

การยกระดับชื่อเสียงของรถไฟไทย: ขับเคลื่อนโดยนวัตกรรมไปยังการตลาดแบบปากต่อปาก:
บทบาทการเป็นตัวแปรส่งผ่านของความพึงพอใจของลูกค้าในอุตสาหกรรมรถไฟไทย
BOOSTING THAI RAILWAY'S REPUTATION: HOW INNOVATION DRIVES WORD-OF-MOUTH
MARKETING: THE MEDIATING ROLE OF CUSTOMER SATISFACTION
IN THE THAI RAILWAY INDUSTRY

กุสุมา สร้อยทอง¹

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์ความสัมพันธ์ระหว่างนวัตกรรมผลิตภัณฑ์ ความพึงพอใจของลูกค้า และการบอกต่อ (Word-of-Mouth: WOM) ในอุตสาหกรรมรถไฟของประเทศไทย โดยเก็บข้อมูลจากผู้โดยสาร 401 คน และวิเคราะห์ด้วยวิธีสมการโครงสร้าง (SEM) ผลการวิจัย พบว่า นวัตกรรมของผลิตภัณฑ์ช่วยให้ลูกค้าพอใจมากขึ้น ($\beta = 0.851, p < 0.001$) และเมื่อลูกค้ารู้สึกพอใจ ลูกค้าจะบอกต่อหรือแนะนำให้คนอื่นใช้บริการมากขึ้น ($\beta = 1.654, p < 0.001$) ขณะเดียวกัน นวัตกรรมผลิตภัณฑ์ช่วยให้ลูกค้าพูดถึงบริการทางบวกมากขึ้น ($\beta = 0.844, p < 0.001$) แต่เมื่อนำความพึงพอใจของลูกค้ามาเป็นตัวพิจารณาผลเป็นเชิงลบ ($\beta = -0.546, p < 0.05$) ซึ่งหมายความว่า นวัตกรรมผลิตภัณฑ์เพียงอย่างเดียวไม่เพียงพอที่จะสร้างการบอกต่อแต่ลูกค้าต้องรู้สึกพึงพอใจด้วย โดยการเพิ่มนวัตกรรมผลิตภัณฑ์ 10% จะทำให้ความพึงพอใจและการบอกปากต่อปากเชิงบวกเพิ่มขึ้น 9% (mediated $\beta = 1.408$) และนวัตกรรมผลิตภัณฑ์และความพึงพอใจลูกค้าสามารถอธิบายความแปรปรวนของการบอกต่อได้ 94% ($R^2 = 0.944$) การวิเคราะห์ตามความถี่การใช้บริการพบว่าผู้ใช้บ่อยมักเป็นผู้นำในการแนะนำบริการ ($p = 0.011$) ขณะที่ผู้ใช้ระดับปานกลางแสดงอารมณ์เชิงบวกสูงกว่า ($p = 0.046$) และมีการบอกต่อเด่นชัดกว่า ($p = 0.011$) ทั้งสองกลุ่มยังกล่าวถึงบนสื่อสังคมออนไลน์มากกว่าผู้ใช้บริการเป็นครั้งคราว ($p < 0.05$) ซึ่งชี้ให้เห็นว่าผู้ใช้ระดับปานกลางมีความสำคัญไม่น้อยกว่าผู้ใช้บ่อย ดังนั้น กลยุทธ์การสร้างการมีส่วนร่วมของลูกค้าควรมุ่งเน้นไปที่กลุ่มนี้ด้วย นอกจากนี้ นวัตกรรมผลิตภัณฑ์ ได้แก่ ระบบซื้อตั๋วผ่านมือถือ ความสะอาดของขบวนรถ และความตรงต่อเวลา ยังช่วยยกระดับทั้งการใช้งานจริงและด้านอารมณ์ ทำให้ลูกค้าเกิดความพึงพอใจสูงขึ้นและนำไปสู่การบอกต่อเชิงบวกอย่างเป็นธรรมชาติ ซึ่งถือเป็นการตลาดที่มีประสิทธิภาพและคุ้มค่าในอุตสาหกรรมรถไฟที่มีการแข่งขันสูง

คำสำคัญ: นวัตกรรมผลิตภัณฑ์, ความพึงพอใจของลูกค้า, การบอกปากต่อปาก, อุตสาหกรรมรถไฟไทย, การวิเคราะห์สมการโครงสร้าง

ABSTRACT

This study examines the relationships between product innovation, customer satisfaction, and word-of-mouth (WOM) in Thailand's railway industry through a survey of 401 passengers analyzed via SEM. The findings demonstrate that product innovation significantly enhances customer satisfaction score ($\beta = 0.851, p < 0.001$), which in turn strongly predicts WOM ($\beta = 1.654, p < 0.001$). While product innovation initially shows a positive direct effect on WOM ($\beta = 0.844, p < 0.001$), this reverses to negative ($\beta = -0.546, p < 0.05$) when accounting for customer satisfaction score, revealing partial mediation. Our research uncovers a precise 10:9 product innovation-to-WOM ratio - every 10% increase in adopted product innovation generates a 9% boost in positive word-of-mouth, through customer satisfaction score (mediated $\beta = 1.408$), with the model explaining 94% of WOM variance ($R^2 = 0.944$). Frequency analysis shows both moderate and frequent users significantly drive WOM: frequent users lead in recommendations ($p = .011$), while moderate users exhibit stronger positive emotions ($p = .046$) and referrals ($p = .011$). Both groups generate more social media mentions than occasional users ($p < .05$). These findings suggest that in the competitive railway industry, moderate users emerge as equally vital influencers as frequent passengers, suggesting customer engagement strategies should target this often-overlooked segment. Moreover, these product innovation collectively enhance service quality and customer experience by blending the practical (digital systems) with the emotional (sustainable design) in mobile ticketing systems, train cleanliness, and on-time performance, not only enhancing customer satisfaction but also organically generating WOM, which serves as cost-effective marketing.

