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Flow, Game Evaluation, and Player Loyalty in Mobile Games: Evidence from Korea and Japan

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Abstract

Mobile-game publishers face the dual challenge of retaining existing players while sustaining continuously updated digital services. This study develops and tests an integrated model linking psychological flow and overall game evaluation, shaped by service quality, system quality, and pricing policy, to satisfaction, word-of-mouth (WOM), and reuse intention. Survey data from adult paying mobile-game users in Korea and Japan were analyzed using partial least squares structural equation modeling, bootstrap inference, measurement-invariance assessment, and multigroup comparisons. Flow and game evaluation were positively associated with satisfaction, which in turn was positively associated with both loyalty intentions. Cross-national comparisons suggested a stronger satisfaction–WOM relationship in Korea and a stronger satisfaction–reuse intention relationship in Japan. These directional patterns persisted after controlling for gender, age, gaming tenure, and daily playtime, although statistical support for between-country differences was sensitive to the outcome and multiple-testing considerations. The findings integrate experiential and operational explanations of player satisfaction and offer cautious implications for sustaining consumer relationships in digital services.

Keywords: mobile games; flow; player loyalty; digital service sustainability; cross-national comparison; word-of-mouth; reuse intention

1. Introduction

The global games market closed 2025 at USD 201.6 billion, with mobile games generating USD 113.3 billion and remaining the largest platform segment [1]. In this mature market, intensified competition and rising user-acquisition costs make retention and the cultivation of durable consumer relationships central to platform viability. Research on mobile applications likewise identifies satisfaction, perceived value, technical attributes, and user experience as central determinants of continuance intention [2,3]. Digital-platform sustainability research also emphasizes platform governance and relationships among ecosystem participants [4], while evidence from e-commerce platforms links value-in-use with sustained use intention [5]. These studies frame continuity of user relationships as relevant to long-term platform viability, without implying that loyalty intention itself measures economic sustainability.

Research on digital games has highlighted two broad mechanisms behind continued engagement. One stream emphasizes flow—the immersive psychological state arising from

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focused, intrinsically rewarding interaction [6]—while another emphasizes evaluations of service and system operations. Recent mobile-game studies continue to show that flow, enjoyment, challenge, social engagement, perceived value, and satisfaction all contribute to retention and loyalty [7–10], while mobile-app research demonstrates that technical, functional, psychological, and social factors jointly shape continuance intention [2,3].

Despite these advances, two gaps remain. First, experiential and operational explanations have largely been studied separately, leaving open the question of how psychological flow and pragmatic service evaluation jointly contribute to satisfaction and loyalty. Second, although Korea and Japan are two mature mobile-gaming markets with considerable value for cross-national comparison, empirical evidence directly examining differences in the relationships among flow, game evaluation, satisfaction, and loyalty across these two markets remains limited. The present study treats this comparison as cross-national rather than as a direct test of cultural mechanisms, since individual cultural orientations were not measured; cultural theory motivates expectations but does not drive the inferences.

This study develops and tests an integrated model in which experiential and operational antecedents jointly shape satisfaction and loyalty, and asks four research questions:

RQ1. What antecedents drive flow in mobile-game users?

RQ2. How do service quality, system quality, and pricing policy shape users' global evaluation of a game?

RQ3. How do flow and game evaluation jointly influence satisfaction and, in turn, WOM and reuse intention?

RQ4. Do these structural relationships—particularly the links from satisfaction to WOM and reuse intention—differ between Korean and Japanese mobile-game users?

The study contributes in three ways. First, it integrates experiential and operational determinants of satisfaction within a single structural model, showing how two conceptually distinct mechanisms converge on the same post-adoption outcome. Second, it conducts a cross-national comparison that separates within-group significance from statistically tested between-group differences and assesses measurement invariance before interpreting those differences—a methodological standard that is increasingly expected but still unevenly applied. Third, it links durable loyalty intentions to the sustainability of consumer–service relationships, providing a conceptual bridge between consumer-behavior findings and the broader viability of digital-service platforms.

2. Theoretical Background and Hypothesis Development

2.1. Flow

Flow is an optimal psychological experience that emerges when individuals perceive their skills as sufficient to meet the demands of an engaging activity [11]. Hoffman and Novak [6] extended flow theory to computer-mediated environments, arguing that users entering a state of flow online spend more time, develop positive emotions, and experience time distortion. This effect is pronounced in gaming, where players become so immersed that they lose track of time. Designing mobile games that effectively induce flow is therefore a core strategy for achieving deep user engagement.

Recent evidence continues to underscore the importance of flow and engagement in digital gaming. Flow has been linked to continuance-related outcomes [12], while research on mobile-game retention identifies enjoyment, challenge, in-game experience, and social engagement as important predictors of continued participation [7]. Kim [8] similarly reports relationships among mobile-game motivations, perceived value, flow, and loyalty. More recently, Deng et al. [13] examined how player engagement evolves over time in online mobile games. Although Deng et al. [13] adopt a dynamic perspective, their findings further

highlight the importance of understanding player engagement. Building on this broader literature, the present study focuses on the factors associated with flow in mobile gaming.

Flow is associated with active and purposeful participation, supported by the balance between skill and challenge, clear goals, and interaction with other players. Drawing on this theoretical foundation, the present study specifies four antecedents of flow: goal clarity, perceived challenge, social interaction, and player skill.

