One pie, many recipes: The role of artificial intelligence chatbots in influencing Malaysian solo traveler purchase intentions

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Accepted for publication in Tourism Management Perspectives.

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Artificial intelligence (AI) chatbots are pervasive in the travel industry. Based on complexity theory, this study examines the factors that stimulate solo travelers' purchase intentions when using AI chatbots, particularly covering the three main aspects of marketing efforts, communication quality, and affective characteristics. Drawing from a sample of 281 solo travelers, this study used partial least squares-structural equation modeling (PLS-SEM) and fuzzy-set qualitative comparative analysis (fsQCA) to examine the proposed relationships. The PLS-SEM results illustrated that interaction, entertainment, trendiness, communication competence, and satisfaction had significant direct effects on purchase intentions. The fsQCA results further revealed four solutions that exhibit high purchase intentions among solo travelers. Different core, peripheral, and necessary causal conditions in each configuration path were identified. The findings enrich the AI chatbot literature by examining the underlying reasons why solo travelers react differently to this emerging technology and produce practical recommendations for designing AI chatbot systems.

Keywords – Chatbot; tourism; solo travelers; purchase intentions

1. Introduction

"*Siri, Siri…where can I buy the ticket to Paris…".*

Artificial intelligent (AI) chatbots such as Apple's Siri, Google's Google Assistant, and Samsung's Bixby are utilized by travelers today to provide answers to various queries. Current knowledge reveals that AI chatbots deliver economic value as they enable businesses to optimize cost-effectiveness and profits (Gursoy et al., 2019; Reddy, 2017). AI chatbot represents one of the most extended cutting-edge applications adopted by hospitality and tourism service providers. For instance, Skyscanner and Expedia adopted AI chatbots as an alternative to offer consumers better recommendations and reservations for flights. Booking.com uses AI chatbots as customer support in 43 available languages to overcome language barriers, making hotel reservations more efficient (Booking.com, 2018). In addition to providing travelers with all the necessary information, Kayak goes beyond offering travelers the list of places they can visit based on their specific budget and keeping them updated on future vacation plans with the aid of AI chatbot functions (MyTravelResearch.com, 2017). In practice, this innovation has opened up a new form of interaction between travelers and destination suppliers, which has enabled more than 25% of virtual interactions to be achieved without human participation (Moore, 2018). Unsurprisingly, the demand for AI chatbots was expected to expand at a double-digit pace since 2019, reaching USD 1.25 billion by 2025, with a compound annual growth rate of 24.3 percent (ClickZ, 2018).

The proliferation of AI chatbots is impacting the rising popularity of solo travel, which was recognized as the number one travel trend by the Klook report in 2019 and the most prominent segment in the travel industry (Travelport, 2019; Lisella, 2019). In the last half-century, language barriers and personal safety were the common fears for solo travelers because many were nervous about getting lost if they could not understand the local language (Yang, 2021).

Technology has significantly alleviated these concerns (Waugh, 2021; Abbas et al., 2019; Li et al., 2022; Zhou et al., 2021), with solo travelers leveraging AI chatbots in planning trips by making reservations or asking for travel information. A Booking.com report (2018) indicates that about 52% of solo travelers rely heavily on technology during trips, due to being unaccompanied and the need to seek extensive information compared to group travelers.

Recent statistics have suggested solo travelers may be among the first group to return when the tourism industry rebounds from the COVID-19 pandemic (French, 2020) and 70% of them are ready to travel internationally (Solo Traveler, 2021). Solo travel is a niche market (Radojevic, Stanisic, and Stanic, 2015; Yang, Yang, and Khoo-Lattimore, 2019), and insufficient knowledge about its characteristics calls for greater investigation (Yang et al., 2022). Previous literature has documented that the expectations and demands of solo travelers are refreshingly different from other types of travelers. As Chen and Dai (2020) pointed out, solo travelers are unoccupied and more immersed during their journeys, and they demand more personalized information to assist in their decision-making. Despite this trend being on the rise, limited research on travel technology (i.e., AI chatbots) has focused on solo travelers to provide a more holistic understanding of their behavior. The extant literature has focused on investigating the linear (symmetric) relationships of antecedents on travel behavior (e.g., Lim et al., 2022; Aman et al., 2019; Azali et al., 2021), while the complexity of travel behavior remains under-researched (Boavida-Portugal et al., 2018). Travel behaviors are a complex process of cognitive and affective sequences, with responses based on a configuration of multiple causal factors that determine expected behavioral intentions (Olya and Akhshik, 2019; Pappas and Glyptou, 2021; Chang et al., 2022). Thus, examining the linear relationships alone may result in inaccurate findings that overlook the complex process of causal interactions. Taking one step forward, this research applies complexity theory as a promising way to justify

the heterogeneity concern in predicting how the functions of AI chatbots can influence solo travel behavior. Complexity theory is built on systems theory, which models and analyzes a complex system - where the outcome is the result of the complex interaction of several variables and differs significantly from the sum of the various variables (Olya & Akhshik, 2019).

