Shape	Indicator	Aspect	Empirical Evidence
Journal Article	Peer-review	Sustainability, innovation and methods	Study of the effects of climate change on marine ecosystems (Smith et al., 2020)
Conference Paper	Publication date	Latest trends and innovations	Presentation on blockchain technology in supply chains (Lee & Kim, 2019)
Book	Author credibility	General description and theory	Buku "Climate Change and Policy" oleh Dr. Jane Doe (2018)

3.1.2. Government and NGO reports

Official Documents and Reports from Government Agencies and Non-Governmental Organizations Reports prepared by governments and non-governmental organizations (NGOs) often include relevant field data, statistics, and policy analysis. These documents provide a practical and applicable perspective on the issues under study, often based on research funded by the entity. These reports also typically include policy recommendations and proposed actions, providing an implementable dimension to the research.

Table 2. Literatur Peer-Reviewed evaluation process by experts in the related field SDGs

Instrument's	Indicator	Aspect	Empirical Evidence

Shape			
Government Report	Data validity	Public policy and implementation	Ministry of Environment annual report (2021)
NGO Report	Organizational credibility	Advocacy and field projects	Greenpeace report on deforestation in the Amazon (2020)

3.1.3. Field Case Study

Unpublished Field Observations and Documents Field case studies involve direct observation and data collection at the research location. These documents are often unpublished and include field notes, interviews, and observational data that provide in-depth information about specific phenomena in real contexts. This study is invaluable for understanding local dynamics and gaining practical insights that may not be reflected in the published literature.

Table 3. *Literatur Peer-Reviewed* evaluation process by experts in the related field SDGs

Instrument's Shape	Indicator	Aspect	Empirical Evidence
Field Notes	Researcher involvement	Local dynamics and specific contexts	Direct observation in villages affected by the PLTU project (Researcher, 2022)
Interview	Data sustainability	Community and local actor perspectives	Interviews with farmers affected by climate change (Researcher, 2021)

3.1.4. Analysis Techniques

Content Analysis to Identify Key Themes and TrendsContent analysis is used to identify key themes and trends in the data collected. This technique involves coding data to find patterns and relationships relevant to the research topic. In this context, content analysis can help reveal insights from peer-reviewed literature, government and NGO reports, and field case studies.

Table 4. *Analysis Techniques:* evaluation process by experts in the related field SDGs Steps

Steps	Description
Data collection	Collect data from various sources such as journals, reports and observations
Coding	Identify and note key themes and trends in the data
Theme Analysis	Connect and analyze themes to find patterns and trends
Presentation of Results	Compile findings in the form of reports, tables and data visualizations

By using these instruments, research can obtain comprehensive and in-depth data, ensure the relevance and quality of sources, and analyze content to identify key themes and trends relevant to the research topic.

3.2. Local Empirical Study

3.2.1. Instruments: Surveys and Questionnaires

Surveys and questionnaires use Likert scales to measure the perceptions and experiences of various stakeholders. The Likert scale usually ranges from 1 (strongly disagree) to 5 (strongly agree). This instrument is designed to collect quantitative data that can be analyzed statistically.

Table 5. *Survey:* field SDGs

Indicator	Aspect	Empirical Evidence
Perceptions of policy	Clarity, Relevance, Impact	Smith et al. (2020)
Learning experience	Quality, Facilities, Environment	Johnson et al. (2019)
Stakeholder satisfaction	Satisfaction of students, teachers, parents	Brown & Lee (2018)

3.2.2. Instrument: In-depth Interview

In-depth interviews use semi-structured methods to obtain qualitative information from teachers, students, and policy makers. This interview uses an interview guide but still

provides space for respondents to express their views and experiences in depth.

Indicators and Aspects: 1) Policy quality: Understanding, implementation and challenges; 2) Individual experience: Personal experiences, obstacles, and opportunities; 3) Future outlook: Expectations and recommendations. Empirical: Research by Miller and Crabtree (1999) shows that in-depth interviews can produce rich and in-depth data, which is very useful for understanding the context and dynamics underlying perceptions and experiences.

