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Exploring the Impact of AI on Tourism Program Personalization: The Mediating Roles of Readiness, Data Quality, and Decision-Making in Egyptian Travel Agencies

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ABSTRACT

This study explores the role of Artificial Intelligence (AI) in enhancing the personalization of tourism programs in Egyptian travel agencies. Using a conceptual framework built on four AI dimensions—predictive analytics, automation, recommendation systems, and natural language processing (NLP)—the research examines how AI can improve personalized service delivery tailored to tourist preferences and behaviors. To deepen the analysis, the study introduces three mediating variables: organizational readiness, customer data quality, and AI-enabled decision-making. These factors are posited to influence the strength of the relationship between AI adoption and tourism program personalization by enabling effective use of technological capabilities within agencies. A quantitative research design was adopted; employing a structured online questionnaire distributed to employees of Category "A" travel agencies across three Egyptian governorates: Cairo, Giza, and Alexandria. A total of 120 valid responses were analyzed using SPSS for descriptive statistics, reliability, and correlation, and AMOS for structural equation modeling (SEM). Evidence from the analysis confirmed the measurement model's robustness in terms of reliability and validity. The findings reveal significant positive relationships between all four AI dimensions and the personalization of tourism programs. Furthermore, the mediating variables were found to enhance these relationships substantially, underscoring the importance of supportive organizational and data environments in realizing AI's full potential. This study offers both theoretical insights and practical implications. It emphasizes that AI adoption alone is not sufficient; agencies must also invest in digital infrastructure, data quality, and organizational preparedness to maximize the benefits of AI-driven personalization. Recommendations are provided for tourism managers and policymakers aiming to enhance customer satisfaction and competitiveness through smart tourism strategies. The research highlights the strategic role of AI in transforming personalized travel experiences, particularly in emerging markets such as Egypt.

KEYWORDS
Artificial Intelligence (AI), Tourism Personalization, Egyptian Travel Agencies, Organizational Readiness, Customer Data Quality, AI-Enabled Decision-Making.

استكشاف تأثير الذكاء الاصطناعي على تخصيص البرامج السياحية: الأدوار الوسيطة للجاهزية وجودة البيانات واتخاذ القرار في وكالات السفر المصرية

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الملخص

تستكشف هذه الدراسة دور الذكاء الاصطناعي (AI) في تعزيز تخصيص البرامج السياحية داخل وكالات السفر المصرية. وبالاعتماد على إطار مفاهيمي مبني على أربعة أبعاد رئيسية للذكاء الاصطناعي—وهي التحليلات التنبؤية، والأتمتة، وأنظمة التوصية، ومعالجة اللغة الطبيعية—(NLP) تفحص الدراسة كيف يمكن للذكاء الاصطناعي تحسين تقديم الخدمات السياحية المخصصة بما يتوافق مع تفضيلات وسلوكيات السائحين. ولتوسيع نطاق التحليل، تقدم الدراسة ثلاث متغيرات وسيطة: الجاهزية التنظيمية، وجودة بيانات العملاء، واتخاذ القرار المدعوم بالذكاء الاصطناعي. وتُفترض هذه العوامل كمؤثرات على قوة العلاقة بين تبنّي الذكاء الاصطناعي وتخصيص البرامج السياحية، من خلال تمكين الاستخدام الفعّال للإمكانات التكنولوجية داخل وكالات السفر .

اتبعت الدراسة منهجًا كميًا، من خلال استخدام استبيان إلكتروني منظم وُزّع على موظفي وكالات السفر من الفئة "أ" في ثلاث محافظات مصرية: القاهرة، والجيزة، والإسكندرية. وتم تحليل 120 استجابة صالحة باستخدام برنامج SPSS للتحليلات الوصفية، والموثوقية، والارتباط، إلى جانب برنامج AMOS لنمذجة المعادلات الهيكلية (SEM). وأكدت نتائج التحليل قوة نموذج القياس من حيث الصدق والثبات. أظهرت النتائج وجود علاقات إيجابية ذات دلالة إحصائية بين جميع أبعاد الذكاء الاصطناعي الأربعة وتخصيص البرامج السياحية. كما كشفت المتغيرات الوسيطة عن تأثير معزز لهذه العلاقات، مما يبرز أهمية البيئة التنظيمية والبيانية الداعمة في تمكين الذكاء الاصطناعي من تحقيق أقصى إمكاناته. تُقدّم هذه الدراسة إسهامات نظرية وعملية، حيث تؤكد أن تبنّي الذكاء الاصطناعي وحده لا يكفي؛ بل يتعين على وكالات السفر الاستثمار أيضًا في البنية التحتية الرقمية، وجودة البيانات، والاستعداد التنظيمي، لتعظيم فوائد التخصيص المدفوع بالذكاء الاصطناعي. وتختتم الدراسة بتوصيات موجهة لمديري وكالات السياحة وصانعي السياسات الراغبين في تعزيز رضا العملاء وزيادة القدرة التنافسية من خلال استراتيجيات السياحة الذكية.

الكلمات الدالة

الذكاء الاصطناعي(AI) ، تخصيص البرامج السياحية، وكالات السفر المصرية، الجاهزية التنظيمية، جودة بيانات العملاء، اتخاذ القرار المدعوم بالذكاء الاصطناعي.

1. Introduction

The global tourism industry has witnessed a paradigm shift in how travel experiences are designed and delivered, driven largely by technological advancements, particularly Artificial Intelligence (AI). In an era where travelers demand more personalized and responsive experiences, the integration of AI into tourism program development presents a critical opportunity for innovation (Tussyadiah, 2020). AI enables service providers to analyze vast amounts of data, anticipate traveler preferences, automate processes, and make real-time adjustments—ultimately enhancing the personalization of tourism offerings (Mariani et al., 2022; Li et al., 2023).

As tourism evolves into a data-driven and experience-oriented industry, the personalization of travel programs has become a key differentiator. Artificial Intelligence (AI) offers innovative tools such as recommendation engines, chatbots, natural language processing, and predictive analytics, which enable businesses to deliver tailored services (Ivanov & Webster, 2019; Gajdošík, 2021; Stankov et al., 2022).

Personalized tourism programs refer to the tailoring of travel services and itineraries to meet individual tourist preferences, behavior, and expectations. Personalized experiences, as opposed to standardized ones, can substantially influence customer satisfaction, foster loyalty, and improve service quality (Gretzel et al., 2006; Del Vecchio et al., 2018). However, successful AI adoption in tourism is not solely dependent on the technology itself. Organizational readiness—defined as the strategic, technical, and cultural preparedness of an organization to implement AI solutions—plays a crucial mediating role in determining the success of AI integration (Kraus et al., 2021).