To better understand the key aspects that facilitate the implementation of AI chatbots as customer service and communication channels for tourism businesses, previous researchers have examined the adoption (Pillai and Sivathanu, 2020; Brandtzaeg and Følstad, 2017), motivation (Jiménez-Barreto, Rubio, and Molinillo, 2021) and benefits for adopting AI chatbots (Luo et al., 2019). Although interactions with AI chatbots are likely to have a direct impact on solo travelers' decision-making processes, comprehension of the influence of user experience with AI chatbots on attitudinal and behavioral responses is sparse (Hoyer et al., 2020). Additionally, Pizzi, Scarpi, and Pantano's (2021) latest study has called for a deeper understanding to explore the effect of user interactions with AI chatbots on the overall experience, particularly for solo travelers. To address the gap, the primary goal of this research was to investigate how marketing efforts and communication quality in AI chatbots influence solo traveler decision-making processes, as well as how satisfaction motivates these travelers to purchase tourism products and services (TPS) (e.g., accommodation, transportation, restaurants, tourism sites, and tour services).

Methodologically, this study applied a multi-method approach (symmetric and asymmetric) to offer a broader understanding. Partial least squares structural equation modeling (PLS-SEM) was applied to gauge the symmetric relationships (net effects) between variables that influence purchasing intentions. Fuzzy-set qualitative comparative analysis (fsQCA) was used to explore

the asymmetric relationships (synergistic effects) by revealing the configurations of various causal factors in attaining high purchase intentions. It also identified core, peripheral, and necessary causal conditions in each configuration path.

2. Theoretical foundation

2.1 Complexity theory

Complexity theory has been used in various disciplines (e.g., health, socioeconomics, psychology, tourism, and marketing) (Woodside, 2014; Olya and Akhshik, 2019; Mehran and Olya, 2020; Papastathopoulos, Kaminakis and Mertzanis, 2020; Pappas and Glyptou, 2021) and is considered as a novel approach in the case of AI chatbots for studying holistic interplays between predictors of an interactive nature (Fiss, 2007). This theory is based on the assumption that highly symmetric relationships between two variables are uncommon in practice, making unidirectional assumptions oversimplified (Woodside et al., 2018). In general, complex systems exist in natural and artificial environments, as several studies have demonstrated the interdisciplinary nature of complexity theory when exploring the interaction between human and AI innovations (Frenken, 2006). Drawing on the principle of equifinality, complexity theory illustrates that different sets of causal conditions will similarly interpret the outcomes (Fiss, 2007; von Bertalanffy, 1968); thus, such conditions will coalesce to show the result in suitable configurations. In addition, a single factor -- the “ingredients” -- never operates in isolation and can have dissimilar effects in various circumstances, and thus cannot be translated meaningfully without considering appropriate configurations -- the “recipes” (Ordanini et al., 2014). This rationale reflects the case of solo travelers' intentions to purchase and the relationships among variables interact in different ways; thus, different causal conditions can result in various outcomes (Olya and Akhshik, 2019).

Based on similar assumptions, a model was proposed that combined marketing efforts, communication quality, and affective characteristics to address the complexity of solo traveler interactions with AI chatbots. AI chatbots are designed to solve problems, meet traveler expectations, and provide access to information on tourism products and services (Chung et al., 2020). Thus, the effects of their marketing efforts, quality communication, and affective characteristics highly influence traveler decision-making. Although positive AI chatbot marketing efforts are more likely to motivate solo travelers to purchase tourism products and services (Chung et al., 2020; Zhang and Dholakia, 2018), and high communication quality and affective characteristics of AI chatbots are important antecedents of influencing purchase intention (Chung et al., 2020), they may still interact with each other in various configurations depending on user needs. That is, the same outcome may be influenced by a particular antecedent either positively or negatively, depending on how it interacts and integrates with the other drivers (Olya and Akhshik, 2019). The causal factors may co-exist in various configurations as user needs always vary (Pappas et al., 2020). Individuals are affected by several factors when adopting technology such as online services or making online purchases (Pappas et al., 2016).

3. Research model and hypotheses formulation

3.1 Marketing efforts of AI chatbots

AI chatbots enable tourism businesses to reach out and engage with solo travelers more efficiently and productively (Sands et al., 2020). They can understand traveler reactions and become more efficient in responding to queries by working 24/7 (Calvaresi et al., 2021). AI chatbot-human interactions are considered the “front-liner” in motivating purchases through positive interactions (Godes et al., 2005), strengthening traveler-brand relationships (Fionda and Moore, 2009), and engaging with travelers in making the decisions (Kim and Ko, 2012).

