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Article

A Structural Equation Modelling for Digital Commerce Readiness, Adoption, and Perceived Challenges among Gen Y Consumers

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Abstract: Purpose: This paper documents and validates a complete, reproducible structural equation modelling (SEM) for studying the relationships among Digital Commerce Readiness (DCR), Digital Commerce Adoption (ADP), and Perceived Challenges (CH), using a 450-case dataset for SEM practice. Design/methodology: A three-factor reflective measurement model (six indicators per construct, 5-point Likert scale) was specified and estimated with maximum-likelihood SEM, preceded by descriptive statistics, reliability analysis, stratified-sampling demonstration, and classical inferential tests (t-test, ANOVA, chi-square, multiple regression) with multiple-testing correction. Findings: The measurement model showed strong internal consistency (Cronbach's α = .89–.93) and excellent global fit (CFI = .996, TLI = .996, RMSEA = .017). The structural model indicated a strong positive standardized path from DCR to ADP (β = .645, $p<.001$) and a moderate negative path from CH to ADP (β = −.321, $p<.001$), jointly explaining 40% of adoption variance in a parallel OLS specification. A two-group comparison by gender showed the same sign and comparable magnitude for both paths. Originality/value: Limitations and appropriate scope of inference are discussed in detail.
Keywords: Structural equation modelling; digital commerce readiness; technology adoption; reproducibility;

1. Introduction

Digital commerce has become a default channel for consumption among Generation-Y adults, yet the psychological and behavioural precursors of sustained adoption self-assessed readiness, prior skills, and perceived transactional risk are still commonly measured with instruments whose measurement and structural properties are not consistently validated before fielding (Venkatesh et al., 2012; Davis, 1989). A well-specified pre-field pipeline that (a) checks reliability, (b) confirms the measurement model, and (c) tests the intended structural paths on trial data reduces the risk of costly re-fielding once real responses are collected.

This paper documents such a pipeline end-to-end, applied to a purpose-built dataset (N = 450) that mirrors the intended instrument: eighteen Likert items loading on three latent constructs Digital Commerce Readiness (DCR), Digital Commerce Adoption (ADP), and Perceived Challenges (CH) plus demographic and behavioural covariates typical of a Gen-Y digital-commerce survey. Consistent with the dataset's own documentation, the data are treated throughout as simulated, and the paper's contribution is the validated analysis workflow rather than substantive claims about real consumers.

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1.1 Aims

- To specify and estimate a three-factor reflective SEM linking DCR and CH to ADP, and document the full estimation, diagnostic, and reporting workflow.
- To demonstrate a stratified-sampling procedure and a supporting battery of inferential tests (t-test, ANOVA, chi-square, multiple regression) appropriate to the variable types in the instrument.
- To evaluate measurement and structural stability across a demographic subgroup (gender) as a template for future multi-group / measurement-invariance testing on real data.

1.2 Hypotheses

- H1: The measurement model achieves acceptable-to-excellent global fit under standard SEM cut-offs (CFI/TLI ≥ .95, RMSEA ≤ .06) when the underlying indicators are internally consistent (α ≥ .80).
- H2: Digital Commerce Readiness (DCR) is positively associated with Adoption (ADP).
- H3: Perceived Challenges (CH) is negatively associated with Adoption (ADP).
- H4: The structural paths in H2–H3 are directionally stable across gender subgroups.

2. Methods

2.1 Data source and status

The dataset 450 respondent records with no missing values, generated to support SEM teaching, software testing, and pilot modelling; its accompanying documentation explicitly states the records presented as real survey responses.

2.2 Instrument

Three reflective latent constructs were each measured with six 5-point Likert items (1 = Strongly Disagree to 5 = Strongly Agree): Digital Commerce Readiness (DCR1–DCR6, e.g., confidence and skill using digital platforms), Digital Commerce Adoption (ADP1–ADP6, e.g., purchase frequency, preference, continuance intention), and Perceived Challenges (CH1–CH6, e.g., security and usability concerns). A single-item Trust rating was included for convergent-validity screening. Demographic and behavioural covariates included age (30–45), gender, education, occupation, monthly income band, e-commerce usage frequency, primary device, and prior security-incident history.