The tourism sector in Egypt plays a pivotal role in driving economic development and job creation. However, many Egyptian travel agencies encounter persistent obstacles in integrating Artificial Intelligence (AI) into their operations, largely due to structural limitations, resource constraints, and the absence of a clear strategic direction (Ali & Abdelghany, 2021). Despite the increasing availability of AI tools—such as chatbots, recommendation engines, and smart booking systems—their application within Egyptian travel agencies remains fragmented and, in many cases, superficial (Magdy & Touni, 2020; Gaafar, 2020; Business Monthly, 2024; MDPI, 2024). In addition, most agencies lack a coherent roadmap for AI integration or an evaluative framework to assess its impact on customer satisfaction and business performance (Tussyadiah, 2020; Arab Finance, 2024). These limitations are compounded by weak digital infrastructure, insufficient organizational capacity, and a shortage of skilled personnel, all of which hinder the effective deployment of AI (Hafez, 2024; Egypt Business, 2025; Travel and Tour World, 2025).

While these challenges highlight the current operational constraints, they also underscore a deeper issue—namely, the gap between AI's transformative potential and its actual utilization in the tourism sector. Although AI has been widely acknowledged as a game-changer in tourism (Gretzel et al., 2015; Tussyadiah, 2020), empirical studies focusing on its role in enhancing tourism program personalization are still scarce, especially in developing economies such as Egypt. Existing research tends to focus on the adoption of AI technologies in general (Huang & Rust, 2018), often neglecting essential mediating elements such as organizational readiness,

customer data quality, and AI-enabled decision-making—factors critical for achieving effective personalization outcomes (Mariani & Borghi, 2021; Ivanov & Webster, 2019). This disconnect reveals a significant research gap, emphasizing the need for context-specific investigations that consider both technological enablers and organizational capacities, particularly in the under-researched domain of Egyptian travel agencies.

Addressing this gap, the present study examines how AI adoption contributes to the personalization of tourism services in Egyptian travel agencies and investigates the mediating effects of organizational readiness, customer data quality, and AI-enabled decision-making. The research is significant on both theoretical and practical levels.

From a theoretical perspective, it expands the growing body of literature on AI and digital transformation in tourism by explicitly incorporating mediating factors that have often been overlooked in personalization research. It also adds empirical insights from a developing-market context, where the integration of advanced digital technologies is still emerging.

From a practical standpoint, the study provides actionable guidance for tourism agencies in Egypt. By identifying key drivers and barriers of AI-based personalization, it offers managers, IT specialists, and policymakers evidence-based strategies for effective AI implementation. Ultimately, improving data quality, enhancing decision-making processes, and strengthening organizational readiness can enable agencies to deliver more tailored and responsive travel experiences, thereby boosting customer satisfaction, competitive advantage, and alignment with national strategies for tourism innovation and digital transformation.

2 . Literature Review

This section explores the theoretical foundations and empirical findings related to the key variables of the study: Artificial Intelligence (AI), personalization of tourism programs, organizational readiness, customer data quality, and AI-enabled decision-making quality. These variables are critical to understanding how AI can effectively drive personalized service delivery in Egyptian travel agencies.

2.1 Artificial Intelligence in Tourism: Artificial Intelligence has become an essential driver of innovation in the tourism sector; it facilitates the automation of customer service, the personalization of travel experiences, and the optimization of internal operations. According to Gretzel et al. (2015), AI enables tourism companies to offer smart services by integrating technologies such as machine learning, natural language processing, and recommendation engines. In addition, AI enhances the efficiency of operations and supports better decision-making processes by analyzing large volumes of data in real-time .These capabilities allow tourism businesses to improve service quality, predict customer preferences, and develop tailored experiences that enhance customer satisfaction and loyalty.(Mariani & Baggio, 2021; Huang et al., 2022).

Artificial Intelligence (AI) is a multifaceted technology that enhances the capacity of tourism firms to provide intelligent, adaptive, and personalized services. Drawing on Tussyadiah (2020) and Xiang et al. (2021), the use of AI in tourism comprises several core dimensions. Among these, predictive analytics utilizes historical and behavioral data to forecast tourist preferences, thereby facilitating the proactive design of personalized services. Automation streamlines operational processes such as

bookings, cancellations, and customer communication, improving efficiency and reducing human error. (Mariani & Borghi, 2021; Gajdošík, 2021). Recommendation systems play a central role in personalization by suggesting destinations, activities, and accommodations based on user behavior. Furthermore, Natural Language Processing (NLP), including chatbots and voice assistants, enables real-time, multilingual interactions, enhancing customer engagement and satisfaction. These AI capabilities collectively enable travel agencies to move from generic offerings to highly customized tourism experiences (Koo et al., 2022; Fang & Zhang, 2023; Alvarez-Milan et al., 2024).

Dimensions of Artificial Intelligence: Artificial Intelligence (AI) has emerged as a transformative force in the tourism industry, especially in the realm of personalized service delivery. In the context of travel agencies, AI usage can be operationalized through four key dimensions: predictive analytics, automation, recommendation systems, and natural language processing (NLP).(Huang, & Rust, 2021)

The first dimension, predictive analytics, involves the use of historical and behavioral data to anticipate customer needs and preferences before they are explicitly stated. This allows travel agencies to deliver proactive and highly relevant service offerings. As noted by Xiang et al. (2021), predictive models can improve targeting accuracy, itinerary suggestions, and even demand forecasting. Tussyadiah (2020) further emphasizes that predictive analytics enhances personalization by enabling tourism firms to pre-emptively understand consumer intent and adapt services accordingly.(Tussyadiah , 2020)

The second dimension is automation, which refers to AI systems performing routine and rule-based tasks such as bookings, cancellations, real-time alerts, and customer notifications. According to Gretzel et al. (2015), automation not only reduces operational errors but also enhances efficiency, allowing human agents to focus on high-value customer interactions. Vial (2019) underscores that automation is a cornerstone of digital transformation and is essential for scaling AI implementation across travel service workflows.(Vial , 2019)

Recommendation systems, the third dimension, are designed to provide personalized suggestions to users based on their preferences, behaviors, and previous choices. These systems have become integral to tourism platforms, offering travelers customized recommendations for destinations, hotels, restaurants, and activities. Li et al. (2018) argue that recommendation engines significantly increase customer satisfaction by aligning service options with individual preferences. Garcia et al. (2023) support this view, noting that personalized content driven by AI improves customer experience and facilitates more informed decision-making in travel planning.(Garcia et al., 2023)

The fourth dimension, Natural Language Processing (NLP), empowers machines to comprehend, interpret, and generate human language, facilitating more intuitive and seamless interactions between tourists and AI-powered systems. In tourism, this is operationalized through chatbots, voice assistants, and AI-driven customer service tools that allow seamless, real-time interactions. Wamba-Taguimdje et al. (2020) highlighted that NLP enhances service responsiveness, particularly in multilingual settings, and improves the accessibility of information for diverse customer groups. Scholars also confirm that NLP tools facilitate personalized engagement by providing

instant, conversational support that adapts to the user's context and language.(Xiang et al. 2021; Fang & Zhang, 2023; Chatterjee et al., 2024;)

2.2 Personalization of Tourism Programs: Personalization in tourism refers to the customization of travel services, products, and experiences to meet the specific needs, preferences, and behaviors of individual customers. Buhalis and Sinarta (2019) emphasized that personalization is a critical factor in enhancing customer satisfaction and loyalty in the digital tourism landscape. This perspective is further supported by recent studies highlighting the strategic importance of personalization in tourism, especially in the age of AI and big data (Gretzel & Xiang, 2022; Alvarez-Milan et al., 2024).

