Al-Kharaj: Journal of Islamic Economic and Business
Volume 8 (2), 2026
P-ISSN: 2686-262X; E-ISSN: 2685-9300

The Impact of Green Economy Initiatives at Universities on Student Expenditures: A Case Study of the Gridwiz E-Bike Program and Water Refill Station at Mataram University

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Keywords:
Green economy, Green campus, Student spending.

Abstract

This study aims to analyze the impact of green economy implementation at Mataram University on student spending through the Gridwiz E-Bike and Water Refill Station (WRS) programs. This study uses a quantitative approach with a pre–post quasi-experimental design and comparison groups to measure the microeconomic impact of green campus initiatives. Data were collected from active students through a structured questionnaire covering variables of green economy implementation, student spending, student engagement, and financial literacy. Data were analyzed using Paired Samples T-test. Results show that the implementation of green economy programs contributes positively to student financial efficiency. The higher the intensity of E-Bike and Water Refill Station usage, the lower the monthly spending on transportation and bottled water consumption. This study provides empirical evidence that green campus initiatives not only support environmental sustainability but also improve student economic well-being, providing practical insights for universities to design sustainability policies aligned with the Sustainable Development Goals (SDGs).

INTRODUCTION

The concepts of a green economy and green campuses are gaining increasing global attention as demands for sustainable development grow. Through the Sustainable Development Goals (SDGs), the United Nations emphasizes the importance of integrating environmental, social, and economic aspects across all development sectors, including the higher education sector as an agent of sustainable development transformation (United Nations, 2015; UNEP, 2011; UNESCO, 2017). Higher education institutions are no longer viewed merely as educational institutions but also as social laboratories for testing various sustainability practices that can be replicated in society. Therefore, adjustments in the education sector are imperative to support the transition toward a low-carbon and environmentally friendly development model. Increased environmental awareness

in the higher education sector has spurred the emergence of green economy initiatives at various universities in Indonesia

Various studies have highlighted the implementation of green campus initiatives in different countries. In Thailand, research conducted by Singjai and Wongrathanandha (2022) found that external environmental pressures led to changes in the adoption of eco-friendly practices among small businesses near universities, which subsequently improved performance through cost efficiency and enhanced business reputation. In Japan, Uehara and Ynacay-Nye (2018) demonstrated that the presence of Water Refill Stations (WRS) encourages pro-environmental behavior among students, reducing the use of single-use plastic bottles by up to 45,191 units per year, and cutting emissions by approximately 10,846 kg of CO_2. Meanwhile, Wellbrock et al. (2022) in Germany studied the adoption of green transportation such as buses and e-bikes, and found that students are willing to switch to eco-friendly modes of transportation if adequate infrastructure and incentives are available. In Brazil, Ribeiro et al. (2019) reported that students view Green Campus initiatives as an important tool in sustainability education, while in Peru, Perez-Nuñez et al. (2024) demonstrated that the implementation of Green IT can improve energy efficiency while reducing electricity operational costs at universities.

In Indonesia, research on green campus practices remains limited. Rahaju et al. (2022) documented Surabaya State University's (Unesa) efforts to implement resource efficiency and effective governance, highlighting their relevance to achieving the SDGs. Furthermore, Akram et al. (2024) found that students at the Indonesia University of Education (UPI) have a fairly high level of awareness regarding the green economy, although more in-depth training and engagement are still needed to align with the national Net Zero Emission 2060 target. These findings indicate that most research in Indonesia remains focused on institutional strategies and student awareness, while the direct financial impacts of green campus implementation on students as end-users are rarely examined.

This situation warrants attention because students are the primary actors who directly experience the economic impacts of sustainability programs—such as e-bike services and Water Refill Stations—in their daily activities. Mataram University in West Nusa Tenggara has implemented a pilot project through the deployment of Gridwiz E-Bikes and Water Refill Stations, two initiatives that directly influence student consumption behavior. However, to date, no empirical research has quantitatively measured the financial effects of these programs on student expenditures.