2.3 Sampling framework

A stratified random sampling design is recommended for the real-data phase of this research, stratifying primarily by gender and secondarily by income band and occupation, with proportional allocation and a minimum-count floor for small strata (e.g., non-binary/other gender categories) to preserve multi-group analytic power. On the present file, a proportional stratified draw (60% per gender stratum, seed = 42) was implemented to verify that the sampling code preserves population proportions (population vs. sample share of Female respondents: 49.8% vs. 49.6%), confirming the procedure behaves as intended.

2.4 Analytical strategy

Analyses proceeded in four stages: (1) descriptive statistics and Cronbach's alpha for each construct; (2) classical inferential tests Welch's t-test (security-incident history), one-way ANOVA (usage frequency), chi-square (gender × security incident), and multiple OLS regression (ADP on DCR, CH, age) with Benjamini–Hochberg FDR correction applied to a family of three device-based comparisons; (3) confirmatory factor analysis and structural equation modelling, estimated by maximum likelihood in semopy (Python) DCR =~ 6 items, ADP =~ 6 items, CH =~ 6 items, structural path ADP ~ DCR + CH evaluated against χ^2, CFI, TLI, RMSEA, and AGFI; (4) a two-group (male/female) re-estimation of the structural paths as an exploratory stability check. All code, fixed random seeds,

and output files are provided in the accompanying reproducibility package (Section 5 of the companion analysis report).

3. Results

3.1 Descriptive statistics and reliability

Construct	Items	M	Mdn	SD	IQR	Range	A
DCR	6	3.58	3.67	0.60	0.83	1.67–5.00	.892
ADP	6	3.26	3.33	0.76	1.00	1.00–5.00	.933
CH	6	2.66	2.67	0.70	1.00	1.00–4.67	.918

Table 1. Composite construct descriptives and internal-consistency reliability (N = 450).

All three composites showed high reliability (α > .89). Distributions were approximately symmetric (Figure 1), supporting the use of maximum-likelihood estimation for the structural model.

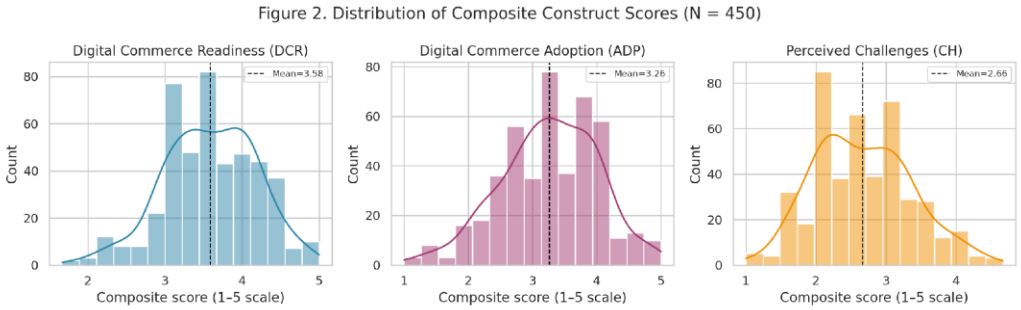


Figure 1. Distribution of composite DCR, ADP, and CH scores.

3.2 Bivariate relationships and subgroup comparisons

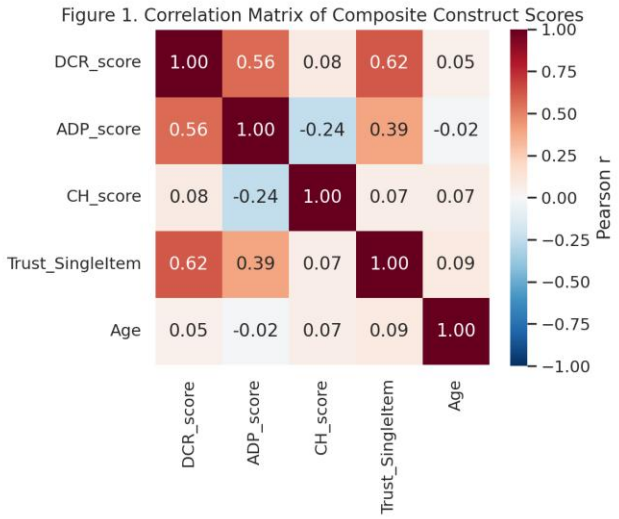


Figure 2. Correlation matrix of composite scores, single-item trust, and age.