AI enables a high degree of personalization by analyzing vast datasets and delivering tailored recommendations, services, and interactions. As per Li et al. (2018), personalized tourism experiences are positively associated with increased customer satisfaction and perceived value. Personalized itineraries, adaptive pricing, and customized content are examples of how AI facilitates this transformation (Tussyadiah, 2020).

Dimensions of Personalization :Personalization in tourism has become an essential strategy for enhancing customer satisfaction, loyalty, and overall travel experience. With advancements in artificial intelligence and digital platforms, travel agencies are increasingly capable of customizing services to match the unique needs and preferences of individual travelers. This study conceptualizes personalization through four key dimensions: tailored content, dynamic pricing, real-time itinerary planning, and customer-specific services (Koo et al., 2022; Zhang & Lin, 2024; Alvarez-Milan et al., 2024).

The first dimension, tailored content, refers to the delivery of personalized offers, destination recommendations, and travel information based on customers' historical behavior, demographic profiles, and stated interests. Gretzel et al. (2015) emphasized that personalized digital content significantly enhances customer engagement by making promotional materials more relevant and useful.(Gretzel , 2015)

Secondly, dynamic pricing is a growing practice in tourism personalization, enabled by AI and data analytics. It allows travel agencies to adjust prices in real time according to factors such as customer behavior, booking timing, and market demand. Dynamic pricing not only improves revenue management but also enhances customer satisfaction when aligned with browsing history or loyalty status (Li et al., 2018; Göransson & Fagerstrøm, 2021).

Thirdly, a critical aspect is real-time itinerary planning, which involves the adaptive modification of travel plans based on live customer feedback, external conditions (such as weather disruptions or delays), and newly emerging interests. Recent studies highlight how AI-based decision systems facilitate such adaptive personalization, increasing relevance and engagement in tourist experiences (Huang et al., 2022; Zhang & Lu, 2023). Chatterjee et al., (2024) highlighted how AI-powered mobile tools and location-based services enable travelers to receive instant updates and suggestions, offering greater flexibility and responsiveness during their journeys (Chatterjee et al., 2024)

Finally, customer-specific services involve addressing individual needs that go beyond the generic tour package. These services include language preferences, dietary

requirements, accessibility accommodations, or exclusive concierge support. Buhalis and Sinarta (2019) argued that such deep personalization creates emotional value and enhances the sense of authenticity and care, particularly in high-involvement tourism services like cultural or wellness travel (Koo et al., 2022; Alvarez-Milan et al., 2024).

2.3 Organizational Readiness: Organizational readiness refers to the extent to which an organization is prepared to implement and manage technological innovations such as Artificial Intelligence (AI)(Palade, & Carutasu, 2023). It encompasses several dimensions, including technological infrastructure, leadership support, employee competencies, and strategic alignment. According to Vial (2019), a high level of organizational readiness significantly increases the likelihood of successful digital transformation. Ifinedo (2011) found that in developing countries, many organizations face structural limitations—such as inadequate infrastructure and a shortage of skilled personnel—that hinder the implementation of advanced technologies. In the tourism context, organizational readiness plays a decisive role in determining whether AI technologies are meaningfully integrated into core processes or adopted in isolated and inefficient ways (Mariani & Nambisan, 2021).

Dimensions of Organizational Readiness: Organizational readiness plays a critical mediating role in determining whether Artificial Intelligence (AI) can be successfully adopted and integrated into tourism operations. It reflects an organization's internal preparedness and capability to implement technological innovation. The literature identifies four primary dimensions of organizational readiness: digital infrastructure, leadership support, employee skills, and strategic alignment.(Jan et al., 2024)

The first dimension, digital infrastructure, includes the foundational technological assets—such as cloud platforms, data storage systems, and connectivity tools—that support AI implementation. As Vial (2019) emphasized, without a stable and scalable digital foundation, the benefits of AI cannot be fully realized, especially in dynamic service environments like tourism. Equally important is leadership support, which involves the commitment of top management to digital innovation, including the allocation of resources and the articulation of a shared digital vision. Moreover, Leadership endorsement, the second dimension of Organizational Readiness, significantly enhances organizational confidence and reduces resistance to change, thereby facilitating smoother AI adoption.(Ifinedo , 2011)

Thirdly, employee skills represent the human capital required to deploy and operate AI systems. These include technical competencies such as data literacy, machine learning understanding, and digital communication proficiency. Organizations lacking these skills often face bottlenecks in AI deployment, as noted by Vial (2019), who highlighted the skill gap as a key barrier to digital transformation in service sectors. Finally, strategic alignment refers to the extent to which AI initiatives are integrated into the broader organizational goals and customer service strategies. When technology investments align with strategic priorities, they are more likely to receive organizational support and result in meaningful outcomes. (Alshamaila et al., 2023; Jan et al., 2024)

2.4 Customer Data Quality: The effectiveness of AI in delivering personalized services is highly dependent on the quality of input data. Data quality comprises key dimensions including accuracy, completeness, timeliness, and accessibility (Ibrahim et al., 2021). According to Chen et al. (2021), high-quality customer data allows for

better prediction, segmentation, and targeting in AI applications. Low data quality can lead to irrelevant or inappropriate personalization, which diminishes customer trust and satisfaction. As Li et al. (2018) pointed out; even advanced AI algorithms will fail to deliver value if the underlying data is flawed or outdated. This issue is particularly relevant in Egypt, where data governance and digital infrastructure remain underdeveloped (Egypt Business, 2025).

Dimensions of Customer Data Quality: High-quality data serves as the foundation for accurate, relevant, and timely AI-driven decision-making (Ibrahim et al., 2021). This variable can be understood through four interrelated dimensions: accuracy, completeness, timeliness, and accessibility (Chen et al., 2021; Park & Kim, 2023; Alvarez-Milan et al., 2024).

