Artificial Intelligence and Competitive Advantage of Tourism Enterprises: A Chain Mediation Effect

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Abstract

In the era of artificial intelligence (AI), tourism companies are leveraging AI to enhance their competitive advantage. Drawing on competition theory, this paper explores the relationships among AI application, innovation capability, organizational culture, and competitive advantage, and verifies the chain mediating effect of innovation capability and organizational culture. Data from 400 tourism enterprises in China were collected through a survey questionnaire, and multiple regression analysis was employed. The results indicate that AI application has a positive and significant effect on the competitive advantage of enterprises. Innovation capability mediates the relationship between AI application and competitive advantage, as does organizational culture. Furthermore, innovation capability and organizational culture exhibit a chain mediating effect. This study broadens the understanding of AI applications in the tourism industry and elucidates the mechanism through which AI influences the competitive advantage of enterprises.

1- Introduction

Artificial Intelligence (AI) applications can be leveraged to increase the competitive advantage of enterprises [1-3]. As a cutting-edge technology, AI is characterized by automation and intelligence. It has shown great potential in a various domain [4]. AI enables machines to not only replace repetitive physical tasks but also perform cognitive functions associated with human thought [5, 6]. With the continuous development of science and technology, the application of AI in various industries has gradually increased, profoundly affecting the competitive advantage of enterprises. and posing new challenges to the competitive advantage and business development of tourism enterprises [7-9]. The relationship between the application of AI and the competitive advantage of enterprises has become a research hotspot in the field of management.

AI has become a daily work technology [10] and an integral part of future work [3, 11]. Research on AI technology application has primarily focused on employee recruitment, preliminary screening, and automatic matching in medium and large enterprises [12], such as Huawei [13], to provide objective and fair performance evaluation references for employees [14]. With the expansion of academic research fields, AI has gradually expanded to data mining, sociology, behavior management, and consumer psychology [15]. For instance, a substantial amount of human resource data is collected, analyzed, and forecasted to provide accurate human resource demand predictions [16]. AI technology can

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recommend personalized training and development plans [17]. Krakowski et al. [18] presented a resource-based perspective to investigate how AI adoption affects competitiveness and performance, identifies AI as a driver of these dynamics, and explains how AI adoption collectively shifts the source of competitive advantage. However, many companies invest time, energy, and resources in AI but struggle to integrate it with existing people, processes, and systems, ultimately failing to achieve the desired goals [19, 20].

The application of AI technology has significant advantages in improving work efficiency and service quality [21]. Tourism companies use AI technology to analyze travelers' preferences and behavior data to achieve personalized travel recommendations and marketing [22]. By using AI technology to analyze factors such as market demand, competitive conditions, and seasonality, travel companies can optimize their pricing strategies to maximize revenue [23], hotel room management and room forecasting, help enterprises better arrange resources and services, and improve operational efficiency [24, 25]. In tourist attractions, AI can be used to develop intelligent guide systems and voice assistants to provide a more convenient guide and service experience [26]. Through the analysis of tourist behavior and trend data, tourism enterprises can predict tourism demand and optimize resource allocation and services [27, 28]. Organizations are entering a landscape characterized by unprecedented collaboration between managers and intelligent machines, and the rational allocation, development and motivation of talent through AI can enhance the competitiveness and overall strength of tourism enterprises [29, 30]. Therefore, the role of AI technology in technological innovation and competitive advantage development of tourism enterprises is worthy of in-depth exploration.

The influence of AI on industries is both extensive and transformative [31, 32]. Its capacity to collaborate, learn, and adapt through employee interactions has led organizational researchers to suggest that the synergy of AI and human creativity creates abundant opportunities for innovative research [33, 34]. A robust organizational culture promotes the exchange of knowledge and fosters innovation, thereby enhancing a firm's competitiveness [35]. However, there remains a significant gap in empirical studies regarding how to effectively integrate innovation capabilities into AI applications and harmonize diverse systems to maximize enterprises' competitive advantages, alongside the effects on organizational culture. Typically, AI applications are perceived and evaluated as a singular dimension, resulting in research findings that lack depth and often emerge from the interplay of multiple levels and factors. Consequently, it is essential to explore further whether innovation capacity and organizational culture serve as a chain mediating factor in the relationship between AI application and competitive advantage.

The existing literature highlights a lack of understanding regarding the long-term effects of AI adoption on employee roles and job satisfaction within the tourism sector. Future studies should investigate the ramifications of AI on workforce dynamics, particularly concerning the risks of job displacement and the approaches that can be taken for workforce reskilling and adaptation [36, 37]. Furthermore, analyzing case studies of effective AI integration in tourism businesses may yield valuable insights into best practices and the challenges encountered during implementation. By identifying these gaps in the literature, this study aims to address them by investigating less explored elements of AI application, such as how organizational culture influences innovation capacity and the enduring sustainability of competitive advantages in the tourism industry.

