# Conversational AI-Powered VR Development Model for Tourism Promotion in Thailand: Expert Assessment and Stakeholder Acceptance

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***Abstract*—Thailand's tourism sector increasingly requires immersive digital innovations that preserve local identity while enhancing visitor engagement. However, there remains a lack of a comprehensive model to guide such developments. This study aims to propose the Conversational AI-powered Virtual Reality Development Model for Tourism Promotion in Thailand, providing an integrated and context-specific framework suitable for practical implementation. A Design and Development Research (DDR) methodology (Type II) was employed in three stages: 1) synthesizing essential components through a scoping review, 2) constructing and validating the model via expert panels using the Content Validity Index (CVI) analysis, and 3) assessing suitability and acceptance through expert evaluation and stakeholder surveys. The model developed in this study, referred to as the 4Ds Model, contributes new knowledge by integrating conversational AI and virtual reality within a four-phase structure—Discover, Design, Develop, and Deploy—supported by five enabling capitals: human, cultural, technological, informational, and financial. The Deploy phase modifies the AISAS communication framework into AICAS (Attention, Interest, Chat, Action, Share) to illustrate the function of conversational AI in improving user interaction and engagement within the context of tourism in Thailand. Results indicated high expert ratings of suitability and strong stakeholder intention to adopt. Multiple regression analysis revealed that technological self-efficacy, perceived interactivity, and perceived tourism benefits were significant predictors, explaining 73.3% of the variance in behavioral intention. The findings demonstrate both the theoretical advancement in AI–VR integration and the practical readiness of the 4Ds Model as a culturally aligned roadmap for digital tourism transformation in Thailand.**

***Keywords*—Virtual reality; conversational AI; Model Development; digital tourism; technology adoption***

## I. Introduction

Tourism is a major economic sector worldwide, playing a vital role in job creation, income generation, and cultural exchange. In recent years, the industry has faced significant challenges, especially due to the COVID-19 pandemic, which accelerated the shift toward digital engagement and virtual-tourism solutions [1]. As a response, technologies such as virtual reality (VR) and conversational artificial intelligence (CAI) have gained prominence as innovative tools for enhancing tourism marketing and traveler engagement [2].

VR allows users to experience simulated environments that replicate real-world tourist destinations. These immersive environments can shape destination image, emotional attachment, and behavioral intention among potential tourists [3], [4]. Multisensory VR—which integrates sound, vision, and other sensory inputs—has been shown to increase emotional engagement and perceived presence, particularly when personalized to specific user groups [4].

CAI plays a complementary role by enabling real-time dialogue and personalized assistance in virtual environments. Services such as language translation, itinerary recommendations, and interactive storytelling help reduce uncertainty and enhance satisfaction for users navigating virtual-tourism experiences [5]. Despite growing global applications of VR and AI in tourism, their integrated use—particularly within culturally diverse and linguistically unique regions like Thailand—remains underexplored [6].

However, existing studies rarely provide a structured model that systematically integrates VR and CAI for tourism promotion, leaving a methodological gap in both research and practice. Without such a structured model, integration efforts risk remaining fragmented, thereby limiting scalability, policy alignment, and long-term impact. For Thailand specifically, aligning immersive technologies with national tourism strategies and embedding local cultural identity are critical considerations, yet current models offer little structured guidance for achieving such alignment.

Research consistently highlights the importance of interactivity, presence, and satisfaction in shaping tourist behavior in VR environments. When VR is combined with conversational systems, emotional immersion is heightened and human-like engagement is created, effectively simulating tour guides or hosts to enrich the tourist's pre-visit experience [4], [7].

This study proposes the Conversational AI-Powered VR Development Model for Tourism Promotion in Thailand as an innovative response to the identified research gap. The model combines immersive virtual environments with conversational

interfaces to enhance engagement and personalization, while remaining aligned with digital tourism strategies. To systematically examine the model, the study focuses on three key aspects: 1) synthesizing its core components, 2) validating its theoretical soundness, and 3) evaluating its suitability and acceptability from expert and stakeholder perspectives. In this study, stakeholders refer not to tourists but to public-sector tourism officers, destination management professionals, and practitioners in provincial tourism promotion units, whose perspectives are essential for policy alignment and implementation. The research also seeks to identify the key factors that predict stakeholders' behavioral intention to adopt the model. These aims directly inform the research objectives and questions outlined in the following section.

## II. Research Objectives

*1)* To synthesize the key components of the conversational AI-powered VR development model for tourism promotion in Thailand.

*2)* To develop and validate the conversational AI-powered VR development model in terms of theoretical soundness.

*3)* To evaluate the model's suitability as perceived by domain experts in the tourism sector.

*4)* To evaluate the model's acceptability as perceived by stakeholders and to identify the key factors predicting their behavioral intention to use the model.

## III. Research Questions

*1)* RQ1: What are the key components of the conversational AI-powered VR development model for tourism promotion in Thailand?

*2)* RQ2: To what extent is the synthesized model valid in terms of theoretical soundness?

*3)* RQ3: To what extent do domain experts in the tourism sector perceive the proposed model as suitable?

*4)* RQ4: To what extent do stakeholders in the tourism sector perceive the proposed model as acceptable, and which overall and specific factors significantly predict their behavioral intention to use it?

## IV. Literature Review

### A. Virtual Reality in Tourism Promotion

Virtual reality (VR) has been widely adopted as a technology-based marketing tool in the tourism industry because it can simulate real-world experiences. Research indicates that VR enables travellers to pre-experience destinations, which in turn shapes their emotional engagement and travel intentions [8]. The immersive quality of VR—particularly in multisensory formats—enhances presence and enjoyment [9]. Studies further suggest that VR can function as a substitute for real visits to sensitive or remote locations, supporting both destination marketing and conservation goals [10]. Recent reviews emphasise VR's growing relevance in the post-pandemic era, as the technology-maintained destination visibility during periods of restricted travel [11]. Moreover, VR has proven effective in reshaping traveller behaviour and expectations, increasing the potential for its long-term use in destination planning [12].