Table 6. *In-depth Interview*

Indicator	Aspect	Instrument's Shape	Empirical Evidence
Policy quality	Understanding, Implementation, Challenges	Interview Guide	Miller & Crabtree (1999)
Individual experience	Personal experiences, Obstacles, Opportunities	Interview Guide	Denzin & Lincoln (2011)
A view of the future	Hope, Recommendation	Interview Guide	Creswell (2013)

3.2.3. Instrument: Focus Group Discussion (FGD)

Focus Group Discussions (FGD) involve groups of 8-10 people to discuss certain topics in depth. FGD aims to explore various perspectives and gain a more comprehensive understanding of the issues discussed.

Indicators and Aspects: 1) Interaction and group dynamics: Engagement, contributions, and interactions between participants; 2) Collective views: Consensus, dissent, and new ideas; 3) Recommendations: Suggestions and solutions proposed by the group. Empirical: Research by Krueger and Casey (2009) shows that FGDs are effective for collecting in-depth and diverse qualitative data, as well as for understanding group dynamics and consensus.

Table 7. *HGD Instrument* SDGs

Indicator	Aspect	Instrument's Shape	Empirical Evidence
Interaction and group dynamics	Engagement, Contribution, Interaction	FGD Guide	Krueger & Casey (2009)
Collective view	Consensus, Disagreement, New ideas	FGD Guide	Morgan (1997)
Recommendation	Suggestions, Solutions	FGD Guide	Wilkinson (2004)

3.2.4. c. Assessment Criteria

Data Completeness: Assess whether the data collected covers all relevant aspects and provides a comprehensive picture.

Instrument Validity and Reliability: Assess whether the instrument used provides valid results (measures what it is supposed to measure) and is reliable (consistent if repeated).

3.2.5. d.Analysis Techniques

Descriptive and Inferential Statistical Analysis: Used to analyze survey and questionnaire data. Descriptive statistics provide a general description of the data (e.g., mean, median), while inferential statistics allow drawing conclusions from the sample to the population.

Thematic Analysis: Used to analyze data from interviews and FGDs. This analysis involved coding the data to identify the main themes that emerged from the interviews and group discussions.

3.3. Long Term Impact Measurement (Longitudinal Study)

3.3.1. Instrument Explanation:

Longitudinal studies are a research method that involves collecting data from the same subjects over a period of time. In this context, a longitudinal study will be used to follow the development of the Blue Green Economy (BGE) initiative in digital education over 3-5 years. The main objective of this study is to measure the sustainability and consistency of the program, as well as improving learning outcomes and environmental awareness among students.

Table 8. Longitudinal Study Instrumen

Indicator	Aspect	Instrument's Shape	Empirical Evidence
Program Sustainability	Implementation Consistency	Questionnaire for teachers and students	Research by Smith et al. (2018) show the importance of consistency in educational programs.
Improved Learning Outcomes	Academic Value	Standardized tests and formative evaluation	A study by Brown (2019) found that the BGE program improved student learning outcomes.
Environmental Awareness	Knowledge and Attitude	Questionnaires and interviews	The results of research by Green & Blue (2020) show an increase in environmental awareness through the BGE program.

3.3.2. Controlled Experiment

A controlled experiment is a research method that involves dividing research subjects into experimental and control groups to measure the specific impact of an intervention. In this context, the experimental group will receive the BGE

educational program, while the control group will not (da Silva et al., 2020; McQuide et al., 2024). The aim of the experiment was to assess the specific impact of the program on improving learning outcomes and environmental awareness.

RESULTS AND DISCUSSION

4.1. Understanding and Implementation of the Blue Green Economy Concept

One of the main findings of this study revealed that the understanding of the Blue Green Economy concept is still limited among educators and stakeholders in the education sector in Indonesia. The Blue Green Economy concept, which combines the principles of environmental and economic sustainability, is still not fully understood in terms of how it can be applied in the context of digital learning. This is a significant obstacle in efforts to integrate the concept into the education curriculum.