Through deep learning, they can communicate with solo travelers in more interactive and automated ways as well as with language barriers (Kunze, 2016). Such marketing efforts are particularly important because AI chatbots are built to provide travel information and product recommendations (Letheren and Glavas, 2017). These automated marketing initiatives help to push travelers through the sales funnel. Chung et al. (2020) described marketing efforts in AI chatbots as comprising the five aspects of interaction, entertainment, customization, problem-solving, and trendiness.

3.1.1 Interaction

In tourism, AI chatbots play a role as interactive virtual agents to increase the interaction between travelers and service providers (Przegalinska et al., 2019). Compared to traditional chatbots, conversational AI chatbots enhance user interactions because they can communicate interactively through voice or text (Pizzi, Scarpi, and Pantano, 2021). The two-way communication makes the virtual interaction almost similar to the real-world experience (Chung et al., 2020), allowing solo travelers to gain more support, save time, and simplify the travel booking process (Holzwarth et al., 2006). In addition, AI chatbots enable previously anonymous travelers to connect, allowing businesses to gain new opportunities and potential referrals (Koponen and Rytsy, 2020). Given the absence of a physical presence, solo travelers may feel more comfortable using AI chatbots compared to offline environments and these interactions may positively influence purchases (Kim et al., 2011; Filieri, 2016; Ponte et al., 2015). Given these reasons, businesses expect the interactions between AI chatbots and solo travelers will perform similarly to interactions with real-world human agents in terms of influencing purchase decisions (Holzwarth et al., 2006). In this study, interaction is defined as providing travel advice and responding to requests.

H_1: *Interaction in AI chatbots positively influences purchase intentions for TPS.*

3.1.2 Customization

Customization is the personalizing, modifying, and tailoring of services to fulfill user needs to create a stronger sense of affinity and loyalty (Wang and Li, 2012; Godey et al., 2016; Perna et al., 2018). By incorporating empathetic intelligence and artificial analysis, AI chatbots may offer high-quality personalized services, tailored conversations, and customer assistance that transcends the traditional recommender systems (Pizzi, Scarpi, and Pantano, 2021). For instance, Kayak's AI chatbot customizes packages based on travelers' specific budgets and preferences (MyTravelResearch.com, 2017). Customization in the artificial world is the key driver in influencing individual behavioral intentions during service encounters (Vendemia, 2017; Liu and Tao, 2022). This research defines customization as providing customized products and services that accommodate the specific needs and preferences of solo travelers. Hence, the association between customization and purchase intentions on products and services in this context seems a logical proposition.

H_2: *Customization in AI chatbots positively influences purchase intentions for TPS.*

3.1.3 Problem-solving

Problem-solving refers to the ability of AI chatbots to offer assistance, actively listen to traveler problems and offer help to provide smooth and satisfying travel experiences (Lee and Choi, 2017). AI chatbots are often expected to have the proper handling skills to deal with complaints, inquiries, reservations, booking changes, and refunds promptly as well as truthfully (Dabholkar et al., 1996; Kim et al., 2016). Similarly, solo travelers who have unsatisfactory expectations or experiences may feel anger and even shame as a result of being restrained (Izard, 1977). Thus, AI chatbots must help solo travelers to solve problems, address questions and, more importantly, reduce confusion during purchases (Haas and Kenning, 2014). It is suggested that

the presence of problem-solving abilities in AI chatbots is an important reason for generating high levels of purchase intentions.

H_3: *Problem-solving in AI chatbots positively influences purchase intentions for tourism products and services.*

3.1.4 Entertainment

Entertainment refers to the incorporation of fun and enjoyment into the offered TPS (Redman and Mathews, 2002). This aspect is perceived to offer various hedonic benefits to users, such as providing good and useful information, enhancing value perceptions, and promoting adoption intentions (Muntinga, Moorman, and Smit, 2011). The entertainment value of AI chatbots can also be a valuable cue to capture user attention, stimulate memorable experiences and drive participation (Zhao and Rao, 2020; Park et al., 2009). Tourism studies have stated that AI chatbots are used not only for service purposes but also to facilitate socialization between service providers and travelers (Brandtzaeg and Følstad, 2017; Kaczorowska-Spychalska, 2018). Indeed, providing enjoyment and fun is one of the effective ways to encourage travelers to purchase TPS (Godey et al., 2016; Muntinga et al., 2011). It is therefore reasonable to suggest that the entertainment aspect of AI chatbots will generate positive purchase intentions among solo travelers.