Based on a review of the existing literature, four major research gaps can be identified. First, a geographical gap, where most studies were conducted outside Indonesia, resulting in limited

empirical evidence from local contexts such as Mataram University. Second, a thematic gap, as previous research has primarily focused on student awareness, institutional image, or energy efficiency, but has not addressed students' microeconomic outcomes. Third, a methodological gap, as most studies rely solely on descriptive surveys or simple regression without a quasi-experimental approach capable of measuring changes before and after the implementation of green programs. Fourth, a theoretical gap, as the theoretical framework used remains limited to the concepts of Green Campus and the SDGs without integrating financial literacy and behavioral economics theories to explain students' decision-making in adopting green technologies.

To address these gaps, this study aims to analyze the impact of green economy implementation at Mataram University on student spending, with a focus on the use of the Gridwiz E-Bike and Water Refill Station. This research is expected to provide empirical evidence regarding the microeconomic outcomes of green campus programs, thereby enriching the academic literature and offering practical contributions to policymakers and higher education institutions in achieving sustainability.

METHODS

Research Design

This study employs a pre–post quasi-experimental design with a comparison group to measure the microeconomic impact of the green campus program's implementation on student spending. A pre–post quasi-experimental design is a research method used when randomization cannot be performed. In this design, researchers measure participants' conditions before and after the treatment (intervention) to assess the extent of the influence or impact caused by the program or action (Joseph & Thomas, 2020). This design compares students' spending patterns before and after using the Gridwiz E-Bike and Water Refill Station (WRS). This approach is expected to provide stronger causal evidence compared to purely descriptive research, which is a common weakness in most previous studies (Ribeiro et al., 2019; Uehara & Ynacay-Nye, 2018).

Population and Sample

The study population consists of all active students at Mataram University during the 2025/2026 academic year. The sampling technique used is purposive stratified sampling, divided into two main groups:

1. Treatment group: students who regularly use the Gridwiz E-Bike and/or WRS for at least one month.
2. Control group: students who do not use or rarely use either of these facilities.

The target number of respondents is at least 200 students, who will be distributed proportionally by faculty. This sample size is considered adequate based on Cohen's guidelines (1992).

Data Collection

Primary data is collected via an online questionnaire (Google Form) with three main sections, namely:

1. Demographic data: including gender, age, faculty, and monthly allowance
2. Consumption and expenditure data: covering students' average monthly expenditures on transportation, bottled water, and other routine needs (in Indonesian rupiah).

To support the pre–post design, respondents were asked to report their expenditure amounts before and after using the campus green program. The validity of self-reported data will be tested through consistency checks and, where possible, cross-verified with institutional operational data (e.g., records of WRS or e-bike usage).

Variables and Measurement

This study focuses on measuring students' monthly expenditures as the primary variable observed under two different time conditions: before and after utilizing the green campus facilities. Student expenditures are defined as the total costs incurred in a single month and measured in rupiah. Measurements are conducted on two main components: bottled water expenditures and transportation expenditures. The pre-condition describes student expenditures before using the Water Refill Station and Gridwiz E-Bike, while the post-condition describes student expenditures after utilizing these facilities. Measurements were taken from the same respondents in both conditions, allowing for a direct analysis of differences in average student expenditures via a paired samples t-test.

Data Analysis Techniques

Data analysis was conducted quantitatively in several stages. First, a descriptive analysis was performed to describe the respondents' profiles as well as students' spending patterns, the frequency of use of the Gridwiz E-Bike and Water Refill Station (WRS), and student engagement. Second, validity and reliability tests were conducted using Pearson's Product-Moment correlation and Cronbach's Alpha to ensure the instruments' suitability. Third, a paired sample t-test is conducted to compare student spending before and after using the green program, as well as an independent t-test to compare differences between groups. All data processing is performed using SPSS version 31 software, with a significance level of 5% ($\alpha = 0.05$).

RESULTS AND DISCUSSION

1. Data Description and Instrument Quality

Based on a descriptive analysis of 235 student respondents at Mataram University, it was found that students' perceptions of the implementation of the green economy fall into the positive category, particularly regarding green policy strategies and the availability of the Gridwiz E-Bike. However, an interesting finding emerged: the adoption of Water Refill Stations (WRS) remains suboptimal compared to the availability of the infrastructure.