H1a. *Goal clarity is positively associated with the user's flow state.*

H1b. *Perceived challenge is positively associated with the user's flow state.*

H1c. *Interactive elements positively influence the flow state of game users.*

H1d. *Player skill is positively associated with the user's flow state.*

Flow is intrinsically rewarding, and prior studies connect flow and game-related enjoyment to satisfaction, loyalty, continuance, and retention [7,8,12,14]. Recent research further highlights the contribution of compelling flow experiences to consumer loyalty in video gaming [15]. Together, these findings suggest that flow is relevant to favorable post-gameplay evaluations and subsequent loyalty outcomes. Building on the established relationship between flow and satisfaction, the present study therefore expects flow to contribute positively to overall satisfaction.

H2. *The flow experienced during gameplay positively influences customer satisfaction with the game.*

2.2. Mobile-Game Operation-Related Factors

While flow captures the user's psychological experience, a game's success also depends on how consumers evaluate service delivery and operational management. An intrinsically enjoyable game can lose its user base through frequent server issues or unresponsive customer support. Operational conditions matter after adoption: system and service characteristics shape satisfaction and continuance in mobile services, and mobile-game research similarly links service quality and satisfaction to continued use and purchase outcomes [2,9]. Three operational antecedents are therefore distinguished:

System Quality: The technical excellence of the game, including a seamless user interface, intuitive navigation, and stable connectivity.

Service Quality: The support provided by the publisher, including prompt responses to inquiries and effective problem resolution.

Pricing Policy: The user's perception of the fairness and value of the game's monetization model; policies perceived as excessive can lead users to switch to alternatives.

Together, these operational attributes are expected to shape users' overall evaluation of a mobile game. A more favorable game evaluation, in turn, is expected to enhance satisfaction.

H3a. *Service quality positively influences the user's overall evaluation of a mobile game.*

H3b. *System quality positively influences the user's overall evaluation of a mobile game.*

H3c. *Pricing policy positively influences the user's overall evaluation of a mobile game.*

H4. *A positive evaluation of a mobile game positively impacts customer satisfaction.*

2.3. Customer Loyalty

A central objective for digital-service providers is to establish durable relationships with consumers. Consistent with established loyalty theory [16], satisfaction and continuance-related evaluations sustain post-adoption relationships, and reviews of mobile applications identify satisfaction and perceived value among the central antecedents of continuance intention [3]. In the present study, loyalty is represented by two distinct expressions: word-of-mouth and reuse intention. These outcomes capture both outward-facing advocacy and inward-facing continuance, and together they offer a richer picture of durable consumer–service relationships than either measure alone. Consistent with this view, Peng and Bai [17] identify satisfaction as a mechanism underlying continuance intention in a game-user experience context, reinforcing the relevance of satisfaction-driven loyalty formation.

H5a. *Satisfaction with mobile games positively impacts word-of-mouth (WOM) recommendation.*

H5b. *Satisfaction with mobile games positively impacts reuse intention (RUI).*

2.4. Cross-National Context and Hypothesized Differences

The relative importance of flow antecedents may differ across national settings. Korea and Japan are both mature gaming markets with distinct histories of game participation, online community formation, and mobile gaming practices [18–20]. Research on Korean and Japanese online gamers reports differences in how community, trust, and satisfaction operate across the two markets [18], and work on regional game cultures describes historically strong communal and multiplayer practices in Korea alongside distinctive personal and mobile gaming trajectories in Japan [19,20].

Theoretical perspectives on cultural self-construal and individualism–collectivism further suggest that the salience of social connections versus personally rewarding mastery experiences may vary across these contexts [21–23]. Taken together, these historical and theoretical considerations provide a basis for exploring whether the relative importance of social interaction, challenge, and skill differs between the two national samples. Drawing on the contextual distinctions discussed above, the present study proposes that interaction will be more strongly associated with flow in Korea, whereas challenge and skill will show stronger associations with flow in Japan. The present study tests these as national-group differences and uses cultural theory as an interpretive lens; individual cultural orientations are not measured in the data.

H6. *National-group membership moderates selected relationships between the antecedents of flow and the flow state.*

H6a. *The influence of interaction on flow is stronger in the Korean sample than in the Japanese sample.*

H6b. *The influences of perceived challenge and game-related skill on flow are stronger in the Japanese sample than in the Korean sample.*

3. Methodology

3.1. Data Collection and Sample

Data were collected between January and March 2024 from adult mobile-game users in Korea and Japan. The questionnaire was developed from established scales and pretested with 95 adult Korean mobile-game users to improve terminology, item clarity, and ease of completion. The Japanese survey was conducted first, followed by the Korean survey within the same three-month period. The Japanese-language version was prepared through

expert-assisted translation and review by a Korean professor affiliated with a university in Japan.

Purposive sampling was used. Respondents were required to be at least 20 years old and to have actual in-game purchase experience, ensuring that pricing-related evaluations were grounded in genuine consumption experience. In Japan, 167 mobile-game users were initially surveyed, of whom 115 met the eligibility criteria. The same criteria were applied in Korea, where recruitment continued until 115 eligible respondents had been obtained, yielding a final analytic sample of 230. Participants were recruited through online gaming communities, social media, and university advertisements, primarily in the Daejeon-Chungcheong region of Korea and the Fukuoka region of Japan. Recruitment focused on users of strategy, action, and role-playing games, where the constructs of challenge, skill, and interaction are substantively relevant. All items used in the PLS model were complete; 17 Japanese respondents had missing values for the descriptive variable 'number of games played per day', which was not used in the primary PLS model.

Participation was voluntary. Before beginning the survey, respondents were informed of the academic purpose of the study, the voluntary nature of participation, the confidentiality and anonymity of responses, and their right to decline. No personally identifying or sensitive information was collected, and informed consent was obtained prior to survey completion.