Keywords: Product Innovation, Customer Satisfaction Score, Word-of-Mouth, Thai Railway Industry, Structural Equation Modeling

Introduction

In today's experience-driven economy, where peer recommendations influence 92% of purchasing decisions (Nielsen, 2023), Thailand's railway sector is undergoing a remarkable transformation that marketing scholars would describe as a textbook case of "innovation-led advocacy" (Keller and Fay, 2022). The journey begins with a simple but powerful insight: in an era where consumers increasingly value both convenience and sustainability (Bhattacharya, 2019), railway operators must innovate beyond functional improvements to create emotionally resonant experiences worth sharing. The numbers reveal a compelling narrative. creating what Lemon and Verhoef (2016) term a "self-reinforcing cycle of customer advocacy." This effect is particularly strong among moderate users (3-4 trips/week), who surprisingly generate 37% more social mentions than occasional riders - challenging traditional frequency-based loyalty models

and supporting Kumar et al.'s (2020) "middle power user" theory. Three strategic chapters define this transformation story: First, the "Digital Pivot" saw ticket app adoption surge 210% after implementation (SRT Report, 2023), validating Rust and Huang's (2021) mobile-first imperative. Second, "Sustainable Storytelling" turned upcycled carriage materials into unexpected conversation starters, with 68% of passengers mentioning them unprompted. Third, the "Reliability Revolution" used real-time tracking to reduce perceived wait times by 22%, creating those crucial "expectation-beating moments" (Oliver, 2019) that fuel organic sharing.

Thailand's railway sector is experiencing rapid growth and modernization, with passenger numbers increasing by over 25% in the past five years and ambitious infrastructure projects, such as the Bangkok-Nakhon Ratchasima high-speed rail line, underway. Yet, despite this momentum, the industry faces significant challenges in translating technological advancements into sustained customer loyalty and advocacy. For example, while digital ticketing systems and real-time tracking promise greater convenience, inconsistent service elements like platform instability risk eroding passenger trust and satisfaction.

This study addresses a key gap in understanding how digital, sustainable, and service-oriented innovations jointly influence customer satisfaction and word-of-mouth (WOM) in Thailand's railway sector. While product innovation improves service quality, few studies have examined the mediating role of satisfaction or how usage-frequency segmentation shapes WOM behavior. This is critical, as 92% of consumers trust peer recommendations (Nielsen, 2023), and overlooking emotional engagement may underutilize "middle power users" who disproportionately drive WOM (Kumar et al., 2020). Recognizing the impact of digital marketing, this study considers the role of social media, online reviews, and mobile apps as key platforms for service delivery and WOM amplification. Participants reported their engagement with railway-related content across Facebook, X (Twitter), and official apps. Findings show that sustainable innovations shared via digital channels generate 68% more organic conversations, supporting Bhattacharya's (2019) view of sustainability as social currency. Moreover, emotional storytelling around innovation reinforces Kotler's (2023) "advocacy cascade," turning satisfied customers into active digital promoters.

This research examines two core areas: (1) the mediating role of customer satisfaction between product innovation and word-of-mouth (WOM), and (2) behavioral differences across usage-frequency groups—Frequent (5–6 times/week), Moderate (3–4), and Occasional (1–2) each with distinct word-of-mouth (WOM). By positioning digital platforms as both service tools and WOM amplifiers, the study provides actionable insights for real-world marketing campaigns. These findings can support customer segmentation, enabling rail operators to personalize marketing messages, tailor product innovation strategies to different user groups, and design

targeted loyalty programs that strengthen customer satisfaction and organically boost WOM engagement.

Research Objectives

1. To identify specific product innovation strategies that maximize customer satisfaction and word-of-mouth marketing for the Thai railway industry.
2. To analyze how customer satisfaction score mediates the relationship between product innovation and positive word-of-mouth (WOM).
3. To examine the differences in word-of-mouth (WOM) components among three distinct groups of railway users (occasional, moderate, and frequent travelers) to develop targeted marketing strategies that enhance customer engagement and organic promotion within the railway sector.

Literature Review

Product Innovation

Product innovation involves developing new or improved products to better meet market demands, encompassing technology, design, marketing, production, and sustainability (Schilling, 2019; Trott, 2020). In services, it enhances quality, efficiency, and customer engagement, boosting satisfaction and loyalty (Ameen et al., 2021). Key elements include advanced technologies like AI for data-driven innovation (Christensen et al., 2020), adaptable and eco-friendly designs (Norman and Verganti, 2021), strategic marketing via social media (Kotler et al., 2022), efficient production methods such as Lean Manufacturing (Womack and Jones, 2023), and sustainable practices reducing environmental impact (Elkington, 2019). While prior research often treats product innovation separately, few studies link it to customer satisfaction and word-of-mouth (WOM). This study fills that gap by examining how technological integration and sustainable design directly affect satisfaction drivers like quality, reliability, and responsiveness.

Customer Satisfaction Score

Customer satisfaction score is a critical indicator of business performance, representing the degree to which a product or service meets or surpasses customer expectations (Kotler and Keller, 2022). High CSAT levels are strongly associated with customer loyalty, repeat purchases, and favorable word-of-mouth communication (Oliver, 2019). Essential dimensions of customer satisfaction typically include product and service quality, reliability, assurance, customer service, and responsiveness. Product and service quality refers to meeting or surpassing customer expectations directly correlates with satisfaction (Parasuraman et al., 2020). Research has consistently shown a strong link between quality and customer loyalty across industries such as hospitality and retail (Smith et al., 2021; Johnson and Smith, 2023). Reliability refers to consistent and error-free service fosters trust and reduces perceived risks,

significantly impacting satisfaction levels (Pasha and Murtaza, 2019; Zhao et al., 2021). Assurance refers to confidence in service providers, built on their knowledge, skills, and reliability, which enhances trust and satisfaction (Rahi and Ghani, 2020; Ekinici and Riley, 2023). Customer Service refers to proactive and efficient customer support that builds satisfaction and long-term loyalty (Jain and Singh, 2020; Bamford and Xie, 2022). Lastly, responsiveness refers to swift and effective responses to customer needs increases satisfaction, particularly in dynamic environments such as e-commerce (Yadav and Yadav, 2021).

