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Green IS Adoption Through Academic Web Services: A UTAUT-Based Evaluation at Universitas Sebelas Maret

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ABSTRACT

Digital academic services at universities do not automatically ensure environmentally responsible use, and the extent to which such platforms support sustainable digital practice remains underexamined in higher education. This study evaluates how university students' use of academic web services contributes to the adoption of Green Information Systems (Green IS) using the Unified Theory of Acceptance and Use of Technology (UTAUT) as the theoretical framework. A quantitative survey collected data from 210 undergraduate and vocational students across 15 faculties at Universitas Sebelas Maret (UNS) who actively use the SIAKAD, SPADA, and OCW web services. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with a Two-Stage Higher-Order Construct approach, in which Green IS was specified as a formative higher-order construct built from three lower-order dimensions: Paperless, Work Efficiency, and Green Awareness. Results show that Social Influence (β=0.378), Facilitating Conditions (β=0.289), and Performance Expectancy (β=0.218) significantly influenced Behavioral Intention, while Effort Expectancy (β=0.078, p = 0.275) likely reflected students' prior familiarity with digital technologies. Use Behavior was the strongest predictor of Green IS adoption (β=0.639), and the Behavior Intention→Use Behavior→Green IS mediation pathway was confirmed as the core adoption mechanism, indicating that intention drives the Green IS outcome primarily through sustained actual use. The Paperless dimension contributed only marginally, suggesting that paperless practice remains in the early stages of Green IS maturity among students. These findings indicate that Green IS adoption in mandatory-use academic settings is driven less by ease of use and more by social expectations, institutional facilitation, and consistent system usage. Universities seeking to advance sustainable digital practices should prioritize social influence-based institutional policies, such as normalizing paperless workflows through lecturer and institutional endorsement.

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■ INTRODUCTION

Universities have become increasingly dependent on information technology systems and infrastructure to support academic, administrative, and research activities. Servers on campuses operate systems that provide various services, such as e-learning. Academic Information Systems, data storage, video conferencing, and research repositories are actively used by students across different programs, with varying intensities and usage patterns (Mahariya et al., 2023). The rapid expansion of digital technologies in higher education has created new challenges regarding the sustainable and effective use of systems (Dwivedi et al., 2022). Websites such as OCW, SIAKAD, and SPADA have become daily tools for academic support, specifically at Universitas Sebelas Maret (UNS). However, their presence does not automatically guarantee the implementation of environmental sustainability principles. Evaluations of digital service usability in the Indonesian higher education context further underscore the importance of understanding actual user behavior beyond mere availability (Alfian et al., 2024).

Digital Information in higher education still reveals a gap between digital potential and actual implementation (Trevisan et al., 2024).

This Gap is further evident in the post-pandemic context, where digital transformation has not automatically translated into sustainable practice in Universities (Filho et al., 2023). Although many academic services are available digitally, practices such as printing documents, visiting administrative offices in person, or using manual processes that could be fully conducted online remain common. This persistence of paper-based habits is particularly puzzling given that the technological substitute already exists: students can retrieve schedules, grades, and academic documents entirely online, yet printing and manual administrative visits continue. This suggests that the barrier to paperless practice is not technological availability but behavioral; students may perceive digital access as a convenience layered on top of, rather than a replacement for, physical documentation, especially in a mandatory-use environment where the system is adopted because it is required rather than because it is intended to displace paper. This condition illustrates that the availability of digital services does not necessarily align with usage behaviors that support Green Information System (Green IS) (Kirchner-Krath et al., 2024) if digital adoption is driven primarily by institutional obligation rather than an explicit sustainability intent. Paperless behavior, one of the three dimensions constituting Green IS, may lag behind other dimensions such as work efficiency, even as overall platform use increases. UTAUT was selected over other technology acceptance frameworks, such as the Technology Acceptance Model (TAM). The DeLone and McLean IS Success Model was selected because it synthesizes constructs from eight prior acceptance theories, including Social Influence and Facilitating Conditions, which TAM does not capture but which are particularly salient for institutionally mandated academic systems such as SIAKAD, SPADA, and OCW. Unlike the IS Success Model, which centers on system, information, and service quality as antecedents of use, UTAUT explains individual-level behavior determinants of adoption and has demonstrated stronger explanatory power in mandatory use university contexts (Venkatesh et al., 2003)

Green IS is defined as the use of information systems to achieve environmental goals, encompassing digital process efficiency, reduced paper use, and the promotion of sustainable usage behavior (Kirchner-Krath et al., 2024). UNS has achieved a ranking of 39th in the world in the UI GreenMetrics World University Ranking nobel, creating institutional pressure to maintain and improve Green IS implementation as part of its sustainability program. However, a systematic evaluation of how the website services for UNS students (SIAKAD, SPADA, and OCW) support Green IS principles has never been conducted.

Numerous studies have examined Green IS and information technology efficiency in higher education (Zhao et al., 2023). Systematic reviews of UTAUT applications in higher education have consistently shown its relevance for explaining technology adoption among students (Hakimi et al., 2024; Xue et al., 2024). Research by Ayaz &Yanartas (2020) demonstrated the relevance of user behavior approaches for evaluating IS adoption in higher education by applying the UTAUT model at Bartin University, Turkey, and found that UTAUT explained 61% of IS usage intention, with Performance Expectancy as the strongest predictor.