### B. Conversational AI in Tourism Applications

Conversational artificial intelligence (CAI)—including chatbots and virtual assistants—has reshaped tourist services by providing real-time, personalized, and multilingual communication. In tourism and hospitality settings, conversational agents improve user satisfaction, assist with bookings, and reduce staff workload [13]. These systems leverage natural language processing to recognize user intent and adjust responses contextually, creating more natural interactions. Tourists also report positive emotional responses to AI-powered services, especially when these systems are integrated seamlessly across digital platforms. Trust, perceived usefulness, and enjoyment are key factors that drive the continued adoption of AI in tourism [13]. Nevertheless, most existing studies examine AI in isolation, focusing on functional or transactional roles with limited attention to its immersive and experiential potential—particularly in tandem with VR.

### C. Integrated Use of VR and Conversational AI

Although VR and CAI have each been applied in tourism, research on their integrated use is still emerging. A combined system offers both immersive visual engagement and interactive verbal communication, effectively simulating local guides or cultural narrators within virtual environments. For instance, integrating speech recognition and natural-language processing into VR environments has been shown to improve user experience and language accessibility, especially for tourists with limited English proficiency [14]. Such systems can adaptively deliver information, answer queries, and provide decision support, making virtual tourism more personalised and engaging. However, there remains a lack of formalized models detailing how these integrated systems should be developed, validated, and deployed—particularly in alignment with national tourism strategies.

### D. Cultural and Linguistic Personalization in Tourism

Cultural and linguistic personalization is critical in tourism-technology design, especially in diverse destinations such as Thailand. AI systems that support native-language interactions and culturally relevant content strengthen trust and reduce uncertainty among tourists [13]. In VR environments, weaving culturally nuanced storytelling and symbolic elements—such as temple architecture or local customs—deepens emotional resonance and visitor satisfaction [8]. Recent studies also indicate that tourists perceive greater authenticity and enjoyment when virtual systems reflect their cultural context and accommodate preferred languages [14]. Nevertheless, few development models systematically incorporate cultural and linguistic personalization—particularly those aligned with public-sector objectives for national tourism promotion.

### E. Determinants of Technology Adoption in Tourism

The adoption of the proposed Conversational AI-Powered VR Development Model by stakeholders—defined in this study as public-sector tourism officers, destination management professionals, and practitioners in provincial tourism promotion units—depends on several interrelated psychological, organizational, and technological factors. These determinants are consistent with established adoption frameworks such as the Technology Acceptance Model (TAM) [15] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [16],

which highlight perceived usefulness, ease of use, facilitating conditions, and behavioral intention as critical predictors of technology adoption.

One of the most critical factors is technological self-efficacy, referring to stakeholders' confidence in their ability to understand, operate, and apply new technologies in their work. Prior studies confirm that self-efficacy strongly influences the adoption of digital platforms in tourism and hospitality [17], [18]. High self-efficacy supports perceived ease of use and perceived usefulness—core constructs in TAM—and shapes favorable attitudes toward adopting innovative tools [19].

Another determinant is attitude toward tourism technology. Stakeholders who perceive VR and AI as valuable for enhancing tourism experiences and promoting destinations are more willing to support and invest in such tools. This aligns with TAM's emphasis on attitude as a mediator of adoption decisions [20] and with UTAUT's construct of performance expectancy [16].

Facilitating conditions—such as institutional support, infrastructure, budget allocation, and training—either enable or constrain system adoption. As emphasized in UTAUT, strong facilitating conditions increase the likelihood of adoption, especially when coupled with organizational readiness [16], [21].

Perceived accessibility—including ease of use, availability across devices, and language inclusivity—further influences adoption. Systems that minimize technical barriers and support local languages are particularly attractive to public-sector tourism personnel in linguistically diverse contexts [14].

Perceived interactivity is a decisive factor for technologies designed for tourism promotion. Dynamic, real-time engagement (e.g., conversational agents embedded in VR) enhances the perceived quality of communication experiences, encouraging adoption [14].

Finally, perceived tourism benefits reflect beliefs that the system can improve destination image, educate tourists, or stimulate visitation. When stakeholders perceive strong benefits aligned with policy priorities, they are more likely to adopt and champion the system [17].

These determinants—self-efficacy, attitudes, facilitating conditions, accessibility, interactivity, and perceived benefits—reflect validated constructs in TAM and UTAUT while addressing the specific needs of Thailand's public-sector tourism stakeholders. Unlike prior studies that examined these factors in isolation or emphasized tourists as the primary users, this study integrates them into a structured model. The determinants are empirically tested as predictors of stakeholders' perceived acceptability of the model and their behavioral intention to use it, underscoring the study's contribution in bridging technology acceptance theory with the policy and operational realities of tourism promotion in culturally diverse contexts.

## V. Methodology

This study employed a Design and Development Research (DDR) Type II methodology, which is well-suited for synthesizing, developing, and evaluating innovative models in real-world contexts where no established models exist. According to Richey and Klein (2014), DDR Type II emphasizes both theoretical rigor and practical applicability. The research proceeded in three stages: 1) Model Synthesis, 2) Model Development and Validation, and 3) Model Evaluation.

### A. Stage I: Model Synthesis

In the first stage, a scoping review was conducted to identify and synthesize the key components of the conversational AI-powered VR development model for tourism promotion in Thailand. Following the framework of Arksey and O'Malley [23], searches were performed in Scopus, IEEE Xplore, and ThaiJO databases covering publications between 2019 and 2025. The search strategy combined keywords such as "virtual reality", "conversational AI", "smart tourism", "digital tourism", "cultural communication", and "government tourism innovation". Three instruments supported this stage: a) Study Screening and Eligibility Checklist, b) Data Charting Form, and c) Evidence Synthesis Matrix. The results of this stage provided the preliminary components of the development model.

