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FROM INFORMATION EXPOSURE TO GREEN BANKING USAGE INTENTION: AN INTEGRATED AWARENESS-TAM-TPB MODEL IN HO CHI MINH CITY

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ABSTRACT

This study develops and tests an integrated model explaining how customers move from exposure to green banking information to an intention to use green banking services. Drawing on information-processing perspectives, the Technology Acceptance Model, and the Theory of Planned Behavior, the model distinguishes green banking information exposure (TT) from green banking service awareness (NT), positions environmental concern (MT) as an antecedent of awareness, and examines perceived usefulness (HI), attitude toward using green banking services (TD), and subjective norms (CQ) as predictors of intention to use green banking services (YD). A cross-sectional survey generated 699 usable responses. The 22-item measurement instrument used a five-point Likert scale, and the proposed relationships were assessed with partial least squares structural equation modeling. All eight hypothesized paths were positive and statistically significant (p < .001). Environmental concern and information exposure were associated with awareness (beta = .545 and .222), while awareness and perceived usefulness were associated with attitude (beta = .549 and .283). Perceived usefulness, attitude, awareness, and subjective norms were directly associated with usage intention (beta = .270, .265, .206, and .197). The model explained 42.8% of awareness, 54.7% of attitude, and 51.4% of usage intention. Significant indirect effects indicated that awareness connects information-related antecedents to intention and that attitude provides complementary mediation for awareness and perceived usefulness. The findings show that repeated exposure alone is insufficient: banks must translate environmental concern into verifiable service knowledge and practical value. Because the archived project documentation contains conflicting age coding, the evidence is interpreted for the full analytical sample rather than as definitive evidence for customers aged 18-30.

Keyword: Green banking; information exposure; environmental concern; customer awareness.

1. INTRODUCTION

Green banking links the provision of financial services with environmental objectives and the responsible use of resources. At the organizational level, it includes financing decisions, environmental risk management, operational processes, and disclosure; at the customer level, it becomes meaningful only when customers can recognize what makes a service green, understand how it differs from ordinary digital convenience, and evaluate whether it is useful for their own banking needs (Khairunnessa et al., 2021; Park & Kim, 2020; Sharma & Choubey, 2022). This distinction matters because digital banking and green banking overlap but are not equivalent. A digital channel may reduce paper or travel in some circumstances, yet the mere presence of an application does not establish a measurable environmental benefit. Similarly, green finance includes a wider set of investment and financing instruments than retail green banking services. A consumer-oriented study therefore requires a clear service boundary rather than treating all digital transactions or financial products as green by default.

The demand side of green banking remains less straightforward than the expansion of green financing at the institutional level. Prior studies have examined customer awareness, technology acceptance, planned behavior, perceived benefits, environmental values, and green attitudes, but they do not define awareness or model its role consistently (Bouteraa et al., 2023; Ellahi et al., 2023; Jain et al., 2025; Rocha et al., 2025; Taneja & Ali, 2021). In some studies, awareness refers to having heard of green banking; in others, it

overlaps with general attitudes toward environmental protection or evaluations of a bank. Such conceptual overlap obscures the process through which customers progress from encountering information to understanding a service and then forming an intention to use it.

This study addresses two connected problems. The first concerns the formation of green banking service awareness. Information exposure creates an opportunity to encounter claims about green products and practices, whereas environmental concern provides a reason to pay attention to those claims. These are theoretically distinct mechanisms: a customer may frequently encounter green banking messages without understanding them, while an environmentally concerned customer may remain unaware of specific services when information is scarce or vague. The second problem concerns the conversion of awareness into usage intention. Understanding a service does not automatically imply that it is useful, positively evaluated, socially supported, or incorporated into a near-term plan. The model therefore separates awareness, perceived usefulness, attitude, subjective norms, and intention instead of treating them as interchangeable expressions of support for sustainability.

The study integrates four complementary perspectives. The Technology Acceptance Model (TAM) explains how perceived usefulness shapes attitude and behavioral intention (Davis, 1989; Davis et al., 1989). The Theory of Planned Behavior (TPB) explains how attitude and subjective norms contribute to intention (Ajzen, 1991). The Elaboration Likelihood Model helps distinguish opportunities for message exposure from motivation to process environmental information (Petty & Cacioppo, 1986). Finally, the Stimulus-Organism-Response logic provides an organizing framework in which information-related stimuli are associated with internal awareness and evaluation, which in turn are associated with intended behavioral responses (Mehrabian & Russell, 1974). The study does not claim to test every construct in these theories. Rather, it uses them selectively to explain a seven-construct, eight-hypothesis model.