Green IT implementation with a Green IS approach in universities encompasses not only technical infrastructure efficiency but also a deep understanding of users' IS usage patterns (Oliveira & Proença, 2025). UNS students in undergraduate and vocational programs are the primary focus of the UTAUT model evaluation in this study, as the way students use UNS website services directly affects environmental impact. Therefore, evaluating the UTAUT model in the context of UNS website service usage is critical for supporting IS sustainability aligned with Green IS principles. Beyond its institutional relevance to UNS, this study contributes to the broader Green IS literature by empirically testing a Two-Stage Higher-Order Construct specification of Green IS within a UTAUT framework in a mandatory-use higher education setting. This combination remains underexplored in prior Green IS research, which has been conducted mostly in organizational and corporate contexts. The findings therefore extend the theoretical applicability of UTAUT Green IS integration to student populations in developing country universities, offering a transferable model for institutions with similar mandatory digital service adoption patterns.

Based on that background, this study aims to evaluate IS usage patterns on the UNS website (OCW, SIAKAD, and SPADA) among UNS students from a Green IS perspective, in order to produce recommendations for more energy-efficient and sustainable IS usage. The study uses UTAUT theory (Venkatesh et al., 2003), which identifies Performance Expectancy, Effort Expectancy, Social Expectancy, Facilitating Conditions, Behavioral Intention, and Use Behavior as key determinants of IS usage. This research is structured around three research questions: (1)

How do UTAUT elements partially influence Behavioral Intention and subsequently drive Use Behavior? (2) How does behavioral intention influence use Behavior and its direct implications on Green IS adoption? (3) What is the mediation mechanism of Behavioral Intention and Use Behavior connecting UTAUT elements to Green IS adoption?

■ METHOD

Research Design

This Study employed a quantitative survey method. As stated by Creswell (as cited in Barella et al., 2024), a quantitative research approach tests theories by analyzing relationships among variables measured using research instruments and analyzing the collected data through statistical processes. The survey method was chosen to collect data from a large number of UNS student respondents to understand IS website usage patterns from a Green IS perspective (Ahmad & Wilkins, 2024). Data Collection was conducted over two weeks in March 2026.

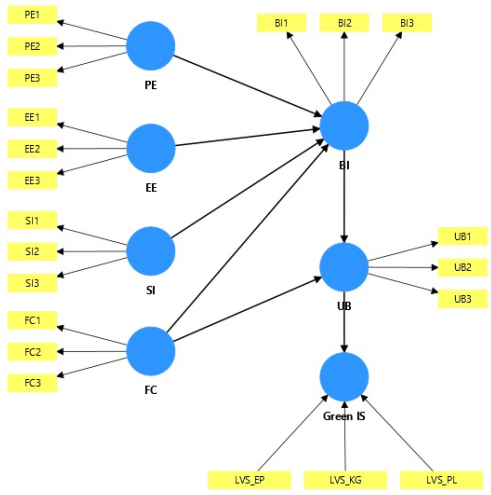

Figure 1. Hypothetical model

Population and Sample

The Population consisted of undergraduate and vocational students at UNS who actively used IS services at UNS (SIAKAD, SPADA, and OCW) in their respective study programs. This Study used purposive sampling with specific criteria (Omid et al., 2024): Active undergraduate or vocational students aged 19-23 years old, currently enrolled in year 2 to 4 with total of 210 respondent were determined as the sample size, Meeting SEM-PLS recommendations of 150-300 respondents or a minimal of 10x the number of the indicator (J. F. Hair et al., 2020; Mumtaz et al., 2020)

Research Instrument

Data were collected using a structured questionnaire with a five-point Likert Scale (1 = Strongly Disagree to 5 = Strongly Agree), which is the dominant instrument for collecting academic opinions (Suárez-García et al., 2024). The Instrument covered six UTAUT constructs, Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Behavioral Intention (BI), and Use Behavior (UB), and three Green IS dimensions, Paperless (PL), Work Efficiency (EP), and Green Awareness (KG). Detailed item statements are available in the Supplementary File. Each construct was measured with three indicator items, for a total of 27 items, meeting the minimum identification threshold recommended in SEM (Hair et al., 2020). The Green IS instrument was adapted from Molla (2013), Aldouri (2023), Mahanta and Sarkar (2023), Nuzir et al. (2023), and UI GreenMetrics standards (*Who We Are — UI GreenMetric*, n.d.). In line with the paperless principle and this study's Green IS framework, the questionnaire was distributed exclusively through an online form (Google Form), with no printed version administered at any stage.

A Pilot Test was conducted with 34 students outside the main sample to identify ambiguous or irrelevant items, with results used to compute Cronbach's Alpha as the basis for instrument refinement (Ahmad & Wilkins, 2024). Based on the results in Table 1, the Cronbach's Alpha values are> 0.6. All nine constructs exceeded the 0.6 acceptability threshold recommended for pilot instrument refinement (Hair et al., 2019). In exploratory research and initial scale adaptations, alpha coefficients ranging from 0.60 to 0.70 are widely regarded as acceptable indicators of reliability (Taber, 2018). Furthermore, because Cronbach's alpha is highly sensitive to the number of items and tends to underestimate scale reliability in short measures, these preliminary results served primarily for item screening, while Composite reliability was deployed as the primary benchmark in the main evaluation stage (Hair Jr et al., 2021)

Data Analysis

Data were analyzed using PLS-SEM with SmartPLS, following a hierarchical component model approach with a two-stage method for the higher-order construct (HC) of Green IS, as recommended for multivariate behavioral research in education (Subhaktiyasa, 2024), because Green IS was created from 3 different