To summarize, the integration of AI is still in its infancy, with research predominantly centered on its technical uses [38]. The competitive edge of businesses is influenced by environmental uncertainties, and AI is being incorporated into the competitive dynamics of tourism firms to foster collaborative and symbiotic growth. In China, tourism has emerged as a cornerstone of the national economy, and the escalating competition within the tourism sector has heightened the demand for high-quality development among these enterprises. By applying competition and innovation theories, this paper investigates the interconnections between AI utilization, innovation capacity, organizational culture, and competitive advantage, while also validating the mediating role of innovation capacity in relation to organizational culture. This research aims to broaden the scope of AI applications within the tourism sector and elucidate the mechanisms through which AI impacts the competitive advantage of businesses for future reference [39].

2- Literature Review and Hypotheses

2-1- AI Applications

The definition of AI has undergone many iterations, yet no unified definition exists [40]. Various academic fields, including psychology, computer science, cognitive psychology, and philosophy, have distinct interpretations of AI [31]. AI objects involve machines and humans, and the goal is that machines help humans perceive, make decisions and act [41], and AI simulates human consciousness and thinking, such as information systems and management disciplines, have different conceptual understandings of AI. Haenlein & Kaplan [42] proposed that AI refers to the ability of a system to understand and learn from external data and continuously upgrade to achieve specific goals and tasks. Thus, the concepts of "artificial" and "intelligent" are combined, where "artificial" mimics human-like cognitive tasks in a more transparent way [43]: "Intelligence is the ability to collect data from past experience and deal with uncertainty about future actions accordingly [44].

The application of AI in tourism enterprises has become a prominent topic in both academia and practice. Previous studies have demonstrated that AI technology in the tourism industry encompasses multiple facets, driving business innovation, enhancing efficiency, and positively impacting business performance and development [44-46]. Ivanov & Webster [45] reported that tourism enterprises could analyze big data and user behavior through AI technology, enabling personalized tourism product recommendations and improving the accuracy and effectiveness of marketing. The introduction of AI technologies in customer service, such as chatbots and intelligent voice assistants, can improve customer satisfaction and enhance customer interaction [46]. Through intelligent supply chain management using AI, enterprises can optimize material procurement and inventory management, reduce costs, and improve operational efficiency [47]. Furthermore, AI can facilitate intelligent human resource deployment, such as forecasting labor needs, planning, optimizing job design, and employee training, to enhance labor efficiency and enterprise performance [48]. However, due to the general lack of understanding and acceptance of AI technology by tourism enterprises, high investment costs, and technical limitations, the widespread application of AI technology is restricted [49]. The application of AI technology in tourism enterprises also faces numerous obstacles and challenges.

2-2- Competitive Advantage

Ansoff [50] proposed that a firm's competitive advantage is derived from the unique assets it possesses, introducing this concept into the field of strategic management. Barney [51] argues that a firm achieves competitive advantage when its competitors or potential competitors are unable to replicate its value-creation strategies. According to Kapoor & Adner [52], a company's market share reflects its competitive advantage and superior value proposition. Davenport et al. [53] suggested that a company has a competitive advantage if it can generate the best value proposition and customer satisfaction through strategies like cost leadership, product differentiation, and new market segmentation. Therefore, a firm's competitive advantage is the comprehensive quality that enables it to achieve superior performance in a competitive market through effective AI adoption, optimal resource allocation, surpassing competitors, and delivering value to the market to seize more development opportunities.

Porter [54] explains in competitive theory how companies can gain and maintain competitive advantage through strategic positioning and resource allocation. According to the resource-based view (RBV) of competition theory, firms are seen as collections of unique resources essential for performing functions that drive profits and achieve long-term competitive advantage [55, 56]. These unique resources are not only profitable but also difficult for competitors to imitate or substitute [51]. Strategic resources are crucial for achieving long-term competitive advantage, allowing companies to secure favorable strategic positions in the market. However, differences between companies arise from the resources they possess; even within the same industry, tourism companies perform differently due to variations in resources [57].

With the advancement of science and technology, the application of AI has varying impacts on different industries, leading to changes in employment structures [58, 59] and enhancing the competitive advantage of enterprises [1, 2]. Alekseeva et al. [60] observed that the intensity of AI adoption in enterprises is positively correlated with enterprise size, capital expenditure (Capex), research and development (R&D), and total investment. Moreover, AI adoption enables enterprises to better respond to market changes, swiftly meet customer needs, and strengthen their competitive position through data-driven decision-making [60, 61]. In the manufacturing sector, the deep integration of AI technology has facilitated the automation and intelligence of production processes, significantly enhancing product quality and production efficiency [19]. Additionally, the extensive application of AI technology in transportation, communications, and education has conferred substantial competitive advantages to these industries, particularly in improving customer experience, optimizing resource allocation, and driving technological innovation [30, 38, 62]. The emergence of AI underscores the new opportunities and challenges it brings to various industries, with the intensity of AI adoption being directly linked to the competitive advantage of enterprises.

