

TECHNICAL RATIONALITY AND CULTURAL SENSIBILITY: THE LIMITATIONS OF AI TRANSLATION AND THE ADAPTATION PATH OF HENAN'S LOCAL CULTURAL INDUSTRY DEVELOPMENT

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ABSTRACT

With the growing use of artificial intelligence (AI) translation technologies in the development of local cultural industries, their application in local cultural communication has demonstrated clear advantages in efficiency, while also revealing significant challenges related to cultural adaptation. This research analyzes the tension between the technical rationality of AI translation and the cultural sensitivity required for the development and dissemination of local culture. Drawing on case comparisons and in-depth interviews, the author finds that AI translation may lead to semantic distortion, emotional loss, and cultural stereotyping when dealing with dialects, intangible cultural heritage terminology, international communication, and local cultural narrative styles. These limitations make it difficult for AI translation to fully meet the industry's core needs for cultural authenticity, narrative depth, and emotional connection. Therefore, this research proposes an adaptive pathway based on human-AI collaboration. In the short term, the process of "AI-assisted initial translation followed by expert review" should be optimized. In the medium term, diversified corpora covering different local cultural themes should be developed. In the long term, interdisciplinary teams of "cultural translators" should be cultivated. Ultimately, this approach can help transform AI translation from a mere substitute tool into an enhanced assistant, thereby supporting higher-quality and more sustainable development of local cultural industries.

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1. INTRODUCTION

With the rapid advancement of globalization, the demand for cross-linguistic communication across different fields is increasing. As a key tool for promoting the development of local cultural industries and facilitating economic exchange, translation has become increasingly important. The emergence of artificial intelligence (AI) translation technology, with its efficiency and speed, has significantly reduced translation costs and improved

translation productivity. Simultaneously, it has brought major changes and challenges to the development of translation, affecting human and machine translation practices. However, although AI translation has made considerable progress and has reduced the investment required for language conversion, its quality still cannot fully meet the requirements of overseas cultural enterprises or the high-quality development needs of local cultural industries. This highlights the indispensable role of post-translational editing.

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Therefore, research into the limitations of AI translation and the necessity of evaluating post-translation editing is of great significance for improving translation quality and promoting the high-quality development of the cultural industry.

Through the dual waves of globalization and digitization, local cultural industries have become one of the most important fields, which highlight cultural uniqueness and promote economic development. Translation becomes an indispensable bridge for transforming local cultural resources (e.g., intangible cultural heritage, local folklore, characteristic crafts, and local knowledge) into cultural products and services that can be disseminated and consumed in the diverse digital context. However, there is a natural gap between the "universality" of technology and the "particularity" of culture, especially local culture with very special dialect characteristics, for the core values of the local cultural industry lie in its authenticity, uniqueness, and emotional resonance, which requires translation to be the transformation of languages and symbols, the transmission of meaning and connotations, the restoration of context, and the regeneration of emotions. Nowadays, many experts and overseas companies complain that AI translation pursues standardization and efficiency, when it encounters cultural content that emphasizes personality and depth of local culture and geography, its limitations, and the contradiction gap between them is immediately exposed. These limitations are not merely technical flaws; rather, they are fundamental issues related to whether culture can be accurately perceived, understood, respected, expressed, and transmitted.

Therefore, the main research questions are as follows:

- What are the deep-level technical and cultural limitations of AI translation when it processes local cultural content
- How do these limitations conflict with the actual needs of local cultural development and related industries?
- Furthermore, is it possible to identify an adaptive development pathway that can both make use of technological efficiency and ensure cultural quality from theoretical and practical perspectives?

2. MATERIALS AND METHODS

Local cultural contexts include various elements, such as social customs, core values, and historical backgrounds, all of which have a profound impact on the understanding and expression of language and meaning. AI translation systems often struggle to adapt to geographical and cultural differences across different contexts. As a result, they are prone to misunderstanding and mistranslation when dealing with dialectical cultural backgrounds and culturally specific texts. Furthermore, the logographic writing system of the Chinese language is regarded as one of the most complex and distinctive in the world. Translating Chinese idioms presents a major challenge,

as the meaning conveyed in the source text often does not fully correspond to that of the translated version.

2.1 Overview and Theoretical Framework

Most previous studies have focused on the general contribution of AI translation and its potential to replace human translation. Some scholars have examined the technical evaluation of AI translation, while others have explored the cultural industry from a macro-level perspective. However, research that combines these two dimensions and focuses specifically on the micro-level context of "local culture" remains insufficient. Particularly, there is still a lack of systemic analysis from the perspective of the entire local cultural industry chain, including production quality, dissemination effects, consumption patterns, and audience acceptance, as well as from the perspective of multiple stakeholders. This research seeks to address this gap by constructing an analytical framework that connects technical critique with cultural needs.