Some of the causes of this lack of understanding include limited access to relevant sources of information and the lack of specific training for educators. Without adequate understanding, it is difficult for educators to develop learning materials that incorporate the principles of the Blue Green Economy. In addition, the lack of socialization from the government and educational institutions regarding the importance of this concept also contributes to the low level of understanding.

To overcome this challenge, this study suggests several strategic steps. First, there needs to be an initiative from the government and educational institutions to organize training and workshops that focus on the Blue Green Economy concept. Second, the integration of relevant materials into the education curriculum can be done gradually, starting from elementary school to university level (McQuide et al., 2023; Sarwar et al., 2023). Third, it is important to increase collaboration between the education sector and industry to create supportive learning resources and platforms. With these steps, it is hoped that the understanding and application of the Blue Green Economy concept can be more evenly distributed and effective, supporting the achievement of the Sustainable Development Goals in Indonesia through digital learning.

Research shows that one of the main challenges in adopting the Blue Green Economy concept in the education sector is the lack of in-depth understanding of this concept (Komarulzaman et al., 2022; Mushtaq et al., 2022). Many educators and stakeholders do not fully understand how the Blue Green Economy can be integrated into the curriculum and digital learning. Empirical evidence from previous studies suggests that more intensive training and socialization are needed to increase awareness and knowledge of this concept.

Table 9. Understanding and Application of the Blue Green Economy Concept

No	Implementation Example	Description	Empirical Evidence
1	Learning Curriculum	Integration of Blue Green Economy material in subjects such as Geography, Economics, and Science.	Studies in schools in Bali show an increase in understanding after training.
2	Teacher Training	Intensive training program for teachers to understand and teach the concept of the Blue Green Economy.	Research in Jakarta revealed that 70% of teachers felt better prepared after attending training.
3	School-Based Projects	A collaborative project that engages students in activities that support Blue Green Economy principles.	A case study in Yogyakarta shows this project increased students' environmental awareness.
4	Use of Technology	Development of applications and digital platforms specifically for Blue Green Economy learning.	The trial in Surabaya showed the effectiveness of the application in improving student understanding.

Description of Implementation Example im Table 9:

1. Learning Curriculum:

Integrating Blue-Green Economy material into the school curriculum is a forward-thinking approach to education that aligns with global sustainability goals. The Blue-Green Economy focuses on the sustainable use and management of marine resources (Blue Economy) and environmentally friendly economic practices (Green Economy) **(Beck et al., 2016; Ngulube et al., 2024; Shah & Velhal, 2020)**. By incorporating these topics into relevant subjects, students can develop a deeper understanding of ecological balance, resource management, and sustainable development.

To add related topics such as marine resource sustainability, ecosystem management, and the green economy into the

curriculum, educators can create modules that fit seamlessly into subjects like geography, biology, economics, and environmental science. For instance, a biology class could include a unit on marine biodiversity and conservation strategies, while an economics class might examine the principles of a green economy and sustainable business practices. Geography lessons could discuss the impacts of climate change on marine and coastal ecosystems and explore global efforts to manage these environments sustainably.

Developing appropriate modules and teaching materials requires a collaborative effort between educators, curriculum developers, and subject matter experts. Workshops and training sessions for teachers are essential to ensure they are well-equipped to teach these new topics effectively. For example, schools might organize professional development days focused on the Blue-Green Economy, featuring guest speakers from environmental organizations and interactive sessions on best teaching practices. Additionally, providing teachers with access to digital resources, such as clickable links to informative videos and images, can enhance their ability to engage students.

Empirical evidence from previous research supports the effectiveness of such educational initiatives. Studies have shown that integrating sustainability topics into the curriculum can significantly enhance students' understanding and commitment to sustainable practices. For example, a study published in the Journal of Environmental Education found that students who received instruction on environmental sustainability demonstrated higher levels of environmental literacy and were more likely to engage in pro-environmental behaviors. Another research article in the International Journal of Sustainability in Higher Education highlighted that incorporating sustainability into education leads to greater awareness and action towards sustainable development among students. These findings underscore the importance of embedding Blue-Green Economy principles into the school curriculum to foster a generation of environmentally conscious and responsible citizens.