In summary, the application of AI technology in tourism enterprises has great potential and advantages, which can promote the innovation and development of enterprises and enhance their competitiveness. As the intensity of AI adoption by tourism companies increases, their competitive advantage in the market significantly increases. Therefore, this study proposes H1:

H1: *The application of AI has a positive and significant effect on the competitive advantage of enterprises.*

2-3- Innovation Capacity

Innovation capability is considered a comprehensive ability, defined by both the content and process of innovation. It emphasizes the generation and commercialization of new knowledge [63, 64]. Innovation capability forms the basis for generating innovation performance, which can be categorized into strategic, organizational, technical, and market capabilities [63, 64]. A business can be viewed as a repository of knowledge [65]. The essence of competence lies in knowledge [66], which is manifested through the development of the latest technologies, new products, product range expansion, quality improvement of existing products, and product flexibility enhancement [67]. Innovation has become

a top priority for companies. The ability to innovate encompasses the capacity to cultivate novel and creative concepts. The innovation and development process primarily revolves around technology, design, development, processes, and services [68].

There is an inevitable correlation between technological and competitive advantages and innovation ability in the process of enterprise innovation. Kinkel et al. [69] noted that the intensity of AI adoption is closely related to the R&D intensity, organizational culture, and digital skills of enterprises. R&D-intensive and knowledge-intensive companies are more inclined to promote AI technologies both domestically and internationally [69]. The study by Gursoy & Kakadiaris [70] highlighted the importance of R&D strategies in enhancing the competitiveness of firms. Continuous investment in AI R&D can not only improve the innovation ability of enterprises but also significantly enhance their competitive advantage [70]. At the technical level, the innovation ability of tourism enterprises is more dependent on R&D capabilities. These capabilities rely not only on resource investment but also on core competencies in the innovation process, having little to do with innovation strategies and synergies. Moreover, there is a lack of operational and transformation capabilities at the level of product innovation, particularly when enterprises do not fully consider market demand and the ability to commercialize knowledge and technology.

One of the goals of an enterprise's innovation capability is to maintain a long-term competitive advantage. The application of AI should consider not only the accumulation of enterprise resources but also the technological restructuring and integration of enterprise resources to innovate, and innovation ability has an intermediary effect on the application of AI and the competitiveness of enterprises. Therefore, this study proposes the following hypothesis:

H2: Innovation ability has a mediating effect on AI application and enterprise competitive advantage.

2-4- Organizational Culture

Since the concept of organizational culture was introduced [71, 72], its definition has been continually enriched and expanded, becoming increasingly rich and multidimensional. Barney [51] defines organizational culture as "a complex set of values, beliefs, assumptions, and symbols that define the way in which a business organization conducts business." Organizational culture influences not only an enterprise's decision-making process and operating model but also significantly shapes employee behavior and attitudes. As the driving force behind all actions within an organization, organizational culture profoundly impacts various aspects, from strategy development and innovation management to employee satisfaction and customer relationships. Azeem et al. [73] defines organizational culture as the values, beliefs, and behavioral norms formed within an enterprise, highlighting how culture, as a social construct, is gradually formed and solidified within an organization. From this perspective, organizational culture comprises shared assumptions, values, and beliefs that are reflected in the organization's practices and goals, helping its members understand how the organization operates. As times change, the role of organizational culture evolves as well; in the intelligent era, the flexibility and innovation of organizational culture have become crucial to enterprise success.

Organizational culture is not merely a static set of beliefs and values; it is dynamic and constantly evolving with time and external environmental changes, influencing all levels of the organization. The successful implementation of AI technology must be aligned with the organizational culture of the enterprise [74]. The value creation and competitive advantage brought by AI technology requires rearchitecting the digital core of the enterprise, necessitating adjustments and optimizations in the organizational culture to better support AI applications. Wang [75] suggested that a green organizational culture (OGC) significantly enhances the green performance and competitive advantage of enterprises through green innovation. Martínez-García [76] observed that a collaborative culture significantly impacts the competitive advantage of firms through the mediation of organizational learning. Jumhur et al. [77] examined the small textile industry in Indonesia and reported that organizational culture mediates competitive advantage and plays a crucial role in the relationship between corporate strategy and competitive advantage. Consequently, there is a clear relationship between organizational culture and the competitiveness of tourism enterprises.

In conclusion, organizational culture is a crucial factor in the success of an enterprise. A positive organizational culture not only facilitates the effective implementation of AI technology but also enhances the competitive advantage of enterprises by fostering innovation and knowledge sharing. The impact of AI technology is influenced not only by technology itself but also by internal factors within the organization, with organizational culture being a key mediating variable. Therefore, this study proposes hypothesis H3:

H3: *Organizational culture has a mediating effect on AI application and enterprise competitive advantage.*

2-5- Mediating Role of Innovation Ability and the Organizational Culture chain

Innovation theory posits that enterprises can enhance their technological capabilities and market competitiveness through continuous R&D and innovation activities. Competition theory, on the other hand, examines how firms can attain sustainable competitive advantage by leveraging both internal resources and external market opportunities. The ability to innovate is not merely a consequence of technology application but also a driving force for technological

advancement [78]. A robust organizational culture promotes knowledge sharing and innovation, thereby boosting the overall competitiveness of the enterprise. A company's market performance is influenced not only by its external environment but also significantly by its internal management and culture [35, 73]. By integrating these two factors, we can gain a more comprehensive understanding of the mediating effect of innovation capability and organizational culture on the adoption intensity of AI and enterprise competitiveness.