2.1.1 The Current Study on AI Translation Technology

Current mainstream research on AI translation technology is based on training with massive parallel corpora. Through deep learning models, AI translation systems learn statistical patterns and mapping relationships between languages. Their advantages lie in speed and high consistency when processing large-scale, clearly structured texts with sufficient contextual information. However, scholars and translation professionals generally agree that AI translation has several limitations. These include weak performance in processing "long-tail" language phenomena beyond the scope of training data, such as slang and newly coined words; insufficient understanding of deep semantic meaning and textual logic; a tendency toward a "neutral" or "average" translation style; and an inability to perform genuine cultural reasoning or creative transformation.

2.1.2 The Characteristics of Local Cultural Industries and the Realistic Needs of Dual-cycle Development

Most scholars emphasize that local cultural industries are strongly place-based, context-dependent, and closely connected to living forms of cultural inheritance. Their content is often rooted in specific geographical, historical, and community environments. As a result, discussions of local cultural translation tend to focus primarily on cultural sensitivity, while paying less attention to technological rationality. When cultural translation involves a large number of culture-loaded words, concepts, and definitions, translation studies emphasize that translation is a form of cross-cultural communication. It requires strategic choices between domestication and foreignization. This places extremely high demands on translators: they must be bilingual, possess bicultural competence, and be able to act as cultural mediators and interpreters.

2.2 The Main Overview of AI Translation Quality

AI translation offers a more structured format and significantly faster processing speed from the surface perspective. However, only human translators can accurately interpret and convey the creative and contextual depth of the original content. While AI translation often appears comparable to human translation in terms of basic output, its underlying algorithm remains a programmed system that cannot fully capture the expressive depth and nuance of human translation. AI translation essentially functions as a database-based system that establishes links between two languages. By contrast, human translators can convey a richer range of emotions, contextual meanings, and cultural nuances based on the original text. The main problems of AI translation can be summarized in the following three aspects.

First, the apparent misinterpretations of AI translations and the loss of local cultural elements in the communication process are the primary challenges in translating Chinese texts.

Kang and Yang (2022) have proposed various theoretical frameworks for Chinese translation and stressed that Chinese idioms should be categorized based on their structure and connotative meaning. Based on this classification, different translation strategies, such as literal translation, free translation, or a combination of the two, can be applied to maintain a balance between the emotional and cultural elements of the original text and those of the translated version. Crack and Tesseur (2020) examined cultural and linguistic dynamics within the framework of sustainable national development and pointed out that, since employees of international non-governmental organizations (INGOs) come from diverse cultural and linguistic backgrounds, translation and interpretation play a crucial role in multilingual development projects. One key issue in such translation practices is the failure to translate certain official documents into local languages, which may reduce the effectiveness of development initiatives.

Second, translation quality is limited by the quality of pre-translation settings, the preparation of specialized corpora, and the effectiveness of algorithmic upgrades.

For local cultural content that requires a high degree of accuracy, such as professional terminology, legal texts, and literary works, AI-based instant translation may produce numerous mistakes and significant errors. Zhao (2022) analyzed the respective strengths and limitations of human and machine translation. Compared with human translators, machine translation offers a more structured format and significantly faster processing speed. Zhao et al. (2023) explored the global dissemination and communication of China's cultural heritage, including the use of information technology. Their study emphasizes the importance of developing museums and creative industries, such as cultural production and design. Lu (2023) illustrated how Chinese culture can be effectively communicated through the example of cultural tourism in Shandong Province,

stressing that this cultural heritage has significant academic and practical value and deserves broader recognition within the global community.

Given China's rich cultural and creative resources, it is essential to present its cultural identity with high quality and accurate translation expression. For instance, Henan Provincial Museum houses a vast collection of ancient artifacts that reflect the nation's profound historical and cultural legacy. The language translation industry in this region is regarded as one of the most important means of communication and cultural knowledge transmission for international audiences. Local cultural products rooted in specific geographical and historical contexts, including literature, films, animation, and video games, have been integrated into the broader entertainment industry. The advancement of information technology has facilitated cross-cultural exchange and contributed to the formation of a global information network. In this context, the more professional and extensive the AI translation corpus is at the initial stage, and the more thoroughly large-scale models are trained, the more likely the resulting translation quality is to approach the standards required by the cultural industry in practice.

Lastly, the professional training of AI translation is in shortage of cultivation standards, and the diverse translation versions are the main bottleneck of overseas companies.