H_4: *Entertainment in AI chatbots positively influences purchase intentions for tourism products and services.*

3.1.5 Trendiness

The term trendiness describes how new innovative technology is used to satisfy individual preferences (Godey et al., 2016). This is regarded as a key element in arousing sub-motivations, including knowledge, surveillance, and inspiration (Muntinga et al., 2011). During travel,

people are motivated to get the latest information to ensure that the products they choose or buy correspond to their trendy lifestyles (Zolkepli and Kamarulzaman, 2015). Technological advances allow solo travelers to discover new products, know about current trends, and read reviews online before making purchases as they perceive technologies as more trustworthy sources of information (Godey et al., 2016). Trendiness in this study is also referred to as the ability of AI chatbots to disseminate the latest and trendiest information to solo travelers when planning trips. Therefore, it is proposed that trendiness can generate a high level of purchase intentions.

H_5: *Trendiness in AI chatbots positively influences purchase intentions for tourism products and services.*

3.2 Communication quality

High-quality AI chatbot-human communication is needed to ensure better purchase experiences, while making the entire process more accurate, smooth, and complete (Emmers-Sommer, 2004). As recommended in previous research (Edwards et al., 2014; Cheng and Jiang, 2021), communication quality is assessed in the three aspects of accuracy, credibility, and communication competence. Accordingly, it is assumed that AI chatbots must deliver accurate, competent, and credible communication to solo travelers.

3.2.1 Accuracy

Accuracy is the degree of correspondence between the information decoded or inferred by a recipient and the information encoded by the communicator (Mehrabian and Reed, 1968). It is often considered the main evaluation element in recommender systems (Pursel et al., 2016). AI algorithms allow AI chatbots to give solo travelers more accurate, reliable, and faster information (Adamopoulou and Moussiades, 2020; Muangkammuen, Intiruk, and Saikaew,

2018). Likewise, tourism scholars have considered AI chatbots to be reliable virtual agents that provide better understanding and recommendations on products and services (Lee and Choi, 2017). The provision of accurate information and recommendations motivates solo travelers to make purchase decisions (Chen and Chang, 2018). It was posited that the accuracy in communication delivered by AI chatbots might significantly influence solo traveler purchase intentions for TPS.

H_6: *Accuracy in AI chatbots positively influences purchase intentions for TPS*.

3.2.2 Credibility

Credibility is the extent to which the source and content of information are deemed to be believable (Wathen and Burkell, 2002). AI chatbots resemble human agents who provide credible communication, with the only difference being that the information is being communicated using AI technology (Pizzi, Scarpi, and Pantano, 2021). In most cases, travelers perceive their communications with AI chatbots as credible and convincing if the virtual agents can provide reliable recommendations which correspond to their inquiries (Edwards et al., 2014). Past literature has shown that credibility is one of the main criteria for affecting individual attitudes and behavior when booking a product or service through virtual platforms (Poston and Speier, 2005). Therefore, it is predicted that the credibility of communications with AI chatbots may influence the purchase intentions of solo travelers.

H_7: *Credibility in AI chatbots positively influences purchase intentions for tourism products and services*.

3.2.3 Communication competence

Competence refers to the expertise of the AI chatbots in the required knowledge and skills (Cheng and Jiang, 2021; Yen and Chiang, 2020) and is a cue for trustworthiness in computer

systems (Nordheim, 2018). Yu (2020) indicated that the competence of AI chatbots is linked with the ability to speak different languages and provide services efficiently. Consequently, solo travelers who perceive communications with AI chatbots to be competent and productive are more likely to positively appraise their believability (Chung et al., 2020), making them more willing to purchase TPS. Thus, good communication competence in AI chatbots is more likely to influence the purchase intentions of solo travelers for TPS.

H_8: *Communication competence in AI chatbots positively influences purchase intentions on TPS.*

3.3 Satisfaction as an affective characteristic

Satisfaction occurs when a person's expectations regarding goods and services are met or exceeded, resulting in positive experiences (Santini, Ladeira, and Sampaio, 2018). The literature on hospitality and tourism demonstrates that satisfaction is driven by expectations or when travelers perceive that products and services fulfill their needs (Mehran and Olya, 2020; Ozturk and Gogtas, 2016). It has been suggested that travelers' positive experiences significantly influence purchase intentions (Jayawardhena et al., 2007). In the case of AI chatbots, it is hypothesized that the purchase intentions of solo travelers might be affected by their satisfaction with AI chatbots.

H_9: *Satisfaction positively influences purchase intentions for TPS.*

3.4 Research and configurational model

Figure 1 graphically illustrates typical conversations with AI chatbots. In line with the complexity theory, this study developed a Venn diagram (Figure 2) of the conditions such as interaction, customization, problem-solving, entertainment, trendiness, accuracy, credibility, communication competence, and satisfaction – and their interactions in predicting the purchase

intentions for TPS by solo travelers. In addition, the overlapping areas in Figure 2 represent possible combinations where one construct may coexist with the others (Abbas et al., 2019; Mubeen et al., 2022) (e.g., AI chatbots with high interaction and accuracy may exhibit high purchase intentions).