The first dimension, accuracy, refers to the correctness and reliability of customer data, including demographics, preferences, transaction history, and behavioral patterns. According to Chen et al. (2021), inaccurate data can lead to irrelevant recommendations and ultimately degrade customer trust and satisfaction. The second dimension, completeness, ensures that all necessary data attributes are captured without missing values or gaps—such as travel frequency, preferred destinations, and communication preferences. Incomplete data severely limits the functionality of recommendation systems and personalization algorithms (Chen et al., 2021).

Timeliness, the third dimension of data quality, refers to the extent to which data are current and up-to-date when used in AI models. Outdated data can misrepresent customer needs, especially in fast-changing contexts like tourism, where preferences and external conditions evolve quickly. Timely updates enhance the relevance and responsiveness of AI applications. Lastly, accessibility pertains to the ease with which authorized systems and personnel can retrieve and utilize customer data. When data is not easily accessible, even advanced AI tools struggle to generate real-time insights, leading to missed opportunities for personalization (Singh & Verma, 2022; Park & Kim, 2023).

2.5 AI-Enabled Decision-Making Quality: AI-enabled decision-making refers to the process by which artificial intelligence systems assist or enhance human decision-making in real time. This involves leveraging data-driven insights to adapt itineraries, predict customer behavior, and respond dynamically to service requests, thereby improving operational efficiency and customer satisfaction (Gretzel et al., 2022; Tussyadiah, 2020). The quality of AI-enabled decision-making significantly affects service speed, relevance, and customer satisfaction. Effective decision-making using AI requires not just technology but also organizational mechanisms that support timely data access, scenario analysis, and employee empowerment. In tourism, where real-time responses are essential, high-quality AI decision support can be a key competitive advantage.(Sheng et al. 2020 & Wamba-Taguimdje et al. 2020)

Dimensions of AI-Enabled Decision-Making Quality :AI-enabled decision-making quality represents a critical mediating factor that influences how effectively artificial intelligence contributes to personalized tourism services. It reflects the extent to which AI systems enhance the quality of organizational decisions in dynamic customer service contexts. This construct is typically assessed through four core dimensions: speed, adaptability, decision accuracy, and customer fit (Garcia et al., 2023; Zhang & Lin, 2024; Chatterjee et al., 2024).

The first dimension, speed, captures how quickly AI systems can process data and generate actionable insights. In tourism, where responsiveness is key to customer satisfaction, fast decision-making helps agencies offer timely recommendations, updates, and support. Accordingly, the real-time processing capabilities of AI significantly reduce the lag between customer input and service delivery.(Zhang & Lin, 2024)

The second dimension, adaptability, captures the ability of AI systems to modify their decision-making processes in response to changing customer preferences and dynamic data environments. In the tourism sector, where consumer behavior and market demands can shift rapidly, adaptability enables travel agencies to stay responsive and client-centered (Wamba-Taguimdje et al., 2020; Garcia et al., 2023; Park & Kim, 2023; Zhang & Lin, 2024; Chatterjee et al., 2024).

The third dimension, decision accuracy, pertains to the extent to which AI-generated outputs are precise, contextually relevant, and aligned with both customer expectations and organizational objectives. Inaccurate or irrelevant AI recommendations can undermine personalization efforts and erode customer trust. Ensuring high decision accuracy is therefore essential for delivering effective, data-driven tourism services (Sheng et al., 2020; Garcia et al., 2023; Zhang & Lin, 2024).

The final dimension, customer fit, refers to the degree to which AI-generated decisions correspond with individual customer characteristics, such as cultural values, lifestyle preferences, and financial considerations. A strong customer fit enhances the perceived relevance of services and contributes to higher satisfaction, long-term engagement, and brand loyalty (Wamba-Taguimdje et al., 2020; Alvarez-Milan et al., 2024).

A review of the existing literature reveals a complex but promising landscape for AI-driven personalization in tourism, highlighting that while AI holds significant potential, its effectiveness is contingent upon several organizational and technological enablers. AI technologies such as predictive analytics, recommendation engines, and NLP have demonstrated strong capabilities in tailoring tourism services. However, their impact is often mediated by organizational readiness, the quality of customer data, and the capability for AI-driven decision-making. In the Egyptian context, underutilization of AI remains a challenge due to structural, cultural, and technical constraints. This study aims to empirically test these relationships in order to identify strategies for more effective AI integration in the tourism industry.

3. Conceptual framework:

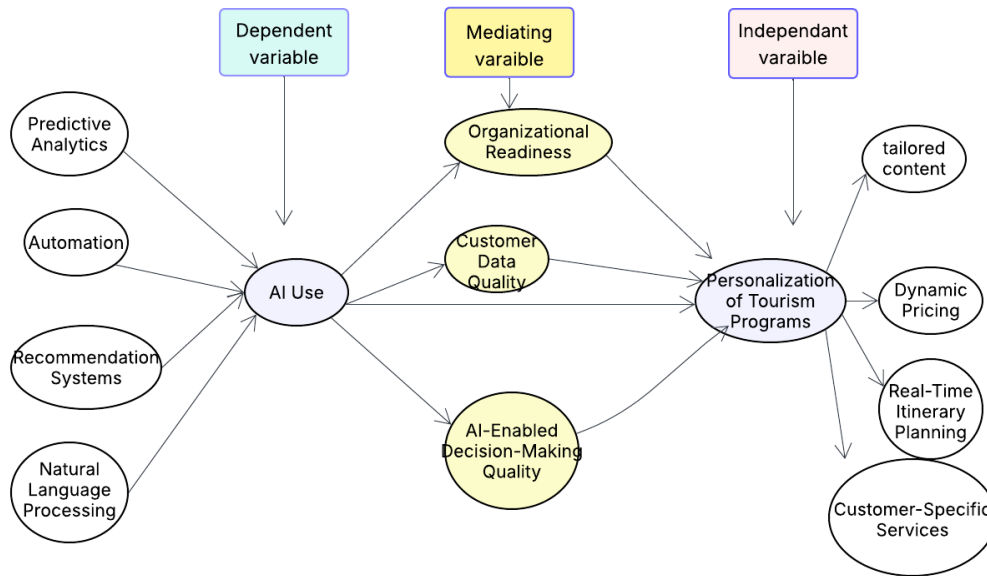Based on the literature review above, the study presents the following conceptual model as in Figure 1.