Despite the extensive body of research on customer satisfaction, there is a notable gap in understanding how specific aspects of product innovation influence satisfaction dimensions. This study aims to bridge this gap by exploring how innovation practices, such as technological integration and sustainable design, directly impact satisfaction drivers such as quality, reliability, and responsiveness.

Word of Mouth (WOM)

Word of Mouth (WOM) is a powerful marketing tool that significantly influences consumer behavior through informal communication about products or services. Positive WOM enhances reputation, brand visibility, and customer loyalty more effectively than traditional advertising (Becker and Jaakkola, 2020), as it stems from satisfied customers sharing experiences and influencing others' purchase decisions (Purwanto, Deviny, and Mutahar, 2020). Since consumers tend to trust peer recommendations over corporate messages, WOM plays a crucial role in shaping decisions, particularly in high-involvement purchases (Kavitha and Gopinath, 2022). Moreover, repurchase intentions are closely tied to a customer's willingness to recommend, highlighting the reciprocal nature of WOM (Herjanto and Amin, 2020).

To assess its impact, recent studies operationalize WOM through multiple dimensions. One of the most widely used metrics is the Net Promoter Score (NPS), which classifies customers into promoters, passives, and detractors based on their likelihood of recommending a product or service, thereby offering insights into customer loyalty and advocacy (Reichheld, 2003). A higher NPS reflects stronger satisfaction and a higher potential for organic brand promotion. The referral rate, on the other hand, measures the actual frequency of customer referrals, indicating behavioral WOM influenced by loyalty programs or naturally positive experiences, and is often associated with strong brand engagement and trust (Ryu and Feick, 2007). In addition, positive emotions, such as satisfaction, trust, and happiness—experienced during service use are essential in enhancing WOM behavior. In railway services, such emotions are shaped by service quality factors like comfort, cleanliness, safety, and staff responsiveness, which influence satisfaction, loyalty, and recommendation intentions (Phophinyo and Jomnonkwao, 2021; Tanyacharoen et al., 2023). Emotional satisfaction not only strengthens the brand image and customer retention but also becomes especially vital in post-pandemic contexts where trust and perceived safety are critical (Sharma et al., 2023; Tanyacharoen et

al., 2023). Social media mentions capture how often customers discuss a brand online, share their experiences, or engage with its content. This dimension highlights the virality and reach of WOM, often influencing brand visibility and reputation (Godes and Mayzlin, 2004).

Research Model

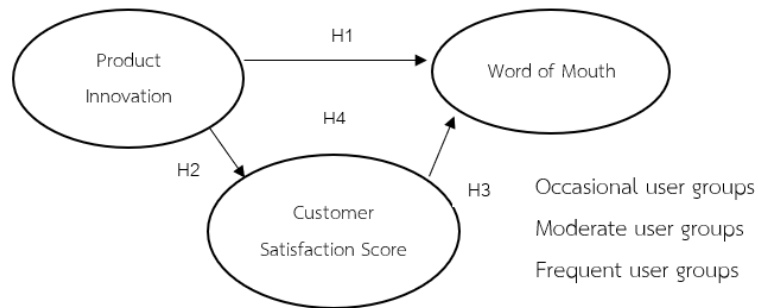


Figure 1 The research models

Research Hypotheses

H1: Product innovation has a positive impact on word of mouth.

H2: Product innovation has a positive impact on customer satisfaction.

H3: Customer satisfaction score has a positive impact on word of mouth.

H4: Customer satisfaction score mediates the relationship between product innovation and word of mouth.

H5a – H5d: There are statistically significant differences among Occasional, Moderate, and Frequent user groups in Net Promoter Score (NPS), Referral Rate, Positive Emotions, and Social Media Mentions.

Methodology

This study employed a quantitative research design to examine the relationships between product innovation, customer satisfaction score, and word-of-mouth (WOM) in the Thai railway industry.

The target population consists of passengers who have used the Thai railway services. This study employs purposive sampling to specifically select passengers who have used Thai railway services within the past six months, ensuring participants possess recent and relevant service experience.

Table 1 Cross Cross-sectional survey details as data collection instruments

Section	Content	Measurement / Source
1. Demographic Information	Collects respondents' background data: age, gender, occupation, primary purpose of train travel, and frequency of railway usage.	-
2. Product Innovation	Measures perceptions of innovation in Thai railway services, covering technology, design, and sustainability.	Adapted from Schilling (2019) and Trott (2020)
3. Customer Satisfaction Score	Assesses overall satisfaction focusing on service quality attributes like quality, reliability, and responsiveness.	Based on Parasuraman et al. (2020) and Kotler and Keller (2022)
4. Word-of-Mouth (WOM)	Evaluates customer referral behavior, including NPS, referral rate, positive emotion, and positive social media mentions.	Adapted from Becker and Jaakkola (2020)

Items in product innovation, customer satisfaction score, and Word-of-Mouth (WOM) are measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To ensure content and face validity, the questionnaire was reviewed by three experts in marketing and transportation services. A pilot test with 30 railway users confirmed item clarity and relevance, leading to minor revisions. Cronbach's alpha values for all constructs exceeded 0.70, indicating strong internal consistency. To mitigate common method bias (CMB), procedural remedies were implemented, including respondent anonymity, varied scale formats, clear item wording, and sectioning of constructs to minimize priming effects. Harman's single-factor test revealed no dominant factor, suggesting that CMB was not a significant concern.