[Insert Figure 1 here]

[Insert Figure 2 here]

4. Methodology

4.1 Collection of data

A cross-sectional study was carried out to address the research objectives. Using purposive sampling, the solo travelers needed to fulfill two criteria to participate in the survey: (1) they must have traveled independently in the previous 12 months, and (2) they had used AI chatbots when planning or during the trips. After the two screening questions, an open question ("List the names of any AI chatbots you used when you bought or booked tourism products and services during your solo trip) was included in the questionnaire to mitigate memory decay (Pant, 2022; Larson & Csikszentmihalyi, 1983) and to ensure there was a significant opportunity that participants may have interacted with AI chatbot and were able to share their experience and knowledge related to the research questions (Bernard, 2017). Before actual data collection, all instruments were validated by a panel of professors and volunteers with solo travel experience. The purpose of this step was to elicit comments about potential issues in the questionnaire format, design, wording, and measurement item ambiguity (Hulland, Baumgartner, and Smith, 2018), subsequently allowing the researchers to address issues such as response bias and misinterpretation (Fink, 2017). A pilot test was then conducted with 30 solo travelers to identify potential errors and optimize survey design, especially if they found

the instruments unclear, ambiguous or difficult to answer. For example, after finalizing the comments, a minor change was made to the sentence structures for several questions.

Data were collected from October to December 2021 through an online self-administered survey. The survey link was generated using Google Forms and distributed to the target respondents – solo travelers from Malaysia via popular social media platforms, including Facebook, Instagram, LinkedIn, and Twitter. Respondents were instructed to read a brief description of AI chatbots and research purposes, and confidentiality and anonymity were assured.

From the 321 responses, 40 responses were discarded due to straight-lining and incompletion reasons, leaving a total of 281 valid responses. The sufficiency of the sample size was checked via a post hoc power analysis (Faul et al., 2009). By assuming an effect size of 0.15 and a power level of 80% with nine predictors, the suggested minimum sample size was 114. The current sample size of 281 also met the minimum sample size of both the inverse square root (n = 160) and gamma exponential methods (n = 146), as suggested by Kock and Hadaya (2018). Overall, most respondents were female, aged between 30 and 40 years old, with an undergraduate degree, and employed They showed great interest in using AI chatbots when booking with travel agents or tour operators (70.10%) (Table 1).

[Insert Table 1 here]

4.2 Measurement

The measures were adapted from previously validated scales. To measure the marketing efforts of AI chatbots (interaction, customization, problem-solving, entertainment, and trendiness), the items were drawn from the studies by Coelho and Henseler (2012), Kim and Ko (2012), Lee and Choi (2017). The items for communication quality (accuracy, credibility, communication

competence), and affective characteristics (satisfaction) were similar to the study by Chung et al. (2020). Finally, the items for purchase intentions were developed by Chen and Barnes (2007). All items were measured on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree).

5. Data analysis

To test the proposed model, a multi-method approach was employed: (1) Partial least squares structural equation modeling (PLS-SEM) via SmartPLS 3.3.9 was used to address the research objectives (Hwang et al., 2020; Hair et al., 2022) and (2) fuzzy-set Qualitative Comparative Analysis (fsQCA) via fsQCA 3.0 software examined the possible combinations of causal conditions in formulating solo traveler purchase intention for TPS. The combination of these two software applications was expected to complement the findings, with PLS-SEM providing estimation based on a linear model for all cases (net effect) and fsQCA identifying multiple causal factors or pathways to explain particular outcomes (Rasoolimanesh et al., 2021).

5.1 Common method bias

Both procedural and statistical remedies were used to manage the common method bias (CMB) issue. Using the procedural remedy, the survey provided contextual information and introductory messages to minimize uncertainties. The anonymity of respondents was assured on the cover page to minimize levels of unease or fear (Babin, Griffin, and Hair, 2016). Using the statistical remedy, the result produced from the Harman's single factor test was 34.428% (< 40%), whereas the full collinearity test on all variables yielded variance inflation factors (VIF) between 1.308 and 2.754 (< 3), signifying CMB was not significant in this research (Kock and Lynn, 2012; Babin, Griffin, and Hair, 2016).

5.2 PLS-SEM analysis

Measurement model: Construct reliability, convergent validity, and discriminant validity were tested (Table 2). All the constructs were reliable, with Cronbach's alpha, rho_A, and CR values exceeding the minimum threshold of 0.7 (Hair et al., 2022). Convergent validity was achieved, with the average variance extracted (AVE) for all constructs with scores above 0.5 and the loading of all items exceeding 0.708 (Hair et al., 2022). The heterotrait-monotrait ratio of correlation (HTMT) was applied to assess discriminant validity (Henseler, Ringle, and Sarstedt, 2015). Table 3 shows all HTMT values were below 0.85, confirming that all constructs were distinct from each other.