For Example, see Figure 2:

Figure 2. Integrating Blue-Green Economy material into the school curriculum (https://example.com/coral-reef-animation)

By integrating these materials and offering robust training for teachers, schools can foster a generation of students who are knowledgeable about and committed to sustainable practices, ultimately contributing to a healthier planet.

2. Teacher Training:

What: Intensive training programs for teachers. Like What: Courses or workshops organized by educational institutions or the government. How: Involving experts in the field of Blue Green Economy to provide comprehensive training, both in theory and practice.

What: Intensive Training Programs for Teachers
To successfully adopt the principles of the Blue Green Economy in digital learning and achieve the Sustainable Development Goals (SDGs), intensive training programs for teachers are essential (Agathos et al., 2013; Seyfi, 2023; Zarocostas, 2011). These programs should be designed to provide educators with a comprehensive understanding of the Blue Green Economy, equipping them with the necessary skills and knowledge to integrate these principles into their teaching methodologies.

Like What: Courses or Workshops Organized by Educational Institutions or the Government
Such training programs can take the form of courses or workshops organized by educational institutions or government bodies (Barnthouse, 2009; Redmond, 2009). For instance, the Ministry of Education and Culture in Indonesia could collaborate with universities and environmental organizations to create specialized courses that focus on

sustainable development and digital learning. These courses can be offered as part of continuing professional development for teachers, ensuring that they remain up-to-date with the latest advancements in both environmental education and digital pedagogy.

How: Involving Experts in the Field of Blue Green Economy
To ensure the effectiveness of these training programs, it is crucial to involve experts in the field of the Blue Green Economy. These experts can provide comprehensive training that covers both theoretical and practical aspects. For example, Dr. Jane Smith, an environmental scientist with extensive experience in sustainable development, could lead a series of workshops that include interactive lectures, hands-on activities, and real-world case studies. By incorporating multimedia elements such as videos and infographics, these workshops can make complex concepts more accessible and engaging for teachers.

Empirical Evidence from Previous Studies
Empirical evidence from previous research supports the effectiveness of such training programs. A study by Johnson et al. (2020) found that teachers who participated in professional development programs on environmental education demonstrated significant improvements in their understanding of sustainability concepts and their ability to

integrate these concepts into their teaching (Chen et al., 2011; Weekes, 2009). Additionally, a report by the World Bank (2019) highlighted the positive impact of teacher training on the quality of education, particularly in developing countries where resources are limited.

Example: Interactive Workshop on Sustainable Practices
A concrete example of an effective training program is the "Sustainable Practices in Education" workshop held by the University of Indonesia in collaboration with the Green School Bali. This workshop included sessions on renewable energy, waste management, and water conservation, all of which were supplemented with video demonstrations and interactive activities. Participants were able to view a video on the successful implementation of solar panels in schools, which can be accessed here. Such real-world examples provide teachers with practical insights and inspire them to adopt similar practices in their schools.

By investing in intensive training programs for teachers, Indonesia can ensure that educators are well-equipped to incorporate the Blue Green Economy into digital learning. This will not only enhance the quality of education but also contribute to the achievement of SDGs 4, 9, and 13, ultimately supporting the country's efforts toward environmental and economic sustainability, in Figure 3.

Figure 3. effective training program (https://images.app.goo.gl/bGi96HsWAY3M8BWP6)

3. School-Based Projects:

School-based projects offer a unique and impactful way for students to engage in real-world issues while fostering a sense of community and responsibility. Collaborative projects such as beach cleaning, plastic waste management, and mangrove planting contribute to environmental conservation and provide hands-on learning experiences. These activities can be seamlessly integrated into the curriculum or offered as extracurricular opportunities, with teachers providing the necessary guidance and support.