### B. Stage II: Model Development and Validation

The second stage refined and validated the preliminary model. A focus group discussion (FGD) was organized with nine purposively selected experts specializing in tourism technology, VR/AI systems, and Thai cultural media. The FGD followed a semi-structured protocol described in [24]. Insights collected from the discussion were thematically analyzed to enhance the structure, terminology, and contextual alignment of the model. Subsequently, the revised model underwent content validation using the Content Validity Index (CVI). A separate panel of five experts—holding doctoral degrees and with at least five years of relevant experience—rated each component on a four-point relevance scale. All item-level CVIs (I-CVI) exceeded 0.80, and the scale-level CVI/Average (S-CVI/Ave) was 0.94, surpassing the 0.90 threshold recommended in [25]. These results confirmed strong content validity.

### C. Stage III: Model Evaluation

This stage evaluated the suitability and acceptability of the proposed model through expert and stakeholder feedback, ensuring both theoretical soundness and practical applicability.

*1) Participants:* This stage engaged two categories of participants to capture complementary perspectives. The expert category included five purposively selected individuals, each holding a doctoral degree in a relevant discipline, with at least five years of professional or research experience in tourism development, immersive technology, or cultural communication, and recognized contributions such as publications, funded projects, or leadership roles. The stakeholder category comprised 120 participants recruited through a multi-stage sampling process. First, Thailand's four geographical regions—North, Central and East, Northeast, and South—were identified. Next, provincial tourism promotion units within each region were targeted. Finally, thirty participants from each region, including government officials, administrators, and practitioners directly engaged in tourism promotion, were selected.

*2) Instruments:* Separate instruments were employed for experts and stakeholders, each tailored to its respondent group. Both used a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree). The expert evaluation form consisted of twelve items corresponding to the four phases of the model—Discover, Design, Develop, and Deploy—focusing on practicality, clarity, and policy alignment. The stakeholder survey was divided into two parts: the first part collected demographic and contextual information, and the second part measured six independent variables, namely Technological Self-Efficacy ($X_1$), Attitude towards Technology in Tourism ($X_2$), Facilitating Conditions ($X_3$), Perceived Accessibility ($X_4$), Perceived Interactivity ($X_5$), and Perceived Tourism Benefits ($X_6$), as well as one dependent variable, Behavioral Intention to Use the Model (Y). These constructs were adapted from previously validated studies [15–19] and contextualized for Thai tourism. Both instruments were pilot-tested with thirty respondents, and their quality was confirmed through expert review (CVI ≥ 0.90) and reliability analysis (Cronbach's alpha ≥ 0.80) [25].

*3) Data collection procedures:* Experts were contacted individually and asked to complete the evaluation form within two weeks. Stakeholders were surveyed in collaboration with regional tourism offices and networks, using both online and in-person administration depending on accessibility. Data collection lasted for one month. Informed consent was obtained from all participants, and confidentiality as well as voluntary participation were assured.

*4) Data analysis:* Data from the expert group (n = 5) were analyzed using descriptive statistics, including means and standard deviations, combined with qualitative synthesis. Inferential analysis was avoided due to the small sample size. Data from the stakeholder group (n = 120) were analyzed using both descriptive and inferential statistics. Descriptive statistics were applied to summarize responses, Pearson's correlation was used to examine relationships among variables, and Multiple Regression Analysis (MRA) was performed to identify predictors of behavioral intention (Y) from the six independent variables ($X_1$–$X_6$). Prior to regression, assumptions were tested for linearity, independence of errors, normality, homoscedasticity, and multicollinearity, with thresholds set at VIF < 10 and Tolerance > 0.1. Sample size adequacy was established based on Green's rule of 15–20 cases per predictor [26], confirming that the sample of 120 participants was sufficient.

*5) Ethical considerations:* This study adhered to the Declaration of Helsinki, the Belmont Report, the CIOMS Guidelines, and the ICH-GCP framework. Ethical approval was obtained from the Human Research Ethics Committee of Rajamangala University of Technology Thanyaburi, Thailand (COA No. 73, RMUTT_REC No. Exp 73/68) through an expedited review on July 7, 2025. All participants provided written informed consent, with full rights to withdraw at any stage.

## VI. Results

### A. The Key Components of the Conversational AI-Powered VR Development Model

The conceptual foundation of the Conversational AI-powered VR Development Model for tourism promotion in Thailand was derived from a synthesis of international and local scholarship in virtual tourism, artificial intelligence, human–computer interaction, and cultural experience design. Based on this review, the model is structured around three interrelated domains—Virtual Reality, Conversational AI, and Human-Centered Design—supported by five enabling capitals that ensure sustainable implementation within Thailand's tourism ecosystem.

Virtual Reality (VR) functions as the primary medium for immersive destination simulation. The literature identifies three levels of immersion—non-immersive, semi-immersive, and fully immersive—with the latter two proving most effective in strengthening spatial presence and influencing travel intention [27–29]. Core components include 3D environmental modelling [52], the integration of cultural content, and multisensory feedback systems [30–32]. Scenario design plays a critical role in tourism applications, where meaningful storytelling enhances emotional engagement with cultural landmarks and traditions [33].

Conversational AI adds an intelligent, interactive layer that facilitates real-time dialogue through natural language processing (NLP), automatic speech recognition, and context-aware dialogue management [34], [35]. These capabilities enable virtual agents to act as culturally aligned local guides, providing personalised and linguistically appropriate recommendations [36], [37]. Research highlights that conversational flow should reflect national etiquette, local expressions, and culturally rooted storytelling in order to resonate with diverse audiences [38], [39].

The human-centered design domain focuses on user engagement, perception, and emotional response. This includes modelling diverse tourist personas, designing accessible interfaces, and applying affective strategies to sustain attention [40], [41]. Emphasis on privacy, inclusivity, and cultural accuracy is essential to building trust and ensuring respectful experiences [42], [43]. In the Thai context, systems must not only deliver visual appeal but also convey the symbolic and cultural depth of places, people, and traditions.

Supporting these domains are five enabling capitals identified in tourism innovation literature: human capital (skills and expertise), cultural capital (traditions and narratives), technological capital (infrastructure and platforms), information capital (user data and content libraries), and financial capital (public and private investment) [44–46]. Together, these resources form the foundation for sustainable development, scalability, and policy alignment in Thailand's digital tourism initiatives.