The ability to innovate is crucial for developing services and solutions that ensure long-term competitive advantage [79, 80]. Brown [81] observed that in a rapidly changing business environment, firms that can cultivate a culture of innovation are more likely to secure a sustainable competitive edge in the marketplace. This culture of innovation requires not only an open and inclusive atmosphere but also a spirit of risk-taking and experimentation that fosters creativity and initiative among employees. Wang et al. [78] found that R&D investment positively moderates the relationship between IT investment and enterprise performance, suggesting that enterprises need to enhance R&D capabilities to maximize the benefits of AI technology. The innovation capability of enterprises is the core element of maintaining their competitive advantage, serving as a key mediating factor in the relationship between the intensity of AI adoption and the competitiveness of enterprises.

The RBV theory posits that competence is crucial in coordinating organizations to achieve their goals [82, 83]. These competencies include technical capabilities, organizational culture, and innovation capabilities. Resources are valuable, rare, inimitable, and irreplaceable due to their high complexity and uniqueness [84]. Research by Raj & Srivastava [85] revealed that organizational learning mediates the relationship between organizational culture, HRM practices, and innovation. This suggests that organizations should enhance their ability to innovate and remain competitive by fostering a culture of competitiveness and market leadership while providing employees with flexibility, autonomy, and growth opportunities. Gürlek & Tuna [86] noted that a green organizational culture positively affects green innovation and competitive advantage, with green innovation fully mediating the influence of green organizational culture on competitive advantage. This indicates that enterprises should promote innovation by cultivating a green organizational culture to enhance their competitiveness. The power of organizational culture is reflected not only in internal management and employee relations but also in the market performance and competitive advantage of enterprises.

In summary, the integration of AI technology and competitive advantage theory should be promoted [87]. Additionally, attention must be given to shaping and managing organizational culture to ensure its compatibility and adaptability. This includes considering the mediating effect of innovation capability and organizational culture on the relationship between AI adoption intensity and enterprise competitiveness. Therefore, hypothesis H4 is proposed:

H4: Innovation ability and organizational culture have a chain mediating effect on AI applications and enterprise competitive advantage.

In summary, because of competition theory and innovation theory, this paper analyzes the relationships among AI application, innovation ability, organizational culture and the competitive advantage of tourism enterprises and verifies the chain mediating effect of innovation ability and organizational culture. The research hypotheses and research framework are shown in Figure 1.
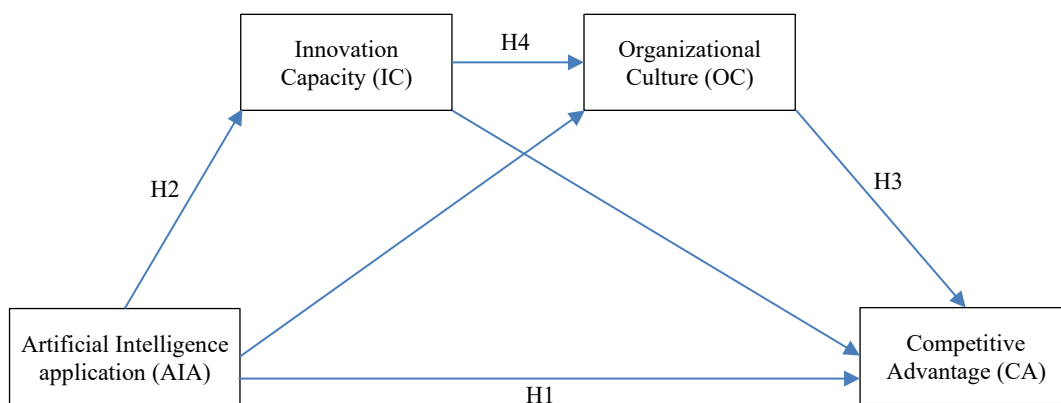

Figure 1. Research model of AI application and competitive advantage

3- Method

Drawing on competition theory and innovation theory, this study examines the impact of artificial intelligence adoption intensity on the competitive advantage of tourism enterprises, mediated by innovation capability and organizational culture. The technical route is depicted in Figure 2. First, the research objectives and questions were formulated based on the research background and problem statement. A research framework was then established through a comprehensive literature review and discussion. Second, to achieve the study's objectives, we employed an