The study makes three contributions. First, it separates green banking information exposure from self-assessed green banking service awareness, allowing the model to test whether repeated contact with messages is associated with actual understanding. Second, it positions environmental concern as a motivational antecedent of service awareness rather than assuming that concern directly substitutes for knowledge or intention. Third, it models awareness as both a direct predictor of intention and an indirect predictor through attitude, while simultaneously accounting for perceived usefulness and subjective norms. This structure clarifies why knowing about a green service may matter even when practical value, affective evaluation, and social expectations are considered.

Empirically, the model is assessed using 699 survey responses collected in Ho Chi Minh City and a 22-item instrument. The results show that all proposed paths are positive in the full analytical sample, but effect sizes differ substantially. Environmental concern has a large association with awareness, awareness has a large association with attitude, and each direct predictor contributes a comparatively small unique effect to usage intention. These findings caution against ranking managerial priorities solely by statistical significance or small differences between standardized coefficients. They also support a communication strategy that combines credible information, service understanding, practical usefulness, and socially supported choice.

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1 Green banking services and customer awareness

Green banking can be understood through three interconnected domains: the allocation of finance to environmentally relevant activities, the environmental design of internal operations, and the delivery of customer-facing services with identifiable environmental content. Institutional research emphasizes policy, governance, financing criteria, and implementation practices (Khairunnessa et al., 2021; Nguyen et al., 2023; Park & Kim, 2020). Consumer research, however, must translate these organizational practices into service attributes that individuals can recognize and evaluate. Customers generally cannot observe a bank's full internal environmental performance; they rely on disclosed product purposes, process descriptions, eligibility conditions, and evidence supporting green claims.

Accordingly, this study defines a green banking service as a banking service whose environmental purpose is expressed through the product content, use-of-funds objective, or delivery process, with attributes that customers can identify from relevant information. This operational definition is deliberately narrower than green finance and more demanding than digitalization alone. It also avoids claiming that respondents can independently verify environmental impact. The awareness construct measures self-assessed recognition and understanding, not objective technical knowledge or audited environmental performance.

Information asymmetry is central to this context. Banks possess more information than customers about product design, financing purposes, risk assessment, and operational processes. Customers mainly encounter selected claims and explanations. Therefore, the quantity of exposure and the quality of understanding should not be conflated. A person may see the phrase green banking repeatedly but remain unable to identify service forms, distinguish environmental objectives from convenience benefits, or explain the basis of a green claim. This distinction motivates the first stage of the model.

2.2 Integrated theoretical framing

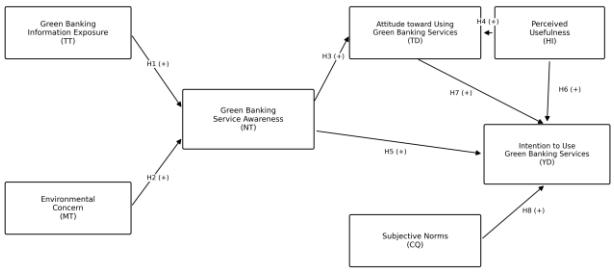
TAM proposes that perceived usefulness - the belief that using a system improves relevant performance - shapes favorable attitudes and behavioral intention (Davis, 1989; Davis et al., 1989). In the present context, perceived usefulness refers to whether a green banking service supports the customer's banking needs and improves transaction effectiveness. Environmental purpose does not remove the need for functional value. A service may be clearly green but still fail to attract usage when customers do not see how it helps them complete relevant banking tasks.

TPB distinguishes attitude, subjective norms, perceived behavioral control, and intention (Ajzen, 1991). This study uses the attitude-intention and subjective norm-intention relationships. Attitude captures the customer's favorable or unfavorable evaluation of using green banking services, while subjective norms capture perceived support or expectations from important others. Perceived behavioral control is outside the tested model; consequently, the results explain intention rather than actual usage or customers' ability to perform the behavior.

Information-processing theory adds a prior stage. The Elaboration Likelihood Model suggests that exposure provides an opportunity to process a message, while motivation and ability affect the depth of processing (Petty & Cacioppo, 1986). Environmental concern can increase the personal relevance of green banking information, encouraging customers to attend to and remember service content. The model therefore treats information exposure as an opportunity mechanism and environmental concern as a motivational mechanism. Awareness is the internal cognitive state that links these antecedents with later evaluation and intention.

The Stimulus-Organism-Response framework is used as an organizing logic rather than as a full replication of its original affective model (Mehrabian & Russell, 1974). Green banking information exposure functions as an external stimulus; awareness and attitude represent internal cognitive and evaluative states; intention represents the planned response. Environmental concern, perceived usefulness, and subjective norms capture individual and social conditions that shape this process. Figure 1 summarizes the proposed relationships.

Figure 1. *Proposed research model*



Note. Variable names are translated into English; the original project codes TT, MT, NT, HI, TD, CQ, and YD are retained.