### B. The Proposed Model for Tourism Promotion in Thailand

The Conversational AI-powered VR Development Model, hereafter referred to as the 4Ds Model, was developed and validated during Stage II of this study. It comprises four

structured phases—Discover, Design, Develop, and Deploy—as illustrated in Fig. 1. The model translates insights from the synthesis of Stage I into a practical framework, refined through expert input to ensure theoretical grounding, contextual relevance, and alignment with Thailand's public-sector tourism promotion priorities.

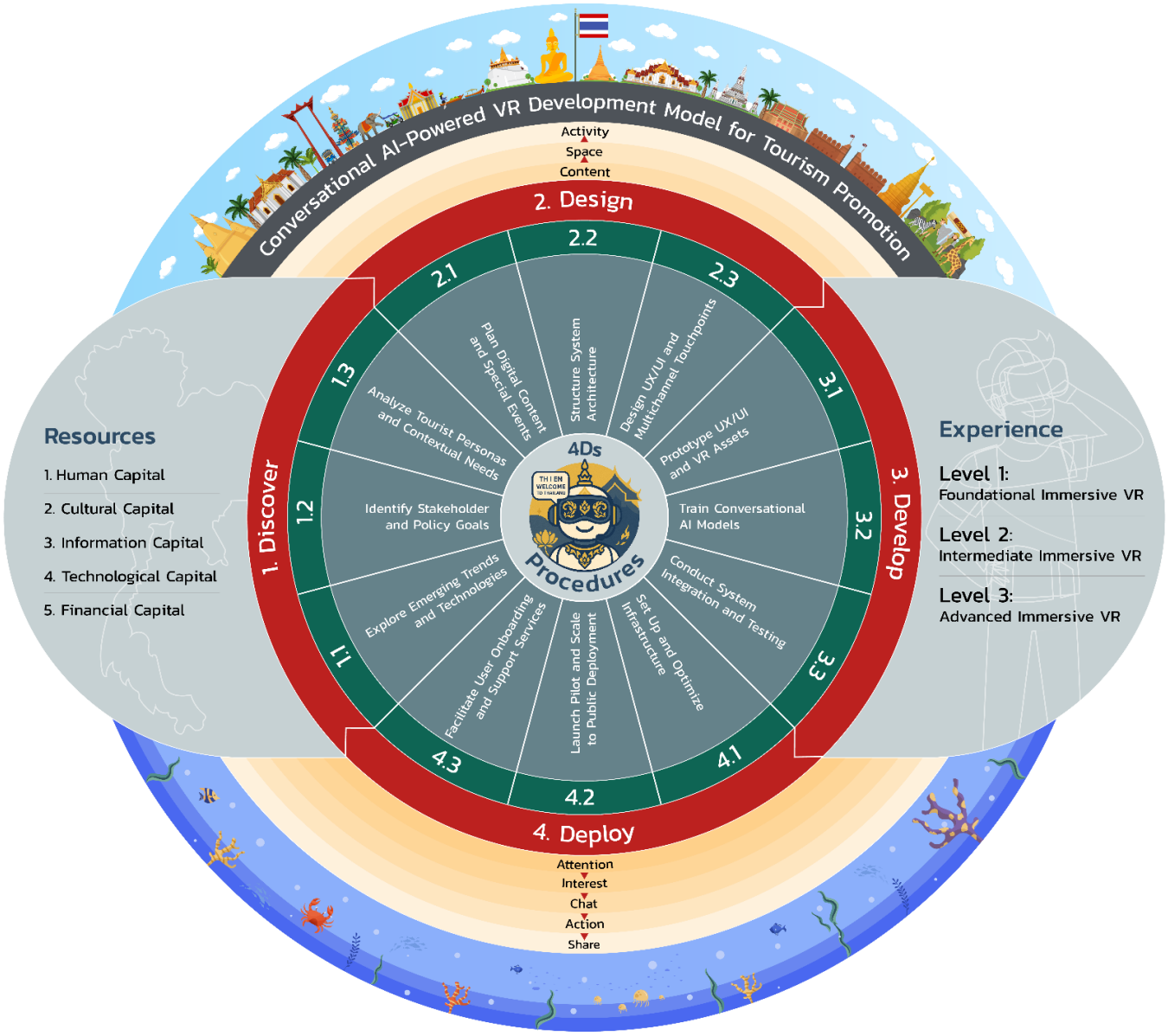


Fig. 1. The conversational AI-powered VR development model for tourism promotion in Thailand.

The Conversational AI-powered VR Development Model for Tourism Promotion in Thailand is structured into four principal phases, comprising a total of twelve systematically organized sub-steps, as follows:

*1) Discover (D1):* This phase focuses on strategic and contextual exploration to ensure that immersive technology development aligns with stakeholder priorities and destination-specific needs. It involves considering the availability and readiness of five enabling capitals—human, cultural, technological, informational, and financial—while also identifying target user personas and tourism communication goals. This ensures that subsequent phases are grounded in real-world constraints and opportunities. It comprises three sub-steps:

*a) Explore emerging trends and technologies:* To investigate recent developments in virtual reality, conversational AI, and digital tourism innovations.

*b) Identify stakeholder and policy goals:* To review national/local tourism policies and align digital initiatives with governmental priorities.

*c) Analyze tourist personas and contextual needs:* To understand target tourist segments, their motivations, behaviors, and cultural expectations.

*2) Design (D2):* This phase emphasizes conceptual planning and experience architecture across three core dimensions: content, space, and activity. It translates insights from the Discover phase into an actionable blueprint, detailing narrative structure, spatial navigation, and interactive elements that reflect cultural heritage. The design ensures that immersive tourism experiences are coherent, contextually meaningful, and engaging. It comprises three sub-steps:

*a) Plan digital content and special events:* To design thematic narratives and cultural programming across physical, digital, and hybrid formats.

*b) Structure system architecture:* To define the platform's modules, integration flow, and interaction logic.