existing maturity scale, modified it to suit this study's requirements, and consulted experts and scholars in related fields for topic review. Subsequently, research subjects were selected, a formal questionnaire was distributed, and data were collected. Third, SPSS software was utilized for data statistics and questionnaire analysis. Finally, based on the analysis results, this paper offers insights into tourism enterprises on adopting artificial intelligence to enhance competitive advantage management.
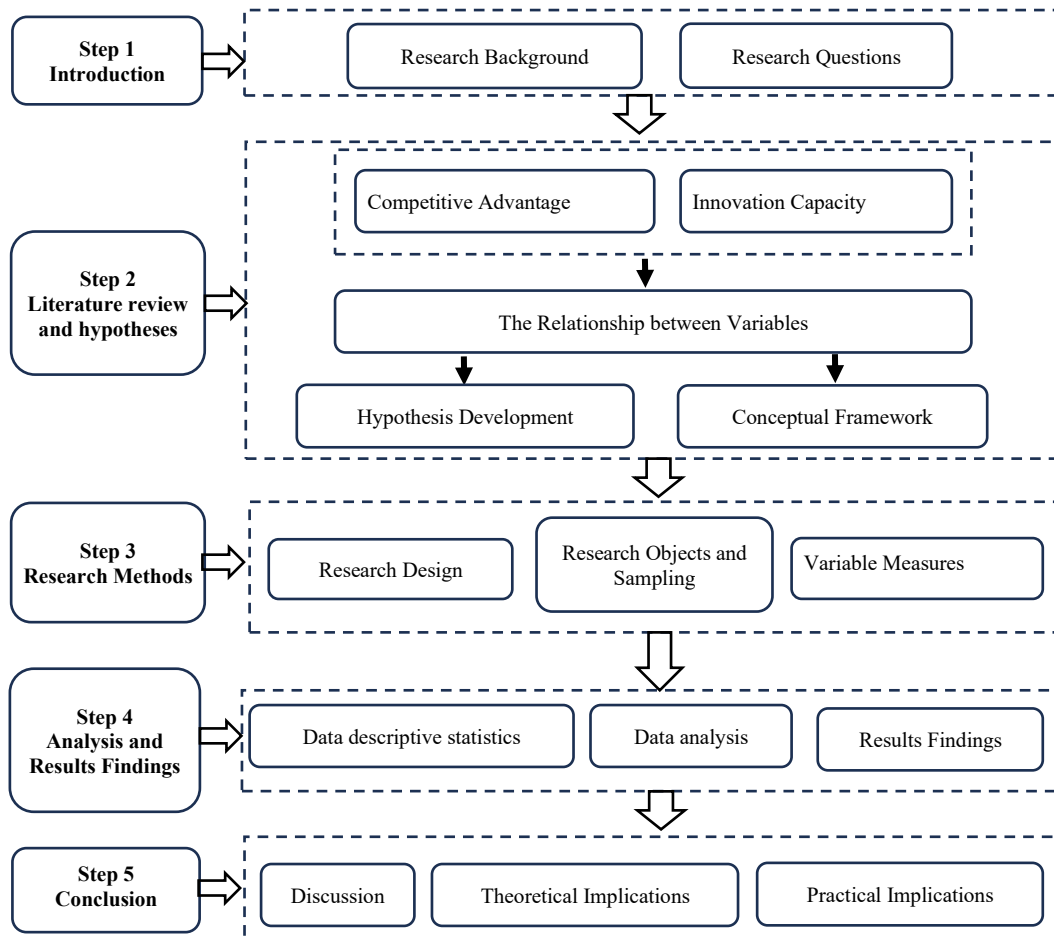

Figure 2. Research roadmap

3-1-Research Objects and Sampling

Yunnan Province, located in Southwest China, boasts abundant tourism resources and leads the country in tourism revenue. Guangdong Province, in South China, shows a promising development trend in the smart tourism industry and has the highest GDP in the nation. Guangxi, also in southern China, is renowned for Guilin, which is considered one of the best tourist destinations in the world. The number of tourists in Guangxi is among the highest, and tourism revenue accounts for 58% of the province's GDP.

The questionnaire survey was conducted using convenience sampling method. Each company issued questionnaires to middle and senior managers, who represent the intensity of AI application adoption and its impact on the company's competitive advantage. A total of 500 questionnaires were distributed both online and offline, with 400 responses received. Of these, 100 questionnaires were rejected due to incomplete information, leaving 400 valid questionnaires, which met the criteria for structural equation modeling data analysis [88].

3-2-Measures

To ensure the rigor of the questionnaire, scholars, professors, and practitioners in related fields were consulted after its design. Following numerous revisions to the questions and grammar, the questionnaire was pretested by 30 professional managers. Statistical analysis of the pretest data was conducted to ensure accuracy, adaptability, and convenience of the questionnaire items. After repeated corrections for semantic appropriateness, the final version of the questionnaire was completed. The questionnaire employs a 7-point Likert scale, where higher numbers indicate stronger agreement with the statement (1 means strongly disagree, 7 means strongly agree). In the questionnaire, the dependent variable is competitive advantage, the independent variable is AI application, and the mediating variables are innovation ability and organizational culture.

The competitive advantage of enterprises refers to the scale developed by Ávila [89] and Zhou & Wu [90], with a total of 5 items. AI applications are scored with reference to the items proposed by Lee et al. [91] for AI application measurement, including natural language processing, computer vision, and machine learning, to evaluate the degree of adoption of three technologies by enterprises (1=no adoption, 2=testing phase, 3=0%–5%, 4=5%–25%, 5=25%–50%, and 6=more than 50%). The reference for enterprise innovation ability is a scale developed by Liao et al. [92] and Ávila [89], with a total of 5 items. Organizational culture refers to the scale developed by Liu et al. [93] and Dubey et al. [94], with a total of 8 items. The control variables are the nature, scale, establishment time, and total operating income of the enterprise. The items for variable measurement are listed in Appendix I.