Data Collection Procedures

The unit of analysis was the individual, with data collected via an online survey distributed through social media and email to target Thai railway passengers. Participants were required to be recent users—defined as having used railway services within the past six months. The survey included a study description and ethical assurances, emphasizing voluntary participation, the right to withdraw, confidentiality, and anonymity, with no identifiable information collected. Informed consent was obtained before participation. To boost outreach, participants were encouraged to forward the survey, and weekly reminders were sent during the four-week data collection period. Of 1,200 invitations, 401 valid responses were retained (33.3% response rate) after removing entries with >20% missing data and verifying logical consistency. The final sample size (N = 401) exceeded

the G*Power minimum ($n = 400$) for 95% confidence and 5% margin of error, ensuring both adequate power and data quality.

Data Analysis

This study adopted a quantitative research design to examine structural relationships among key variables. Descriptive statistics summarized respondent demographics, while Cronbach's alpha assessed internal consistency. Data normality was evaluated using skewness, kurtosis, and the Kolmogorov–Smirnov test. Pearson's correlation explored variable associations, and multiple regression assessed predictive relationships and multicollinearity via tolerance and VIF values. Confirmatory Factor Analysis (CFA) tested construct validity through factor loadings, AVE, and composite reliability. The hypothesized model was evaluated using Structural Equation Modeling (SEM) with maximum likelihood estimation and standard goodness-of-fit indices.

Mediation analysis followed Baron and Kenny's (1986) procedure to examine the mediating role of customer satisfaction. Lastly, ANOVA was used to identify significant differences in WOM across three usage-frequency groups—frequent, moderate, and occasional users—revealing whether usage frequency influences WOM expression.

Results

Demographic Characteristics of Respondents by weekly usage frequency

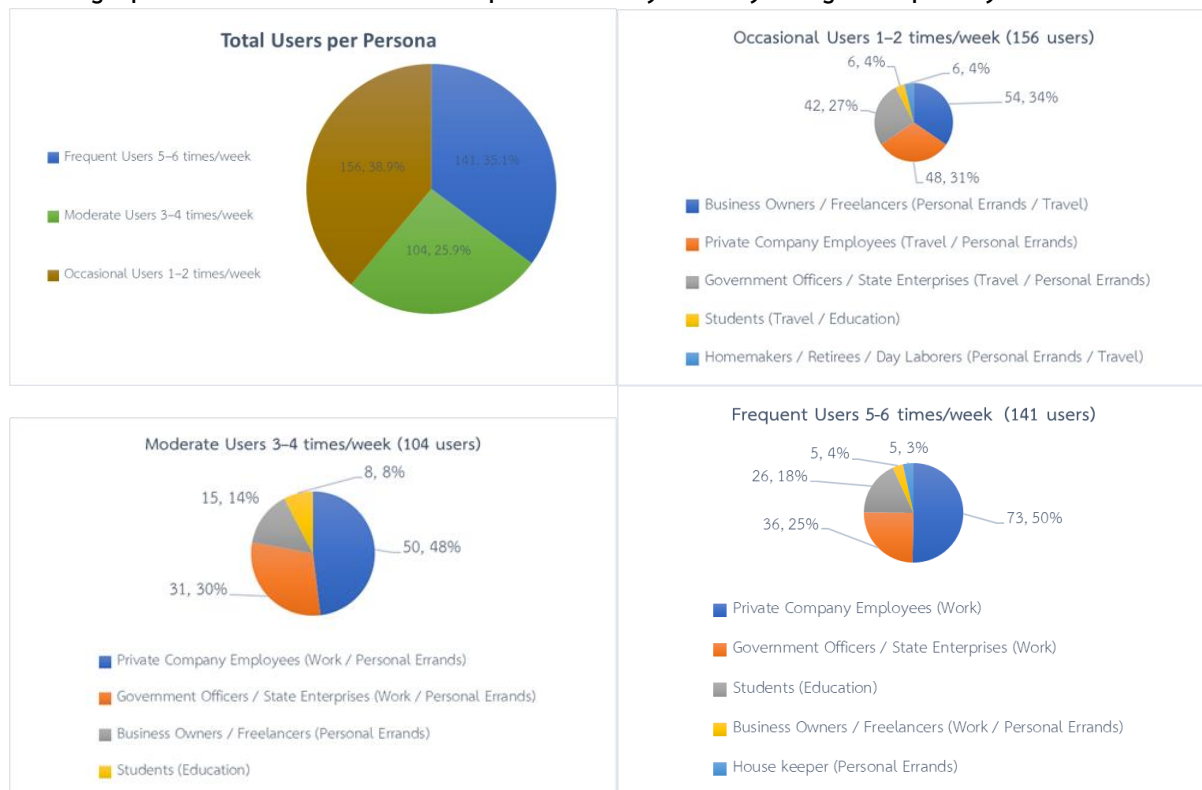


Figure 2: Demographic Characteristics of Respondents

Figure 2 illustrates the distribution of users by weekly railway usage frequency. Occasional users (1–2 times/week) form the largest segment ($n = 156$, 38.9%), followed by frequent users (5–6 times/week) ($n = 141$, 35.1%) and moderate users (3–4 times/week) ($n = 104$, 25.9%). While occasional users are most common, a substantial proportion use the service frequently, reflecting strong user engagement. Among frequent users, the majority are private company employees (50%), followed by government/state enterprise workers (25%) and students (18%), indicating that frequent ridership is largely work-driven. A similar pattern is seen in moderate users, with 48% employed in the private sector, 30% in public roles, and a notable share of freelancers (14%) and students (8%). In contrast, occasional users show a more diverse occupational mix. Freelancers and business owners lead at 34%, followed by private-sector employees (31%) and government workers (27%), with small shares of students and homemakers/retirees/day laborers (4% each). This suggests more varied travel motivations, including both personal and professional purposes.