Based on the validity test results, all statement items in each research variable were deemed valid because they had correlation coefficients greater than the r-table value used as the reference threshold. This finding indicates that each indicator is capable of accurately measuring the intended construct, both for the student expenditure variable and for variables related to the implementation of the green campus program. Furthermore, the reliability test results show that the Cronbach's Alpha values for all variables are above the minimum threshold of 0.70, indicating a good level of internal consistency of the instrument. Thus, the questionnaire used in this study is deemed reliable and suitable for measuring student expenditure conditions before and after the utilization of green campus facilities, and can serve as a strong foundation for further statistical analysis.

2. Results of the Paired Samples t-test

To measure the economic effectiveness of implementing the Green Economy at Mataram University, a paired samples t-test was conducted. This test aimed to compare students' daily expenditure levels before and after adopting the use of the Gridwiz E-Bike and utilizing the Water Refill Station (WRS).

Table 1. Paired Samples Statistic Water Refill Station

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRETEST	36280.85	235	16131.599	1052.309
	POSTTEST	25961.70	235	13578.303	885.751

Source: SPSS 31

The results of the paired t-test indicate a decrease in the average monthly student expenditure following the use of the water refill station. Average monthly spending before the program was recorded at 36,280.85, while after the program it decreased to 25,961.70. This decrease indicates that the use of water refill stations has a cost-saving effect on students' routine monthly spending. Additionally, the lower standard deviation after the program indicates that the variation in students' monthly spending has become more controlled.

Table 2. Paired Samples Test Water Refill Station

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	PRETEST - POSTTEST	10319.149	13184.921	860.089	8624.641	12013.657	11.998	234	<,001	<,001

Source: SPSS 31

The results of the paired samples t-test indicate that there is a significant difference in students' average spending before and after using the Water Refill Station (WRS). The average difference in expenditure (pretest–posttest) was recorded at Rp10,319.15, with a t-value of 11.998

and degrees of freedom (df) of 234. The two-tailed significance value (p-value) < 0.001 indicates that the difference is statistically significant at a significance level of α = 0.05. The 95 percent confidence interval for the mean difference ranges from Rp8,624.64 to Rp12,013.66, all of which are positive values, indicating that students' expenditures after using the Water Refill Station were lower than before using the facility.

Table 3. Paired Samples Statistic E-Bike Gridwiz

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreTest	42234.0426	235	17382.09705	1133.88299
	PostTest	32306.3830	235	15802.18805	1030.82109

Source: SPSS 31

With the use of the Gridwiz E-Bike, students' average monthly expenses also decreased after the program was implemented. Average monthly expenses before using the E-Bike were 42,234.04, then decreased to 32,306.38 after the program began. These results indicate that the use of eco-friendly transportation on campus contributes to reducing students' monthly expenses, particularly those related to transportation costs. The decrease in the standard deviation following the program suggests a trend toward more stable monthly spending among students.

Table 4. Paired Samples Test E-Bike Gridwiz

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	PreTest - PostTest	9927.65957	13077.96643	853.11246	8246.89695	11608.42220	11.637	234	<,001	<,001

Source: SPSS 31

The results of the paired samples t-test indicate that there is a significant difference in students' average spending before and after using the Gridwiz E-Bike facility. The average difference in expenditure (pretest–posttest) was recorded at Rp9,927.66, with a t-value of 11.637 and 234 degrees of freedom (df). The two-tailed significance value (p-value) < 0.001 indicates that the difference is statistically significant at a significance level of α = 0.05. The 95% confidence interval for the mean difference ranges from Rp8,246.90 to Rp11,608.42, all of which are positive values, indicating that students' monthly expenses after utilizing the E-Bike Gridwiz facility are lower than before its implementation.

Overall, the paired statistical results show that the implementation of green campus facilities, both water refill stations and the E-Bike Gridwiz, is associated with a decrease in the average monthly student expenditure. Both programs contribute to reducing students' routine

expenses, particularly regarding drinking water consumption and daily transportation within the campus environment. These findings indicate that the implementation of green economy principles at the campus level not only impacts environmental aspects but also provides tangible economic benefits for students.

DISCUSSION

a. The Impact of the Green Economy on Student Spending

The research findings demonstrate that the implementation of a green economy at Mataram University, through the provision of Gridwiz e-bikes and water refill stations (WRS), has led to changes in students' spending patterns. These findings confirm that campus infrastructure not only impacts the institution's image but also affects the microeconomic aspects of its users.