3.2. Research Model

Figure 1 presents the research model. Player loyalty is explained through two complementary pathways: an experiential path centered on psychological flow, and an operational path in which service quality, system quality, and pricing policy shape a global evaluation of the game. The two pathways converge on satisfaction, which in turn predicts WOM and reuse intention. The subsequent cross-national multigroup analysis then examines whether these structural relationships differ between the Korean and Japanese samples.

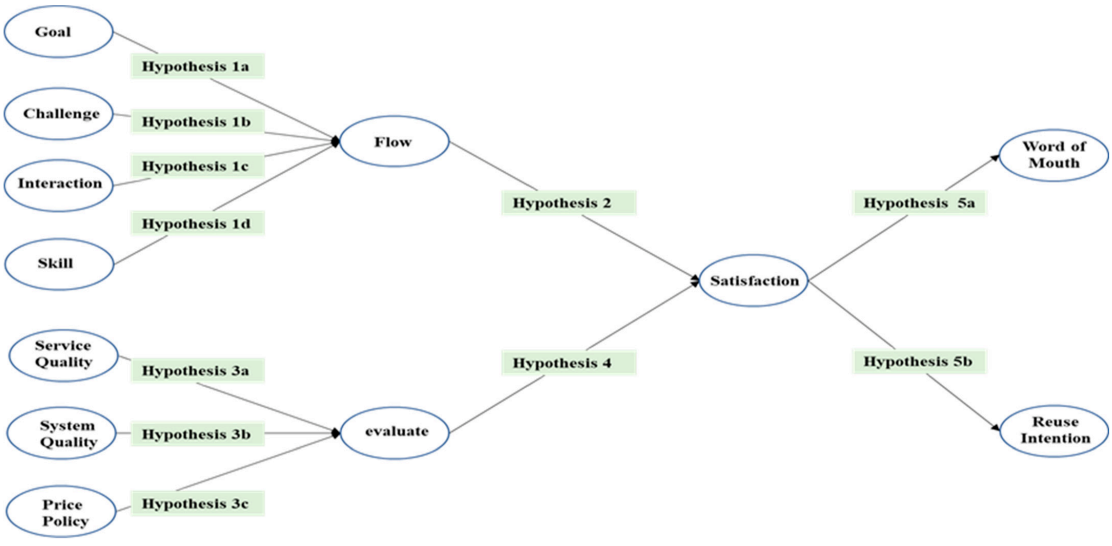


Figure 1. Research Model.

3.3. Measures

The research team developed the questionnaire items for the mobile-game context by drawing on conceptual and measurement approaches in prior work on flow, digital-service quality, pricing and customer loyalty. The items were not directly adopted as an unchanged published scale or copied from a single existing questionnaire. In particular, flow-related constructs were informed by Hoffman and Novak [6], Su et al. [14], Novak et al. [24]

and Admiraal et al. [25]; operational and pricing constructs were informed by research on digital-service continuance [2,3] and pricing research [26]; and post-adoption outcomes were informed by loyalty and flow research [14,16]. The questionnaire was pretested with 95 adult Korean mobile-game users to improve item clarity and contextual suitability. All items used a seven-point Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree"). Table 1 presents the retained item codes, item wording, and construct-level conceptual foundations. These citations identify the literature informing item development, not exact sources of verbatim questionnaire items. Goal, Challenge, Interaction, Skill, Flow, Service Quality, System Quality, and Price Policy were modeled with multiple indicators; Game Evaluation, Satisfaction, WOM, and Reuse Intention were measured by single items, as specified in the original analysis (see Section 6.4).

Table 1. Measurement Items.

Construct	Code	Item Wording	Conceptual Foundation *
Goal	P16	Game results and objectives are clear and easy to understand.	[6,14,24,25]
	P17	It is clear what I should do in the game.	
	P18	Sufficient information is provided to achieve game goals.	
	P19	My current action/play is clear.	
Challenge	P10	Playing well requires concentration.	[6,14,24,25]
	P11	The game is challenging relative to other mobile activities.	
	P12	Playing the game feels like a contest against myself.	
	P13	The game maximizes my concentration and ability.	
Interaction	P20	The game provides ways to exchange opinions with others.	[14,25]
	P21	The game supports group and community activities.	
	P22	Skilled gamers are recognized and valued.	
Skill	P7	I know how to play the game.	[6,14,24]
	P8	I am highly skilled at playing the game.	
Flow	P2	Playing the game is exciting and fun.	[6,11,14,24]
	P3	I remain continuously interested while playing.	
	P4	I become completely immersed in the game.	
Service Quality	M7	The operator responds quickly when problems occur.	[2,3]
	M8	Customer service is kind and helpful.	
	M10	Developers quickly reflect user requests.	
System Quality	M2	The game screens are easy to understand.	[2,3]
	M3	Information is easy to find.	
	M5	The game provides a comfortable play environment.	
Price Policy	P23	Paid transactions are not expensive relative to other games.	[26]
	P24	The cost of using the game is not burdensome.	
	P25	The game's pricing policy is appropriate.	
Game Evaluation	P26	This game is suitable for me to enjoy.	[2,3]
Satisfaction	P28	I am pleased and happy to use this game.	[14,16]
Word of Mouth	P29	I am willing to recommend this game to others.	[14,16]
Reuse Intention	P30	I intend to continue using this game in the future.	[14,16]

Note. * References indicate the conceptual literature consulted in developing each set of study-specific items; no verbatim adoption of a published questionnaire is claimed.