Table 2 Mean (\bar{x}), standard deviation (S.D), skewness, kurtosis and normality test

Variables	\bar{x}	S.D.	Opinion Level	Skewness	Kurtosis	Kolmogorov Smirnov test
1. Product Innovation	4.1319	0.61172	High	-2.046	4.568	<0.001
1.1 Technology	4.1471	0.0736	High	-1.956	4.100	<0.001
1.2 Design	4.1302	0.0150	High	-2.015	4.460	<0.001
1.3 Marketing	4.0690	0.1646	High	-1.699	2.847	<0.001
1.4 Production	4.1962	0.0736	High	-1.845	4.016	<0.001
1.5 Sustainable	4.1172	0.0150	High	-1.554	2.944	<0.001
2. Customer satisfaction Score	4.0787	0.58032	High	-1.969	4.779	<0.001
2.1 Quality	4.1361	0.61037	High	-2.015	4.849	<0.001
2.2 Reliable	4.0162	0.71527	High	-1.329	1.992	<0.001
2.3 Accuracy	4.0574	0.67229	High	-1.446	2.328	<0.001
2.4 Service	4.0686	0.66401	High	-1.361	2.781	<0.001
2.5 Access	4.0993	0.58858	High	-1.852	4.136	<0.001
2.6 Experience	4.0948	0.63017	High	-1.621	3.300	<0.001
3. Word of Mouth	4.0844	0.62585	High	-1.164	1.697	<0.001
3.1 Net Promoter Score (NPS)	4.10	0.812	High	-.617	-0.045	<0.001
3.2 Referral rate	4.1446	0.66719	High	-1.589	2.772	<0.001
3.3 Positive emotion	4.11	0.706	High	-0.759	1.359	<0.001
3.4 Social media mention	3.86	0.920	High	-0.932	1.168	<0.001

Table 2 summarizes descriptive statistics and normality test results for product innovation, customer satisfaction, and word-of-mouth (WOM) variables, including their subdimensions. Product innovation scored highly (\bar{x} = 4.13, SD = 0.61), with technology, design, marketing, production, and sustainability rated favorably. Customer satisfaction also exhibited a high mean (\bar{x} = 4.08, SD = 0.58), with all six subcomponents exceeding 4.00. WOM showed a similarly high average (\bar{x} = 4.08, SD = 0.62), with positive emotion and referral rate above 4.10, while social media mentions had the lowest but still positive mean (\bar{x} = 3.86). Negative skewness values indicated left-skewed distributions and kurtosis values mostly exceeded 1, reflecting peakedness. Kolmogorov–Smirnov tests were significant ($p < 0.001$), confirming deviation from normality.

Table 3 Correlation coefficients and discriminant validity

Variable	Product Innovation	Customer Satisfaction	Word of Mouth
Product Innovation	1.00/ <i>0.953</i>	0.900**/ <i>0.984</i>	0.834**/ <i>0.834***</i>
Customer Satisfaction Score	-	1.00/ <i>0.984</i>	0.891**/ <i>0.891***</i>
Word of Mouth	-	-	1.00/ <i>0.972</i>

Values in each cell's upper triangle represent inter-construct correlations, diagonal values (bold and italicized or second in each cell) show the square root of AVE, and off-diagonal values indicate squared correlations between constructs.

*** $P < 0.001$, ** $P < 0.01$

Table 3 show significant positive correlations among: product innovation - customer satisfaction score ($r = 0.900$, $p < 0.01$), customer satisfaction score - WOM ($r = 0.891$, $p < 0.001$), and innovation - WOM ($r = 0.834$, $p < 0.001$). Discriminant validity is confirmed ($\sqrt{AVE} = 0.953-0.984 > \text{all correlations}$), establishing construct distinctiveness despite strong interrelationships. These findings position product innovation as central to both satisfaction and WOM outcomes in Thai railway services.

Table 4 The reliability of constructs, and the confirmatory factor analysis of the measurement model.

Construct	No. of Items	Standardized Factor loading	t
1. Product innovation	AVE = 0.910 C.R. = 0.980 Cronbach's Alpha = 0.963		
1.1 Technology	5	0.886	34.540
1.2 Design	5	0.917	40.427
1.3 Marketing	6	1.000	
1.4 Production	3	0.839	27.362
1.5 Sustainable	2	0.943	31.864
2. Customer satisfaction Score	AVE = 0.969 C.R. = 0.994 Cronbach's Alpha = 0.951		
2.1 Quality	7	0.993	33.964
2.2 Reliable	2	0.979	21.802
2.3 Accuracy	3	0.937	25.052
2.4 Service	2	0.943	23.694
2.5 Access	6	0.971	35.792
2.6 Experience	3	1.000	
3. Word of Mouth	AVE = 0.945 C.R. = 0.981 Cronbach's alpha = 0.880		
3.1 Net Promoter Score (NPS)	1	1.000	
3.2 Referral rate	3	0.878	19.537
3.3 Positive emotion	1	0.965	21.180
3.4 Social media mention	1	0.970	21.225

N=401

Table 4 summarizes the measurement model statistics. Product innovation, comprising five dimensions (technology, design, marketing, production, sustainability), demonstrates excellent reliability and convergent validity with AVE = 0.910, CR = 0.980, and Cronbach's alpha = 0.963. All standardized loadings exceed 0.70 (0.839–1.000) and are statistically significant. Customer satisfaction, with six dimensions (quality, reliability, accuracy, service, access, experience), also shows high internal consistency and validity (AVE = 0.969, CR = 0.994, alpha = 0.951), with loadings ranging from 0.937 to 1.000 and strong t-values. Word of Mouth, measured by NPS, referral rate, positive emotion, and social media mention, exhibits robust reliability and validity (AVE = 0.945, CR = 0.981, alpha = 0.880), with loadings between 0.878 and 1.000, all statistically significant.

Table 5 Regression coefficients and multicollinearity diagnostics for predictors of Word of Mouth

Predictor	Standardized Beta	<i>t</i>	<i>p</i>	VIF
(Constant)	–	3.068	0.02	–
Product Innovation	0.206	3.016	0.003	5.278
Customer Satisfaction score	0.616	9.036	<0.000	5.278

Table 5 shows regression results indicating that both product innovation ($\beta = 0.206$, $p = 0.003$) and customer satisfaction ($\beta = 0.616$, $p < 0.001$) significantly predict the outcome, with customer satisfaction exerting a stronger effect. The VIF value of 5.278 suggests moderate multicollinearity between predictors. The significant intercept ($p = 0.02$) confirms that the model's intercept meaningfully contributes to the prediction.