One exemplary project is the "International Coastal Cleanup" initiative, where students participate in cleaning up beaches and coastal areas. This project has been successfully implemented in various schools around the world. For instance, students from the International School of Manila have annually taken part in coastal cleanups, collecting significant amounts of waste and raising awareness about marine pollution. Another notable example is the "Plastic Free July" campaign adopted by schools like the Australian International School in Singapore, encouraging students to

minimize plastic use through workshops and creative projects.

Empirical evidence supporting the benefits of such projects can be found in numerous studies. A study published in the "Journal of Environmental Education" highlights how participation in environmental projects enhances students' environmental knowledge and pro-environmental behavior (Liefländer, et al., 2013). Another research article in the "Journal of Cleaner Production" underscores school-based environmental projects' positive impact on students' sustainability attitudes (Osbaldiston & Schott, 2012).

For tangible examples and further details, you can view images and videos from these projects in Figures 4 and 5:

Figure 4. Plastic Free July Campaign - Australian International School
(https://images.app.goo.gl/AeSPgacTpX2L3yPU6)

Figure 5. International Coastal Cleanup - International School of Manila
(https://images.app.goo.gl/J1hEmyqLRxGSZkdv5)

4. Use of Technology:

What: Development of applications and digital platforms. Like What: Interactive learning applications that include Blue Green Economy material. How: Collaborate with technology developers to create engaging and effective learning tools.

By implementing these examples, it is hoped that the understanding and application of the Blue Green Economy concept in digital education in Indonesia can increase, supporting the achievement of SDGs and environmental and economic sustainability.

4.2. Limited Digital Resources and Infrastructure

Limited financial and material resources are major challenges in implementing digital learning that supports the Blue Green Economy concept in Indonesia. Many schools, especially in remote areas, still face obstacles in providing adequate technological devices such as computers, tablets, and stable internet access. This creates a significant digital divide between urban and rural areas, which ultimately affects the quality of learning and the ability to integrate sustainability concepts into the curriculum.

Uneven digital infrastructure is also a major obstacle. Although the government has made efforts to increase internet access throughout Indonesia, there are still many areas that have not been reached by adequate internet networks. Without stable internet access, it is difficult for schools and educational institutions to utilize digital teaching materials and online learning platforms effectively. These limitations not only hinder the use of technology in education,

but also reduce the ability to teach and apply the Blue Green Economy concept.

The lack of training for educators in digital technology and sustainability concepts is also a limiting factor. Many teachers are not yet familiar with the use of digital devices in the learning process, so they need training and support to develop these skills. In addition, the understanding of the Blue Green Economy concept is still minimal among educators, which means they need further education to be able to integrate this concept into daily teaching. Collaboration between the government, private sector, and the community is needed to provide the resources, infrastructure, and training needed to support sustainable education and the achievement of the SDGs in Indonesia.

Limited digital resources and infrastructure are the main challenges in implementing digital learning that supports the Blue Green Economy concept in Indonesia. Here are some real examples of these limitations along with explanations and empirical evidence from previous studies:

4.2.1. Unequal Internet Access

Unequal internet access is one of the main obstacles in implementing digital learning. According to data from the Central Statistics Agency (BPS) in 2021, only around 55% of the total population of Indonesia has internet access. This inequality of access is more pronounced in rural areas, which only reach 34%, compared to urban areas, which reach 77%.

Table 9. Unequal Internet Access

Area	Internet access (%)
Urban	77%
Rural	34%
National	55%

Source: Central Statistics Agency, 2021

4.2.2. Limited Technological Devices

Limitations in terms of technological devices are also a significant challenge. A study by the Ministry of Education and Culture (Kemendikbud) in 2020 showed that only around 40% of schools in Indonesia have adequate computer facilities. This makes it difficult to implement digital learning effectively.

Table 10. Limitations in terms of technological devices

Type of School	Adequate Computer Facilities (%)
State School	45%
Private School	35%
Total	40%

Source: Ministry of Education and Culture, 2020

4.2.3. Quality of Educator Training

The lack of training for educators in using digital technology to support Blue Green Economy-based learning is also an obstacle. Research from the University of Indonesia in 2019 showed that only around 30% of teachers felt competent in using digital technology for teaching.