4- Results and Discussion

4-1- Sample Characterization Analysis

Table 1 shows that 67.33% of the enterprise are private enterprises, 20% are foreign-funded enterprises, 10% are mixed-ownership enterprises and 2.67% are state-owned enterprises. Travel agencies accounted for 67%, hotel accommodations accounted for 30%, tourism product design and development accounted for 1.67%, and scenic spot operations accounted for 1.33%. Enterprise size is 43.33% for medium and medium–sized enterprises, 35.67% for small enterprises, 11.33% for large enterprises and 9.67% for microenterprises. A total of 25.67% was less than 5 years, 48% were 5--10 years, 20.67% were 11-30 years, and 5.67% were over 30 years. A total of 30.67% of enterprise is less than 1 million, 33% is 100-5 million, 500-10 million is (7%) and 9.33% is greater than 10 million. A total of 41.67% of the enterprises were in the mature stage, 41.33% were in the development stage, 15.33% were in the start-up stage, and 1.67% were in the transition stage. In the region, the underdeveloped provinces account for 64%, and the developed provinces account for 36%. Among the questionnaire respondents, 63.24% were males, and 36.36% were females. Sixty-five percent of the respondents were senior managers, 25% were middle managers, and 10% were others; the average age was 38 years.

Table 1. Sample characteristics

Variable	%	Variable	%	Variable	%
Enterprise type		**Enterprise size**		**Corporate capital**	
State-owned enterprises	2.67	Microenterprises	9.67	Less than 1 million	30.67
Private enterprises	67.33	Small business	35.67	100-5 million	33
Foreign-funded enterprises	20	Medium-sized businesses	43.33	500-10 million	27
Mixed-ownership enterprises	10	Large	11.33	More than 10 million	9.33
Enterprise category		**Enterprise age**		**Enterprise maturity**	
Travel agency category	67	Less than 5 years	25.67	Start-up stage	15.33
Hotel accommodation	30	5-10 years	48	Development period	41.33
Scenic spot operation	1.33	11-30 years	20.67	Transition period	1.67
Tourism product design and development	1.67	More than 30 years	5.67	Maturity	41.67

4-2- Confirmatory Factor Analysis

The sample data were analyzed via SPSS 27.0 statistical software, and the mean, standard deviation and correlation coefficient of each variable are shown in Table 2. Table 2 shows that the correlation coefficients between AI application, innovation ability, organizational culture, and corporate competitive advantage range from 0.271--0.492, all of which reach significant levels, indicating that there is a moderate positive correlation between each aspect and entrepreneurial behavior. The Cronbach's α coefficient of each study variable was greater than 0.7, the combinatorial reliability value was greater than 0.7, the average variant extraction amount reached 0.5, and the convergence validity reached the recommended standard of relevant scholars [95]. The discriminative validity was determined via the trust interval method, and the results revealed that the correlation coefficient between the constructs did not include 1 in the upper and lower values after adding or subtracting two standard errors, which met the standard of good discriminative validity. The results showed that the questionnaire had good reliability and validity and that the scale used had good measurement quality.

Considering that each questionnaire was completed by the same respondent, there may be common method bias (CMV) in the data source, and the Harman one-way method was used to solve the problem of common method bias. The analysis revealed that the first factor explained 23.47% of the variance in the case of no rotation, which did not account for the majority, indicating that the common method bias in this study would not affect the results of the study.

Table 2. Mean, standard deviation and correlation coefficient

Variable	Mean	SD	1	2	3	4	5	6	7
1. CA	6.068	0.360	1						
2. AIA	5.963	0.594	0.318**	1					
3. IC	6.019	0.443	0.424**	0.492**	1				
4. OC	6.083	0.394	0.294***	0.255***	0.271**	1			
5. Enterprise type	8.614	4.885	0.233***	0.217***	0.068	0.258***	1		
6. Enterprise size	28.413	6.342	0.203***	0.246***	-0.007	0.261***	0.374***	1	
7. Enterprise age	3.344	0.906	0.114*	0.158**	0.135*	0.143**	0.163**	0.022	1
Cronbach's α			0.852	0.930	0.901	0.835			
CR			0.913	0.933	0.951	0.962			
AVE			0.601	0.637	0.682	0.676			

*Notes: N=400. *p <0.05, **p <0.01, ***p < 0.001. Notes: AIA is an artificial intelligence application. IC is innovation capacity. OC is the organizational culture. CA is a competitive advantage.*

4-3- Direct Effects

The results revealed that the fit index of the four-factor model was significantly greater than that of the alternative factor model ($\chi 2/df$ = 1.156, RMSEA=0.023, SRMR=0.028, CFI=0.915, TLI=0.920), indicating that the fit index of the four-factor model was good and that the discriminant validity between the variables was good. Hayes & Scharkow [96] proposed Model 6 in the PROCESS statistical analysis software to test the hypothesis of the sample data, and the results are shown in Table 3. The nature, scale, establishment time and total operating income of enterprises were used as control variables to verify the impact of AI application, innovation ability, organizational culture and competitive advantage of tourism enterprises, and the results revealed that the impact of AI application on enterprise competitive advantage ($\beta=0.193***$, $t=6.126$) had a positive and significant impact, indicating that the application of AI directly affects the competitive advantage of tourism enterprises.