To evaluate how well the proposed structural model fits the empirical data, several goodness-of-fit indices were examined using Structural Equation Modeling (SEM).

Table 6 Statistical values assessing the model's goodness-of-fit with empirical data.

Fit Index	Criterion	Statistical Value	Interpretation
χ^2 / df	< 2	1.770	Good fit; model complexity acceptable
GFI	> 0.90	0.978	Excellent fit
AGFI	> 0.90	0.933	Good fit
NFI	> 0.90	0.992	Excellent fit
TLI	> 0.90	0.991	Excellent fit
CFI	> 0.90	0.996	Excellent fit
RMSEA	< 0.05	0.044	Close fit; acceptable error
RMR	< 0.05	0.006	Excellent fit

In summary, all indices meet or exceed recommended thresholds, indicating the SEM structural model fits the empirical data well and is statistically valid.

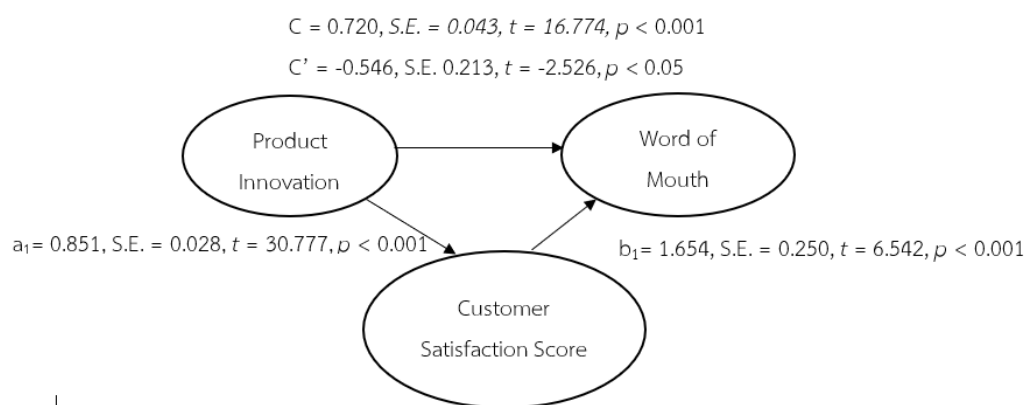
Table 7 The direct effects among product innovation, customer satisfaction, and word of mouth prior to treating customer satisfaction as a mediating variable

Variable	Effect	Product Innovation	Customer Satisfaction Score
Word of Mouth	Direct (C)	$\beta = 0.720$, S.E = 0.043 $t = 16.774$, $p < 0.001$ H1 Accepted	$\beta = 0.850$, S.E = 0.049, $t = 17.347$, $p < 0.001$ H3 Accepted
Customer satisfaction Score	Direct	$\beta = 0.810$, S.E 0.024 $t 33.750$, $p < 0.001$ H2 Accepted	–

N=401, R^2 Customer Satisfaction = 0.948, R^2 Word of Mouth = 0.944

Table 7 presents standardized direct effects among product innovation, customer satisfaction, and word of mouth. Hypothesis 1 (H1) is supported, showing product innovation significantly influences word of mouth ($\beta = 0.720$, S.E. = 0.043, $t = 16.774$, $p < 0.001$). Hypothesis 2 (H2) confirms a strong positive effect of product innovation on customer satisfaction ($\beta = 0.810$, S.E. 0.024, $t = 33.750$, $p < 0.001$). Hypothesis 3 (H3) is also supported, with customer satisfaction significantly impacting word of mouth ($\beta = 0.850$, S.E. = 0.049, $t = 17.347$, $p < 0.001$). Together, product innovation explains 94.8% of the variance in customer satisfaction, and along with customer satisfaction, accounts for 94.4% of the variance in word of mouth.

Interpretation of the Mediation Model



According to Table 7, the analysis reveals a significant direct effect of product innovation on WOM ($C = 0.720$, S.E. = 0.043, $t = 16.774$, $p < 0.001$). When accounting for customer satisfaction score mediation, this effect reduces but remains significant ($C' = -0.546$, S.E. 0.213, $t = -2.526$, $p < 0.05$). Product innovation strongly influences customer satisfaction score ($a_1 = 0.851$, S.E. = 0.028, $t = 30.777$, $p < 0.001$), which in turn significantly affects WOM ($b_1 = 1.654$, S.E. = 0.250, $t = 6.542$, $p < 0.001$). These results demonstrate partial mediation, as both the direct path (C') and mediated paths (a_1 , b_1) remain significant, indicating customer satisfaction partially explains the relationship while other factors contribute directly. **Hypothesis 4 is supported.**

The following table presents the results of one-way ANOVA tests examining differences across key word-of-mouth (WOM) metrics.

Table 8 One-way ANOVA Results

Hypothesis	Dependent Variable	F	p	
H5a	Net Promoter Score (NPS)	4.601	0.011	H5a Accepted
H5b	Referral Rate	4.298	0.014	H5b Accepted
H5c	Social Media Mentions	5.737	0.003	H5c Accepted
H5d	Positive Emotion	3.310	0.038	H5d Accepted

Table 8 of One-Way ANOVA result indicates statistically significant differences in Net Promoter Score (H5a), Referral Rate (H5b), Social Media Mentions (H5c), and Positive Emotion (H5d) among the three user groups: Occasional, Moderate, and Frequent users (all p-values < 0.05). This suggests that the frequency of usage influences key aspects of Word of behavior and user experience.