These results align with the research by Wellbrock et al. (2022) in Germany, which found that the availability of green transportation infrastructure (such as e-bikes) is a key prerequisite for students to switch modes of transportation, which ultimately affects the cost efficiency of their travel. At Mataram University, the presence of Gridwiz provides a mobility alternative that influences the allocation of students' daily transportation costs.

Furthermore, these findings also support the study by Uehara and Ynacay-Nye (2018), which states that drinking water facilities (WRS) contribute to pro-environmental behavior, leading to a reduction in the purchase of plastic bottles. The statistical significance of this variable confirms that campus policies in providing green facilities are concrete steps whose financial impact is directly felt by students, addressing a gap in previous research that focused more on macro impacts or the university's image alone.

b. Differences in Average Student Expenditures Before and After the Intervention

The results of the analysis using a paired samples t-test showed that there was a significant difference in students' average spending before and after the use of green campus facilities. These findings indicate a change in students' spending patterns following the availability of the Water Refill Station (WRS) and E-Bike Gridwiz facilities on campus.

Regarding the Water Refill Station facility, students' average monthly spending decreased significantly following the intervention. The difference in average spending of Rp10,319.15 per month demonstrates that access to free, potable drinking water reduces students' reliance on purchasing bottled water. This decrease in spending is consistent, as evidenced by the 95% confidence interval, which is entirely within the positive range, thereby strengthening the validity of the obtained t-test results.

Similar findings were observed regarding the utilization of the E-Bike Gridwiz facilities. The average student expenditure after the intervention was recorded as lower than before the intervention, with an average difference of Rp9,927.66 per month. This indicates that the availability of alternative electric bicycle-based transportation can help students reduce daily transportation costs. This efficiency is particularly relevant for students who regularly commute within the campus area and its surroundings.

The significant difference in average expenditures between the two facilities indicates that the implementation of the green campus concept not only impacts environmental aspects but also provides direct economic benefits for students. In the context of student economics, monthly expenditure savings, although relatively small in the short term, can become significant when accumulated over a longer period, such as one semester or one academic year.

From a methodological perspective, the use of a paired t-test in this study is appropriate because measurements were taken from the same respondents under two different time conditions. Thus, the identified differences reflect changes in students' spending conditions before and after the intervention, rather than differences between individuals or groups. This approach provides a more accurate picture of the changes experienced by students following the utilization of green campus facilities.

Overall, the results of this study indicate that the provision of green campus facilities tailored to students' needs can contribute to spending efficiency without sacrificing comfort and mobility. These findings reinforce the argument that green campus policies can serve as a relevant strategy not only in supporting environmental sustainability but also in enhancing students' economic well-being.

CONCLUSION

The results of this study indicate that the implementation of green economy concepts through the Gridwiz E-Bike and Water Refill Station (WRS) programs is associated with differences in students' average expenditures before and after the utilization of these facilities at Mataram University. Based on the results of the paired t-test, students' average expenditures after utilizing the green campus facilities were found to be lower compared to the period before utilization. This finding indicates that green campus programs not only provide ecological benefits but are also associated with improved economic efficiency for students, particularly through savings on transportation costs and the consumption of bottled drinking water.

This finding suggests that the provision of green campus facilities is associated with improved efficiency in student spending within the context of daily economic activities. Although this study does not aim to explain complex causal relationships, the results provide empirical evidence that green campus policies can provide direct economic benefits to students, in addition to the ecological benefits that have been the primary objective of implementing the green campus concept. Thus, the development and optimization of green campus facilities have the potential to be a relevant strategy in supporting environmental sustainability while alleviating the burden of student expenses.

However, this study has limitations regarding its scope, as the location and observation period are restricted to a single institution. Further research is recommended to expand the context to other universities and consider external factors such as local government support, energy policies, and the general public's transportation behavior. Institutionally, the findings of this study provide recommendations for universities to strengthen green campus policies through the expansion of eco-friendly facilities, the provision of financial incentives for students who actively participate, and the integration of financial literacy and sustainability into the curriculum. At the public policy level, these findings can serve as a foundation for developing a dual-oriented higher education development model—combining economic efficiency and environmental sustainability—as a concrete manifestation of the implementation of the Sustainable Development Goals (SDGs) in Indonesia's education sector.

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