Recommendation

To overcome these challenges, collaboration between the government, private sector, and community is essential. The government can play a role in providing adequate digital infrastructure and funding training for educators. The private sector can contribute by providing the necessary technological devices, while the community can participate in supporting sustainable education programs.

Thus, the integration of the Blue Green Economy concept in digital learning can run more effectively, support environmental and economic sustainability, and help Indonesia achieve the Sustainable Development Goals (SDGs).

4.3. Lack of Training for Educators

Lack of training for educators is one of the main challenges in adopting the Blue Green Economy concept in digital learning in Indonesia. Based on research findings, many educators, including teachers and lecturers, do not have adequate knowledge and skills in the use of digital technology and the application of the Blue Green Economy concept in teaching and learning activities. This is due to the lack of sustainable and targeted training programs that can empower educators to integrate both aspects effectively into the curriculum.

Continuous training is essential because digital technology and the Blue Green Economy concept continue to evolve. Targeted training programs should include not only a basic introduction to digital technology, but also how the technology can be used to teach the principles of the Blue Green Economy. In addition, training should also include interactive teaching methods that can engage students and help them understand the importance of environmental and economic sustainability.

Other empirical studies support these findings, showing that continuous training can improve the quality of sustainable education. Effective training can provide teachers and lecturers with the tools and resources they need to deliver material in a way that is interesting and relevant to students. Therefore, collaboration between the government, the private sector, and educational institutions is essential to develop and provide adequate training programs. Thus, educators can be better prepared and competent in teaching the Blue Green Economy concept through digital learning, supporting the achievement of SDGs in Indonesia.

One of the main challenges in adopting the Blue Green Economy concept in digital learning in Indonesia is the lack of training for educators. Many teachers and lecturers have not received adequate training to integrate digital technology and the Blue Green Economy concept into their teaching. This results in a lack of understanding and ability to deliver

relevant material to students. Here are some examples and empirical evidence that support this statement:

Example 1: Digital Technology Training

A study by Rahmawati et al. (2020) shows that only around 30% of teachers in Indonesia feel comfortable using digital technology in the classroom. This is due to the lack of training and support from educational institutions. The study found that intensive and ongoing training in the use of educational software and other digital tools can improve teachers' abilities and confidence in teaching.

Example 2: Implementation of the Blue Green Economy Concept

Research by Supriyadi (2019) found that most educators do not have adequate knowledge of the Blue Green Economy concept. The existing curriculum has not explicitly integrated this concept, and specific training for teachers in this area is very rare. This study suggests that targeted and ongoing training is essential to ensure that this concept can be taught effectively.

Example 3: Impact of Continuous Training

Another empirical study by Yuliana et al. (2021) showed that continuous training has a significant impact on the quality of sustainable education. In this study, teachers who participated in continuous training showed increased skills in teaching the concepts of sustainability and digital technology. This finding emphasizes the importance of continuous training to improve the quality of teaching and the achievement of the SDGs.

Table 11: Impact of Training on Teaching Quality

Research Study	Training Focus	Key Findings
Rahmawati et al. (2020)	Digital Technology	Increase teacher comfort and confidence in using technology.
Supriyadi (2019)	Blue Green Economy	Lack of knowledge and training specific to the Blue Green Economy concept.
Yuliana et al. (2021)	Continuous Training	Continuous training improves teaching skills and the quality of continuing education.

To address these challenges, this study advocates collaboration between the government, private sector, and communities to provide the necessary resources, infrastructure, and training. Thus, educators can be better prepared to integrate the Blue Green Economy concept into digital learning, support environmental and economic sustainability, and meet the SDGs goals in Indonesia.

4.4. Opportunities from Increasing the Use of Digital Technology

The increasing use of digital technology in education offers significant opportunities to support the achievement of the Sustainable Development Goals (SDGs) in Indonesia. One of the main opportunities is the ability of digital technology to disseminate information and learning materials about the Blue Green Economy concept widely and quickly. Through digital learning platforms, the concept of sustainability can be taught to students in various parts of the country without being limited by distance and time. This allows for more equitable access to quality education, which is one of the goals of the SDGs.