3.4. Analytical Strategy

PLS-SEM was selected because the model combines reflective multi-item constructs with single-item outcomes and because the sample size is moderate relative to the number of structural paths [27]. Estimation used the cSEM R package [28], path weighting, 5000 bootstrap resamples, and bias-corrected 95% confidence intervals. Measurement invariance was assessed with MICOM using 5000 permutations [29]. Between-group differences

in the original eleven structural paths were evaluated primarily with the 5000-permutation Chin test; the Henseler and Nitzl procedures provided supplementary checks. Because eleven path comparisons were examined, the familywise implication of Bonferroni correction was considered when interpreting the original multigroup findings. PLSpredict used 10 folds and 10 repetitions [30]. Robustness analyses included gender, age, gaming tenure, and daily playtime in both pooled and separate country-specific PLS-SEM models. An additional Chin permutation comparison (5000 permutations; seed = 20261102) assessed two focal satisfaction–loyalty paths in the country-specific controlled models. These two tests are reported as unadjusted exploratory sensitivity analyses, not as a replacement for the eleven-comparison family.

A sensitivity analysis was conducted to clarify sample-size adequacy for the structural regressions in the model. For the pooled sample (N = 230), the model has approximately 80% power to detect f^2 values of about 0.042–0.053 depending on the number of predictors in each regression block. For the country-specific analyses (n = 115 per group), the detectable f^2 range is approximately 0.086–0.108. These calculations characterize the sensitivity of the structural regression blocks within each sample; they do not directly establish statistical power for individual path coefficients or for between-group coefficient differences. Detailed sensitivity results are provided in Supplementary Table S6.

Pooled structural path estimates and indirect effects were obtained using cSEM with 5000 bootstrap resamples (seed = 20261021). The original measurement-invariance, multigroup, predictive, and pooled robustness results remain in Supplementary Tables S1–S6. Separate country-specific controlled models used 5000 bootstrap resamples (seed = 20261101), and the controlled Chin comparison used 5000 permutations (seed = 20261102); the additional results are presented in Supplementary Table S7.

4. Results

4.1. Sample Characteristics

The analytic sample comprised 230 paying adult mobile-game users, with 115 respondents from Korea and 115 from Japan. Korean respondents reported an average of 1.68 games played per day (SD = 0.93), while the Japanese mean was 2.35 (SD = 1.25; n = 98 because 17 values were missing). Average daily playtime was 101.35 min (SD = 68.95) in Korea and 112.17 min (SD = 64.33) in Japan. Gaming tenure differed between groups: 28.7% of the Korean sample and 43.5% of the Japanese sample reported more than five years of mobile-game experience. Gender composition was similar (Korea: 71 men, 44 women; Japan: 68 men, 47 women). The Japanese sample contained a larger proportion of respondents in their twenties; students accounted for 41.7% of the Korean and 45.2% of the Japanese sample. These demographic and usage differences motivated the country-specific controlled robustness analysis reported in Section 4.5.

Construct-level means and standard deviations by country are reported in Table 2, with between-group comparisons based on Welch's t-test.

Table 2. Construct Descriptive Statistics and Mean Differences by Country.

Construct	Korea M (SD)	Japan M (SD)	KR − JP	*p*
Goal	5.05 (1.04)	4.63 (1.41)	0.42	0.010
Challenge	3.94 (1.37)	3.50 (1.37)	0.44	0.016
Interaction	4.16 (1.40)	4.32 (1.52)	−0.16	0.416
Skill	5.33 (1.19)	4.46 (1.37)	0.88	<0.001
Flow	5.05 (1.16)	4.52 (1.40)	0.53	0.002

Table 2. *Cont.*

Construct	Korea M (SD)	Japan M (SD)	KR − JP	*p*
Service Quality	4.30 (1.40)	4.23 (1.26)	0.07	0.705
System Quality	5.10 (1.02)	5.08 (1.28)	0.02	0.879
Price Policy	4.02 (1.57)	4.26 (1.61)	−0.24	0.252
Game Evaluation	5.41 (1.30)	5.56 (1.25)	−0.15	0.381
Satisfaction	5.02 (1.35)	5.63 (1.21)	−0.62	<0.001
Word of Mouth	5.13 (1.51)	4.76 (1.65)	0.37	0.074
Reuse Intention	5.13 (1.58)	5.45 (1.33)	−0.32	0.097

Note. *p* values from Welch's *t*-tests.

4.2. Measurement Model and Measurement Invariance

All multi-item constructs demonstrated satisfactory indicator reliability, internal consistency, and convergent validity. Table 3 reports item codes, factor loadings, Cronbach's alpha, composite reliability (ρc), and average variance extracted (AVE). Cronbach's alpha ranged from 0.740 to 0.899, composite reliability from 0.850 to 0.929, and AVE from 0.654 to 0.798, all exceeding conventional thresholds; retained indicator loadings were above 0.75.

Table 3. Measurement Model: Loadings, Reliability, and Convergent Validity.