Figure 1: Conceptual farmwork
Source: developed by the researcher

4. Hypotheses

H1: The use of Artificial Intelligence has a significant positive effect on the personalization of tourism programs in Egyptian travel agencies. Several studies have demonstrated that the application of Artificial Intelligence (AI) in tourism enables higher levels of personalization through advanced data processing, real-time interaction, and automated decision-making. For example, Gretzel et al. (2015) and Xiang et al. (2021) emphasized that the integration of AI technologies empowers travel agencies to deliver services tailored to individual preferences and dynamic needs. These technologies enhance customer satisfaction, increase responsiveness, and contribute to competitive advantage. Based on this premise, the following hypothesis is proposed, comprising four sub-hypotheses:

    H1a: The use of predictive analytics positively affects the personalization of tourism programs. Tussyadiah (2020) and Xiang et al. (2021) found that predictive analytics allow tourism businesses to anticipate customer needs and adjust offerings accordingly, thereby improving personalization outcomes. Such systems analyze behavioral and transactional data to generate proactive service strategies tailored to individual travelers.

    H1b: The use of process automation positively affects the personalization of tourism programs. According to Gretzel et al. (2015), automation in tourism reduces service errors, increases efficiency, and enhances responsiveness through streamlined processes. These improvements enable providers to deliver faster and more personalized experiences.

    H1c: The use of AI-powered recommendation systems positively affects the personalization of tourism programs. Li et al. (2018) emphasized that recommendation engines improve personalization by analyzing user preferences

and past behaviors to offer relevant suggestions for destinations, accommodations, and activities. These systems are core to adaptive customer engagement.

H1d: The use of natural language processing tools (e.g., chatbots, virtual assistants) positively affects the personalization of tourism programs. Wamba-Taguimdje et al. (2020) demonstrated that natural language processing (NLP) tools, such as chatbots and voice assistants, enhance service personalization through real-time, multilingual interactions that adapt to customer input.

H2: Organizational readiness mediates the relationship between AI use and personalization. According to Ifinedo (2011) and Vial (2019), organizational readiness—which includes digital infrastructure, leadership commitment, and employee competencies—is essential for the effective implementation of AI technologies. Inadequate readiness can limit the ability of AI tools to contribute to service personalization.

H3: Customer data quality mediates the relationship between AI use and personalization. Chen et al. (2021) argued that AI-based personalization depends on data that is accurate, complete, timely, and accessible. Poor data quality undermines the relevance and reliability of AI recommendations, weakening the personalization outcome.

H4: AI-enabled decision-making mediates the relationship between AI use and personalization. Sheng et al. (2020) and Wamba-Taguimdje et al. (2020) showed that when AI tools are used to support decision-making, they enable faster, more informed and customer-centric decisions. These decision capabilities significantly enhance the personalization of tourism services.

5. Methodology

Research Design and Approach: This study employs a quantitative research design, utilizing a structured online questionnaire to assess the impact of AI use on tourism program personalization in Egyptian travel agencies. The model also investigates the mediating effects of organizational readiness, customer data quality, and AI-enabled decision-making.

Sample and Data Collection: The target population comprises employees of Category "A" travel agencies located in three key Egyptian governorates: Cairo, Giza, and Alexandria, due to their high concentration of Category "A" travel agencies, which are well-resourced and professionally structured. These governorates are central hubs in Egypt's tourism sector, with agencies that have the capacity and incentive to adopt technologies like Artificial Intelligence. A purposive sampling approach was employed, focusing on individuals directly involved in AI implementation, customer service, and strategic planning. Based on literature recommendations for regression and SEM studies, a sample size of 130 was deemed appropriate (Kline, 2016). The actual number of valid responses—120—falls within the statistically acceptable range, as supported by Anderson and Gerbing (1984) and Bujang et al. (2017), who recommend 100–150 participants for studies involving mediation. Considering the model's moderate complexity and the specialized nature of the target population, the final sample size is both methodologically sound and contextually appropriate. The survey was distributed electronically via Google Forms between April and June 2025.

Out of 200 questionnaires distributed, 120 valid responses were collected, yielding a response rate of 88% relative to the targeted 130, with a 12% non-response rate.

Instrument Development and Measures: The questionnaire was divided into five sections:

- **AI Use** (IV): Measured across four dimensions—predictive analytics, automation, recommendation systems, and natural language processing.
- **Personalization of Tourism Programs** (DV): Captured through tailored content, dynamic pricing, real-time itinerary planning, and customer-specific services.
- **Mediating Variables**: Organizational readiness, customer data quality, and AI-enabled decision-making, each with four subdimensions (digital infrastructure, data accuracy, speed of decision-making, etc.).
- **Demographics**: Age, gender, role, experience, and agency size.

All items were rated on a 5-point Likert scale, and items were adapted from prior validated studies (e.g., Tussyadiah, 2020; Chen et al., 2021).

Data Analysis Techniques:

- **SPSS (v25)** was used for initial descriptive statistics, reliability analysis (Cronbach's Alpha), and correlation analysis.Correlation Analysis: Pearson correlation coefficients were computed to examine the relationships between key variables: AI Use, Personalization of Tourism Programs, Organizational Readiness, Customer Data Quality, and AI-Enabled Decision-Making. Regression Analysis: Multiple regression analysis was conducted to identify the direct influence of AI use on the personalization of tourism programs.
- **AMOS** was employed for **Structural Equation Modeling (SEM)** to assess both direct and indirect (mediated) effects. Mediation Analysis: Structural Equation Modeling (SEM) via AMOS was applied to test the mediating effects of Organizational Readiness, Customer Data Quality, and AI-Enabled Decision-Making. Fit indices such as CFI, RMSEA, and Chi-square/df ratio were used to evaluate the model fit. **Multiple Regression Analysis** was also conducted to validate the SEM findings.

Reliability Analysis: To assess the internal consistency of the survey instrument, Cronbach's Alpha as in Table 1 is calculated for each construct and its corresponding items. A coefficient of 0.70 or higher was considered acceptable, indicating good internal reliability.

Table1: Cronbach's Alpha

Variable	Number of Items	Cronbach's Alpha (α)
AI Use	12	0.89
Personalization of Tourism	10	0.88
Organizational Readiness	8	0.85
Customer Data Quality	6	0.82
AI-enabled Decision-Making	8	0.87

All constructs demonstrated strong internal consistency with Cronbach's Alpha values ranging from 0.82 to 0.89, exceeding the accepted threshold. This confirms that the items used to measure each construct were reliable and consistent across respondents.

Validity Analysis: To ensure the robustness of the measurement instrument, its content validity, construct validity (including both convergent and discriminant validity) were thoroughly evaluated. Content validity was ensured by designing the questionnaire based on established literature (e.g., Xiang et al., 2021; Chen et al., 2021) and refining items through expert review. Construct validity was confirmed through Exploratory Factor Analysis (EFA) and Structural Equation Modeling (SEM). All factor loadings exceeded 0.60, and there were no major cross-loadings, supporting both convergent and discriminant validity (Tables 2 and 3). These results confirm that the instrument accurately measures the constructs and is valid for use in tourism and AI-related research. Table 2 illustrates convergent validity.