2.3 Hypothesis development

2.3.1 Green banking information exposure and green banking service awareness

Green banking information exposure (TT) refers to the frequency with which customers encounter information about green banking services and

initiatives during the previous three months. Exposure increases opportunities to notice service names, compare attributes, and remember available service forms. Nevertheless, exposure does not guarantee understanding because repetitive slogans or poorly specified claims may create familiarity without knowledge. By measuring exposure separately from awareness, the study tests whether more frequent contact is positively associated with customers' self-assessed understanding of green banking services (Bouteraa et al., 2023; Ellahi et al., 2023).

H1. Green banking information exposure has a positive association with green banking service awareness.

2.3.2 Environmental concern and green banking service awareness

Environmental concern (MT) captures attention to environmental degradation, concern about the long-term consequences of pollution, and the importance assigned to protecting living conditions for future generations. Concern does not itself demonstrate knowledge of a banking service. However, it can increase the personal relevance of environmental information and motivate customers to search for, process, and retain information about financial choices linked to environmental objectives. Prior green banking studies show that environmental considerations are connected with evaluations and adoption processes, although their position in the model differs across studies (Jain et al., 2024; Jain et al., 2026; Taneja & Ali, 2021).

H2. Environmental concern has a positive association with green banking service awareness.

2.3.3 Green banking service awareness and attitude toward using green banking services

Green banking service awareness (NT) is the customer's self-assessed ability to understand the meaning of green banking, recognize environmental features, distinguish environmental objectives from ordinary convenience, and identify service forms available to individuals. Attitude toward using green banking services (TD) is a favorable evaluation of the act of using such services. Awareness can provide a more concrete basis for evaluation: customers who understand what a service is and how its green content is expressed can judge the behavior itself rather than merely react to a label. Evidence linking awareness and attitude has emerged in green banking research, although measurement and contexts vary (Meirani et al., 2026; Rocha et al., 2025).

H3. Green banking service awareness has a positive association with attitude toward using green banking services.

2.3.4 Perceived usefulness and attitude toward using green banking services

Perceived usefulness (HI) reflects the extent to which customers believe that a green banking service helps them address banking needs and perform transactions effectively. TAM predicts that useful systems generate more favorable evaluations because customers can connect the service with valued outcomes (Davis, 1989; Davis et al., 1989). In green banking, functional usefulness complements environmental meaning. Customers may support sustainability in general while remaining unfavorable toward a service that appears difficult to apply or irrelevant to their needs. Evidence on perceived benefits and green banking adoption further supports the evaluative role of practical value (Jain et al., 2025).

H4. Perceived usefulness has a positive association with attitude toward using green banking services.

2.3.5 Green banking service awareness and intention to use green banking services

Customers must recognize and understand a service before they can meaningfully include it in a near-term usage plan. Awareness may have a direct association with intention because customers who know the relevant service forms can more easily identify when a suitable need arises. This direct path is retained alongside the indirect path through attitude. Prior findings are mixed: awareness is important in several green banking and green FinTech adoption models, while some studies report no direct awareness-intention relationship after accounting for other mechanisms (Bouteraa et al., 2023; Meirani et al., 2026; Sharma et al., 2025; Tanchangya et al., 2025).

H5. Green banking service awareness has a positive association with intention to use green banking services.

2.3.6 Perceived usefulness and intention to use green banking services

TAM allows perceived usefulness to influence intention directly as well as indirectly through attitude (Davis et al., 1989). Customers may plan to use a service because it solves a banking problem effectively, even when their broader affective evaluation is only moderately favorable. This direct route captures the practical value of green banking services. Because performance expectancy and perceived benefits do not operate identically in all prior models, the proposed relationship remains an empirical question rather than an assumption that usefulness is always the dominant predictor (Jain et al., 2025; Tanchangya et al., 2025).

H6. Perceived usefulness has a positive association with intention to use green banking services.

2.3.7 Attitude toward using green banking services and usage intention

Attitude reflects whether using green banking services is viewed as good, favorable, and worth choosing. Both TAM and TPB predict that a favorable evaluation strengthens intention, while maintaining a conceptual distinction between evaluation, planning, and actual behavior (Ajzen, 1991; Davis et al., 1989). Green banking studies similarly identify attitude as a central mechanism connecting beliefs and values with adoption intention (Jain et al., 2026; Taneja & Ali, 2021).

H7. A favorable attitude toward using green banking services has a positive association with intention to use green banking services.