Construct	Item	Loading	α	ρc	AVE
Goal	P16 P17 P18 P19	0.860 0.901 0.903 0.838	0.899	0.929	0.767
Challenge	P10 P11 P12 P13	0.763 0.780 0.798 0.893	0.826	0.884	0.657
Interaction	P20 P21 P22	0.877 0.872 0.823	0.820	0.893	0.736
Skill	P7 P8	0.909 0.877	0.748	0.888	0.798
Flow	P2 P3 P4	0.828 0.762 0.835	0.740	0.850	0.654
Service Quality	M7 M8 M10	0.851 0.895 0.790	0.800	0.883	0.716
System Quality	M2 M3 M5	0.848 0.854 0.800	0.781	0.873	0.696
Price Policy	P23 P24 P25	0.861 0.798 0.905	0.824	0.891	0.733
Game Evaluation	P26	1.000	Single item	—	—
Satisfaction	P28	1.000	Single item	—	—
Word of Mouth	P29	1.000	Single item	—	—
Reuse Intention	P30	1.000	Single item	—	—

Discriminant validity was supported by both the Fornell–Larcker and HTMT criteria (Table 4): diagonal √AVE values exceed off-diagonal correlations, and HTMT ratios lie below conventional thresholds. Measurement invariance was next assessed through MICOM with 5000 permutations prior to any multigroup comparison. Table 5 reports

Step 2 (compositional invariance), which was established for ten of the twelve constructs; Challenge and Flow did not meet the compositional-invariance criterion. All loyalty constructs—Satisfaction, WOM, and Reuse Intention—satisfied compositional invariance, which strengthens the cross-national comparison of the loyalty paths. Comparisons that involve Challenge or Flow are flagged where they appear.

Table 4. Discriminant Validity: Fornell–Larcker (lower triangle, correlations) and HTMT (upper triangle).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Goal (1)	**0.876**	0.291	0.589	0.582	0.427	0.432	0.594	0.475	0.450	0.348	0.410	0.352
Challenge (2)	0.253	***0.810***	0.518	0.298	0.536	0.146	0.111	0.164	0.047	0.209	0.186	0.146
Interaction (3)	0.504	0.431	***0.858***	0.351	0.567	0.450	0.357	0.446	0.304	0.397	0.319	0.398
Skill (4)	0.478	0.231	0.276	***0.893***	0.511	0.328	0.603	0.191	0.349	0.337	0.344	0.345
Flow (5)	0.363	0.415	0.450	0.387	***0.809***	0.439	0.563	0.294	0.469	0.583	0.607	0.552
Service Quality (6)	0.366	0.121	0.369	0.255	0.340	***0.846***	0.617	0.484	0.433	0.463	0.351	0.351
System Quality (7)	0.497	0.080	0.288	0.466	0.451	0.489	***0.834***	0.448	0.571	0.550	0.403	0.432
Price Policy (8)	0.405	0.059	0.347	0.153	0.250	0.409	0.362	***0.856***	0.376	0.328	0.267	0.236
Game Eval (9)	0.429	0.026	0.281	0.308	0.427	0.388	0.505	0.362	***1.000***	0.686	0.431	0.519
Satisfaction (10)	0.332	0.197	0.365	0.298	0.528	0.413	0.486	0.302	0.686	***1.000***	0.472	0.622
WOM (11)	0.387	0.184	0.289	0.301	0.528	0.312	0.357	0.257	0.431	0.472	***1.000***	0.507
Reuse Int (12)	0.335	0.146	0.362	0.302	0.491	0.313	0.383	0.229	0.519	0.622	0.507	***1.000***

Note. Bold diagonal entries are √AVE. Lower triangle: construct correlations. Upper triangle: HTMT ratios.

Table 5. MICOM Step 2: Compositional Invariance (5000 Permutations).

Construct	c	*p*	Status
Goal	0.9986	0.663	Established
Challenge	0.9818	0.023	Not established
Interaction	0.9995	0.811	Established
Skill	0.9956	0.305	Established
Service Quality	0.9968	0.504	Established
System Quality	0.9995	0.862	Established
Price Policy	0.9981	0.748	Established
Flow	0.9890	0.020	Not established
Game Evaluation	1.0000	1.000	Established
Satisfaction	1.0000	1.000	Established
Word of Mouth	1.0000	1.000	Established
Reuse Intention	1.0000	1.000	Established

Detailed MICOM Step 2 and Step 3 results are reported in Supplementary Table S1.

4.3. Structural Model, Indirect Effects, and Predictive Assessment

The structural model was evaluated using 5000 bootstrap resamples. All 5000 solutions were admissible, and all predictor variance inflation factors were below conventional thresholds. Table 6 reports standardized path coefficients, bias-corrected 95% confidence intervals, *p* values, effect sizes (f^2), and hypothesis decisions.

Among the flow antecedents, challenge ($\beta = 0.236$, 95% BC CI [0.079, 0.383], $p = 0.003$), interaction ($\beta = 0.252$, 95% BC CI [0.092, 0.401], $p = 0.002$), and skill ($\beta = 0.231$, 95% BC CI [0.098, 0.363], $p < 0.001$) significantly predicted flow, supporting H1b–H1d; goal clarity was not significant ($\beta = 0.065$, $p = 0.398$), so H1a was not supported. Flow ($\beta = 0.288$, $p < 0.001$) and game evaluation ($\beta = 0.563$, $p < 0.001$) both predicted satisfaction, supporting H2 and H4. On the operational pathway, system quality was the strongest predictor of game evaluation ($\beta = 0.379$, $p < 0.001$), followed by price policy ($\beta = 0.170$, $p = 0.007$) and service

quality ($\beta = 0.133$, $p = 0.036$), supporting H3a–H3c. Satisfaction in turn predicted WOM ($\beta = 0.472$, $p < 0.001$) and reuse intention ($\beta = 0.622$, $p < 0.001$), supporting H5a and H5b.

Table 6. Structural Model and Hypothesis Tests.