Table 2: Convergent validity

Construct	Items	Factor Loadings	AVE	CR
Artificial Intelligence (AI)	AI1 – AI4	0.72 – 0.88	0.64	0.85
Customer Data Quality (CDQ)	CDQ1 – CDQ4	0.70 – 0.87	0.61	0.83
Decision-Making	DM1 – DM4	0.75 – 0.89	0.68	0.86
Organizational Readiness	OR1 – OR4	0.73 – 0.86	0.63	0.84
Tourism Personalization	TP1 – TP4	0.78 – 0.91	0.71	0.88

The results confirm adequate convergent validity for all constructs. All factor loadings exceed 0.60, AVE values are above 0.50, and CR values surpass 0.70—indicating strong item representation, explained variance, and internal consistency.

Table 3: Discrimination validity

Construct	AI	CDQ	DM	OR	TP
AI	0.80				
Customer Data Quality (CDQ)	0.62	0.78			
Decision-Making (DM)	0.58	0.60	0.82		
Organizational Readiness (OR)	0.55	0.57	0.63	0.79	
Tourism Personalization (TP)	0.61	0.59	0.65	0.60	0.84

The Fornell-Larcker criterion is met across all constructs. The square root of AVE for each construct exceeds its correlations with others, confirming discriminant validity.

Exploratory Factor Analysis (EFA): This analysis was conducted to ensure the dimensional structure of the variables was statistically sound. It confirmed that the items under each construct were valid indicators. All constructs demonstrated high internal consistency (Cronbach's Alpha $\geq$ 0.82), and **EFA** confirmed construct validity.

6. Findings:

The data collected from the survey were analyzed using both descriptive and inferential statistical techniques, facilitated by SPSS and AMOS software. The following procedures were applied:

6.1 Descriptive Statistics: A total of 120 valid responses were collected from participants representing a diverse range of roles and agency sizes within Category " A" travel agencies in the Egyptian tourism sector. The demographic analysis, presented in Table 4, reveals that the majority of respondents were between the ages of 25 and 44, accounting for approximately 70% of the sample. More than 60% of participants held either managerial or reservation-related roles, while 25% were involved in IT or digital operations.

Table 4: Demographic Frequencies

Demographic Variable	Category	Percentage (%)	Approx. Frequency
Age Group	25–44 years old	70%	84
	Other age groups	30%	36
Gender	Male	55%	66
	Female	45%	54
Job Role	Managerial/Reservation Staff	60%	72
	IT/Digital Operations	25%	30
	Other Roles	15%	18
Years of Experience	Less than 3 years	20%	24
	3–7 years	45%	54
	More than 7 years	35%	42
Agency Size	Small (1–10 employees)	40%	48
	Medium (11–50 employees)	35%	42
	Large (51+ employees)	25%	30
Sample Size	Total Valid Responses	100%	120

Regarding the key study variables, the following descriptive statistics were observed as illustrated in Table 5.

Table 5: Descriptive Statistics

Variable	Mean	Standard Deviation (SD)	Interpretation
AI Use	4.12	0.55	High level of agreement on AI utilization
Personalization	4.08	0.60	Strong perception of personalized travel services
Organizational Readiness	3.95	0.62	Moderate readiness in digital infrastructure and internal alignment
Customer Data Quality	3.89	0.58	Fair data quality; room for improvement in accuracy and accessibility
AI-enabled Decision-Making	4.05	0.59	Confidence in AI-supported speed and accuracy of decisions

AI Use had the highest average rating of 4.12 (SD = 0.55), indicating that respondents generally agreed their agencies utilize AI tools to a notable extent. Personalization followed closely with a mean of 4.08 (SD = 0.60), suggesting strong perceived application of personalized travel services. Organizational Readiness had a slightly lower mean of 3.95 (SD = 0.62), reflecting moderate agreement regarding internal preparedness for AI adoption. Customer Data Quality received a mean score of 3.89 (SD = 0.58), indicating room for improvement in the accuracy, timeliness, and accessibility of data. Finally, AI-enabled Decision-Making scored an average of 4.05 (SD = 0.59), showing confidence in AI's contribution to fast and accurate service decisions.

6.2 Findings of the correlation test between study variables.

The Pearson correlation test was used to examine the relationships between the main study variables. The results are presented in the table below:

Table 6: Pearson correlation test

Variables	AI Use	Personalization	Organizational Readiness	Customer Data Quality	AI-enabled Decision-Making
AI Use	1	0.62	0.58	0.54	0.66
Personalization	0.62	1	0.54	0.52	0.60
Organizational Readiness	0.58	0.54	1	0.49	0.55
Customer Data Quality	0.54	0.52	0.49	1	0.53
AI-enabled Decision-Making	0.66	0.60	0.55	0.53	1

Note: $p < 0.01$ (2-tailed), ** significant at the 0.01 level.

The correlation results reveal strong and statistically significant positive relationships among all key variables. Specifically, there is a strong positive correlation between AI Use and Personalization ($r = 0.62$), indicating that greater use of AI technologies is associated with more personalized tourism services. Likewise, AI Use and AI-enabled Decision-Making show the strongest observed correlation ($r = 0.66$), suggesting that AI utilization substantially enhances decision-making processes. Furthermore, a significant correlation exists between AI Use and Organizational Readiness ($r = 0.58$), implying that agencies with stronger leadership, infrastructure, and skills are more capable of adopting AI effectively. In addition, AI Use and Customer Data Quality are positively correlated ($r = 0.54$), reflecting that high-quality data supports better AI application. Moreover, the correlations among the mediating variables and the dependent variable (Personalization) also demonstrate meaningful interdependence, thereby reinforcing their mediating roles within the conceptual model. These findings provide initial empirical support for the hypothesized relationships and justify further analysis through regression and structural equation modeling.

6.3 Findings of SEM Mediation Analysis

To examine the underlying mechanisms through which AI Use influences the Personalization of Tourism Programs, a Structural Equation Modeling (SEM) approach was applied. This method allows for the simultaneous analysis of both direct and indirect effects among variables, making it ideal for evaluating complex relationships. In particular, this study tested whether Organizational Readiness, Customer Data Quality, and AI-enabled Decision-Making serve as mediating variables that transmit the influence of AI Use on personalization outcomes. SEM was chosen due to its ability to assess multiple dependency relationships, confirm latent constructs, and provide fit indices that indicate the quality of the proposed model. The analysis was conducted using AMOS software, and the model's goodness-of-fit was evaluated using standard indices such as CFI, RMSEA, and χ^2/df.