2.3.8 Subjective norms and usage intention

Subjective norms (CQ) represent perceived support or expectations from people who are important to the customer. In TPB, such social influence contributes to intention alongside personal evaluation (Ajzen, 1991). Green banking is partly a values-laden choice, and endorsement from trusted people may legitimize unfamiliar services or encourage customers to investigate them. The construct does not identify a specific source such as family, friends, or influencers; it captures the overall perceived social expectation surrounding the customer's own use decision (Jain et al., 2026).

H8. Subjective norms have a positive association with intention to use green banking services.

3. METHOD

3.1 Research design, sampling, and data quality

The study used a cross-sectional quantitative design. The intended population described in the project was individual banking customers aged 18-30 who lived, studied, or worked in Ho Chi Minh City and had used personal banking services during the previous 12 months. Data were collected online between April and October 2026 using non-probability recruitment that combined eligibility criteria, convenience access, and respondent referrals. The project recorded 729 returns and removed 30 invalid questionnaires, leaving 699 observations for analysis.

The archived project documentation contains a material inconsistency in the age variable. One descriptive table presents all 699 respondents in three categories between 18 and 30 years, whereas the project abstract, conclusion, and data-quality notes state that only 95 respondents were coded in a young age category and 604 were older than 30. The available archive does not resolve whether the discrepancy arose from relabeling, coding, or documentation. To avoid unsupported population claims, this manuscript reports structural estimates for the full analytical sample and does not interpret them as definitive evidence for customers aged 18-30. Age-specific descriptive statistics are therefore withheld pending verification against the original questionnaire and raw coding scheme.

Data screening showed complete responses for the 22 model items, all within the intended range of 1-5. The project also reported 520 unique response patterns across 30 recorded variables and 179 records that repeated a pattern occurring earlier in the file. Because respondent identifiers and timestamps were unavailable, repeated patterns could not be classified as duplicate participation and were not automatically removed. This limitation is considered when discussing the precision and generalizability of the results.

Table 1. *Operationalization of the constructs*

Construct	Code	Operational definition	Items	Primary sources
Green banking information exposure	TT	Frequency of encountering information about green banking services and initiatives during the previous three months.	3	Ellahi et al. (2023); Bouteraa et al. (2023)
Environmental concern	MT	Attention to environmental degradation, pollution consequences, and protection of living conditions for future generations.	3	Taneja and Ali (2021); Jain et al. (2024, 2026)
Green banking service awareness	NT	Self-assessed recognition and understanding of the meaning, environmental features, and accessible forms of green banking services.	4	Ellahi et al. (2023); Rocha et al. (2025)
Perceived usefulness	HI	Belief that the described green banking service supports banking needs and improves transaction effectiveness.	3	Davis (1989); Jain et al. (2025)
Attitude toward using green banking services	TD	Favorable evaluation of using the described green banking service.	3	Ajzen (1991); Taneja and Ali (2021)
Subjective norms	CQ	Perceived support or expectations from important others regarding use of green banking services.	3	Ajzen (1991); Jain et al. (2026)
Intention to use green banking services	YD	Plan and willingness to choose a green banking service within the next six months when a relevant need arises.	3	Ajzen (1991); Taneja and Ali (2021)

Note. Construct names are translated into English; variable codes and item codes are retained from the source project.

3.2 Measurement instrument

The model contains seven reflective constructs measured by 22 items on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). The English construct names used in this article are translations of the Vietnamese project terminology, while the original variable codes and item codes are retained exactly: green banking information exposure (TT; TT1-TT3), environmental concern (MT; MT1-MT3), green banking service awareness (NT; NT1-NT4), perceived usefulness (HI; HI1-HI3), attitude toward using green banking services (TD; TD1-TD3), subjective norms (CQ; CQ1-CQ3), and intention to use green banking services (YD; YD1-YD3).

The awareness items were administered before the survey explanation of green banking services so that they would reflect respondents' pre-existing self-assessed understanding. The remaining evaluation and intention items referred to a neutral service description presented later in the questionnaire. Intention was bounded to the next six months and to situations in which a relevant banking need arose. This design reduced the risk of asking respondents to commit to a product that was unrelated to their circumstances. Appendix A provides the complete English wording while preserving the original codes and the five-point response format.

The measurement development drew on TAM, TPB, prior green banking research, and a structured content-review protocol described in the project. However, the supplied archive includes the expert-review forms and selection criteria rather than completed signed consultation records. The article therefore treats the measurement instrument as literature-grounded and empirically evaluated, without claiming independent verification of a completed expert panel process.

3.3 Analytical strategy

The analysis followed a two-stage PLS-SEM procedure. The reflective measurement model was evaluated using outer loadings, Cronbach's alpha, rho_A, composite reliability (rho_C), average variance extracted (AVE), and the heterotrait-monotrait ratio (HTMT). Loadings around .708, reliability values between .70 and .95, AVE above .50, and HTMT below .85 were used as reference points (Hair et al., 2022; Henseler et al., 2015). Values above .95 were not treated as automatically superior because they may indicate redundant item content.