Table 1. Pilot test

Variable	Indicator	Cronbach Alpha	Sources
Performance Expectancy	PE1	0.675	(Ayaz & Yanartaş, 2020; Venkatesh et al., 2003)
	PE2		
	PE3		
Effort Expectancy	EE1	0.620	
	EE2		
	EE3		
Social Influence	SI1	0.661	
	SI2		
	SI3		
Facilitating Conditions	FC1	0.819	
	FC2		
	FC3		
Behavioral Intention	BI1	0.625	
	BI2		
	BI3		
Use Behavior	UB1	0.756	
	UB2		
	UB3		
Paperless	PL1	0.801	(Molla, 2013; Nuzir et al., 2023)
	PL2		
	PL3		
Work Efficiency	EP1	0.885	
	EP2		
	EP3		
Green Awareness	KG1	0.850	
	KG2		
	KG3		

dimensions. That Approach was chosen because the repeated-indicator approach allows the lower-order constructs (Paperless, Work Efficiency, and Green Awareness) and the higher-order Green IS construct to be conceptually and empirically distinct. The repeated indicator approach tends to produce inflated path estimates and construct-level bias when the number of lower-order constructs is small, as in this study's three dimension formative specification (Sarstedt et al., 2019). The Two-Stage Approach also allows latent variable scores from the first-stage measurement model to be used directly as indicators of the second-stage formative construct, providing more parsimonious and statistically stable estimation of Gree IS as a Higher-Order Construct. First-Order Construct (LOC) Evaluation examined : (a) Convergent Validity through Outer Loading (> 0.7 or acceptable > 0.4 if AVE is unaffected) (Hair et al., 2022) and AVE (> 0.5) (Hair et al., 2019) (b) Reliability through composite reliability rho_C (> 0,7) and rho_A (0,6 – 0,7 is still acceptable) (Hair et al., 2021) and (c) Discriminant Validity through HTMT ratio (< 0,9) (Henseler et al., 2015; Roemer et al., 2021).

Second-Order Construct (HOC) Evaluation of the formative Green IS construct included: Redundancy Analysis for convergent validity (path coefficient > 0,7), VIF test for multicollinearity (< 3.0), and Outer Weight significance through bootstrapping (Hair et al., 2019). Structural Model (Inner Model) Evaluation comprised: VIF multicollinearity test, R^2 coefficient of determination (with thresholds of 0.67 = strong, 0,33 is moderate and 0,19 is weak (J. F. Hair et al., 2019), Effect Size (F^2) (0,35 is large, 0,15 is medium ad 0,02 is small (J. Hair & Alamer, 2022), Predictive Relevance Q^2 (> 0 indicates predictive relevance (Hair et al., 2021)) and hypothesis testing through bootstrapping (5,000 – 10,000 subsamples) with acceptance criteria of T-Values > 1,96 and P-Value < 0,05 at 5% significance level (Hair et al., 2021; Ringle et al., 2020).

■ RESULT AND DISCUSSION

Respondent Characteristics

The composition of 210 respondents across various faculties in this study is shown in Figure 3. All 210 distributed questionnaires were successfully returned and completed in full, resulting in a usability rate of 100%. The

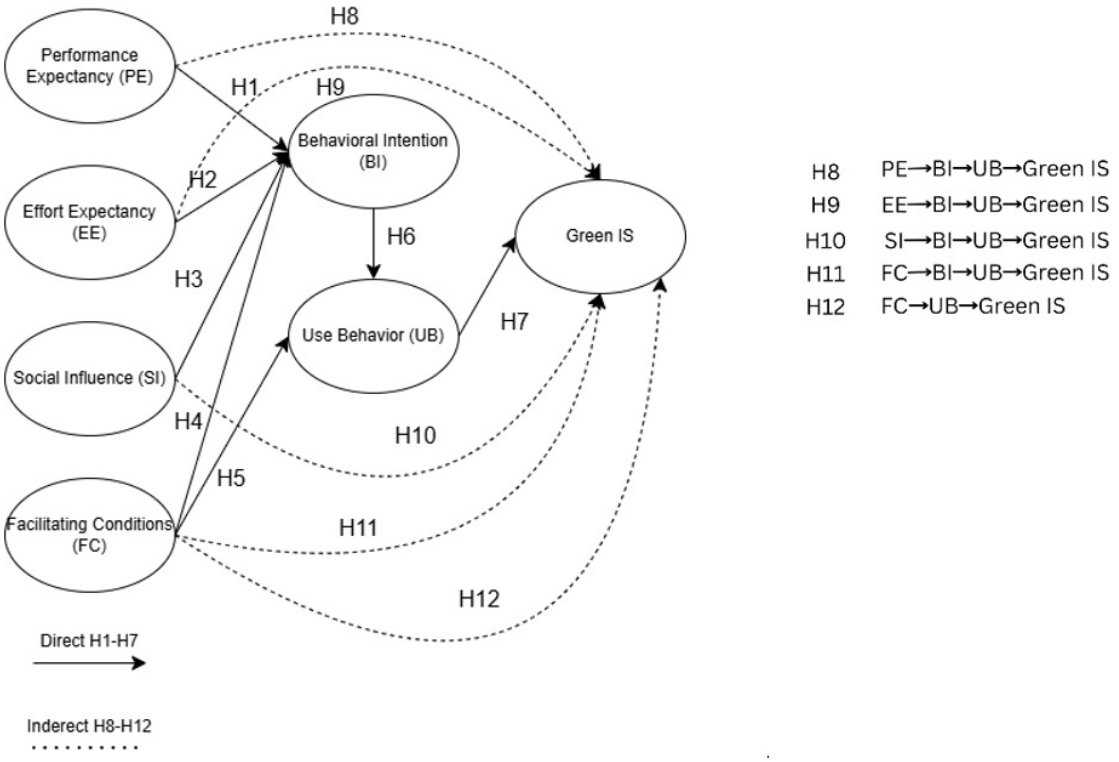

Figure 2. Research hypothesis

respondents came from 15 faculties and schools at UNS, with the highest proportion originating from the Faculty of Teaching Training and Education (FKIP) at 42.9%, followed by the faculty or Fine Arts and Design (FSRD) at 10.5% and the Faculty of Agriculture at 8.6%. Regarding website use, 94.3% of students reported using the UNS website for academic and administrative activities. Among the available platforms, SPADA was the most frequently used service, accessed by 80.5% of respondents, while 40.4% reported using OCW.