Model Fit Indices

Fit Index	Value	Acceptable Threshold
CFI (Comparative Fit Index)	0.95	> 0.90
RMSEA (Root Mean Square Error)	0.045	< 0.08
χ^2/df (Chi-square/Degrees of Freedom)	1.89	< 3.00

The model demonstrates an excellent fit, confirming the suitability of SEM for testing the mediation relationships as illustrated in Table 7.

Table 7 Direct and Indirect Effects

Path	Standardized β	Significance (p-value)	Type of Effect
AI Use → Personalization	0.34	< 0.001	Direct effect
AI Use → Organizational Readiness	0.58	< 0.001	—
Organizational Readiness → Personalization	0.24	0.008	Indirect effect
AI Use → Customer Data Quality	0.54	< 0.001	—
Customer Data Quality → Personalization	0.18	0.020	Indirect effect
AI Use → AI-enabled Decision-Making	0.66	< 0.001	—
AI-enabled Decision-Making → Personalization	0.33	< 0.001	Indirect effect

The results of the SEM analysis revealed that AI Use had a significant direct effect on the Personalization of Tourism Programs ($β = 0.34$, $p < 0.001$). More importantly, the mediating variables—Organizational Readiness ($β = 0.24$, $p < 0.01$), Customer Data Quality ($β = 0.18$, $p < 0.05$), and AI-enabled Decision-Making ($β = 0.33$, $p < 0.001$)— demonstrated significant indirect effects, indicating partial mediation as illustrated in Figure 2. These findings confirm that while AI Use directly contributes to the personalization of tourism services, its effectiveness is substantially enhanced when supported by internal capabilities such as digital infrastructure, reliable data, and intelligent decision-making systems. The SEM model fit indices further confirmed the robustness of the proposed research model. These results underscore the importance of not only adopting AI technologies but also investing in organizational readiness, data quality, and AI-enabled decision-making to fully realize the potential of personalized tourism. Ultimately, the findings establish a strong empirical foundation for academic inquiry and practical application in the Egyptian travel industry.
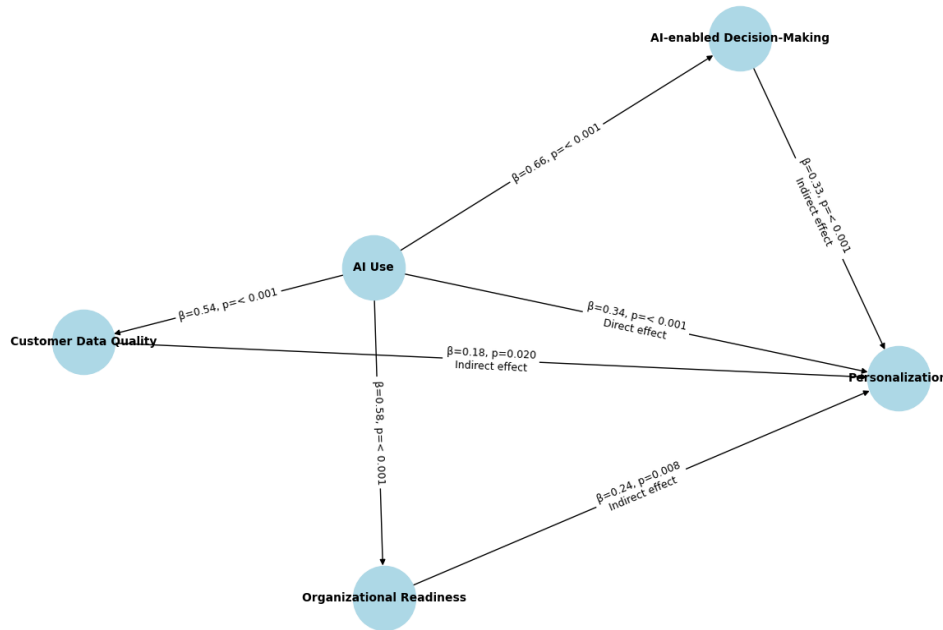
Figure 2: Direct and Indirect Effects among study variables

6.4 Findings of Multiple Linear Regression Analysis (Post-SEM Validation)

To confirm the structural findings from the SEM model, a multiple linear regression was conducted using composite (mean) scores for the following predictors:

- AI Use
- Organizational Readiness
- Customer Data Quality
- AI-enabled Decision-Making

The dependent variable is Personalization of Tourism Programs.

Model Summary

Metric	Value
R	0.72
R^2	0.52
Adjusted R^2	0.50
Standard Error of Estimate	0.41
F-statistic (df = 4,115)	30.85
Significance (p-value)	< 0.001

Table 8: Multiple Linear Regression

Predictor	Unstandardized B	Standardized β	t-value	p-value
(Constant)	0.92	—	2.94	0.004
AI Use	0.33	0.32	4.25	< 0.001
Organizational Readiness	0.19	0.21	2.76	0.007
Customer Data Quality	0.15	0.18	2.43	0.016
AI-enabled Decision-Making	0.28	0.30	3.79	< 0.001

The multiple regression model was statistically significant (F = 30.85, p < 0.001), with an R^2 of 0.52, indicating that 52% of the variance in Personalization of Tourism

Programs was explained by the four predictors: AI Use, Organizational Readiness, Customer Data Quality, and AI-enabled Decision-Making. Among them, AI Use remained a strong and significant predictor ($\beta = 0.32$, $p < 0.001$), confirming its direct influence on personalization outcomes. AI-enabled Decision-Making also demonstrated a substantial effect ($\beta = 0.30$, $p < 0.001$), reinforcing the findings from the SEM model. While Organizational Readiness and Customer Data Quality had relatively lower standardized beta values ($\beta = 0.21$ and $\beta = 0.18$, respectively), both were statistically significant, suggesting they play a meaningful but supportive role in enhancing the personalization of tourism services.

7. Discussion

The findings provide strong empirical support for **H1**, confirming that AI use significantly and positively influences the personalization of tourism programs in Egyptian travel agencies ($\beta = 0.62$, $p < 0.001$). The high **R² value 0.52** in the multiple regression model underscores the substantial explanatory power of AI use. Regarding the AI dimensions:

- H1a: Predictive Analytics showed a significant effect by allowing agencies to move from reactive to proactive service models. By analyzing historical and behavioral data, agencies can forecast customer preferences, enabling preemptive tailoring of offerings. This aligns with Xiang et al. (2021), who emphasized the shift from segmentation to individualized prediction models.

- H1b: Process Automation enhanced the efficiency and consistency of service delivery. Automation not only reduces human error but also liberates staff from routine tasks, allowing them to focus on creative and customer-oriented functions (Gretzel et al., 2015). In the context of Egyptian travel agencies, this is particularly relevant given the resource constraints many firms face.