4-4- Mediating Effects Analysis

The nonparametric bootstrap method was used for the mediating effect test, and the bootstrap sample sampling was set with a 95% confidence interval. The results are shown in Table 3. The mediating effect of innovation ability on AI application and enterprise competitive advantage was ($\beta=0.157***$, $t=4.347$), 95% CI= [0.075, 0.254]. None of the confidence intervals include zeros, and H2 is supported. The mediating effect of organizational culture on AI application and enterprise competitive advantage was ($\beta=0.028***$, $t=5.683$), 95% CI= [0.003, 0.064]. None of the confidence intervals included zero, and H3 was supported. The mediating effect of innovation ability and organizational culture on AI application and enterprise competitive advantage was $\beta=0.016$, $t=2.184$), the 95% CI= [0.002, 0.035] confidence intervals did not include zero, and H4 was supported. Therefore, innovation ability has a mediating effect on AI application and enterprise competitive advantage, organizational culture has a mediating effect on AI application and enterprise competitive advantage, and innovation ability and organizational culture have a chain mediating effect.

Table 3. Results of bootstrapping

Hypothesis	Effect	Path	Bootstrap		95% CI		Result
			Estimate	Standard error	Lower	Upper	
H1	Direct effect	AIA→ CA	0.193	0.034	0.127	0.259	Supported
H2		Lnd1: AIA →IC → CA	0.157	0.047	0.075	0.254	Supported
H3	Indirect effect	Lnd2: AIA → OC → CA	0.028	0.016	0.003	0.064	Supported
		Lnd1- Lnd2	0.129	0.050	0.340	0.229	
H4		Lnd3: AIA → IC → OC → CA	0.016	0.009	0.002	0.035	Supported
		Lnd1- Lnd3	0.140	0.047	0.059	0.240	
		Lnd2- Lnd3	0.011	0.017	-0.019	0.048	

Notes: AIA is an artificial intelligence application. IC is innovation capacity. OC is the organizational culture. CA is a competitive advantage.

4-5- Robustness Test

This paper tests the chain mediation effect between innovation capability and organizational culture using stepwise regression to ensure the reliability and robustness of the research findings. The results are presented in Table 4.

Table 4. Robustness test results

	CA	IC	CA	OC	CA	OC	CA
Enterprise type	-0.049	0.034	-0.062	0.017	-0.053	0.008	-0.063
Enterprise size	0.091	-0.050	0.110	-0.019	0.096	-0.006	0.111
Enterprise age	-0.090	-0.040	-0.075	0.030	-0.097	0.041	-0.081
AIA	0.316***	0.320***	0.193***	0.258***	0.254***	0.171**	0.167**
IC			0.383***			0.273***	0.342***
OC					0.239***		0.150**
R²	0.105	0.106	0.236	0.068	0.158	0.135	0.255
F	8.451	8.563	17.786	5.298	10.815	8.969	16.402
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: N=400. $^*p <0.05$, $^{**}p <0.01$, $^{***}p < 0.001$. Notes: AIA is an artificial intelligence application. IC is innovation capacity. OC is the organizational culture. CA is a competitive advantage.

5- Conclusions

In the age of intelligence, artificial intelligence presents both opportunities and challenges for human society, and practical evidence indicates that AI applications can significantly enhance the competitive edge of businesses. This research is the first to investigate the influence of AI implementation on the competitive advantage of tourism companies, drawing data from 400 surveys conducted across three provinces in China through a questionnaire. The findings confirm that AI utilization positively and substantially impacts innovation capabilities, organizational culture, and the competitive advantage of firms, aligning with previous studies [1, 18, 21]. Specifically, AI applications in the tourism sector can streamline resource allocation and foster innovative capabilities [21, 38, 62], thereby reinforcing organizational cultural norms and driving changes that amplify competitive advantage.

Moreover, the study demonstrates that both innovation capabilities and organizational culture exert a significant positive influence on a firm's competitive advantage, building upon earlier research [74, 89, 92]. Additionally, it reveals that innovation capabilities mediate the relationship between AI application and competitive advantage, while organizational culture also serves as a mediator in this dynamic. Furthermore, both innovation capability and organizational culture collectively exhibit a chain mediating effect. This research highlights the critical roles that innovation capability and organizational culture play in linking AI application to the competitive advantage of enterprises, broadening the understanding of AI's role within the tourism industry and elucidating the mechanisms through which AI affects competitive advantage, thus contributing valuable theoretical and practical insights.

5-1- Theoretical Implications

This study presents a research model that positions innovation ability and organizational culture as chain mediators between AI application and enterprise competitive advantage. It enriches the competition theory model by elucidating the relationships among AI application, innovation ability, organizational culture, and enterprise competitive advantage. Furthermore, it uncovers the chain mediating mechanism involving innovation ability and organizational culture in the context of AI application and competitive advantage. This paper extends the application of AI at the organizational level, incorporating the innovation scenarios of the AI era into the research discourse, thereby broadening the scope of competition and innovation theory.

Based on sample data from tourism enterprises in Yunnan, Guangdong, and Guangxi, China, AI applications have been shown to enhance enterprise innovation capabilities, service quality, and competitive advantages [22]. AI applications can assist individuals through AI-based chatbots for travel planning services [62] and can also promote innovation and organizational culture change at the organizational level. This transformation positively affects the interaction experience with users and suppliers, as well as user engagement [61]. This study provides a valuable supplement to competition and innovation theories, demonstrating that the positive effects of AI application on competitive advantage are also applicable in the tourism industry.