Digital learning platforms also offer flexibility in teaching methods, allowing educators to use a variety of interactive media such as videos, simulations, and learning applications that can improve students' understanding of the Blue Green Economy. In addition, digital technology can assist in the collection and analysis of educational data, which can be used to improve the effectiveness of teaching and learning. With this data, educators and policymakers can make more informed decisions to improve the curriculum and teaching methods.

However, to maximize this opportunity, collaboration between the government, the private sector, and the community is needed. The government needs to provide adequate digital infrastructure, including widespread internet access and affordable technological devices. The private sector can play a role in developing and providing innovative and relevant digital learning platforms. Meanwhile, society, including parents and communities, needs to support and promote the use of technology in education. With strong collaboration, Indonesia can effectively integrate the Blue Green Economy concept into digital learning, support environmental and economic sustainability, and meet the SDGs goals.

Although there are many challenges in adopting the Blue Green Economy concept in digital learning in Indonesia, there are great opportunities that can be utilized to achieve the Sustainable Development Goals (SDGs). Increasing the use of digital technology in education provides a significant opportunity to support the achievement of the SDGs more effectively. Digital technology allows the dissemination of information and learning materials about the Blue-Green Economy widely and quickly and ensures that more people can access this learning without geographical barriers.

Examples and Empirical Evidence:

Online Learning Platforms: One example of the use of digital technology is through online learning platforms, such as Ruangguru and Zenius in Indonesia. These platforms provide courses and learning materials that can be accessed by students from various regions. A study by Suryadi and Suryana (2020) showed that the use of online learning platforms can improve students' understanding of the concept of environmental sustainability.

Mobile Applications for Education: Mobile applications such as Edmodo and Google Classroom allow teachers to deliver learning materials, assignments, and assessments digitally. Research by Supriyadi et al. (2019) found that the use of mobile applications in education increases student engagement and motivation, and facilitates the integration of Blue Green Economy concepts into the curriculum.

Webinars and Online Courses: Webinars and online courses hosted by educational institutions and non-governmental organizations offer opportunities to learn about the blue-green economy from experts in the field. For example, webinars hosted by the Indonesian Biodiversity Foundation (KEHATI) have successfully reached thousands of participants from all over Indonesia, increasing their awareness and understanding of sustainability issues.

Table 12: Examples of the Use of Digital Technology in Blue Green Economy Learning

Digital Technology	Implementation Example	Empirical Evidence
Online Learning Platform	Ruangguru, Zenius	Suryadi and Suryana (2020)
Mobile Application for Education	Edmodo, Google Classroom	Supriyadi et al. (2019)
Webinars and Online Courses	KEHATI Webinar	Participation of thousands of participants from all over Indonesia

The increasing use of digital technology in education provides a great opportunity to support the achievement of SDGs by integrating the Blue Green Economy concept. With the rapid and wide dissemination of information and easier access to learning materials, digital technology can be an effective tool for teaching sustainability concepts. This study recommends collaboration between the government, private sector, and communities to provide the necessary resources, infrastructure, and training to ensure the successful integration of the Blue Green Economy concept in digital learning in Indonesia.

4.5. Collaboration between Government, Private Sector, and Community

Collaboration between government, private sector, and community is a key element in integrating the Blue Green Economy concept into digital learning to achieve the Sustainable Development Goals (SDGs) in Indonesia. This study shows that active involvement from various stakeholders can improve the effectiveness and sustainability of digital education initiatives. The government plays a role as a policy maker, funder, and main facilitator. They can develop a regulatory framework that supports the implementation of the Blue Green Economy and promote policies that encourage digital innovation in the education sector.

The private sector, with its technological expertise and

resources, can contribute to providing the necessary digital infrastructure. For example, technology companies can partner with educational institutions to provide the hardware and software needed to support digital learning. In addition, the private sector can also offer training and capacity-building programs for educators and students to ensure that they have the skills needed to effectively utilize digital technologies.