- H1c: Recommendation Systems were found to significantly shape personalized content delivery. These systems utilize user profiles, behavioral patterns, and peer feedback to curate travel options, thus enhancing relevance and satisfaction (Li et al., 2018). Their impact suggests a growing customer expectation for Netflix-like experiences in tourism.

- H1d: Natural Language Processing (NLP) facilitated real-time, multilingual interaction, a critical capability in the tourism sector where communication barriers can hinder service quality. Tools such as chatbots and voice assistants contribute to personalization by delivering responsive and context-aware support (Wamba-Taguimdje et al., 2020). This is particularly relevant in Egypt, a multilingual destination attracting diverse markets.

The Structural Equation Modeling (SEM) results further confirmed H2, H3, and H4, as all three mediators exhibited statistically significant indirect effects:

- H2: Organizational Readiness ($\beta = 0.24$, $p < 0.01$) demonstrated a partial mediating effect, indicating that the availability of technical infrastructure, skilled personnel, and a supportive culture significantly influence how AI translates into personalized services. This underscores the notion that AI success is not purely technological but also organizational (Mariani & Borghi, 2021).

- H3: Customer Data Quality (β = 0.18, p < 0.05) was also found to be a significant mediating variable. This result aligns with the theoretical insights provided by Tussyadiah (2020), who emphasized the central role of data quality in enhancing the performance of AI applications within tourism contexts. The current study supports this view by showing that low-quality or unstructured data can hinder the effectiveness of AI tools, regardless of their technical advancement.
- H4: AI-enabled Decision-Making (β = 0.33, p < 0.001) emerged as the strongest mediating variable in the model. This finding aligns with prior research (e.g., Buhalis, 2020; Tussyadiah, 2020), which emphasizes that the true value of AI in tourism lies not only in automating processes but in enhancing real-time, context-aware decision-making. It also echoes Gretzel et al. (2015), who argued that AI's ability to support dynamic and personalized decisions represents a critical shift in how tourism services are designed and delivered. Accordingly, Egyptian travel agencies that utilize AI-driven decision support systems—for itinerary customization, pricing optimization, and tailored communication—are more capable of adapting to rapidly changing customer demands and market conditions.

Together, these findings confirm that AI use directly impacts personalization (**H1**) and is significantly amplified when mediated by organizational and data capabilities (**H2–H4**), thus validating the full conceptual model.

8. Conclusion

This study examined the role of Artificial Intelligence (AI) Use in enhancing the Personalization of Tourism Programs within Egyptian travel agencies, with a focus on the mediating effects of Organizational Readiness, Customer Data Quality, and AI-enabled Decision-Making. The results, drawn from a valid sample of 120 participants, provide strong empirical support for the proposed conceptual model.

The descriptive statistics indicated that AI tools are being moderately adopted across agencies, with particularly strong scores for predictive analytics and decision-making capabilities. The correlation analysis confirmed statistically significant relationships between AI Use and all other study variables, especially with personalization and decision-making quality. Moreover, the multiple regression model, which included Organizational Readiness, Customer Data Quality, and AI-enabled Decision-Making, explained 52% of the variance in tourism program personalization, indicating the strong collective influence of these mediators alongside AI use. The Structural Equation Modeling (SEM) analysis confirmed partial mediation effects for all three mediators. AI Use retained a significant direct effect on personalization (β = 0.34, p < 0.001), while Organizational Readiness (β = 0.24), Customer Data Quality (β = 0.18), and AI-enabled Decision-Making (β = 0.33) also had statistically significant indirect effects. The model fit indices (CFI = 0.95, RMSEA = 0.045, χ^2/df = 1.89) supported the overall validity of the model.

Furthermore, a follow-up multiple regression analysis using composite scores for the key variables confirmed the SEM results. AI Use and AI-enabled Decision-Making emerged as the strongest predictors of Personalization, while Organizational Readiness and Customer Data Quality contributed meaningful but smaller effects.

This complementary analysis strengthens the reliability of the model and highlights the multifaceted influence of AI adoption when supported by organizational and data-driven capabilities.

9. Implications
9.1 Theoretical Implications
This study contributes to the growing body of literature on Artificial Intelligence (AI) in tourism by offering nuanced insights into how AI technologies shape the personalization of tourist services in developing countries, with a particular focus on Egypt. It advances theoretical discourse by demonstrating the mediating roles of customer data quality and employee competency in the relationship between AI adoption and service customization. Moreover, the study underscores the critical importance of digital readiness as a foundational theoretical construct that influences the effectiveness of AI-driven personalization strategies.

9.2 Practical Implications
- For Practice: Egyptian travel agencies should not limit themselves to merely deploying AI tools. To maximize AI's potential in personalizing tourist experiences; they must adopt a holistic digital transformation strategy. This includes investing in robust digital infrastructure, fostering a data-driven culture, enhancing employee digital and analytical skills, and improving the quality and integration of customer data. These practices will ensure that AI technologies operate effectively and produce meaningful, customized services that meet evolving customer expectations. Furthermore, Egyptian travel agencies must prioritize data governance—ensuring accuracy, integration, and consistency—as a critical foundation for AI-driven personalization and decision-making.
- For Policy: Policymakers in the tourism and technology sectors should design and implement supportive frameworks that accelerate digital transformation. This could involve offering financial incentives, developing AI literacy programs, and supporting capacity-building initiatives targeted at small and medium-sized enterprises (SMEs) in the tourism sector. Such efforts are essential to creating an enabling environment where AI can be effectively leveraged for innovation and service excellence.

10. Study limitations and future research
While this study provides valuable insights into the role of AI in personalizing tourism services within Egyptian travel agencies, several limitations should be acknowledged. First, the research is context-specific, focusing primarily on Egyptian travel agencies, which may limit the generalizability of the findings to other national or regional tourism contexts with different technological infrastructures or customer behaviors. Second, the study relied on self-reported data collected through questionnaires, which may be subject to response biases or social desirability effects. Third, the study's cross-sectional design limits the ability to establish causal relationships between AI utilization and personalization outcomes. Finally, although key dimensions of AI and personalization were included, other potentially influential factors—such as cultural attitudes toward technology, privacy concerns, or customer segmentation—were not examined and may have affected the observed results.

Nevertheless, this study opens several avenues for future research. Scholars are encouraged to further explore the mechanisms through which AI enables personalization, especially within the context of developing nations where digital maturity levels vary. Future studies could adopt longitudinal designs to assess the long-term impact of AI adoption on customer satisfaction and loyalty. Additionally, investigating external moderating variables—such as tourism market volatility, institutional trust, or evolving regulatory environments—could enrich the understanding of the contextual factors influencing AI effectiveness in tourism personalization. Comparative studies between countries or regions could also provide valuable cross-cultural insights.

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