[Insert Table 2 here]

[Insert Table 3 here]

Structural model: Table 4 presents the results of the structural model assessment. The VIF values for all constructs were below the threshold of three, indicating collinearity was not a critical issue (Hair et al., 2022). Path coefficients were assessed to show the causal relationships between the constructs using the bootstrapping technique with 5,000 sub-samples (Streukens and Leroi-Werelds, 2016). The results demonstrated that purchase intentions for TPS were influenced by interaction ($\beta = 0.084$, $p < 0.05$), entertainment ($\beta = 0.097$, $p < 0.05$), trendiness ($\beta = 0.141$, $p < 0.001$), communication competence ($\beta = 0.242$, $p < 0.001$) and satisfaction ($\beta = 0.474$, $p < 0.001$). The direct influences of customization, problem-solving, accuracy, and credibility on purchase intentions were insignificant. Therefore, H1, H4, H5, H8, and H9 were supported (Figure 3).

[Insert Figure 3 here]

Overall, the model exhibited a substantial explanatory capacity as all predictors explained about 58.7 % of the variance in purchase intentions. The results for effect sizes (f^2) showed that communication competence (f^2 = 0.065) and trendiness (f^2 = 0.037) had a small effect size, while satisfaction exhibited a medium effect size (f^2 = 0.266) on purchase intentions. Meanwhile, the remaining predictors had trivial effect sizes (Cohen, 1988)

[Insert Table 4 here]

Next, we assessed the model's predictive relevance using the PLSpredict[1] (Shmueli et al., 2019). The Q^2_predict showed a value of 0.550, supporting the model's predictive accuracy. Further, the PLSpredict was predicted at the item level (Chin et al., 2020; Shmueli et al., 2019). Based on the results in Table 5, the PLS-SEM analysis yielded moderate prediction accuracy, offering support for the model's predictive power. In this case, heterogeneity issues could be the potential reason the overall data did not obtain strong predictive power (Becker et al., 2013). That is, each respondent (e.g., in subgroups) might have a recipe for the causal prediction. This issue was further explored in each case with fsQCA.

[Insert Table 5 here]

5.3 Fuzzy set qualitative comparative analysis

Deeper insights were sought by applying necessity analysis to identify the sufficient and necessary conditions that could generate purchase intentions among solo travelers when using AI chatbots (Figure 2). By using fsQCA, the data calibration process was first performed by

[1] We used ten folds and ten replications, comparing the RMSE values from the PLS-SEM analysis with those generated by a naive linear benchmark.

transforming the latent variable scores from PLS-SEM for both the independent variables and the dependent variable (i.e., continuous variables formed by several items) into fuzzy-set variables [0,1] with a crossover point of 0.50 (Rasoolimanesh et al., 2021).

Next, a truth table reduction was performed using the process adopted by Ragin (2009): (i) at least 80% of cases in each sample were retained, and (ii) a minimum consistency threshold of 0.75 was adopted. Finally, the intermediate solution was analyzed as it only included simplifying assumptions (i.e., easy counterfactuals) and is considered superior (Rihoux and Ragin, 2009). The results of the fuzzy set analysis for purchase intentions are presented in Table 6. The consistency values for each configuration and the overall solution exceeded the recommended threshold of 0.75 (Ragin, 2009)[2][3]; hence all four configurations were retained. The coverage value for each solution also varied from 0.240 to 0.739, with small acceptable variations (Aguilera-Caracuel et al., 2014). The overall solution coverage was equal to 0.982, explaining the percentage of observations that could be explained by a particular combination of four solutions[4] .

[Insert Table 6 here]

The fsQCA results suggest the presence of four configuration paths that would result in high purchase intentions. *(i) Solution 1*: Customization appears to be a core condition, while interaction, problem-solving, trendiness, accuracy, credibility, communication competence,

[2] Consistency shows the degree that a relationship has been approximated, and coverage evaluates the empirical relevance of a consistent subset (Ragin, 2009).
[3] The overall consistency is similar to the correlation showing how strong is the solution, and the overall solution coverage indicates the extent to which high satisfaction may be determined from the existing configurations and is comparable to the R^2 value reported in traditional regression analyses.
[4] The coverage index indicates the empirical relevance of a consistent subset and is seen as analogous to R^2 in conventional regression analysis (Rihoux and Ragin, 2009; Woodside, 2013).

and satisfaction show as peripheral conditions. *(ii) Solution 2:* Similar to solution 1, except that high entertainment is required rather than personalization. *(iii) Solution 3*: Both customization and entertainment are highly required, while others appear as peripheral conditions, and credibility may be absent. *(iv) Solution 4:* High customization can be combined with low interaction, entertainment, and trendiness, with the rest being peripheral. Overall, solutions 1, 2, and 3 explain 73.4%, 73.7%, and 73.9% of the sample, respectively, while solution 4 only explains 24% of the solo travelers with high purchase intentions.