The structural model was evaluated using inner variance inflation factors (VIF), standardized path coefficients, bootstrap t values, p values, bias-corrected 95% confidence intervals, coefficients of determination (R^2), effect sizes (f^2), and specific indirect effects. The project output did not document all resampling settings, such as the exact number of bootstrap subsamples. Consequently, the article reports the supplied statistics without inventing missing software parameters. Q^2 values from a cross-validated redundancy procedure are reported as supplementary in-sample evidence; they are not interpreted as out-of-sample predictive performance.

The cross-sectional design supports tests of theoretically specified associations, not temporal causality. Accordingly, the terms effect and influence are avoided when causal interpretation would be implied. Hypotheses are considered supported when the coefficient has the expected positive sign and its 95% confidence interval excludes zero.

4. RESULTS

4.1 Sample characteristics and descriptive statistics

The final sample comprised 203 men (29.0%) and 496 women (71.0%). More than half had completed university education (53.8%); 23.6% had completed intermediate or college education, 13.3% high school, and 9.3% postgraduate education. Reported banking-use experience was distributed across less than one year (20.2%), one to under two years (34.9%), two to under three years (21.9%), and three years or more (23.0%). When asked which service category they primarily had in mind, 60.5% selected payment and digital banking services, 23.6% green bank cards, 11.7% green finance, and 4.1% green credit. The predominance of digital services reinforces the need to distinguish digital convenience from verified environmental content.

Construct means were above the midpoint of the five-point scale, but no formal tests compared the means with the midpoint or with each other. Environmental concern had the highest mean (M = 3.675), followed by perceived usefulness (M = 3.617), awareness (M = 3.585), attitude (M = 3.556), and information exposure (M = 3.451). Intention (M = 3.316) and subjective norms (M = 3.312) were lower. The descriptive gap between environmental concern and usage intention is consistent with the study's conceptual premise that general concern does not automatically become a plan to use a specific banking service.

Table 2. *Sample characteristics (N = 699)*

Characteristic	Category	n	%
Gender	Male	203	29.0
Gender	Female	496	71.0
Education	High school	93	13.3
Education	Intermediate/college	165	23.6
Education	University	376	53.8
Education	Postgraduate	65	9.3
Banking-use experience	Less than 1 year	141	20.2
Banking-use experience	1 to <2 years	244	34.9

Characteristic	Category	n	%
Banking-use experience	2 to <3 years	153	21.9
Banking-use experience	3 years or more	161	23.0
Primary service category imagined	Green credit	29	4.1
Primary service category imagined	Green finance	82	11.7
Primary service category imagined	Green bank cards	165	23.6
Primary service category imagined	Payment and digital banking services	423	60.5

Note. Age is not reported because the archived source contains conflicting age coding that requires verification against the original questionnaire and codebook.

Table 3. *Construct-level descriptive statistics*

Construct	Code	Items	Mean	SD
Green banking information exposure	TT	3	3.451	0.829
Environmental concern	MT	3	3.675	0.897
Green banking service awareness	NT	4	3.585	0.893
Perceived usefulness	HI	3	3.617	0.826
Attitude toward using green banking services	TD	3	3.556	0.977
Subjective norms	CQ	3	3.312	0.890
Intention to use green banking services	YD	3	3.316	0.996

4.2 Measurement model

All 22 outer loadings ranged from .836 to .955, exceeding the conventional reference value of approximately .708. Cronbach's alpha ranged from .845 to .933, rho_A from .847 to .938, and composite reliability from .906 to .957. AVE ranged from .764 to .881. These results support internal consistency and convergent validity. The composite reliability of attitude was .957, slightly above the .95 reference point, indicating that the three attitude items may be highly similar and should be reviewed for content redundancy in future measurement development.

All HTMT values were below .85. The highest ratio was .749 between awareness and attitude, followed by .695 between environmental concern and awareness and .692 between attitude and intention. The results support discriminant validity under the point-estimate criterion. Because the supplied output did not include inferential HTMT confidence intervals, the conclusion is limited to these point estimates.

Table 4. *Outer loadings, internal consistency, and convergent validity*

Item	Loading	Construct	Alpha	rho_A	rho_C	AVE
TT1	.898	TT	.897	.921	.935	.828
TT2	.895					

Item	Loading	Construct	Alpha	rho_A	rho_C	AVE
TT3	.936					
MT1	.840	MT	.846	.856	.907	.764
MT2	.881					
MT3	.900					
NT1	.904	NT	.924	.928	.946	.815
NT2	.920					
NT3	.906					
NT4	.880					
HI1	.935	HI	.893	.909	.933	.823
HI2	.887					
HI3	.899					
TD1	.936	TD	.933	.938	.957	.881
TD2	.924					
TD3	.955					
CQ1	.891	CQ	.853	.858	.911	.773
CQ2	.881					
CQ3	.866					
YD1	.836	YD	.845	.847	.906	.764
YD2	.874					
YD3	.910					

Note. Reliability and AVE values are shown on the first item row of each construct. Alpha = Cronbach's alpha; rho_C = composite reliability; AVE = average variance extracted.