Hyp.	Path	β	95% BC CI	*p*	f^2	Decision
H1a	Goal → Flow	0.065	[−0.095, 0.210]	0.398	0.004	Not supported
H1b	Challenge → Flow	0.236	[0.079, 0.383]	0.003	0.066	Supported
H1c	Interaction → Flow	0.252	[0.092, 0.401]	0.002	0.061	Supported
H1d	Skill → Flow	0.231	[0.098, 0.363]	<0.001	0.060	Supported
H2	Flow → Satisfaction	0.288	[0.177, 0.390]	<0.001	0.147	Supported
H3a	Service Quality → Game Evaluation	0.133	[0.006, 0.256]	0.036	0.018	Supported
H3b	System Quality → Game Evaluation	0.379	[0.255, 0.491]	<0.001	0.150	Supported
H3c	Price Policy → Game Evaluation	0.170	[0.044, 0.292]	0.007	0.033	Supported
H4	Game Evaluation → Satisfaction	0.563	[0.448, 0.665]	<0.001	0.560	Supported
H5a	Satisfaction → WOM	0.472	[0.338, 0.589]	<0.001	0.287	Supported
H5b	Satisfaction → Reuse Intention	0.622	[0.504, 0.713]	<0.001	0.631	Supported

Satisfaction had significant indirect effects on both loyalty outcomes. The indirect effect of flow on WOM through satisfaction was 0.136 (95% BC CI [0.076, 0.202], $p < 0.001$), and the corresponding indirect effect on reuse intention was 0.179 (95% BC CI [0.105, 0.253], $p < 0.001$). Game evaluation likewise exerted significant indirect effects on WOM (0.266, 95% BC CI [0.174, 0.367], $p < 0.001$) and reuse intention (0.350, 95% BC CI [0.247, 0.446], $p < 0.001$), underscoring the central mediating role of satisfaction. Full indirect-effect estimates are reported in Supplementary Table S3.

The model explained 32.5% of the variance in Flow, 30.4% in Game Evaluation, 53.8% in Satisfaction, 22.3% in WOM, and 38.7% in Reuse Intention. PLSpredict (10 folds, 10 repetitions) returned positive Q^2predict values for every endogenous indicator (range: 0.133–0.282), indicating out-of-sample predictive relevance; linear-model benchmark comparisons were mixed. SRMR was 0.095, which is reported here as a descriptive index of approximate fit rather than as evidence of strong overall fit. The structural model's performance is therefore characterized by its explained-variance values and by moderate out-of-sample predictive relevance; indicator-level predictive metrics are reported in Supplementary Table S4.

The standardized path coefficients for the full structural model are displayed in Figure 2.

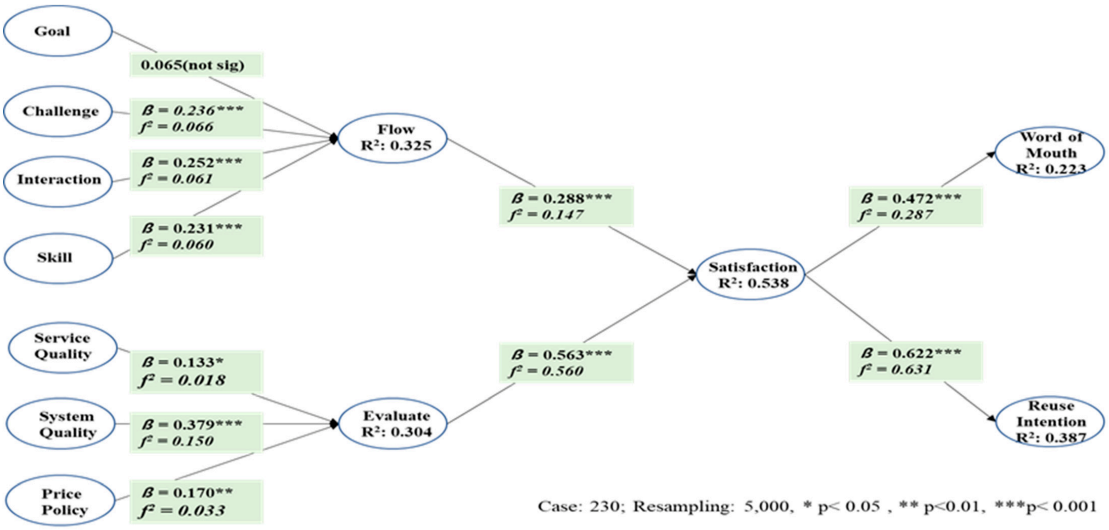


Figure 2. Structural Model Results.

4.4. Cross-National Multigroup Analysis

Table 7 reports the country-specific standardized path coefficients and 5000-permutation Chin tests for all eleven structural paths. At the loyalty stage, the original unadjusted Chin comparisons indicated that the satisfaction–WOM path was stronger in Korea ($\beta = 0.638$; 95% BC CI [0.484, 0.755]) than in Japan ($\beta = 0.400$; 95% BC CI [0.221, 0.560]; permutation $p = 0.039$). The satisfaction–reuse intention path was stronger in Japan ($\beta = 0.746$; 95% BC CI [0.628, 0.838]) than in Korea ($\beta = 0.521$; 95% BC CI [0.330, 0.662]; permutation $p = 0.026$). Satisfaction, WOM, and Reuse Intention satisfied the reported compositional-invariance assessment, although inference remains limited by single-item measurement. Importantly, these two p-values were obtained without correction within the family of eleven structural comparisons, and neither survives a Bonferroni-adjusted significance threshold of $0.05/11 = 0.0045$. Thus, the country patterns are descriptive and suggestive rather than confirmatory evidence of distinct national loyalty mechanisms. Controlled country-specific sensitivity results are reported separately in Section 4.5 and Supplementary Table S7.

Table 7. Country-Specific Paths and 5000-Permutation Multigroup Differences.