While Table 1 reflected the preliminary reliability of the adapted items during the pilot test phase, Table 2 details the comprehensive outer model evaluation for the final dataset with 210 respondents, showing that all first-order construct AVEs are> 0.5 and Cronbach's Alpha is> 0.6. With all values increasing significantly, especially on AVE and Cronbach's Alpha, the items in this study are all valid and reliable, as presented in Table 2.

Measurement Model (Outer Model)

First-order construct validity and reliability

Most indicators met the outer loading criterion, with values exceeding 0.7, except for SI1, which recorded a loading value of 0.665. Nevertheless, this value is considered acceptable because the deletion is within the normal range for the construct's Average Variance Extracted (AVE). After all, after deleting item SI1, the AVE increased from 0.665 to 0.803, but the hair study stated that the minimum number of research items is 3 (Hair Jr et al., 2021). Therefore, the researcher retained item SI1 for use in the study. The Outer loading values for all constructs are presented in Figure 4. Outer Loading Research.

All first-order constructs (PE, EE, SI, FC, BI, UB) were confirmed to be valid and reliable, as shown in Table 2, with AVE values above 0.5 and Composite Reliability above 0.7. Discriminant validity was established by the HTMT ratio to ensure the empirical independence of the latent variables, with all pairwise estimations reported in Table 3.

All HTMT values between constructs were below the 0.9 threshold, indicating that each construct is empirically distinct from the others. These results confirm that the model satisfies the discriminant validity requirement (Henseler et al., 2015; Roemer et al., 2021). The highest values were observed for the Use Behavior-Behavioral Intention pair (0.797) and the Use Behavior-Social Influence pair (0.800); both approach the stricter 0.85 boundary yet remain below it, confirming that discriminant validity between these constructs is still adequately established. The proximity of the UB-BI value to the 0.85 threshold is theoretically expected, since Behavioral

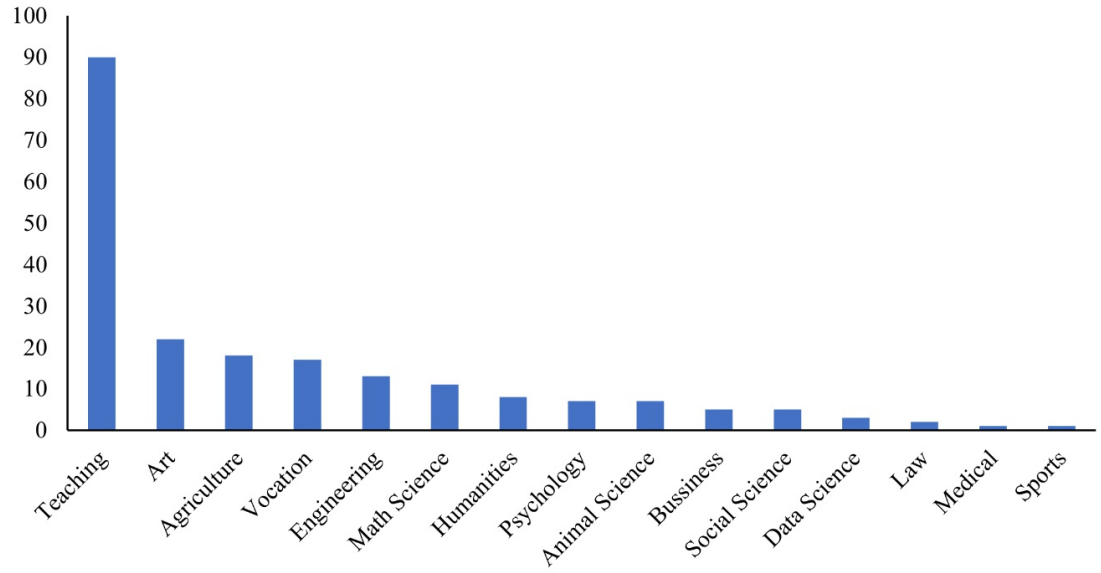

Figure 3. Respondent characteristics

Intention serves as the direct antecedent of Use Behavior within the UTAUT framework, naturally producing greater shared variance between the two constructs than between other pairs. A similar pattern is evident in the EP-PL pair (0.813), reflecting conceptual overlap between usability-oriented constructs, though this value likewise remains within an acceptable range. Overall, these results confirm that discriminant validity across the model is satisfactory, with no HTMT value exceeding 0.90, and only the UB-BI and UB-SI relationships warranting closer attention as they lie closest to the stricter 0.85 boundary.