Kerimbaev et al. (2020) investigated the process of learning Chinese in Central Asia. The expansion of trade and economic relations with China has significantly contributed to the growing interest in Chinese language learning in the region. Chinese enterprises operating globally tend to prioritize candidates who possess proficiency in the Chinese language during the recruitment process. Currently, Chinese language instruction is widely offered in public and private higher education institutions, Confucius Institutes, and dedicated Chinese language centers. A distinguishing feature of Confucius Institutes is that, in addition to language instruction, they also provide cultural education. Through activities such as celebrating Chinese national holidays and introducing traditional customs, songs, dances, and poetry, these institutions deeply engage with and introduce Chinese culture to the overseas students. These higher-level professional training programs in Confucius Institutes are effective communication methods, which serve as key channels for promoting traditional Chinese culture and advancing China's soft power strategy.

2.3 Methodology

To conduct a thorough and comprehensive examination of the research questions, this research pays particular attention to recent studies exploring the evolving relationship between traditional human translation and AI translation. It also incorporates an analysis of the Belt and Road Initiative of the People's Republic of China, a strategic program aimed at promoting balanced and sustainable development across countries on multiple

continents while emphasizing the preservation and global dissemination of China's cultural heritage.

Typical cases and comparative approaches to processing Chinese-language texts were examined through systemic analysis. This made it possible to identify limitations inherent in emerging AI technologies and traditional human translation methods. Based on this review, potential solutions to challenges in the language industry were identified. The main forms of AI-assisted translation and predictive algorithms for Chinese were also synthesized, considering the language's unique linguistic characteristics. This was done to optimize system parameters and better reflect culturally specific and personalized traditions and concepts.

Inductive reasoning was applied to synthesize insights from individual facts and specific problem areas, leading to a general conclusion regarding the importance of developing language services in the context of cross-cultural information exchange between countries. Cultural translation was examined as a form of communicative activity, defined as the exchange of information between representatives of different cultural backgrounds.

Deductive reasoning was employed to analyze the challenges involved in translating complex languages and to evaluate potential solutions. The method of concretization was used to illustrate specific examples of neural machine translation models and algorithms, as well as different approaches to Chinese text processing and their practical implementation. In addition, a natural language processing method based on a knowledge repository of Chinese linguistic features was introduced. A comparative analysis was conducted to investigate current translation practices in the development of Henan culture and to identify common challenges in processing translations involving these languages. The linguistic differences between Chinese and English were examined, particularly in terms of their impact on intercultural communication in both AI translation and human translation.

Using the method of generalization, this research identifies difficulties relevant to linguistic activity, as well as notable achievements and best practices in the translation industry that may be applied in practical contexts. The logical relationship between Henan culture and its linguistic carrier is also explored, along with the cultural nuances that emerge when translating Henan cultural content into Chinese and other languages.

This research collected the original Chinese copywriting used in the selected cases, the initial translations produced by mainstream AI tools (e.g., ChatGPT-4, DeepL, and Wenxin Yiyan), and the final versions adopted by professional translators. A detailed comparative textual analysis was then conducted to identify and code different types of translation errors.

The research also conducted in-depth interviews with 12 participants, including three local cultural practitioners,

three cultural industry managers, three local cultural scholars or professional translators, and three foreign tourists or consumers. The interviews focused on participants' perceptions of AI translation, their experience of using it, their main sources of dissatisfaction, and their core expectations regarding translation quality.

Additionally, the researchers participated in a collaborative human-AI translation project involving intangible cultural heritage materials. This made it possible to observe, in practice, both the points of friction and the forms of collaboration that emerged within the translation workflow. The methodological approaches used to account for economic entities, as presented in Table 1, are discussed in detail below.

3. RESULTS

Through the analysis of case texts and interview materials, the limitations of AI translation were found to be reflected mainly at the following three levels.

3.1 The Limitations of AI Translation: The Conflict Between Technical Rationality and Local Cultural Sensitivity

3.1.1 Language and Symbol Layer: Invalidity of "Non-standard" Information

Local cultural texts are rich in dialect vocabulary, archaic expressions, specialized industry terminology, and the distinctive rhythm of oral literature. AI translation systems often struggle with such "non-standard" information, especially when they have not been trained on similar themes or fields.