This study explores the mediating role of innovation ability and organizational culture in extending the application of innovation theory within AI management [39, 74]. By expanding on innovation diffusion theory and considering technological threats and temporal dynamics, the study finds that AI's relative advantages, compatibility, and observability positively influence employees' attitudes toward AI adoption. It proposes that AI applications offer a powerful and emerging theoretical perspective for innovation research. Furthermore, the study compares a model where innovation ability and organizational culture serve as dual-chain mediators in AI application with models addressing the needs of individuals and organizations. It reveals that the mediating effect of individual needs is the most significant.

The findings suggest that dual-chain mediation is a superior intermediary variable for explaining how AI application affects the competitive advantage of tourism enterprises. Lastly, the relevance of core competition theory and innovation theory in the AI domain should be further verified [51, 75].

5-2- Practical Implications

Enterprise managers should select the appropriate path for AI adoption based on their specific circumstances. Firstly, the application of AI is influenced by multilevel and multifactor interactions, rather than a single level or factor. It follows a dual-chain intermediary path involving innovation capability and organizational culture. Secondly, enterprises should thoroughly consider the environment and development trends, choose the most suitable driving path, and enhance it in a targeted manner to achieve AI that is "desired, daring, usable, and sustainable." Thirdly, enterprises should evaluate their current technological capabilities and resources, identify areas of technological infrastructure that require investment and improvement [82], leverage external resources such as government support, introduce new technologies and facilities, and allocate R&D funds for technological innovation. Fourthly, enterprises should establish an employee education and training mechanism to enable employees to participate in the identification and experimentation of AI applications. This will improve the technical capabilities of all employees and encourage the formation of cross-functional teams comprising application developers, data scientists, data engineers, business developers, and business experts to envision, build, deploy, and operate AI in a more rapid and scientific manner.

In the era of the digital revolution, the nature of innovation, technology, and markets has undergone significant changes, rendering traditional innovation methods and processes obsolete [97-99]. Although the implementation of AI in tourism enterprises is still in its early stages and faces challenges such as privacy and cybersecurity concerns, AI-driven innovation can enhance enterprise competitiveness and promote sustainable development. Enterprises should proactively incorporate AI across all dimensions of innovation, rapidly upgrade and iterate new products, and foster creative knowledge, motivation, and capability. This approach is beneficial for improving innovation efficiency and effectiveness, thereby strengthening overall competitiveness.

5-3- Limitations and Future Research

This study is constrained by limited resources and may not encompass all tourism enterprises and managers, potentially leading to sample selection bias. Consequently, the study's findings may only be representative of a specific region or type of tourism enterprise, and caution is advised when generalizing these results to other regions or business types. Future research should further investigate the distinct roles of various types of organizational culture in this process and explore how to optimize AI application through cultural development and innovation management.

6- Declarations

6-1- Author Contributions

Conceptualization, C.H. and H.B.; methodology, C.H.; software, H.B.; validation, C.H., H.B., and S-Z.H.; formal analysis, C.H.; investigation, C.H.; resources, C.H.; data curation, H.B.; writing—original draft preparation, C.H.; writing—review and editing, H.B.; visualization, C.H.; supervision, H.B.; project administration, S-Z.H. All authors have read and agreed to the published version of the manuscript.

6-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6-4- Institutional Review Board Statement

The study was approved by the Institutional Review Board of the Walailak University with the IRB certificate number "WUEC-25-057-01".

6-5- Informed Consent Statement

Not applicable.

6-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I: Variable and Measurement

Variable	Measurement
Competitive Advantage (CA)	1. In terms of R&D, the company outperforms its competitors. 2. The company demonstrates superior capacity management compared to its competitors. 3. The company achieves greater profitability than its competitors. 4. The company's corporate image is more favorable than that of its competitors. 5. Competitors struggle to attain a competitive advantage over my company.
Artificial intelligence application (AIA)	1. Natural language processing (NLP, i.e., speech and pattern recognition and chatbots). 2. Computer vision (CV, i.e., image labeling, image recognition). 3. Machine Learning (ML, i.e., Recommendation and Prediction)
Innovation Capacity (IC)	1. The ability to innovate is a key factor in recruitment. 2. In general, our company encourages employees to be innovative. 3. Our company always facilitates the acquisition of new skills or equipment to improve manufacturing operations or service-oriented processes. 4. New skills are constantly evolving, transforming old products into new ones, and innovating my products are market-oriented. 5. Compared with competitors, our company has superior R&D capabilities in new products or services.
Organizational Culture (OC)	1. The glue that unites our organization is loyalty and tradition, with a commitment to run high. 2. Our organization is a very dynamic and entrepreneurial place where people are willing to take risks. 3. The glue that binds our organization together is a commitment to foster innovation and development, with an emphasis on products and services. 4. Our organization emphasizes the importance of growing by developing new ideas, generating new products or services. 5. The glue that holds our organization together are formal rules and policies, and it's important to follow them. 6. Our organization emphasizes persistence and stability, and efficiency is important. 7. Our organization is a very production-oriented place, and people care about getting the job done. 8. Our organization emphasizes results and achievements, and it is important to achieve goals.