Predictive Validity in fsQCA: Following Woodside's (2013) guidelines, the sample was divided into a subsample and a holdout sample to test the predictive power of the developed model compared with the holdout sample. Two configurations in Table 7 represent models to be plotted against the outcome variable (i.e., purchase intentions). As presented in Figure 4, when Model 1 was applied to the data from the holdout sample, high consistency (0.981) and coverage (0.545) were found, indicating strong predictive validity concerning purchase intentions when heterogeneity is in the data (using different solo traveler expectations).

[Insert Table 7 here]

[Insert Figure 4 here]

6. Discussion and implications

6.1 Discussion

Traveling in pandemic times requires even more planning by solo travelers. The presence of AI chatbot technologies has significantly alleviated concerns such as language barriers and personal safety in trip planning or booking. However, human behaviors are a process of cognitive and affective sequences, with responses based on a complex configuration of multiple causal factors that determine behavior (Olya and Akhshik, 2019). To offer more nuanced insights into investigating this outcome, there is a need to use a multi-method

approach to assess the causal effects of proposed variables (Woodside, 2014; Rasoolimanesh et al., 2021). By considering travelers are heterogeneous (Dolnicar, 2008), focusing on the needs of a niche segment is the best way to cater to everyone in the group. This research explored the knowledge gaps from the perspective of solo travelers using both PLS-SEM and fsQCA in tandem to offer a broader methodological contribution to AI chatbot research.

The results of the symmetric PLS-SEM demonstrated that solo travelers' purchase intentions were positively influenced by several factors, including interaction (H1), entertainment (H4), trendiness (H5), and communication competence (H8), and satisfaction (H9). Often referred to as "interactive virtual agents", AI chatbot interactions have made online purchase experiences similar to real-world purchasing. Aligning with previous findings (McLean and Osei-Frimpong, 2017; Chung et al., 2020), effective two-way communication is recommended to positively influence the purchase intentions of solo travelers. In line with previous studies, the entertainment component supported the notion that AI chatbots are not only regarded as customer service but also an entertainment source that encourages solo travelers to purchase TPS (Brandtzaeg and Følstad, 2017; Kaczorowska-Spychalska, 2018). The findings also support previous works and suggest that trendiness in AI chatbots is particularly important to solo travelers as they perceive technologies to provide up-to-date information that matches their trendy lifestyles (Zolkepli and Kamarulzaman, 2015). Consistent with Chung et al. (2020)'s finding, it was found that good competence in communication in AI chatbots increases their believability and encourages solo travelers to make immediate purchases. Furthermore, when solo traveler expectations are met, the positive experiences with AI chatbots influence their purchase intentions for TPS.

Although customization and problem-solving have been identified as important components in marketing efforts, the PLS-SEM results reveal that they are not the main antecedents in motivating purchases. Customization service and the ability to solve problems by AI chatbots may provide good user experiences, as reported by Vendemia (2017), Liu and Tao (2022), and Lee and Choi (2017), but solo travelers do not consider this as a direct factor for their purchases. Interestingly, although accuracy and credibility are found as important cues in influencing technology adoption (Pursel et al., 2016; Adamopoulou and Moussiades, 2020; Pizzi, Scarpi, and Pantano, 2021), this research discovered that solo travelers generally assume the information provided by AI chatbots is accurate, reliable and believable; therefore, these are not the main reasons in influencing their purchases.

A single attribute is likely to influence an outcome in a symmetric relationship, as presented by the PLS-SEM results (Rasoolimanesh et al., 2021). However, when a complicated condition is created (by combining two or more conditions), an outcome condition is generated that is more likely to yield a consistently high score. The interconnected causal relationships and interdependencies across attributes can be explained by an asymmetric perspective (fsQCA). In all four solutions, the fsQCA results indicated that accuracy, problem-solving, communication competence, and satisfaction were present and are necessary causal conditions when establishing a high score of purchase intentions. Other variables are either present (with high or low effects) or absent.