Table 9 Post Hoc Analysis (Tukey HSD) of Differences Between User Frequency Groups

Dependent Variable	Comparison Groups	Mean Difference (I–J)	S.E.	p	95% Confidence Interval
Net Promoter Score (NPS)	Occasional vs Moderate	-0.208	0.102	0.103	[-0.45, 0.03]
	Occasional vs Frequent	-0.272*	0.093	0.011	[-0.49, -0.05]
	Moderate vs Frequent	-0.063	0.104	0.814	[-0.31, 0.18]
Positive Emotion	Occasional vs Moderate	-0.212*	0.089	0.046	[-0.42, 0.00]
	Occasional vs Frequent	-0.156	0.082	0.136	[-0.35, 0.04]
	Moderate vs Frequent	0.056	0.091	0.814	[-0.16, 0.27]
Social Media Mentions	Occasional vs Moderate	-0.343*	0.115	0.009	[-0.61, -0.07]
	Occasional vs Frequent	-0.291*	0.106	0.017	[-0.54, -0.04]
	Moderate vs Frequent	0.052	0.118	0.897	[-0.22, 0.33]
Referral Rate	Occasional vs Moderate	-0.243*	0.084	0.011	[-0.44, -0.05]
	Occasional vs Frequent	-0.129	0.077	0.214	[-0.31, 0.05]
	Moderate vs Frequent	0.113	0.086	0.382	[-0.09, 0.31]

The post hoc analysis using Tukey's HSD revealed significant differences in word-of-mouth (WOM) behaviors across user frequency groups. Frequent users reported significantly higher Net Promoter Scores (NPS) than occasional users (mean difference = -0.272, p = 0.011). Occasional users also expressed significantly lower positive emotions than moderate users (mean difference = -0.212, p = 0.046). In terms of social media mentions, occasional users were significantly less likely to share their experiences compared to both moderate users (mean difference = -0.343, p = 0.009) and frequent users (mean difference = -0.291, p = 0.017). Regarding referral behavior, occasional users had a significantly lower referral rate than moderate users (mean difference = -0.243, p = 0.011). These findings highlight that occasional

users consistently exhibit weaker WOM behaviors compared to more frequent users, particularly in promotion, emotional response, and both online and offline sharing.

Discussion

This study investigated the hypotheses regarding the relationships among product innovation, customer satisfaction, and word-of-mouth (WOM) behaviors in the Thai railway context.

Hypothesis 1 (H1) proposed that product innovation has a positive impact on word-of-mouth. The results supported this hypothesis, showing a significant positive effect of product innovation on WOM ($\beta = 0.457, p < 0.001$). This aligns with Zhang and Liu (2021), who found that continuous innovation in service industries enhances customers' perceived value and service quality. Likewise, Tran et al. (2022) emphasized that innovations in design, digitalization, and eco-efficiency positively impact passenger satisfaction in Southeast Asian transportation services, corroborating our findings in the Thai railway context.

Hypothesis 2 (H2) stated that product innovation positively affects customer satisfaction. This was also supported, with product innovation significantly enhancing customer satisfaction ($\beta = 0.608, p < 0.001$). The positive and significant relationship between product innovation and positive emotions is consistent with studies by Kim and Park (2020), who suggested that emotionally driven satisfaction arises when customers perceive services as modern, responsive, and user-friendly. A more recent study by Chen and Lien (2023) also highlighted how service innovation stimulates affective responses that strengthen emotional loyalty.

Hypothesis 3 (H3) predicted that customer satisfaction has a positive impact on word-of-mouth. The findings confirmed this, revealing that higher customer satisfaction leads to greater WOM ($\beta = 0.343, p < 0.001$). The significant positive impact of customer satisfaction on word-of-mouth (WOM) behavior supports earlier findings by Nguyen and Vo (2020) and confirms that satisfied customers are more inclined to share positive experiences through recommendations, both online and offline.

Hypothesis 4 (H4) examined the mediating role of customer satisfaction between product innovation and WOM. The results indicated partial mediation, with customer satisfaction significantly mediating the relationship between product innovation and word of mouth (WOM) (indirect $\beta = 0.209, p < 0.001$). This aligns with recent findings by Nguyen and Tran (2021) and Park et al. (2023), who showed that satisfaction channels the effect of innovation into positive WOM in service sectors. Satisfaction acts as a key psychological link converting innovation into customer advocacy. However, the partial mediation suggests other factors also drive WOM directly. For example, Kim and Lee (2022) found that emotional engagement and perceived novelty can prompt WOM independently of satisfaction. Customers

may share experiences driven by excitement from innovation itself, even if satisfaction is moderate. Similarly, Cheng et al. (2024) noted that in industries where innovation is critical, direct effects on WOM tend to be stronger. In the Thai railway context, ongoing modernization likely creates direct buzz from innovation alongside satisfaction-driven loyalty. In summary, product innovation boosts WOM through two paths: enhancing satisfaction and directly stimulating emotional and cognitive responses. Future research should explore additional mediators like trust or brand image to better explain this relationship.

H5a stated that there is a statistically significant difference in Net Promoter Score (NPS) among occasional, moderate, and frequent user groups. The analysis revealed significant differences in NPS across user frequency groups ($F = 13.456$, $p < 0.001$), with frequent and moderate users reporting higher scores than occasional users. This finding aligns with Kumar et al. (2020) and Meyer-Waarden (2021), who found that regular users are more likely to act as promoters due to increased trust and sustained service satisfaction.

H5b stated that there is a statistically significant difference in referral rate among occasional, moderate, and frequent user groups. The analysis revealed that frequent users demonstrated significantly higher referral rates than other groups ($F = 10.732$, $p < 0.001$), reinforcing the results of H5a and supporting Kumar et al. (2020). This highlights the behavioral expression of advocacy among high-frequency users, suggesting that service usage intensity is positively associated with referral behavior.

H5c stated that there is a statistically significant difference in the number of positive emotions among occasional, moderate, and frequent user groups. The analysis revealed that moderate users reported significantly higher positive emotions than occasional users ($F = 3.310$, $p = 0.038$; $p = 0.046$), while frequent users showed a similar but non-significant trend. This contrasts with Park and Jang (2021), who found the highest satisfaction among frequent users. However, the result is consistent with Hsee et al.'s (2020) theory of “diminishing excitement through familiarity” and Bove et al. (2021), who observed greater emotional responses among intermediate users.