Path	Korea β [95% BC CI]	Japan β [95% BC CI]	Diff.	*p*	Inference
Satisfaction → WOM	0.638 [0.484, 0.755]	0.400 [0.221, 0.560]	0.238	0.039	Nominally significant
Satisfaction → Reuse Intention	0.521 [0.330, 0.662]	0.746 [0.628, 0.838]	−0.225	0.026	Nominally significant
Goal → Flow	0.227 [0.071, 0.369]	−0.059 [−0.303, 0.158]	0.286	0.048	Nominally significant *
Challenge → Flow	0.085 [−0.123, 0.280]	0.304 [0.113, 0.478]	−0.218	0.179	Not significant *
Interaction → Flow	0.420 [0.204, 0.593]	0.134 [−0.076, 0.332]	0.286	0.085	Not significant *
Skill → Flow	0.129 [−0.046, 0.299]	0.385 [0.183, 0.560]	−0.256	0.076	Not significant *
Service Qual. → Game Eval.	0.165 [−0.021, 0.355]	0.108 [−0.062, 0.271]	0.057	0.667	Not significant
System Qual. → Game Eval.	0.348 [0.142, 0.507]	0.416 [0.253, 0.577]	−0.069	0.584	Not significant
Price Policy → Game Eval.	0.129 [−0.049, 0.290]	0.190 [0.011, 0.339]	−0.061	0.635	Not significant
Flow → Satisfaction	0.309 [0.158, 0.456]	0.408 [0.256, 0.540]	−0.099	0.377	Not significant *
Game Eval. → Satisfaction	0.586 [0.442, 0.720]	0.471 [0.300, 0.622]	0.115	0.323	Not significant

Note. The reported p-values are based on the 5000-permutation Chin test and are unadjusted for multiple comparisons. Nominal significance indicates $p < 0.05$ before adjustment; none of the eleven between-group comparisons remains significant after Bonferroni correction ($\alpha = 0.0045$). * Comparisons involving Challenge or Flow are flagged because MICOM did not establish compositional invariance for these constructs. Alternative multigroup-test results are reported in Supplementary Table S2.

Within-group estimates for the flow antecedents produced visibly different patterns across countries. In Korea, goal ($\beta = 0.227$) and interaction ($\beta = 0.420$) significantly predicted flow; in Japan, challenge ($\beta = 0.304$) and skill ($\beta = 0.385$) were significant. Among the formal between-group tests, however, only the goal → flow difference reached conventional significance ($p = 0.048$); differences for challenge ($p = 0.179$), interaction ($p = 0.085$), and skill ($p = 0.076$) did not meet the 0.05 criterion. Hypotheses 6a and 6b are therefore not supported at the conventional level, although the country-specific coefficient directions align with the hypothesized patterns. The operational pathway was comparatively stable across countries, and the within-Japan significance of pricing policy did not translate into a significant between-group difference ($p = 0.635$).

4.5. Robustness Analysis with Control Variables

To test whether sample-composition differences might account for the results, gender, age, gaming tenure, and daily playtime were included in the pooled PLS-SEM model. The principal pooled structural relationships remained broadly stable; the original pooled

robustness estimates are reported in Supplementary Table S5. We additionally re-estimated the same PLS-SEM measurement and structural specification within Korea and Japan ($n = 115$ each), including the same four controls in each structural regression. With controls, the satisfaction–WOM path was $\beta = 0.661$ in Korea (95% bias-corrected CI [0.508, 0.791]) and $\beta = 0.377$ in Japan ([0.202, 0.542]); the difference (Korea minus Japan = 0.284) was significant in the unadjusted 5000-permutation Chin test ($p = 0.019$). The satisfaction–reuse intention path was $\beta = 0.523$ in Korea ([0.323, 0.690]) and $\beta = 0.726$ in Japan ([0.611, 0.821]); this difference (−0.203) was not significant at the 5% level ($p = 0.0576$). The direction of both country-specific patterns persisted with demographic and usage controls, but only the focal WOM difference reached the nominal 5% level. These additional focal tests were not corrected for multiplicity and should not be taken to resolve the multiple-comparison limitation in the original eleven-path MGA. Country-specific path estimates and the controlled Chin test are provided in Supplementary Table S7.

5. Discussion

The results support an integrated experiential-operational account of mobile-game satisfaction and suggest potentially meaningful cross-national differences in the relationships between satisfaction and loyalty intentions. Challenge, interaction, and skill each contribute to flow; service quality, system quality, and pricing policy each contribute to a global evaluation of the game; and flow and game evaluation are both associated with satisfaction, which in turn is associated with outward-facing advocacy (WOM) and continued-use intentions (reuse). These findings are consistent with recent evidence that mobile-game retention and loyalty rest on both experiential and service-related conditions rather than on hedonic value alone [7–9].

The loyalty-stage patterns merit careful interpretation. In the Korean sample, the satisfaction–WOM coefficient exceeded that in the Japanese sample; for reuse intention, the Japanese coefficient exceeded that in Korea. The original unadjusted between-group tests suggested both contrasts, but neither remained significant after Bonferroni correction across eleven structural comparisons. After including gender, age, gaming tenure, and daily playtime separately in each national model, the WOM contrast remained nominally significant (unadjusted $p = 0.019$), whereas the reuse-intention contrast did not ($p = 0.058$). Thus, the data suggest potentially different satisfaction–loyalty associations, but they do not establish two statistically confirmed country-specific mechanisms. The findings describe associations in national samples and do not directly measure cultural orientations or demonstrate cultural causes.