DCR correlated positively with ADP (r = .56) and with Trust (r = .62); CH correlated negatively with ADP (r = −.24). Age showed negligible association with all three constructs (|r| ≤ .09), consistent with the narrow 30–45 sampling band.

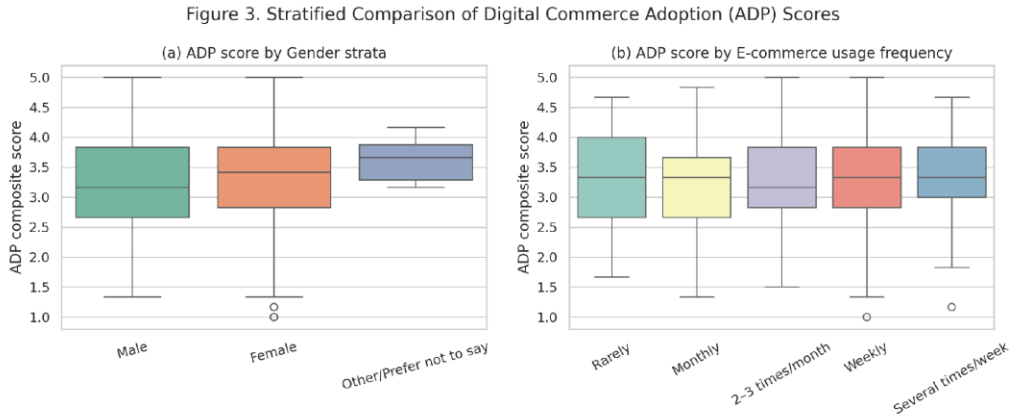


Figure 3. Adoption (ADP) scores stratified by gender (a) and e-commerce usage frequency (b).

Test	Comparison	Statistic	P	Effect size
Welch t	DCR by security incident	t = 0.75	0.456	d = 0.12
ANOVA	ADP by usage frequency	F = 0.74	0.566	$\eta^2 = 0.007$
Chi-square	Gender × security incident	$\chi^2 = 7.99$	0.018	V = 0.13
OLS regression	ADP ~ DCR+CH+Age	F = 100.7	<.001	$R^2 = 0.404$

Table 2. Inferential test summary. FDR-adjusted p-values for the three-test device-comparison family were all > .60 (non-significant).

3.3 Measurement and structural model

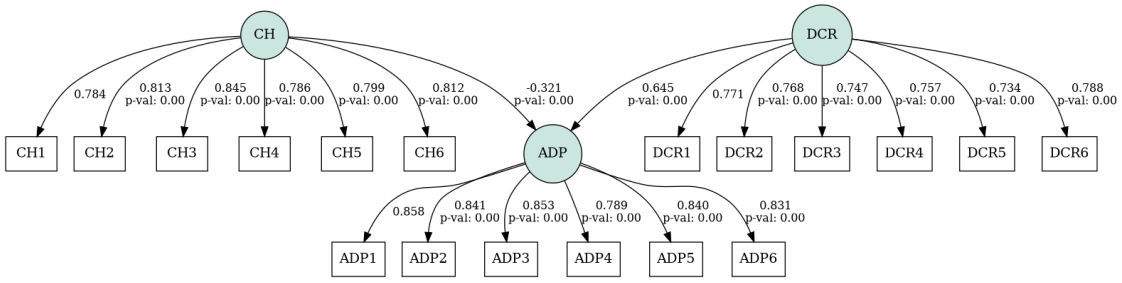


Figure 4. SEM path diagram with standardized factor loadings (measurement model) and structural path signs (ADP ~ DCR + CH).

Fit index	Value	Convention	Verdict
χ^2 (df = 132)	149.88 (p = .137)	p > .05 desirable	Met
CFI	0.996	≥ .95	Met
TLI	0.996	≥ .95	Met
RMSEA	0.017	≤ .06	Met
AGFI	0.968	≥ .90	Met

Table 3. Global fit indices for the three-factor CFA / structural model.