Second-order construct (HOC) green IS

The Green IS construct was specified as a formative, higher-order construct. Convergent validity was evaluated using redundancy analysis, which produced a path coefficient of 0.838 and an R^2 value of 0.703. Both values exceeded the recommended threshold of 0.70 (J. F. Hair et al., 2022), indicating that the construct demonstrates adequate convergent validity. The assessment of multicollinearity among the three lower order construct (LOC) revealed no concerns, as all VIF values were below 3.0, namely Work Efficiency (EP = 2.158), Green Awareness (KG = 1.496), and Paperless (PL = 1.790)

From Figure 4 Outer Loading Research. With respect to the formative measurement assessment, Work Efficiency (β = 0.624, p = 0.000) and Green Awareness (β = 0.362, p = 0.002) showed significant contributions to the formation of the Green IS construct. In

Table 2. First order construct

Variable	Indicator	Mean	Standard Deviation	Cronbach's Alpha	Composite Reliability	AVE	Status
PE	PE1	4.220	0.757	0.746	0.853	0.660	Valid and Reliable
	PE2	3.876	0.888				
	PE3	3.569	0.931				
EE	EE1	4.062	0.848	0.794	0.879	0.708	Valid and Reliable
	EE2	3.756	1.037				
	EE3	3.933	0.920				
SI	SI1	4.043	0.909	0.719	0.840	0.640	Valid and Reliable
	SI2	3.541	1.053				
	SI3	3.416	1.053				
FC	FC1	4.292	0.833	0.801	0.881	0.713	Valid and Reliable
	FC2	4.598	0.627				
	FC3	4.258	0.847				
BI	BI1	3.909	0.889	0.725	0.843	0.644	Valid and Reliable
	BI2	4.316	0.798				
	BI3	3.612	0.947				
UB	UB1	3.665	0.924	0.788	0.802	0.704	Valid and Reliable
	UB2	3.785	0.879				
	UB3	3.789	0.960				

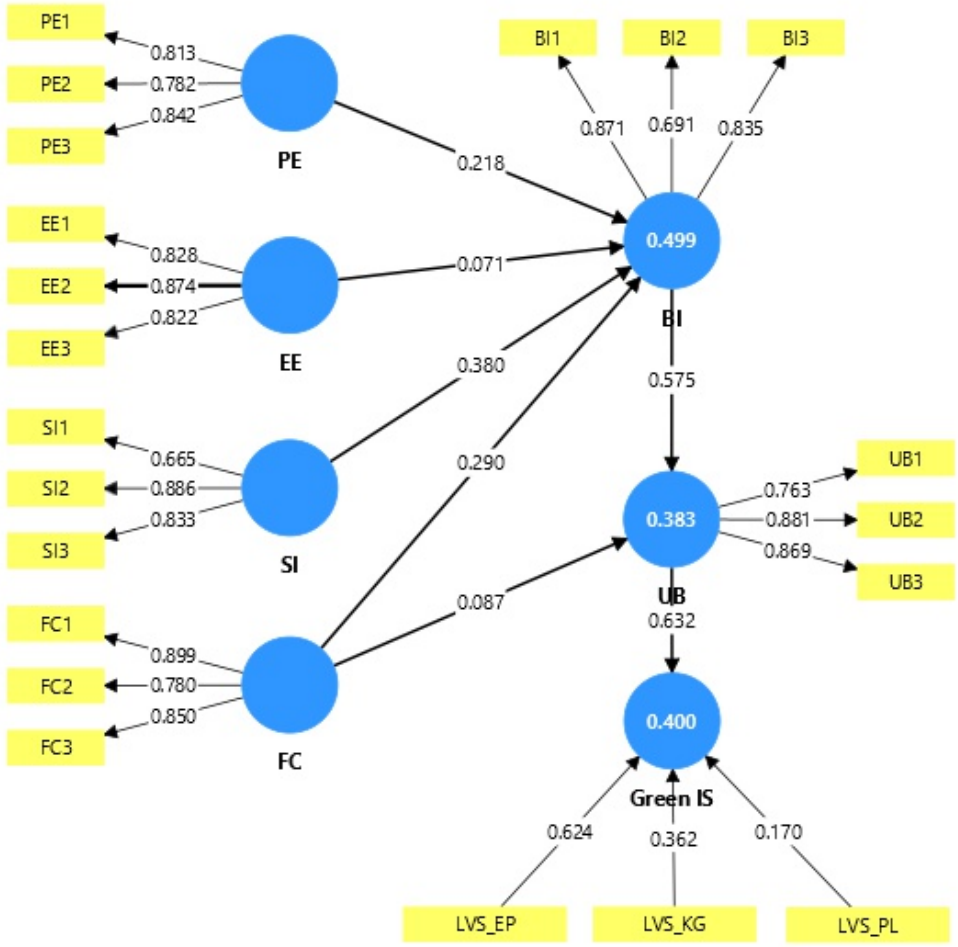

Figure 4. Outer loading research

contrast, Paperless (β = 0.170, p = 0.274) did not exhibit a statistically significant outer weight. Nevertheless, in accordance with the recommendations of Gudergan et al. (2025) and Hair and Alamer (2022), the Paperless dimension was retained in the model because its outer loading of 0.739 exceeded the minimum acceptable threshold of 0.5 and its VIF indicated the absence of multicollinearity.

Structural Model (Inner Model)

Model fit indicator

The inner-model collinearity diagnostics (VIF) and effect sizes (f^2) for all structural paths are reported in Table 4. All inner-model VIF values were below 3.0, indicating no multicollinearity concerns (Hair Jr. et al.. R^2 values were moderate for all endogenous constructs — BI = 0.499 (adj. 0.489), UB = 0.383 (adj. 0.377), and Green IS = 0.400 (adj. 0.397) — falling within the 0.33–0.67 range considered satisfactory for behavioral and technology-adoption studies (Henseler et al., 2009). The moderate R^2 for BI is consistent with the rejection of H2 (EE→BI), as Effort Expectancy contributed almost no unique variance (f^2 = 0.007); with only three of four UTAUT predictors contributing meaningfully, the ceiling for BI's R^2 is inherently capped, so the moderate rather than strong value reflects the removal of a weak predictor rather than a flaw in model specification.