System quality emerged as the strongest predictor of game evaluation in both country samples, reinforcing the view that operational excellence is a baseline condition for favorable post-adoption responses. Pricing policy and service quality both contributed to game evaluation in the pooled sample, and the operational pathway was comparatively stable across countries. The within-Japan significance of pricing policy is best read as a sample-specific coefficient rather than as a cross-national difference, since the formal between-group comparison was not significant.

The flow-antecedent results are directionally consistent with cultural expectations—interaction is strongly associated with flow in the Korean sample, while challenge and skill are strongly associated with flow in the Japanese sample—but formal between-group tests at the 0.05 level support only the goal-to-flow difference. Hypotheses 6a and 6b are therefore directionally plausible but not confirmed at the conventional level in the present sample. One interpretation is substantive: the core flow mechanics (challenge–skill balance and interactive engagement) appear to operate in both mature markets, and the remaining country differences may be small enough to require larger samples than the current

$n = 115$ per group. The within-country patterns remain useful for theory development and for localization research.

From a digital-service sustainability perspective, the findings connect consumer-level responses to the broader relational foundations of mobile-game platforms in two ways. First, operational conditions—particularly system quality—show a strong association with game evaluation, which is in turn associated with satisfaction and both forms of loyalty intention; this pattern highlights the role of operational conditions in supporting the consumer-level responses that may underpin durable service relationships. Second, the observed differences in satisfaction–loyalty relationships suggest that strategies for maintaining consumer relationships may need to consider market-specific conditions. Although these differences remain exploratory, they highlight the potential value of examining advocacy and continued use as distinct loyalty outcomes. Recent research on mobile-game monetization likewise examines free-to-play microtransactions [31] and models trade-offs between monetization and user retention in platform business models [32], treating engagement and retention as important inputs to a sustainable platform business model. Because the present study measures stated intentions rather than realized retention, revenues, or environmental outcomes, its sustainability implications remain indirect.

6. Conclusions

6.1. Summary

This study develops and tests an integrated model of mobile-game loyalty in two national samples. Psychological flow and game evaluation contribute to satisfaction, which predicts WOM and reuse intention. The directional pattern—a stronger satisfaction–WOM relationship in Korea and a stronger satisfaction–reuse intention relationship in Japan—was observed in both the original and covariate-adjusted group analyses. Under covariate adjustment, the WOM contrast reached nominal significance ($p = 0.019$), whereas the reuse contrast did not ($p = 0.058$). Neither original contrast survived familywise correction across eleven comparisons. Country differences therefore remain exploratory, particularly given the measurement-invariance limitations and country-specific sample composition.

6.2. Practical Implications

For managers, the pooled results support consideration of both experiential and operational quality: challenge, interaction, and skill were associated with flow, while system quality was particularly relevant to overall game evaluation. The observed national patterns suggest potentially useful hypotheses for market-specific experimentation—for example, evaluating advocacy or community-sharing interventions in Korea and retention-oriented interventions in Japan—but these should not be treated as established differences between national markets. Managers should test such interventions in their own player populations before drawing causal or generalizable conclusions.

6.3. Theoretical Implications

The study offers three theoretical contributions. First, it integrates experiential and operational pathways within one satisfaction-centered explanation of alternative loyalty intentions. Second, the observed associations indicate that the relative strength of satisfaction–loyalty relationships can exhibit different directional patterns across national samples: satisfaction was more strongly connected to advocacy intentions in Korea and to reuse intentions in Japan. The WOM-oriented contrast remained nominally significant in a covariate-adjusted comparison. This pattern motivates further research on the boundary conditions under which satisfaction connects to advocacy versus continuance; it does not establish cultural causation or withstand familywise adjustment across the original eleven comparisons.

Third, the study illustrates the methodological value of combining measurement-invariance assessment, direct between-group tests, multiple-testing controls, and country-specific covariate adjustment rather than interpreting within-group significance as evidence of national differences.

6.4. Limitations and Future Research

Four limitations warrant acknowledgment. First, the sample comprises paying adult users recruited from limited regions in Korea and Japan, includes a substantial proportion of students, and differs across countries in background characteristics. Separate controlled models reduced—but cannot eliminate—concerns about sample-composition differences. Second, the four single-item constructs limit construct breadth and make their invariance evidence less informative than that of well-validated multi-item scales. Third, MICOM compositional invariance was not established for Challenge or Flow, while nominally significant multigroup differences in the original eleven-path family did not survive familywise correction; the new two-path controlled tests are exploratory and unadjusted. Fourth, cultural orientations and subsequent observed behavior were not measured. Future studies should incorporate validated multi-item measures, directly assessed cultural orientations, larger and more diverse samples, and behavioral or longitudinal outcomes.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su182111334/s1, Supplementary Data S1: De-identified analysis dataset (CSV); Supplementary Data S2 Codebook (XLSX): Variable definitions, coding schemes, and PLS-SEM measurement specification; Supplementary Tables S1–S7: Additional measurement, structural, predictive, and robustness analysis results.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to its anonymous, minimal-risk nature involving an adult survey that collected no personally identifying or sensitive information, in accordance with Article 13 of the Enforcement Rule of the Bioethics and Safety Act of the Republic of Korea, which exempts such studies from institutional review. No prospective Institutional Review Board review or formal exemption determination was obtained before data collection. Participation was voluntary.

Informed Consent Statement: Informed consent for participation was obtained from all subjects involved in the study. Participants were informed of the academic purpose of the study, the voluntary nature of participation, the confidentiality and anonymity of responses, and their right to decline participation.

Data Availability Statement: The de-identified analysis dataset used for this study is provided as Supplementary Data S1, with its codebook. Detailed supporting results appear in Supplementary Tables S1–S7.

Conflicts of Interest: The authors declare no conflicts of interest.

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