*c) Design UX/UI and Multichannel Touchpoints:* To develop user interfaces and engagement pathways across devices and formats.

*3) Develop (D3):* This phase involves the technical realization of the system, including asset creation, system integration, and iterative testing. It operationalizes three progressive levels of immersive experience—foundational, intermediate, and advanced—each tailored to different user expectations and technological capabilities. It also includes training conversational AI agents to support real-time user interaction. It comprises three sub-steps:

*a) Prototype UX/UI and VR assets:* To produce visual, spatial, and interactive elements reflecting cultural context.

*b) Train conversational AI models:* To develop and localize intelligent agents capable of multilingual, context-aware interaction, ensuring that users from diverse linguistic backgrounds—such as Thai, English, Chinese, and regional ASEAN languages—can access tourism content seamlessly. This involves training models not only to handle literal translation but also to adapt cultural nuances, idiomatic expressions, and domain-specific terminology, thereby supporting inclusive, natural, and contextually appropriate communication across different audiences.

*c) Conduct system integration and testing:* To combine all components into a working prototype and evaluate its functionality and usability.

*4) Deploy (D4):* This final phase focuses on implementation, public rollout, and ongoing engagement. It adopts the AICAS strategy—Attention, Interest, Chat, Action, and Share—adapted from the AISAS model (Attention, Interest, Search, Action, Share) [47], [48]. In this adaptation, Search is replaced with Chat to reflect dialogic, real-time inquiry within conversational AI–enabled VR environments, where users obtain information through natural-language interaction rather than traditional keyword search. This modification aligns the engagement funnel with CAI-led user journeys while preserving the intent of the original AISAS framework. It comprises three sub-steps:

*a) Set up and optimize infrastructure:* To ensure technical readiness and system reliability for public deployment.

*b) Launch pilot and scale to public deployment:* To initiate small-scale trials and refine before wide release.

*c) Facilitate user onboarding and support services:* To provide orientation, assistance, and ongoing user engagement support.

### C. The Suitability of the Proposed Model from Expert Perspectives

Five experts were invited to evaluate the overall suitability of the proposed 4Ds Model for tourism promotion in Thailand, focusing on its twelve sub-steps across the four phases. Their assessments reflected perceptions of the clarity, relevance, and appropriateness of each sub-step within the Thai tourism context. As shown in Table I, mean scores ranged from 4.40 to 4.80, with an overall mean of 4.55. Although these results are based on a small expert panel (n = 5) and should therefore be interpreted as indicative rather than generalizable, the standard deviations remained consistent at 0.53, suggesting strong agreement among the experts.

TABLE I. THE SUITABILITY OF THE CONVERSATIONAL AI-POWERED VR DEVELOPMENT MODEL FOR TOURISM PROMOTION

| Assessment Items | | M | SD | Suitability Level |
|---|---|---|---|---|
| **Phase** | **Sub-steps** | | | |
| 1. Discover (D1) | 1.1 Explore Emerging Trends and Technologies | 4.40 | 0.55 | Agree |
| | 1.2 Identify Stakeholder and Policy Goals | 4.60 | 0.55 | Strongly Agree |
| | 1.3 Analyze Tourist Personas and Contextual Needs | 4.40 | 0.55 | Agree |
| 2. Design (D2) | 2.1 Plan Digital Content and Special Events | 4.60 | 0.55 | Strongly Agree |
| | 2.2 Structure System Architecture | 4.60 | 0.55 | Strongly Agree |
| | 2.3 Design UX/UI and Multichannel Touchpoints | 4.40 | 0.55 | Agree |
| 3. Develop (D3) | 3.1 Prototype UX/UI and VR Assets | 4.40 | 0.55 | Agree |
| | 3.2 Train Conversational AI Models | 4.80 | 0.45 | Strongly Agree |
| | 3.3 Conduct System Integration and Testing | 4.60 | 0.55 | Strongly Agree |
| 4. Deploy (D4) | 4.1 Set Up and Optimize Infrastructure | 4.40 | 0.55 | Agree |
| | 4.2 Launch Pilot and Scale to Public Deployment | 4.80 | 0.45 | Strongly Agree |
| | 4.3 Facilitate User Onboarding and Support Services | 4.60 | 0.55 | Strongly Agree |
| Overall | | 4.55 | 0.53 | Strongly Agree |

Qualitative feedback reinforced these quantitative results. Experts particularly highlighted the Design phase, which they valued for its structured articulation of content modules, spatial navigation, and interaction logic, and the Deploy phase, which was praised for operationalizing the AICAS strategy (Attention, Interest, Chat, Action, Share) that reflects dialogic, real-time engagement in CAI–VR environments. Collectively, these judgments indicate that the 4Ds Model is conceptually robust, technically coherent, and contextually applicable to Thailand's tourism promotion efforts. Experts further emphasized that the model's flexible procedures make it adaptable across six categories of tourist attractions: 1) wellness and lifestyle tourism (e.g., spas, retreats, health resorts); 2) cultural and heritage tourism (e.g., temples, historical parks, historical museums); 3) nature and ecotourism (e.g., national parks, marine reserves); 4) creative and community-based tourism (e.g., local crafts, village experiences); 5) educational or edutainment tourism (e.g., zoos, aquariums, science centers); and 6) academic and medical tourism (e.g., universities, teaching hospitals, specialty clinics).

### *D. The Descriptive Statistics and Correlation Analysis of Stakeholders' Responses*

A total of 120 stakeholders participated in the survey, comprising 73 females (60.83%) and 47 males (39.17%). Their ages ranged from 18 to 63 years, with a mean of 28.15 years (SD = 10.96) and a median of 24 years, indicating that the majority were young to middle-aged adults. In terms of educational attainment, most respondents held a bachelor's degree (59.17%), followed by those with a master's degree (30.83%) and a doctoral degree (10.00%).