According to the data analysis, most participants agreed that AI translation offers numerous advantages and is mainly represented by neural machine translation and speech recognition technologies. It performs effectively in everyday communication contexts where extremely high translation quality is not required. However, it remains inferior to human translation, particularly when dealing with complex texts that require the accurate preservation of lexical meaning, logical relationships, and cultural nuance. The integration of post-editing workflows and a clear division of labor between human translators and machine systems can help address these limitations. The quality of AI translation is directly influenced by the type of text being processed. Since AI translation primarily serves the functions of information retrieval and process acceleration (Table 1), participants showed different tendencies in its use, depending on their individual needs and professional backgrounds. This suggests that AI translation is mainly suitable for basic and relatively simple cultural texts, rather than culturally dense or highly specialized materials.

Table 1. The mode and usage tendency of AI translation

Number	AI translation mode	The usage mode description of AI translation	Tendency of market usage in the culture industry
1	Direct translation	High efficiency at low cost	91.67% participants will choose to support for free.
2	Secondary translation	The human translator does primary translation, and the AI machine is a secondary tool	66.67% participants will choose to accept specific cultural product requirements.
3	Modular translation	Mixed translation, using both humans and software	58.33% participants will choose to use for a higher-level translator profession quality.

Source: Developed by the authors.

Despite the limitations of AI translation, its role in facilitating intercultural communication remains highly significant due to its free cost and efficiency benefits. When integrated with human translation, it contributes to improving the communication quality of cultural

products and enhancing a nation's international image and cultural influence. However, excessive reliance on AI and machine translation in Chinese tradition (Fan & Yun, 2022) should be reconsidered based on its translation principles and focus usage (Table 2).

Table 2. Principles of AI and machine translation usage

Number	Main principles	Focus on translation usage	Delphi ranking
1	Importance principle	Translation versus original	5.0
2	Responsibility principle	The translator who is responsible for the translation	4.5
3	Loyalty principle	for interpersonal, client, translator	4.3
4	Principle of justice	translator's interests	4.1
5	Principle of harmonic ethical relations	Stakeholders	3.5
6	Potential risks of other non-ethical behaviour	linguistic diversity and creative expression	2.9

Source: Compiled by the authors based on (Fan et al., 2022).

As shown in Table 2, the Delphi ranking of these principles indicates that participants expressed different concerns regarding the principles of AI translation. It can also be seen that language translation serves the development of local culture not only as a medium for transmitting information, but also as a fundamental carrier of national cultural identity. When working with cultural texts, translators inevitably engage with the cultural and social contexts embedded in the source material. However, different principles for using AI translation may lead to different levels of translation quality problems.

3.1.2 Culture and Meaning Layer: The Gaping Between “Deep Context” and the Flattening of Imagery

AI equipment and agency cannot understand the history, legends, and collective emotions behind cultural symbols, causing the translation to stay on the surface and even produce misreading. For example:

- **Image distortion.** Simply translating “龙纹” which is very common to see in Henan museums and Henan local cultures as “dragon pattern” in English may cause negative associations in the Western context, but fails to convey its symbol of “power and auspiciousness” in Chinese culture. Professional translators may avoid these twisted images during their translation practice and add or adjust the expression.

- **Narrative fracture.** Henan local legends and Yellow River stories often have non-linear and metaphorical narrative characteristics. Most participants agree that AI translation tends to reorganize them into a linear narrative that conforms to the logic of the target language, weakening their original sense of mystery and narrative charm, especially since automatic translation always leads to expressions that are regarded as twisted or wrong in local people's understanding.
- **Lack of emotion and style.** For the translation of Henan local folk songs, AI can rhyme and convey the literal meaning accurately, but according to the interview, most participants agree that AI translation cannot express the ‘wild’ energy and earthy aura of the original song's meaning. This unique style and emotional color are the soul of Henan local culture.

To ensure the full appreciation of this unique cultural expression by an international audience, accurate and culturally sensitive translation is essential for effective cross-cultural communication (Table 3).

As shown in Table 3, most participants agreed that AI translation is widely used in international cultural activities and functions as part of a dynamic interaction among cultural products, translators, and the market. Many translation problems may be observed but overlooked when they do not directly affect the sales performance of cultural products.

Table 3. AI Translation Strategies

Number	The Ranking of AI translation strategies	Main characteristics	Percentage of participants
1	Literal translation	Translation is nearly identical to the source text	100%
2	Equivalence	Translation has the same meaning and function as in the source text	91.67%
3	Substitution	The target text uses the source text words	83.33%
4	Explication	Used to explain a cultural concept with several phrases	75.0%
5	Omission	Cultural link is fully excluded	66.67%
6	Adaptation	For the target language and culture to determine meanings, comparable to the original	58.33%
7	Substitution of the cultural term by deictics	Especially when combined with an on-screen gesture or visual cue	50.0%
8	Generalization	Neutralization of the original	41.67%

Source: Developed by the author.