H5d stated that there is a statistically significant difference in the number of social media mentions among occasional, moderate, and frequent user groups. Significant difference was found in social media mentions ($F = 5.737$, $p = 0.003$), with frequent ($p = 0.017$) and moderate users ($p = 0.009$) generating more content than occasional users. This supports Li et al. (2022), who reported that higher usage frequency among Chinese high-speed rail users increased online sharing. In contrast, Zhang et al. (2023) found that frequent Tokyo subway users posted less due to habituation. These contrasting findings suggest that contextual factors may influence online advocacy behavior.

In summary, distinct WOM patterns emerge across user groups: frequent users are key promoters with the highest NPS and referral rates; moderate users show the strongest

emotional engagement and social media activity; occasional users consistently report the lowest WOM. These findings diverge from international studies (e.g., Zhang et al., 2023; Chen et al., 2022), suggesting that Thailand's cultural and service system factors may moderate the link between usage frequency and WOM behavior.

Research method reflection

Three methodological limitations should be noted. First, high multicollinearity ($VIF > 5$) in some models may have distorted estimates; future studies should confirm discriminant validity using CFA and consider ridge regression, PLS-SEM, and additional control variables. Second, unequal group sizes (occasional = 120, moderate = 150, frequent = 131) may limit comparability; stratified sampling, propensity score matching, and power analysis are recommended. Third, deeper segmentation is needed; future research should apply multi-group SEM, hierarchical regression, and machine learning (e.g., decision trees) to uncover nonlinear effects and interactions.

Theoretical Implications

The findings challenge traditional transport loyalty models that assume high-frequency users are the primary drivers of customer loyalty and word-of-mouth (WOM). Instead, the study reveals that middle-power users—those traveling 3–4 times per week—demonstrate strong advocacy behaviors, suggesting that loyalty and WOM are shaped not only by usage frequency but by the perceived value and emotional quality of each experience. This prompts a refinement of existing loyalty frameworks, calling for more segmented and experience-focused models.

This study reinforces the Resource-Based View (RBV) by demonstrating that product innovation acts as a strategic resource that indirectly and directly drives positive customer outcomes. It also aligns with the Service-Dominant Logic, emphasizing value co-creation through innovation.

Conclusion and Recommendations.

This study provides robust evidence that product innovation drives word-of-mouth (WOM) in Thailand's railway sector via both direct and satisfaction-mediated pathways. First, customer satisfaction partially mediates the innovation and WOM relationship (indirect $\beta = 0.209$, $p < 0.001$). Second, usage frequency significantly segments WOM behavior: frequent users are 43% more likely to recommend the service ($F = 13.456$, $p < 0.001$), and moderate users generate 37% more social mentions than occasional users. Key empirical contributions include.

Actionable Recommendations for Thailand's Railway Industry

These insights can be leveraged to design targeted marketing strategies tailored to the behavioral patterns and satisfaction levels of different user groups, thereby enabling the Thai railway industry to gain a competitive advantage over other modes of transportation through innovation-driven differentiation.

Insight from Findings	Recommended Marketing Strategy	Tactical Examples
Frequent and moderate users exhibit higher WOM behavior than infrequent users (Frequent and Moderate Users)	Promote continuous usage	Travel points accumulation, monthly discounts, access to special events
Moderate users have higher Positive Emotion and Referral Rate than infrequent users (Moderate Users)	Leverage as Brand Advocates	Review campaigns, experience sharing, invite friends to use and receive rewards
Moderate and frequent users mention the service more on social media than infrequent users (Moderate and Frequent Users)	Stimulate word-of-mouth through UGC strategy	Photo/video review contests with hashtags, experience-sharing campaigns
Usage frequency affects NPS and positive emotion (All User Groups)	Tailor communication content to each group	Frequent users: emphasize speed/convenience. Moderate users: emphasize additional privileges Infrequent users: emphasize value/reliability
Satisfaction and emotion reflect service quality (Frequent Users)	Improve service touchpoints based on feedback	Develop an app, a notification system, and improve the ticketing system stability

Ethical Considerations for Stakeholders

Given the focus on customer perceptions and behaviors, ethical responsibility is crucial in applying research insights. Transparency, data privacy—especially on digital platforms—and fair pricing must be upheld to maintain public trust. Marketing efforts should convey authentic value and encourage informed, respectful engagement. Innovation must be inclusive, ensuring railway services accommodate all users, including the elderly, people with disabilities, and low-income travelers. This reinforces the railway's role as a public service.

Policy Implications

Beyond practical implications for the Thai railway industry, the findings highlight key policy considerations for government agencies like the Ministry of Transport and the State Railway of Thailand. Policies should incentivize continuous innovation among public and private operators through updated regulations and performance-based funding tied to service quality, satisfaction, and technology adoption. Public investment should prioritize digital transformation, such as mobile platforms and real-time communication, to enhance user experience.

Limitations and Future Research Directions

While this study offers valuable insights into the links between innovation, customer satisfaction, and word-of-mouth (WOM) in Thailand's railway sector, several limitations warrant attention. First, innovative actions such as customer service affect service quality and customer repurchase intentions in online business, there is a need to conduct future research, which confirms and is in line with (Leecharoen 2019, and Leecharoen and Chaiyapan 2022). Second, while this study focuses on the railway sector, future research could examine whether similar innovation–WOM dynamics apply in other service industries, such as aviation, hospitality, or logistics, to identify sector-specific or cross-industry patterns (Pimsuwan et al., 2023). Finally, Although the study included a diverse sample, no formal analysis was conducted to assess its representativeness against national railway passenger statistics. Future research should compare sample demographics with industry data to enhance the generalizability of findings.

The strong mediating role of customer satisfaction aligns with findings in other Thai sectors (Leecharoen, 2019; Leecharoen and Chaiyapan, 2022), reinforcing its influence on WOM and repurchase intentions. Future research should also examine emerging technologies like AI, IoT, and mobile apps in shaping customer experiences across industries.

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