The moderate R^2 observed for Use Behavior (0.383) raises the question of whether this same elimination of Effort Expectancy is responsible for weakening the final model's predictive power. Since EE was not hypothesized to act directly on UB but only indirectly through BI, its negligible effect (f^2 = 0.007) primarily limits BI's explanatory ceiling rather than UB's. However, because BI is the principal antecedent of UB, any constraint on BI's variance explained is necessarily transmitted downstream, meaning UB's moderate R^2 is best understood as an inherited effect of EE's weak contribution rather than a separate deficiency in the UB-Green IS pathway itself. In other words, the elimination of EE does not independently weaken the model's predictive relevance for UB; rather, it

Table 3. Discriminant validity (HTMT)

	BI	EE	EP	FC	KG	PE	PL	SI	UB
BI									
EE	0.529								
EP	0.747	0.603							
FC	0.586	0.414	0.451						
KG	0.631	0.587	0.679	0.375					
PE	0.667	0.515	0.604	0.279	0.487				
PL	0.476	0.420	0.813	0.279	0.514	0.416			
SI	0.764	0.577	0.560	0.314	0.558	0.690	0.547		
UB	0.797	0.493	0.724	0.416	0.604	0.684	0.578	0.800	

caps the variance available to be passed on to UB through BI, which is a structural consequence of a well-specified model, not a shortcoming in overall predictive capability.

Effect-size (f^2) analysis showed large effects for UB→Green IS (0.667) and BI→UB (0.427); medium effects for SI→BI (0.185) and FC→BI (0.148); and small effects for PE→BI (0.064), FC→UB (0.010), and EE→BI (0.007). The negligible EE effect is attributable to students' existing familiarity with digital platforms — particularly UNS's website services — rather than a model deficiency (Venkatesh et al., 2003). Predictive-relevance (Q^2) values were positive for all endogenous constructs (BI = 0.463, UB = 0.380, Green IS = 0.266) confirming the model's adequate predictive capability (Hair Jr et al, 2021).

Hypotheses testing

To evaluate the proposed structural relationships, in this study bootstrapping procedure with 5,000 resamples was conducted by following the recommendation of Hair Jr et al. (2021) to ensure stable parameter estimates and adequate statistical power to compute path coefficients, T-Stat, and p-values; the results of both direct and indirect hypotheses are summarized in Table 5.

Table 4. Model fit indicator

	VIF	f^2
BI -> UB	1.253	0.427
EE -> BI	1.375	0.007
FC -> BI	1.134	0.148
FC -> UB	1.253	0.010
PE -> BI	1.474	0.064
SI -> BI	1.554	0.185
UB -> Green IS	1.000	0.667

H1: Performance Expectancy affects Behavioral Intention

Performance Expectancy (PE) has a positive and significant effect on Behavioral Intention (BI). This result suggests that students' intention to utilize UNS website services is driven by utility; they are highly motivated to adopt these platforms when they perceive them as useful tools that directly support and enhance their academic efficiency. This behavior aligns with the fundamental premise of the UTAUT framework (Venkatesh et al., 2003), which identifies PE as a primary determinant of acceptance. Furthermore, this finding is consistent with Yudiatmaja et al. (2022), who confirm that Indonesian university students are pragmatic users who prioritize functional benefits, such as ease of accessing grades or submitting assignments, when engaging with institutional digital platforms.

H2: Effort Expectancy affects Behavioral Intention

Effort Expectancy (EE) did not have a significant effect on BI. This finding indicates that the perceived ease of using UNS website services is no longer a major factor influencing students' intention to use them. One possible explanation is that students are already accustomed to using digital technologies, including university website services, from the early stages of their academic journey or even

before entering higher education. This result is consistent with Venkatesh et al. (2003), who argued that the influence of ease of use tends to diminish as users gain experience with a technology. Similar findings were reported by Yudiatmaja et al. (2022), where EE was also found to be insignificant among technology-savvy academic users.

H3: Social Influence affects Behavioral Intention

Social Influence (SI) exhibited the strongest effect on BI among all UTAUT variables. This result highlights the important role of the social and academic environment, particularly lecturers' expectations, instructions, and institutional norms, in shaping students' intention to use university website services. The finding is consistent with UTAUT theory (Venkatesh et al., 2003). It is supported by Al-Mamary (2022) and Yudiatmaja et al. (2022), who emphasized that authority figures within educational institutions can strongly influence technology adoption through mandatory academic activities such as assignment submissions and online assessments.

H4: Facilitating Conditions affects Behavioral Intention

Facilitating Conditions (FC) were found to significantly influence BI. This indicates that the availability of supporting resources, such as reliable internet access and appropriate digital devices, encourages students to develop stronger intentions to use UNS website services. The result aligns with the findings of Nofitriyani et al.(2022) and Budianto Pattiasina & Dirgahayu (2024), who reported that adequate technological infrastructure positively contributes to users' behavioral intentions toward digital platforms.

H5: Facilitating Condition affects Use Behavior

The direct relationship between FC and Use Behavior (UB) was not statistically significant, contrary to the acceptance of H4 (FC → BI), and uncovers a critical behavioral paradox. While robust infrastructure successfully builds students' intention, it fails to trigger direct usage behavior. This logical discrepancy occurs because institutional infrastructure acts merely as a passive enabler. It eliminates technical anxiety and establishes psychological readiness, which explains its significant impact on intention (H4). However, because a university portal is a strictly utilitarian platform, students do not actively log in simply because a stable network is available. This is consistent with Mosweu et al. (2017), who noted that the presence of electronic systems does not guarantee active usage without internal motivational factors.