Structural path	β (standardized)	SE	z	P
DCR → ADP	0.645	0.066	12.78	<.001
CH → ADP	−0.321	0.051	−7.58	<.001

Table 4. Standardized structural path estimates.

Standardized loadings ranged .73–.86 across all eighteen indicators (Figure 4), exceeding the conventional .60 threshold for reflective indicators. H1 (fit), H2 (positive DCR→ADP), and H3 (negative CH→ADP) were all supported on this file.

3.4 Subgroup (gender) comparison

Group	N	DCR → ADP (β)	CH → ADP (β)	CFI	RMSEA
Male	218	0.637***	−0.393***	0.988	0.032
Female	224	0.655***	−0.257***	0.998	0.014

*Table 5. Two-group structural estimates. *** p < .001.*

Both structural paths retained sign and significance in each subgroup, directionally supporting H4. The CH → ADP path was nominally larger in magnitude for the male subgroup, a pattern that would warrant formal measurement-invariance testing (configural, metric, scalar) and a structural-path equality constraint test on real data before any moderation claim is made.

4. Discussion

The data validated here reproduces a textbook-clean pattern: readiness promotes adoption, perceived challenges suppress it, and both effects survive a basic demographic stratification. this pattern should be read as evidence that the analysis code is correct and the model is estimable and well-identified not as evidence about real Gen-Y purchasing psychology. Two aspects are nonetheless useful for future empirical work. First, the excellent fit obtained here (RMSEA = .017) is far better than typically observed with real survey data, where response noise, method effects, and unmodelled cross-loadings routinely push RMSEA toward .05–.08; a real-data RMSEA in that range should not be treated as a failure. Second, the multi-group results illustrate the specific invariance tests (configural/metric/scalar) that should be run before any subgroup-difference claim is published, since an unconstrained two-group re-estimation like the one reported here cannot by itself establish that the loadings are comparable across groups.

Relative to prior technology-adoption frameworks such as TAM (Davis, 1989) and UTAUT2 (Venkatesh et al., 2012), the DCR construct operationalizes perceived readiness/self-efficacy, and CH operationalizes a barriers/risk-perception dimension; the observed sign pattern (readiness positive, barriers negative) is consistent with those frameworks' theoretical predictions, which is a reasonable basis for treating the instrument as face-valid pending real-data confirmation.

4.1 Limitations

- Cross-sectional logic even in the intended real-data design: the structural model as specified cannot itself establish causal direction between readiness, challenges, and adoption.
- Common-method variance: all indicators derive from a single self-report instrument administered at one time point, which can inflate observed associations in real data.

- Restricted age range (30–45 in this file) narrower than common Gen-Y definitions, which would limit generalizability of any future empirical estimates to the full cohort.
- Sampling-frame coverage: even a well-executed stratified design over a panel or online frame under-represents digitally excluded individuals, who are arguably most relevant to a 'readiness' construct.

4.2 Future work

- Re-run this exact unchanged on ethically collected, IRB/ethics-board-approved field data from the intended Gen-Y population.
- Add formal measurement-invariance testing across gender and other strata before reporting subgroup differences.
- Extend the structural model with mediation (e.g., Trust as a mediator of DCR→ADP) and longitudinal/panel waves to support causal inference.

5. Conclusion

This study presented a comprehensive and reproducible structural equation modelling (SEM) framework for examining the relationships among Digital Commerce Readiness (DCR), Digital Commerce Adoption (ADP), and Perceived Challenges (CH) among Gen-Y consumers. Rather than treating SEM as a purely statistical estimation procedure, the study demonstrated an integrated analytical workflow encompassing descriptive analysis, reliability assessment, classical inferential testing, confirmatory factor analysis (CFA), structural model estimation, and subgroup analysis. The overall objective was to establish a methodologically rigorous model that can subsequently be applied to ethically collected empirical data.