Table 5. *Heterotrait-monotrait ratio (HTMT) matrix*

Construct	CQ	HI	MT	NT	TD	TT	YD
CQ	-						
HI	.298	-					
MT	.391	.511	-				
NT	.232	.581	.695	-			
TD	.297	.620	.623	.749	-		
TT	.480	.458	.368	.437	.503	-	
YD	.445	.665	.599	.649	.692	.590	-

Note. All reported HTMT values are below .85.

4.3 Structural model and hypothesis tests

Inner VIF values ranged from 1.094 to 2.240, providing no indication of problematic collinearity in the specified equations. The model explained 42.8% of the variance in green banking service awareness, 54.7% of the variance in attitude, and 51.4% of the variance in usage intention. The cross-validated redundancy values supplied for awareness, attitude, and intention were .345, .476, and .388, respectively. These positive values provide supplementary evidence that the model reconstructs information in the endogenous indicators under the reported procedure, but they do not establish out-of-sample prediction.

All eight hypothesized paths were positive and statistically significant at $p < .001$. Information exposure was positively associated with awareness (beta = .222, f^2 = .076), supporting H1. Environmental concern was positively associated with awareness (beta = .545, f^2 = .460), supporting H2. Awareness was positively associated with attitude (beta = .549, f^2 = .475), supporting H3, and perceived usefulness was positively associated with attitude (beta = .283, f^2 = .126), supporting H4.

Four constructs had direct positive associations with usage intention. Awareness was associated with intention (beta = .206, f^2 = .042), supporting H5. Perceived usefulness was associated with intention (beta = .270, f^2 = .093), supporting H6. Attitude was associated with intention (beta = .265, f^2 = .064), supporting H7. Subjective norms were associated with intention (beta = .197, f^2 = .073), supporting H8. The direct coefficients for usefulness and attitude differ by only .005; without a formal test of the difference, the results do not support a claim that one is statistically more important than the other. Similarly, all four intention predictors had small unique effect sizes after the remaining predictors were included.

The estimated structural model is shown in Figure 2. Standardized coefficients describe associations among evaluations measured at the same point in time. They should not be converted into percentage changes in adoption, transaction volume, or environmental outcomes.

Table 6. *Structural model results*

Hyp.	Path	beta	t	p	95% CI	f^2	VIF	Decision
H1	TT -> NT	.222	7.154	< .001	[.158, .280]	.076	1.129	Supported
H2	MT -> NT	.545	17.107	< .001	[.480, .604]	.460	1.129	Supported
H3	NT -> TD	.549	18.695	< .001	[.490, .604]	.475	1.398	Supported
H4	HI -> TD	.283	9.282	< .001	[.222, .342]	.126	1.398	Supported
H5	NT -> YD	.206	5.485	< .001	[.134, .278]	.042	2.063	Supported
H6	HI -> YD	.270	7.287	< .001	[.196, .339]	.093	1.601	Supported
H7	TD -> YD	.265	6.215	< .001	[.181, .348]	.064	2.240	Supported
H8	CQ -> YD	.197	6.947	< .001	[.139, .251]	.073	1.094	Supported

Note. All confidence intervals are bias-corrected 95% bootstrap intervals as reported in the supplied output.

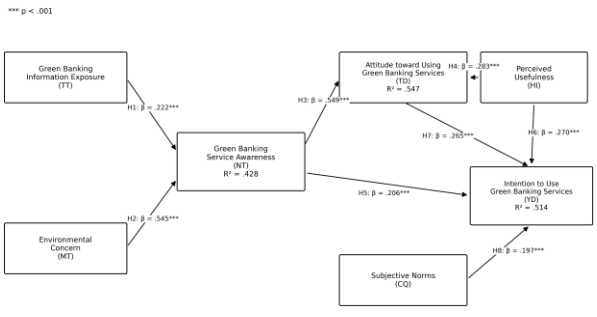


Figure 2. *Estimated structural model*

*Note. Standardized path coefficients are shown. *** $p < .001$. R^2 values are reported for endogenous constructs.*

4.4 Indirect effects

The indirect effect of awareness on intention through attitude was .145 (95% CI [.099, .199]), while the indirect effect of perceived usefulness through attitude was .075 (95% CI [.047, .108]). Because the corresponding direct paths remained positive and significant, attitude provides complementary mediation rather than replacing the direct associations of awareness and perceived usefulness with intention.