With respect to occupation, the largest group consisted of public-sector tourism officers and staff in provincial tourism promotion units (45.00%). They were followed by private-sector tourism professionals such as tour guides, hotel staff, and travel agency operators (35.00%), and by media professionals or content creators specializing in tourism promotion (20.00%). This composition reflects a balanced mix of public officials, private-sector practitioners, and communication agents, consistent with the study's emphasis on stakeholder perspectives rather than tourists.

Regarding prior experience with technology in tourism, most respondents had never used VR (40.83%), while others had used it once (26.67%), two to three times (20.83%), or four to five times and above (11.67%). In contrast, AI applications for tourism were more widely adopted: 39 respondents (32.50%) had never used them, 28 (23.33%) had used them once, 31 (25.83%) had used them two to three times, and 22 (18.33%) had used them four to five times or more.

The descriptive statistics and Pearson's correlation coefficients of the stakeholder survey responses are presented in Table II. The results show that the mean values of the independent variables ranged from 4.19 to 4.47, while the dependent variable— Behavioral Intention to Use the Conversational AI-powered VR Development Model — had a mean score of 4.33 (SD = 0.65). As all means were above the scale midpoint (3), this indicates a consistently high level of acceptance toward the proposed model among stakeholders. Furthermore, all independent variables were positively and significantly correlated with behavioral intention (Y). The strongest correlations with Y were observed for Perceived Interactivity (r = .806), Perceived Tourism Benefits (r = .800), and Perceived Accessibility (r = .721). Although some intercorrelations were relatively high (e.g., $X_5$ and $X_6$), none exceeded problematic thresholds, suggesting that multicollinearity was not severe at this stage. It should also be noted that correlation analysis does not establish causality but provides a statistical foundation for subsequent regression testing.

TABLE II. THE DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

| Variable | M | SD | X1 | X2 | X3 | X4 | X5 | X6 | Y |
|---|---|---|---|---|---|---|---|---|---|
| 1. Technological Self-Efficacy ($X_1$) | 4.20 | 0.54 | 1 | | | | | | |
| 2. Attitude towards Technology in Tourism ($X_2$) | 4.47 | 0.47 | .500 | 1 | | | | | |
| 3. Facilitating Conditions ($X_3$) | 4.19 | 0.64 | .596 | .438 | 1 | | | | |
| 4. Perceived Accessibility ($X_4$) | 4.28 | 0.60 | .534 | .546 | .741 | 1 | | | |
| 5. Perceived Interactivity ($X_5$) | 4.28 | 0.57 | .591 | .537 | .785 | .802 | 1 | | |
| 6. Perceived Tourism Benefits ($X_6$) | 4.32 | 0.54 | .517 | .510 | .675 | .741 | .821 | 1 | |
| 7. Behavioral Intention to Use the Conversational AI-powered VR Development Model ($Y$) | 4.33 | 0.65 | .602 | .509 | .703 | .721 | .806 | .800 | 1 |

### *E. Assumption Testing for Multiple Regression*

Regression assumptions were tested prior to model estimation. The Durbin–Watson statistic was 1.70, confirming independence of errors. The Shapiro–Wilk test ($p < .001$) indicated some deviation from perfect normality; however, given the adequate sample size (n = 120), residuals were approximately normally distributed, as supported by histogram and Q–Q plots. This meets the robustness criteria for regression with moderate to large samples [49], [50].

Homoscedasticity was supported by residual plots showing no funnel pattern. Variance Inflation Factor (VIF) values ranged between 1.61 and 5.05, below the threshold of 10, indicating no serious multicollinearity, though $X_5$ showed relatively higher collinearity. Overall, the assumptions were sufficiently met.

### *F. Multiple Regression Results*

As presented in Table III, the multiple regression model significantly predicted stakeholders' behavioral intention to use the Conversational AI-powered VR Development Model, $F(6, 113) = 51.689$, $p < .001$. The six predictors together explained 73.3% of the variance in behavioral intention ($R^2 = .733$), with an adjusted $R^2$ of .719, indicating strong explanatory power of the model within this dataset.

TABLE III. MODEL SUMMARY OF MULTIPLE REGRESSION

| R | $R^2$ | Adjusted $R^2$ | F | Sig. (p) |
|---|---|---|---|---|
| .856 | .733 | .719 | 51.689 | < .001 |

TABLE IV. REGRESSION COEFFICIENTS OF PREDICTORS ON BEHAVIORAL INTENTION TO USE THE CONVERSATIONAL AI-POWERED VR DEVELOPMENT MODEL

| Predictor | B | SE | Beta | t | Sig. | 95% CI for B | VIF |
|---|---|---|---|---|---|---|---|
| Constant | -0.507 | 0.33 | – | -1.54 | .129 | [-1.16, 0.15] | – |
| 1. Technological Self-Efficacy ($X_1$) | 0.174 | 0.077 | 0.146 | 2.25 | .027* | [0.02, 0.33] | 1.78 |
| 2. Attitude towards Technology in Tourism ($X_2$) | 0.029 | 0.085 | 0.021 | 0.34 | .736 | [-0.14, 0.20] | 1.61 |
| 3. Facilitating Conditions ($X_3$) | 0.085 | 0.087 | 0.084 | 0.98 | .328 | [-0.09, 0.26] | 3.07 |
| 4. Perceived Accessibility ($X_4$) | 0.068 | 0.097 | 0.063 | 0.70 | .484 | [-0.12, 0.25] | 3.40 |
| 5. Perceived Interactivity ($X_5$) | 0.313 | 0.124 | 0.277 | 2.53 | .013* | [0.07, 0.55] | 5.05 |
| 6. Perceived Tourism Benefits ($X_6$) | 0.461 | 0.106 | 0.384 | 4.36 | .000*** | [0.25, 0.67] | 3.29 |

Note: *p < .05, ***p < .001

As shown in Table IV, three variables emerged as significant predictors: Technological Self-Efficacy ($X_1$), Perceived Interactivity ($X_5$), and Perceived Tourism Benefits ($X_6$). The remaining predictors—Attitude towards Technology in Tourism ($X_2$), Facilitating Conditions ($X_3$), and Perceived Accessibility ($X_4$)—did not reach statistical significance.