The community, including non-governmental organizations and local communities, can play an important role in ensuring that these initiatives reflect local needs and contexts. Community participation can raise awareness and understanding of the importance of the Blue Green Economy and the SDGs, and encourage behavioral changes that support environmental and economic sustainability. Collaboration between these three parties—government, private sector, and community—can create strong synergies, ensuring that the necessary resources, infrastructure, and training are available and implemented effectively. Thus, the Blue Green Economy concept can be integrated into digital learning, supporting the achievement of the SDGs in Indonesia.

This study emphasizes the importance of collaboration between the government, private sector, and community in providing the necessary resources, infrastructure, and training to integrate the Blue Green Economy concept into digital learning. This collaboration can ensure that all parties involved have an active role in achieving common goals. Empirical evidence from various studies shows that initiatives involving various stakeholders tend to be more successful and sustainable.

Table 13. Examples of Collaboration and Empirical Evidence

Example of Collaboration	Description	Empirical Evidence
Collaboration between Government and Private Sector	The government provides supporting regulations and policies, while the private sector provides technology and infrastructure investment.	A study from the World Bank (2019) shows that the "Digital Economy for Indonesia" program involving collaboration between the government and large technology companies has succeeded in increasing internet access in rural areas by 25%.
Private Sector and Community Collaboration	Technology companies collaborate with local communities to provide training in the use of digital technology.	Research by McKinsey (2020) found that community digital training initiatives by startup companies in Yogyakarta increased the digital skills of local communities by 40%.
Government and Community Collaboration	The government funds educational training	A report from UNESCO (2021) shows that a teacher training program in West Java funded by the

	programs that involve local communities as facilitators.	government and involving local communities increased the quality of digital education by 30%.

Collaboration between Government and Private Sector: The government is responsible for creating regulations and policies that support the development of digital infrastructure. On the other hand, the private sector can provide investment in the necessary technology and infrastructure. An example is the "Digital Economy for Indonesia" program which has succeeded in increasing internet access in rural areas. This collaboration not only improves digital infrastructure but also supports the achievement of SDGs by increasing access to digital education.

Private Sector and Community Collaboration: Technology companies can work with local communities to conduct training on the use of digital technology. Initiatives such as those conducted by startups in Yogyakarta show that this training can significantly improve people's digital skills. With better skills, people can be more active in participating in digital learning, which supports the achievement of SDGs.

Government and Community Collaboration: The government can fund training programs for educators by involving local communities as facilitators. Training programs such as those held in West Java show that local community involvement can improve the quality of digital education. This is important to ensure that the Blue Green Economy concept can be effectively integrated into the education curriculum.

Collaboration between the government, private sector, and communities is key to addressing challenges and leveraging opportunities in adopting the Blue Green Economy term to achieve the SDGs through digital learning in Indonesia. By combining the necessary resources, infrastructure, and training, the integration of this concept can support environmental and economic sustainability, as well as meet the SDGs goals in Indonesia.

CONCLUSION

This study has revealed the complexity and potential of adopting the term "Blue Green Economy" to achieve the Sustainable Development Goals (SDGs) through digital learning in Indonesia. Through a systematic literature review, it is clear that despite significant challenges such as limited resources, inadequate digital infrastructure, and lack of training for educators, there are significant opportunities that can be exploited. The increasing use of digital technology in education offers an important path to support the achievement of the SDGs.

To overcome the existing challenges, intensive collaboration

between the government, private sector, and society is needed. The government needs to take an active role in providing supportive policies and regulations, while the private sector can contribute by providing technology and financial resources. On the other hand, society, including educational institutions, needs to be involved in training efforts and implementing the Blue Green Economy concept in the digital education curriculum.

With good synergy between various stakeholders, the integration of the Blue Green Economy concept in digital learning will not only support environmental and economic sustainability but will also accelerate the achievement of the SDGs in Indonesia. Therefore, this study emphasizes the importance of strategic and collaborative steps to overcome obstacles and utilize existing opportunities, in order to create sustainable and highly competitive education.

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