The first solution focused on high customization. It is apparent that solo travelers' primary consideration is highly personalized service and tailored conversation, while the other attributes are important but not core factors. If customization greatly facilitates purchase processes, the entertainment value is not relevant in this scenario. As opposed to solution 1,

the second solution concerns the entertainment aspect but customization appears to be lacking, while others are present as peripheral conditions. Consistent with earlier findings (Brandtzaeg and Følstad, 2017; Kaczorowska-Spychalska, 2018), solo travelers expect AI chatbots to deliver entertainment experiences and provide them with enjoyment. This situation illustrates that solo travelers are not just using AI chatbots for travel planning and information search, but sometimes they are seeking hedonic advantages that drive their purchase intentions. The third generated solution consists of almost all attributes, except for credibility. What is interesting here is that both customization and entertainment co-exist and are highly important, with the presence of others showing as peripheral conditions. The importance of customization and entertainment were also evident in the previous two solutions. Consequently, depending on the purpose of travel, solo travelers are heavily influenced by these two aspects when seeking customized planning and hedonic benefits in AI chatbots. In this scenario, the importance of providing credible communication is negligible in driving purchases. Solution 4, while similar to solution 3, is focused on high customization with all other attributes existing. Once again, when customization appears as the core condition, it is worth noting that solo travelers have lower needs for interaction, entertainment, and trendiness, while the presence of other aspects is relevant but considered peripheral.

6.2 Theoretical implications

Theoretically, this research is the first to demonstrate greater complexity and heterogeneity among solo travelers based on AI chatbots. This finding aligns with previous research that has related a demographic group effect to solo travelers (Radojevic et al., 2015), supporting the fact that differences exist within demographic and tripographic groups of travelers. The findings also deepen the knowledge of solo traveler purchase intentions for TPS via AI chatbots, which has received limited academic attention. Embracing complexity theory (Woodside, 2014), this research built upon the principle of equifinality in which multiple recipes

(configurations) can lead to the same outcome. With very few studies delving into the complexity of tourist behavior, the data collected from solo travelers offer fresh perspectives on the direct effect of antecedents and how they interact to form configurations that exhibit high purchase intentions.

6.2 Practical implications

The findings obtained can be of value to tourism businesses that are attempting to leverage AI chatbot technology to serve the needs of solo travelers, given this prominent and growing segment in the industry. The findings offer four practical implications. First, tourism businesses are advised to consider marketing efforts (i.e., interaction, entertainment, trendiness), communication quality (i.e., communication competence), and affective characteristics (i.e., satisfaction) when designing AI chatbot technology. To ensure better AI chatbot-human interactions, it is insufficient for the chatbots to provide simple answers in conversations. For solo travelers to feel their presence, more engaging and anthropomorphic human interactions are required. This study also recommends AI developers consider the need for trendiness and entertainment. Some suggestions for built-in features include more images, emoticons, animation, and humanized greetings to facilitate social connections. To make it easier for solo travelers to seek assistance from AI chatbots, communication competency and capability must always be improved, as well as providing satisfying user experiences.

Second, the multiple solutions provide new ways for tourism businesses to influence solo travelers' behavior when using AI chatbots. Each solution has different configurations, and there is no single ideal recipe producing high purchase intentions (Pappas et al., 2016). The findings also can serve as a reference point for tourism businesses on “what to focus upon” when designing their AI chatbot technology for solo travelers. Accordingly, tourism businesses

should focus on instilling problem-solving skills, accuracy, communication competence, and satisfaction which all are necessary conditions for achieving high purchase intentions, as shown in all four solutions.

Third, tourism businesses must strengthen the customization capability of AI chatbots by offering customizable flexibility for solo travelers. AI chatbots should have the flexibility to take a step further by gathering data about every solo traveler and connecting with them socially based on their interests. For instance, in response to concerns about safety, AI chatbots can assist by searching for someone nearby to walk with at night or team up with another solo traveler who shares a similar itinerary for a stroll. Lastly, it should be noted that high purchase intentions can be achieved through strong entertainment value in AI chatbots. In many cases, solo travelers are looking for companions or meeting new friends during their travels (Yang, 2021). AI chatbots can potentially act as virtual travel companions by socializing and entertaining solo travelers.

7. Conclusions

This is the first empirical study to explore the experiences of solo travelers with AI chatbots by using complexity theory as a theoretical basis to explain the complex interactions of multiple causal factors. To offer more nuanced insights into investigating this outcome, this research applied a multi-method approach (symmetric and asymmetric) to provide a broader methodological advance. Solo travel is a niche and growing segment that should be approached individually. By understanding their expectations and behavior, tourism marketers can better target this group that holds significant potential with AI chatbots.

7.1 Limitations and future research directions

The present research has some limitations that open up opportunities for future studies. While the findings of this research may not be generalizable, future research could extend the model to investigate across different demographic categories such as couples and families since they have different motivations for travel (Yang, 2021). Lim et al. (2021) suggest that future studies should explore the differences in individual personalities such as prevention and promotion focuses across the use of AI chatbots. Experiences of different gender in solo travelers (e.g., Yang et al., 2022; Bernard, Rahman, and McGehee, 2022) is another fascinating area to explore since this research did not consider gender differences. Furthermore, the scope of the subjects covered was limited to one country, and the popularity of AI chatbots differs by country and culture. It would be informative to expand future research by focusing on different countries and cultural backgrounds.

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