Consequently, the transition from infrastructure availability to actual usage requires a cognitive catalyst such as an academic assignment, which is captured within Behavioral Intention (BI). This indicates a mechanism of full mediation, in which technical facilities translate into actual behavior only when filtered through explicit student intent. This finding differs from Al-Mamary (2022) and Trisnadi et al. (2025), who reported a significant direct effect of FC on UB. In the context of UNS, this discrepancy confirms that actual engagement is driven more by internal academic commitment and specific modular requirements than by the mere availability of supporting facilities.

H6: Behavioral Intention affects Use Behavior

Behavioral Intention (BI) had a strong and significant positive effect on UB, confirming that intention is the primary driver of actual system usage. This finding is consistent with the fundamental assumption of UTAUT (Venkatesh et al., 2003), which posits that stronger intentions are likely to translate into greater usage behavior. Similar conclusions were reported by Al-Mamary (2022) and Batucan et al. (2022), who found that students' commitment and willingness to

Table 5. Direct and indirect hypotheses testing

Hypotheses	Path	β	T-Statistics	p-values	Status
H1	PE→BI	0.218	3.264	0.001	Accepted
H2	EE→BI	0.078	1.091	0.275	Rejected
H3	SI→BI	0.378	6.037	0.000	Accepted
H4	FC→BI	0.289	4.909	0.000	Accepted
H5	FC→UB	0.089	1.299	0.194	Rejected
H6	BI→UB	0.575	10.822	0.000	Accepted
H7	UB→Green IS	0.639	13.085	0.000	Accepted
H8	PE→BI→UB→Green IS	0.079	2.831	0.005	Accepted
H9	EE→BI→UB→Green IS	0.026	1.043	0.297	Rejected
H10	SI→BI→UB→Green IS	0.138	4.287	0.000	Accepted
H11	FC→BI→UB→Green IS	0.105	4.146	0.000	Accepted
H12	FC→UB→Green IS	0.055	1.268	0.205	Rejected

use technology significantly influence their actual utilization of digital systems for academic purposes.

H7: Use Behavior affects Green IS

Use Behavior (UB) demonstrated the strongest path coefficient in the entire model, indicating that actual engagement with UNS website services is the most influential factor in promoting Green IS adoption. This result suggests that the environmental and sustainability benefits associated with Green IS can only be realized when digital systems are actively and consistently used. The finding supports the Green IS perspective advanced by Brocke et al. (2013) and Kirchner-Krath et al. (2024), who argued that Green IS generates meaningful organizational and environmental outcomes only when it becomes embedded in routine operational activities.

Indirect Hypothesis Testing (Mediation)

H8: Performance Expectancy affects Green IS mediated by Behavioral Intention nd Use Behavior

The indirect effect of Performance Expectancy (PE) on Green IS, mediated by Behavioral Intention (BI) and Use Behavior (UB), was significant. This result indicates that students who perceive greater benefits from the UNS website services are more likely to develop stronger intentions to use the system, which subsequently translate into actual usage behavior and ultimately contribute to Green IS adoption. As highlighted by Gopinathan et al. (2025), PE, which reflects perceived usefulness and positive expectations toward technology, serves as an important antecedent of BI in the context of Green IS adoption. The finding is also consistent with the Theory of Reasoned Action and the Theory of Planned Behavior, which emphasize BI as the primary predictor of actual behavior (Gopinathan et al., 2025). Furthermore, the result confirms that consistent use of the system is essential for transforming positive intentions into tangible Green IS outcomes.

H9: Effort Expectancy affects Green IS mediated by Behavioral Intention and Use Behavior

The indirect relationship between Effort Expectancy (EE) and Green IS, mediated by BI and UB, was not statistically significant. This outcome is a direct consequence of the non-significant effect of EE on BI observed in H2. The finding suggests that perceived ease of use is no longer a determining factor in encouraging students to adopt Green IS, particularly among users who already possess sufficient digital literacy and experience with technology. This result supports the findings of Gopinathan et al. (2025), who also reported that EE did not significantly influence attitudes toward Green IS adoption. It is further aligned with Venkatesh et al. (2003), who argued that the importance of EE tends to diminish as users become more familiar with a technology and gain greater experience using it.

H10: Social Influence affects Green IS mediated by Behavioral Intention and Use Behavior

The indirect effect of Social Influence (SI) on Green IS, mediated by BI and UB, was significant. This finding demonstrates that social influence, including encouragement from peers, expectations from lecturers, and institutional requirements, plays an important role in shaping students' intentions to use UNS website services. These intentions subsequently lead to actual usage behavior, which in turn supports Green IS adoption. The result reinforces the findings of H3 and is consistent with previous studies by Al-Mamary (2022) and Yudiatmaja et al. (2022), which highlighted the substantial influence of authority figures and social norms within higher education institutions on technology adoption and usage behavior.

H11: Facilitating Conditions affect Green IS mediated by Behavioral Intention and Use Behavior

Facilitating Conditions (FC) were found to have a significant indirect effect on Green IS through BI and UB. This suggests that the availability of technological infrastructure and organizational support contributes to Green IS adoption by first strengthening students' confidence and readiness to use the system. These favorable conditions foster stronger behavioral intentions, which in turn encourage actual usage and ultimately support Green IS outcomes. The finding is consistent with Nofitriyani et al. (2022). It is further supported by the significant relationship identified in H6, indicating that FC influences Green IS indirectly through students' commitment to using technology sustainably.