The regression equation is presented in Eq. (1):

$$Y = 0.507 + 0.174X_1 + 0.029X_2 + 0.085X_3 + 0.068X_4 + 0.313X_5 + 0.461X_6 \quad (1)$$

where, Y represents behavioral intention, $X_1$ denotes technological self-efficacy, $X_2$ denotes attitude towards technology in tourism, $X_3$ denotes facilitating conditions, $X_4$ denotes perceived accessibility, $X_5$ denotes perceived interactivity, and $X_6$ denotes perceived tourism benefits.

A simplified model with only significant predictors is shown in Eq. (2):

$$Y = 0.507 + 0.174X_1 + 0.313X_5 + 0.461X_6 \quad (2)$$

From the stakeholder perspective, multiple regression analysis indicated that $X_1$ (technological self-efficacy), $X_5$ (perceived interactivity), and $X_6$ (perceived tourism benefits) were significant predictors of $Y$ (behavioral intention). Collectively, these three factors accounted for 73.3% of the variance in behavioral intention, demonstrating the model's strong explanatory power and practical relevance for tourism promotion in Thailand. However, the findings should be interpreted as context-specific evidence drawn from the surveyed stakeholder group—public-sector tourism officers, destination management professionals, and provincial tourism practitioners—and therefore may not be directly generalizable to tourists or to broader populations beyond the study sample.

## VII. DISCUSSION

This study set out to design, validate, and evaluate the Conversational AI-powered VR Development Model for tourism promotion. The results provided convergent evidence across expert evaluations and stakeholder responses, confirming both theoretical soundness and practical feasibility. In the following discussion, the findings are organized around the four research questions (RQ1 to RQ4) and further interpreted in relation to existing theories and empirical studies in VR, AI, and technology adoption.

Addressing RQ1, which investigated the key components of the model, the study confirmed that the Conversational AI-powered VR Development Model can be systematically structured around three interrelated domains—Virtual Reality, Conversational AI, and Human-Centered Design—supported by five enabling capitals: human, cultural, technological, informational, and financial. This configuration echoes the systematic reviews of Calisto and Sarkar [11] and Mariani et al. [34], who highlighted the need for integrated frameworks that unify immersive technologies with user-centered design principles, and resonates with broader system design methodologies that emphasize iterative cycles of requirements analysis, architectural specification, and prototyping [22], [37]. A distinctive feature of the model is its explicit articulation of three progressive levels of immersion—non-immersive, semi-immersive, and fully immersive—corresponding respectively to foundational, intermediate, and advanced experiences. This dual framing bridges technical VR typologies with operational deployment categories, aligning with Slater and Sanchez-Vives [28] and with Anaya-Sánchez et al. [51], who empirically demonstrated that immersion moderates the impact of VR experiences on destination image and visit intentions. Furthermore, the model structures immersive experiences across content, space, and activity dimensions, offering developers a blueprint that is both flexible and technically rigorous, ensuring applicability across diverse organizational and user contexts [15], [16].

In relation to RQ2, which examined theoretical validity, both content validity testing and expert review indicated strong soundness (I-CVI≥ .80; S-CVI/Ave = .94), following guidelines by Yusoff [25]. Experts noted that the phased, modular structure is consistent with Thailand's policy directions for technology-enhanced tourism promotion. This contextual applicability reflects Wu and Zhang [39], who emphasized that immersive technologies must reflect policy and cultural conditions to achieve sustainable adoption. It also resonates with Guttentag [10] and Phoong et al. [29], who stressed that VR initiatives must consider real-world constraints and tourism development trajectories to evolve from novelty to mainstream adoption. By embedding system design within both technological and policy

contexts, the 4Ds Model demonstrates theoretical rigor while preserving contextual relevance.

For RQ3, concerning suitability, experts rated the model highly across phases (M = 4.55, SD = 0.53). The Design phase was valued for its structured articulation of content modules, spatial navigation, and interaction logic, consistent with UX principles in VR system design [37], [42]. The Deploy phase was praised for operationalizing the AICAS strategy (Attention, Interest, Chat, Action, Share), adapted in this study from the AISAS model originally proposed by Dentsu [47]. By substituting "Search" with "Chat," the model reflects dialogic, real-time inquiry in CAI–VR environments. These judgments are reinforced by Anaya-Sánchez et al. [51], who confirmed that the clarity of immersive structuring and intensity directly shape user perceptions of destination image and travel intention. Similarly, these technical elements are consistent with Rafi et al. [31], who demonstrated that navigability and UI quality strongly influence behavioral outcomes, and with Calisto and Sarkar [11], who underscored the necessity of embedding interactivity into coherent system architectures.

Turning to RQ4, the findings revealed high stakeholder intention to adopt the model (M = 4.33, SD = 0.65) among both public-sector officials and private-sector practitioners. Regression analysis identified technological self-efficacy, perceived interactivity, and perceived tourism benefits as significant predictors, collectively explaining 73.3% of the variance ($R^2 = .733$). These predictors align with Davis [15] on TAM, Venkatesh et al. [16] on UTAUT, and the self-efficacy construct developed by Compeau and Higgins [19] and later refined by Compeau et al. [21]. They also echo Anaya-Sánchez et al. [51], who showed that perceived immersion strengthens both destination image and behavioral intention, underscoring why interactivity and perceived benefits emerged as significant predictors in this study. Together, these findings confirm that stakeholder acceptance of the 4Ds Model is firmly grounded in both classical and contemporary theories of technology adoption.

Beyond answering the research questions, this study contributes more broadly to academic discourse and system design practice. Theoretically, it integrates VR, CAI, and human-centered design into a unified process model that links requirements analysis, architectural specification, iterative development, and deployment strategy, consistent with system design methodologies [22], [37]. This integration responds to Mariani et al. [34] and Slater and Sanchez-Vives [28], who emphasized bridging immersive depth with structured frameworks. Practically, the 4Ds Model provides policymakers and developers with a technically actionable roadmap to translate contextual needs into architectural components, immersive experiences, and engagement strategies. Its graded immersion levels [28], [51] and conversational engagement design [47], [48] illustrate operational feasibility while preserving adaptability across contexts.