Information exposure was indirectly associated with intention through awareness (beta = .046, 95% CI [.028, .069]) and through the sequential path awareness-attitude (beta = .032, 95% CI [.020, .049]). Environmental concern showed larger indirect associations through awareness (beta = .112, 95% CI [.073, .155]) and through awareness-attitude (beta = .079, 95% CI [.053, .112]). Information exposure and environmental concern also had significant indirect associations with attitude through awareness (beta = .122 and .299, respectively). Because the model does not specify direct paths from information exposure or environmental concern to intention, these results are described as indirect mechanisms rather than as evidence of full mediation.

For descriptive comparison, the total association of awareness with intention was .351 (.206 direct + .145 indirect), and the total association of perceived usefulness was .345 (.270 direct + .075 indirect). The values are nearly identical and were not accompanied by a confidence interval for their difference. The totals therefore clarify the combined pathways but do not establish a rank ordering of managerial importance.

Table 7. *Specific indirect effects*

Indirect path	beta	t	p	95% CI
TT -> NT -> TD -> YD	.032	4.413	< .001	[.020, .049]
HI -> TD -> YD	.075	4.791	< .001	[.047, .108]
MT -> NT -> TD	.299	11.634	< .001	[.250, .350]
MT -> NT -> YD	.112	5.351	< .001	[.073, .155]
NT -> TD -> YD	.145	5.730	< .001	[.099, .199]
TT -> NT -> TD	.122	6.737	< .001	[.087, .156]
TT -> NT -> YD	.046	4.451	< .001	[.028, .069]
MT -> NT -> TD -> YD	.079	5.236	< .001	[.053, .112]

5. DISCUSSION

5.1 Interpretation of the findings

The findings support the proposed distinction between exposure to green banking information and awareness of green banking services. Information exposure had a positive association with awareness, but its effect size was small. Repeated visibility may create opportunities to learn, yet it does not ensure that customers understand the environmental objective, recognize relevant attributes, or distinguish green content from ordinary digital convenience. This result extends research that places customer awareness within green banking adoption processes (Bouteraa et al., 2023; Ellahi et al., 2023) by explicitly separating the frequency of contact from the cognitive outcome of understanding.

Environmental concern had a much larger association with awareness. Customers who care about environmental degradation may pay more attention to green claims, search for additional information, and retain service details. The result is theoretically consistent with an information-processing account in which personal relevance increases motivation to elaborate on a message. It also refines prior green banking research by positioning environmental concern before service awareness rather than using concern as a

substitute for attitude or directing it indiscriminately toward every behavioral outcome. Nevertheless, the cross-sectional data cannot rule out reverse selection: customers who already understand green banking may become more attentive to environmental information.

Awareness had a large association with attitude and a smaller but significant direct association with intention. This dual role is important. Customers who understand the service can evaluate it more concretely, and they can also identify circumstances in which it may enter a future banking plan. The result aligns with studies that distinguish green banking awareness from later evaluative constructs (Rocha et al., 2025) and helps explain why some prior studies find an awareness-intention relationship while others do not. The direct path may depend on how awareness is defined, whether attitude and usefulness are included, and whether respondents can identify actual service forms.

Perceived usefulness was associated with both attitude and intention, consistent with TAM. Environmental purpose alone is insufficient; customers still expect the service to meet banking needs and improve transaction effectiveness. At the same time, the findings do not justify describing usefulness as the single dominant factor. Its direct coefficient for intention was almost identical to that of attitude, and its unique effect size remained small after the other predictors were included. The practical value of green banking should therefore be communicated alongside credible environmental content rather than used to replace it.

Attitude and subjective norms both contributed to intention. The attitude finding reinforces the distinction between understanding a service and favorably evaluating its use. The subjective norm finding indicates that customers' plans also reflect perceived expectations from important others. However, the construct does not reveal whether family, friends, colleagues, educators, online communities, or influencers are responsible for the association. The evidence supports social endorsement as a general mechanism, not a specific influencer-marketing prescription.

5.2 Theoretical contributions

First, the study extends consumer green banking research by specifying a cognitive formation stage before conventional adoption beliefs. Information exposure and environmental concern explain awareness through different mechanisms: opportunity to encounter information and motivation to attend to it. This distinction prevents communication reach from being mistaken for customer understanding.

Second, the study integrates awareness with TAM and TPB without collapsing conceptually adjacent constructs. Awareness reflects self-assessed knowledge of the service; perceived usefulness reflects personal functional value; attitude reflects evaluation of using the service; subjective norms reflect perceived social expectations; and intention reflects a near-term usage plan. The supported discriminant validity results show that these constructs are empirically related but not interchangeable in the supplied sample.