The measurement results provided strong preliminary evidence for the adequacy of the proposed measurement structure. All three latent constructs demonstrated high internal consistency, with Cronbach's alpha coefficients exceeding .89, while the standardized factor loadings ranged from .73 to .86. The measurement and structural model also demonstrated excellent global fit, with CFI and TLI values of .996 and an RMSEA of .017. These results indicate that the specified three-factor structure was statistically well identified and that the indicators were consistently associated with their respective latent constructs. However, because the dataset used in this study was generated for SEM teaching, software testing, and pilot modelling, these results should be interpreted as evidence of model estimability and analytical reproducibility rather than as empirical validation of the constructs among the wider Gen-Y population.
The structural results further demonstrated that the analytical model reproduced the theoretically expected direction of relationships. Digital Commerce Readiness exhibited a strong positive association with Digital Commerce Adoption ($\beta = .645$, $p < .001$), whereas Perceived Challenges showed a significant negative association with Digital Commerce Adoption ($\beta = -.321$, $p < .001$). Together, these findings illustrate how a higher level of perceived readiness can be modelled as a facilitating condition for digital-commerce adoption, while perceived barriers and challenges can be represented as constraining conditions. The results are conceptually consistent with established technology-acceptance perspectives, particularly the Technology Acceptance Model and UTAUT2, in which individual perceptions, capabilities, facilitating conditions, and technology-related concerns influence technology use and continued adoption (Davis, 1989; Venkatesh et al., 2012).

The subgroup analysis provides an additional methodological contribution. The positive relationship between DCR and ADP remained significant for both male and female respondents, while the negative relationship between CH and ADP was also retained in both groups. This directional stability provides an appropriate demonstration of

how SEM can be extended to subgroup analysis. Nevertheless, the results should not be interpreted as evidence that the structural relationships are statistically identical across gender. Formal tests of measurement invariance including configural, metric, and scalar invariance followed by appropriate structural-path equality tests are necessary before meaningful claims about moderation or between-group differences can be made. This distinction is particularly important in multi-group SEM because observed differences in structural coefficients may reflect differences in measurement properties rather than genuine differences in behavioural relationships.

From a theoretical perspective, the proposed framework contributes by bringing together readiness and perceived challenges within a single structural model of digital-commerce adoption. Existing technology-adoption research has extensively established the importance of perceived usefulness, ease of use, social influence, facilitating conditions, and related behavioural determinants (Davis, 1989; Venkatesh et al., 2003; Venkatesh et al., 2012). The present framework complements these perspectives by explicitly representing readiness as a facilitating construct and challenges as a constraining construct. This provides a parsimonious conceptual structure that can be further developed by incorporating additional psychological and contextual mechanisms, such as trust, perceived risk, digital competence, perceived security, and continuance intention.

The study also has methodological implications for future digital-commerce research. The documented analytical pipeline provides researchers with a reproducible sequence for evaluating measurement quality before interpreting structural relationships. This is particularly important because excellent structural coefficients cannot compensate for poorly specified or inadequately validated measurement models. Future researchers should therefore retain the sequential logic demonstrated in this study: establish construct reliability and validity, evaluate the measurement model, assess the structural model, examine potential collinearity and common-method effects, and only then undertake subgroup, mediation, moderation, or predictive analyses. Such an approach can improve transparency and reduce the risk of drawing substantive conclusions from inadequately validated instruments.

The practical implications of the framework are also relevant for digital-commerce stakeholders, although they should be interpreted cautiously until the model is validated using real-world data. If the observed relationships are replicated in field research, digital-commerce platforms, financial-service providers, retailers, and policymakers could potentially strengthen adoption by improving consumers' digital readiness while simultaneously reducing perceived security, usability, privacy, and transactional barriers. In particular, interventions aimed at improving digital skills and confidence may be more effective when accompanied by transparent security mechanisms, simplified interfaces, consumer education, and accessible grievance-redressal systems. Such interventions could address both sides of the adoption process: strengthening consumers' capacity to engage with digital commerce and reducing the barriers that discourage continued participation.