Nevertheless, limitations remain. The stakeholder survey excluded tourists, limiting direct insights into consumer adoption. While the sample was adequate for regression analysis [26], broader sampling across diverse user groups would strengthen generalizability. Future research should conduct pilot implementations across Thailand's four regions to test system performance, scalability, and integration with analytics platforms [29], [31]. Parallel prototyping with tourists as end-users will provide usability evidence, while cross-border application in ASEAN will test adaptability across diverse cultural and policy environments.

## VIII. Conclusion

This study proposed the Conversational AI-powered VR Development Model, referred to as the 4Ds Model, as a structured framework for integrating immersive technologies into Thailand's tourism promotion. The model integrates conversational AI, virtual reality, and human-centered design, supported by five enabling capitals: human, cultural, technological, informational, and financial. It is organized into four sequential phases—Discover, Design, Develop, and Deploy—comprising twelve sub-steps. Specifically, the Discover phase mobilizes enabling capitals to ensure contextual readiness; the Design phase structures experiential elements across content, space, and activity; the Develop phase specifies immersion levels and operationalizes interactive features; and the Deploy phase incorporates the AICAS strategy (Attention, Interest, Chat, Action, Share) to sustain engagement through conversational interaction.

The key contribution of this study lies in establishing a unified, culturally grounded framework that bridges conversational AI and virtual reality for digital tourism development in Thailand. The findings confirm that the 4Ds Model is both theoretically robust and practically applicable. Expert evaluations underscored its contextual relevance, while assessments by public-sector tourism officers, destination management professionals, and practitioners in provincial tourism units indicated strong acceptance. Regression analysis revealed that technological self-efficacy, perceived interactivity, and perceived tourism benefits significantly predict stakeholders' behavioral intention to adopt the model.

Theoretically, this research advances digital tourism and AI–VR integration literature by articulating how immersive communication and user-centered design can co-exist in culturally sensitive contexts. Practically, it provides policymakers and practitioners with a replicable roadmap for designing, implementing, and sustaining immersive tourism initiatives that reflect local identity and community values.

Nevertheless, the study acknowledges certain limitations, including the representativeness of the expert sample, the limited scope of stakeholder testing, and the absence of longitudinal validation in real-world deployments. Future research should pilot and refine the 4Ds Model in live tourism projects, explore cross-cultural applicability within ASEAN, and integrate emerging AI capabilities such as generative agents and multimodal interfaces. Thus, the 4Ds Model serves not only as a validated framework for Thailand's digital tourism transformation but also as a transferable reference for immersive tourism innovation across the ASEAN region.

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## APPENDIX: QUESTIONNAIRE REGARDING FACTORS INFLUENCING THE INTENTION TO USE THE CONVERSATIONAL AI-POWERED VR DEVELOPMENT MODEL FOR TOURISM PROMOTION IN THAILAND

Instructions: Before completing this questionnaire, respondents were required to watch a short video presentation introducing the Conversational AI-Powered VR Development Model for Tourism Promotion in Thailand. The video outlined the model's purpose, structure, and potential applications to ensure that participants clearly understood the context before responding. Responses were measured on a 5-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

| Variable | Item | Scale |
|---|---|---|
| **Part 1: General Information** | | |
| Demographics | Gender, Age, Region, Education, Occupation, Experience with VR, Experience with AI | Categorical |
| **Part 2: Independent Variable (IV)** | | |
| Technological Self-Efficacy (X1) | 1. I am confident that I can learn to use new technologies on my own.<br>2. I can troubleshoot basic technical problems when using devices or software.<br>3. I can apply technology to support my work or activities.<br>4. I believe that I have sufficient skills to maximize the benefits of technology.<br>5. I can adapt quickly to technological changes. | 1–5 |
| Attitude towards Technology in Tourism (X2) | 1. I believe technology makes tourism more attractive.<br>2. I feel that technology use in tourism should be encouraged.<br>3. I have a positive view of integrating technology into tourism businesses.<br>4. I think technology enhances tourism experiences in Thailand.<br>5. I support the use of technology in tourism promotion. | 1–5 |
| Facilitating Conditions (X3) | 1. My organization has the necessary devices (e.g., computers, VR headsets).<br>2. My organization provides sufficient internet connectivity for smooth system use.<br>3. I receive technical support when needed.<br>4. My organization offers training or manuals to learn how to use technology.<br>5. My organization encourages the use of technology in tourism work. | 1–5 |
| Perceived Accessibility (X4) | 1. The Conversational AI-powered VR system can be accessed anytime and anywhere for tourism purposes.<br>2. The system is easy to use for tourism personnel.<br>3. I can use the system even with limited technical knowledge.<br>4. The system can be accessed through multiple devices for tourism experiences.<br>5. The system requires minimal time to start using in tourism work. | 1–5 |
| Perceived Interactivity (X5) | 1. The system interacts appropriately when presenting tourism information.<br>2. The system responds immediately to my actions.<br>3. Using the system feels like two-way communication between providers and tourists.<br>4. The system can adjust content based on tourist behaviors or interests.<br>5. The system makes tourism experiences more realistic and engaging. | 1–5 |
| Perceived Tourism Benefits (X6) | 1. The system increases the attractiveness and value of destinations.<br>2. The system helps tourists decide on destinations more easily.<br>3. The system allows providers to deliver more in-depth information to customers.<br>4. The system motivates actual visits and service use.<br>5. The system supports tourism revenue and sustainable community development. | 1–5 |
| **Part 3: Dependent Variable (DV)** | | |
| Behavioral Intention to Use (Y) | 1. I am interested in learning more to develop skills for using the system effectively.<br>2. I intend to use the system to support my tourism-related work in the future.<br>3. I plan to continuously use the system in my organization if given the opportunity and resources.<br>4. I am committed to applying the system to enhance tourist experiences.<br>5. I would recommend the system to partners or networks in the tourism industry. | 1–5 |