H12: Facilitating Conditions affect Green IS mediated by Use Behavior

The indirect effect of FC on Green IS through UB alone was not significant. This result indicates that the mere availability of facilities and technological resources is insufficient to promote Green IS adoption without strong user intention. In other words, supporting infrastructure alone does not

guarantee active system use that contributes to Green IS outcomes. This finding is consistent with Venkatesh et al. (2003), who suggested that the direct influence of FC on usage behavior is more likely to be significant among older and more experienced users. The result also supports rejecting H5, further confirming that the FC → UB pathway does not meaningfully contribute to Green IS adoption in this study. This finding further strengthens the evidence for a full mediation mechanism in which Behavioral Intentions serve as the essential bridge between facilitating conditions and the use of sustainable technology.

Overall Discussion

The results show that 8 of the 12 proposed hypotheses were accepted (66.67%). The model explained 49.9% of the variance in Behavioral Intention (BI) ($R^2 = 0.499$), 38.3% in Use Behavior (UB) ($R^2 = 0.383$), and 40.0% in Green IS ($R^2 = 0.400$). The average explanatory power (42.7%) and predictive relevance (37.0%) exceeded the thresholds suggested by Henseler et al. (2009), indicating that the model has adequate explanatory and predictive capability in the context of technology adoption.

The findings support the applicability of the UTAUT model (Venkatesh et al., 2003) in explaining the use of UNS website services. Three UTAUT constructs—Performance Expectancy (PE), Social Influence (SI), and Facilitating Conditions (FC)—significantly influenced Behavioral Intention (BI), while Effort Expectancy (EE) did not. This result reinforces the findings of Yudiatmaja et al. (2022), suggesting that perceived ease of use is no longer a key determinant of technology adoption among digitally literate students. The insignificant effect of EE indicates that UNS students are already familiar with digital technologies, making ease of use less relevant in shaping adoption decisions. This aligns with Almiah et al. (2022), who found that familiarity with an e-learning system among university students reduces the role of perceived ease of use in adoption behavior.

The most important finding is the strong influence of Use Behavior (UB) on Green IS adoption ($\beta = 0.639$), which is the largest coefficient in the model. This supports the Green IS perspective proposed by Molla (2013) and Kirchner-Krath et al. (2024), which emphasizes that environmental benefits from information systems can only be achieved through actual system use. Consistent use of UNS website services was found to contribute to Work Efficiency and Green Awareness, supporting the findings of Viera Trevisan et al. (2024) regarding the role of digital transformation in promoting environmental sustainability in higher education.

However, the non-significant contribution of the Paperless dimension (outer weight = 0.170, $p = 0.274$) indicates that Green IS implementation at UNS has not yet fully translated into paper reduction practices. This finding is consistent with Al Jaberi et al. (2022), who argued that achieving a paperless campus requires explicit institutional policies, not merely the provision of digital services. Furthermore, the significant BI → UB → Green IS pathway confirms that Behavioral Intention and actual Use Behavior are the primary mechanisms through which the benefits of Green IS are realized.

■ CONCLUSION

This study examined the use of UNS website services among 210 undergraduate and vocational students, employing a PLS-SEM model that integrates UTAUT with a Two-Stage Approach to the Higher-Order Construct of Green IS. Three key conclusions were identified. First, among the four UTAUT constructs, Social Influence ($\beta = 0.380$, $p = 0.000$) emerged as the strongest determinant of Behavioral Intention (BI), followed by Facilitating Conditions ($\beta = 0.290$, $p = 0.000$) and Performance Expectancy ($\beta = 0.218$, $p = 0.001$). In contrast, Effort Expectancy ($\beta = 0.078$, $p = 0.275$) was not significant, indicating that ease of use is no longer a major consideration because students are already familiar with mandatory systems such as SIAKAD, SPADA, and OCW. A reflection of the sample's age demographic (19-23 years old), who represent true digital natives. Furthermore, BI significantly influenced Use Behavior (UB) ($\beta = 0.575$, $p = 0.000$). At the same time, Facilitating Conditions did not directly affect UB ($\beta = 0.089$, $p = 0.194$), suggesting that infrastructure contributes to usage only when supported by user intention.

Second, UB was the most influential factor in the model and had a strong positive effect on Green IS adoption ($\beta = 0.639$, $p = 0.000$). This confirms the BI → UB → Green IS pathway as the primary mechanism underlying Green IS adoption at UNS. Regular use of website services contributed to the Work Efficiency and Green Awareness dimensions. However, the Paperless dimension was not significant (outer weight = 0.170, $p = 0.274$), indicating that Green IS implementation at UNS has not yet been fully translated into paper reduction practices.

Third, BI and UB functioned as effective mediators between UTAUT constructs and

Green IS adoption. Three indirect effects (PE, SI, and FC through BI → UB) were significant, whereas EE and the FC → UB pathway were not. These findings indicate that social and institutional influences play a greater role than technological ease in driving Green IS adoption among UNS students.

Overall, the study provides evidence that digital transformation through UNS website services supports both academic effectiveness and environmental sustainability. Given that social influence and compliance drive student behavior, institutional enforcement through explicit paperless policies represents the most effective strategy to accelerate Green IS implementation and support UNS sustainability initiatives. Future studies are encouraged to incorporate the original UTAUT moderating variables (gender, age, and experience), include more diverse samples such as postgraduate students, and employ qualitative approaches to explore the development of Green IS awareness among students (Pathiranage & Madrika, 2024).

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