Third, the study demonstrates that awareness contributes to intention through both direct and attitude-mediated routes. Looking only at the direct coefficient would understate the total association of awareness with intention. Conversely, treating attitude as the sole mechanism would ignore the remaining direct relationship. The complementary mediation pattern offers a more nuanced account of how understanding and evaluation jointly support intended use.

Fourth, the effect-size pattern provides a methodological contribution to interpretation. Every structural path had $p < .001$, but only environmental concern to awareness and awareness to attitude had large f^2 values. All direct predictors of intention had small unique f^2 values. Statistical significance in a large sample should therefore not be equated with a large managerial lever.

5.3 Managerial implications

Banks should move beyond high-frequency green labels and design information that customers can interpret. A useful communication unit should identify the service, explain the environmental feature, clarify whether the feature arises from the product purpose or delivery process, identify the relevant customer need, and state the basis for the green claim. Communication performance should be evaluated not only by impressions or clicks but also by whether customers can accurately explain the service after exposure.

Environmental concern should be connected with concrete banking choices. Educational content can show how a transaction process, product eligibility rule, or use-of-funds condition relates to a specific environmental objective. This approach is more credible than using general sustainability language or guilt-based appeals. For customers who are interested in environmental issues, the practical next step should be easy to identify without implying that every digital transaction is environmentally beneficial.

Service design and communication must make usefulness visible. Banks should explain which needs a service address, what steps are required, what constraints apply, and which benefits are supported by operational evidence. Claims about time, cost, convenience, or environmental outcomes should be limited to what the service can substantiate. Because usefulness and attitude contributed through both direct and indirect routes, favorable evaluation is most likely when practical performance and green content are mutually consistent.

Social support can be developed through trustworthy peer explanation, customer education, and transparent experience sharing. Any endorsement should disclose relevant relationships and avoid social pressure. Since the study measured a general subjective norm rather than the effects of specific reference groups, banks should test different sources of social proof rather than assume that celebrity or influencer communication is optimal.

Finally, managerial pilots should measure multiple stages: exposure, correct understanding, perceived usefulness, attitude, intention, and verified usage where consent permits. Higher usage caused by a temporary incentive does not necessarily indicate stronger green awareness, and improved awareness may not immediately produce a transaction when the customer has no relevant need. A staged measurement system is better aligned with the model than a single campaign conversion metric.

5.4 Limitations and future research

Several limitations constrain interpretation. First, the age variable is inconsistent across the archived report. The intended scope was customers aged 18-30, but the available documentation does not provide a defensible reconciliation of the age coding. The findings should therefore be treated as full-sample evidence until the raw questionnaire and codebook are verified. Future studies should use an explicit numeric age item and retain an auditable codebook.

Second, the design is cross-sectional and based on self-reports. It cannot establish temporal causality or actual service use. Awareness is self-assessed rather than objectively tested, and common method bias was not evaluated with a design-based or statistical procedure reported in the archive. Longitudinal surveys, information experiments, objective knowledge questions, and consented behavioral records would provide stronger evidence.

Third, the sample was recruited through non-probability online methods. Response patterns repeated across records, but the absence of identifiers and timestamps prevented a definitive duplicate-response audit. Future data collection should retain privacy-preserving response IDs, timestamps, survey-version metadata, and pre-specified quality rules.

Fourth, 60.5% of respondents primarily associated the survey with payment and digital banking services. Because digital banking is not automatically green banking, respondents may have differed in the service they imagined. Future research should randomly assign clearly defined service scenarios or analyze distinct product categories.

Fifth, the attitude scale had composite reliability above .95, suggesting possible item redundancy. The PLS-SEM archive did not provide all bootstrap settings, inferential HTMT confidence intervals, or an out-of-sample prediction assessment. Future work should refine the attitude items, preserve complete analysis settings, and evaluate predictive performance using a holdout or cross-validation procedure appropriate to the research objective.

6. CONCLUSION

This study explains green banking usage intention as a multi-stage process rather than a direct response to environmental messages. Information exposure and environmental concern are associated with service awareness; awareness and perceived usefulness are associated with attitude; and awareness, usefulness, attitude, and subjective norms are associated with intention. Significant indirect paths show that awareness

connects the information stage with intended use and that attitude provides complementary mediation.

The central managerial lesson is that visibility is not equivalent to understanding and environmental concern is not equivalent to adoption. Banks need credible explanations of what makes a service green, evidence that the service is useful for relevant banking needs, consistent experiences that support favorable evaluation, and social communication that informs rather than pressures customers. The results provide a useful integrated framework, while the age-coding, cross-sectional, and documentation limitations should be resolved before the estimates are generalized to a specific young-customer population.

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