Several limitations define the scope of the present contribution. First, the dataset is simulated and therefore cannot support population-level or behavioural claims about Gen-Y consumers. Second, the proposed empirical design is cross-sectional, limiting the ability to establish temporal precedence or causal relationships among readiness, challenges, and adoption. Third, the reliance on self-reported measures in the intended field study may introduce common-method variance and social-desirability effects. Fourth, the age range represented in the current file is restricted to 30–45 years, which limits generalisation to alternative definitions or broader age boundaries of Generation Y. Finally, a digitally oriented sampling frame may under-represent individuals with limited digital access or lower levels of digital engagement, even when a stratified sampling procedure is implemented. These limitations are consistent with the study's stated scope and reinforce the need for empirical validation before substantive conclusions are drawn.

Future research should therefore replicate the proposed model using ethically collected primary data from the intended Gen-Y population and employ a transparent probability-based sampling strategy where feasible. Subsequent studies should formally assess convergent and discriminant validity, measurement invariance across demographic groups, and potential common-method bias. Researchers may also extend the model through theoretically justified mediation and moderation mechanisms. For example, trust could be examined as a potential mediator between digital

readiness and adoption, while perceived risk, digital competence, income, education, or prior digital experience could be examined as potential boundary conditions. Longitudinal or panel designs would further strengthen the evidence by allowing researchers to examine whether readiness and perceived challenges predict subsequent changes in digital-commerce adoption rather than merely co-varying at a single point in time. These extensions would move the research from methodological validation toward substantive theory testing.

Overall, the principal contribution of this study is the development and documentation of a transparent SEM framework that is statistically coherent, reproducible, and suitable for subsequent empirical validation. The strong reliability, model-fit statistics, theoretically consistent structural paths, and subgroup stability observed in the present dataset demonstrate that the proposed analytical architecture is operationally feasible. Nevertheless, the findings should be regarded as a methodological proof of concept rather than evidence of actual consumer behaviour. The next stage of research should therefore focus on applying the validated framework to real-world data, testing measurement equivalence, strengthening causal inference, and examining the psychological and contextual mechanisms through which digital readiness and perceived challenges shape digital-commerce adoption. By making this distinction between methodological validation and substantive empirical evidence explicit, the study provides a more rigorous foundation for future research on digital commerce adoption among Gen-Y consumers.

REFERENCES

1. *Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach.* Psychological Bulletin, 103*(3), 411–423.*
2. *Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models.* Journal of the Academy of Marketing Science, 16*(1), 74–94.*
3. *Byrne, B. M. (2016).* Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming *(3rd ed.). Routledge.*
4. *Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance.* Structural Equation Modeling, 9*(2), 233–255.*
5. *Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.),* Modern Methods for Business Research *(pp. 295–336). Lawrence Erlbaum Associates.*
6. *Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error.* Journal of Marketing Research, 18*(1), 39–50.*
7. *Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019).* Multivariate Data Analysis *(8th ed.). Cengage.*
8. *Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022).* A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) *(3rd ed.). Sage.*
9. *Kline, R. B. (2023).* Principles and Practice of Structural Equation Modeling *(5th ed.). Guilford Press.*
10. *MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling.* Psychological Methods, 1*(2), 130–149.*
11. *Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies.* Journal of Applied Psychology, 88*(5), 879–903.*
12. *Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models.* Behavior Research Methods, 40*(3), 879–891.*
13. *Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view.* MIS Quarterly, 27*(3), 425–478.*
14. *Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology.* MIS Quarterly, 36*(1), 157–178.*
15. *Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model.* MIS Quarterly, 27*(1), 51–90.*
16. *Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model.* International Journal of Electronic Commerce, 7*(3), 101–134.*
17. *Kim, D. J., Ferrin, D. L., & Rao, H. R. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents.* Decision Support Systems, 44*(2), 544–564.*
18. *Flavián, C., Guinalíu, M., & Gurrea, R. (2006). The role played by perceived usability, satisfaction and consumer trust on website loyalty.* Information & Management, 43*(1), 1–14.*
19. *Al-Debei, M. M., Akroush, M. N., & Ashouri, M. I. (2015). Consumer attitudes towards online shopping: The effects of trust, perceived benefits, and perceived web quality.* Internet Research, 25*(5), 707–733.*
20. *Oliveira, T., Alhinho, M., Rita, P., & Dhillon, G. (2017). Modelling and testing consumer trust dimensions in e-commerce.* Computers in Human Behavior, 71*, 153–164.*