Based on the sales performance of cultural products and the practical needs of the cultural industry, participants generally considered certain AI translation strategies (e.g., literal translation, substitution, and omission) to be acceptable in specific contexts.

3.1.3 Ethics and Creativity: Cultural Stereotyping and the Strangulation of Innovation

- **The mediocrity of “safety”.** To avoid translation mistakes, AI tends to choose the most common and “safe” translation terms, this will cause the translations of all local cultures to express the same from AI translation responses for users, by obliterating uniqueness and forming the wrong language modal logic. Most participants point out the fact that AI translation will use the wrong mode and wrong logic expression on local culture translation again and again, which generally leads to the spread of misinformation about translation quality among different cultural product markets.
- **The digestion of subjectivity.** The translation process is the process of self-interpretation and re-

creation of cultural subjects. Relying entirely on AI is tantamount to ceding part of the right of cultural interpretation to an algorithm that does not have cultural subjectivity. In the long run, it may weaken the interpretation ability and inheritance motivation of the cultural community.

The objective of translation, particularly in the context of Chinese cultural texts, is to convey the richness and aesthetic value of Chinese civilization. However, due to the unique characteristics of the Chinese language, direct or literal translation often fails to capture the depth, nuance, and diversity of its ancient cultural heritage. Consequently, such translations may lack accuracy and fail to represent the original message fully. Therefore, when translating culturally embedded texts, it is essential to employ a range of translation strategies that enable speakers of other cultures not only to understand the literal meaning of the source text but also to grasp its deeper cultural significance (Sheng & Kong, 2023) (Table 4).

Table 4. Translation Characteristics of Tourist Attractions in Henan Province

Number	Items	ChatGPT	DeepL	Comparative analysis
1	Lexical peculiarities	“Yin ruins in Anyang” “Peach Blossom Valley in Zhengzhou” Xinyang Nanwan Lake in summer is like a huge gem encrusted among green mountains and ridges. Suixianqiao Village, Tea Culture Street, Loufang Village Pastoral Youth, Hejiazhai Campground, Jiamu Tea Estate...	“Anyang Yin Ruins” “Zhengzhou’s peach blossom valleys ‘rich and heavy human heritage’” In summer, Xinyang Nanwan Lake looks like a big pearl nestled between green hills and verdant mountains. Xianqiao Village Tea Culture Sleeping Street, Fanghua Lu Fangfan Village Garden, Hejiazhai Holiday Base, Jiamu Drinking Tea Estate.....	Both translations use beautiful words that emphasize the features of the sights, but do not fully convey the historical significance of the cultural heritage and its correct name.
2	Syntax peculiarities	The mighty Yellow River flows... “Songs for the People” was performed at the Henan Museum.	A yellow river flowing staged at the Henan Museum	Translations of tourist attractions present information in the form of simple sentences. ChatGPT uses more verbs, while DeepL uses participles to convey meaning. In both cases, there are few conjunctions between sentences.

3	Cultural peculiarities	Luoyang Museum of Ancient Tombs launched the scenario “How many towers in the fog and rain” Blue-and-white porcelain smoker from Northern Song Jingdezhen kiln, blue-and-white bowl with water crab from Ming dynasty Jingdezhen kiln, green glaze dripping glass, with a Ming dragon pattern, a blue and white number one cup from the Jingdezhen kiln of the Ming dynasty, a celadon-colored bowl with story patterns from the Lunquan kiln of the Ming dynasty...	Luoyang Museum of ancient tombs launched a murder scenario, “How many platforms under the smoke rain” Northern Song Dynasty green and white porcelain incense burner, Ming Dynasty blue and white porcelain cup with floating crab, green glaze drip bowl with dragon, Ming Dynasty blue and white porcelain cup, Ming Dynasty green porcelain cup Longquan Dynasty green porcelain cup with the story...	When translating the names of cultural values, there are significant differences in the wording of the names. There are also words used that are not inherent to traditional Chinese culture.
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Source: *Compiled by the authors based on (Sheng et al., 2023).*

Based on the case comparison analysis presented in Table 4, most participants agreed that the primary responsibility of a cultural translator is to facilitate the exchange of intercultural knowledge. In this context, the training of highly qualified AI translation professionals is critically important. The acquisition of translation skills is grounded in the practical application of theoretical knowledge and real-world experience. This can be effectively achieved only through a well-balanced

curriculum supported by the active engagement of trainers and instructors (Sun, 2020). To enhance translation accuracy and consistency, various typologies of culture-specific items (CSIs) have been developed. These classification systems are based on a comparative analysis of the cultural elements present in the source text (ST) and their corresponding representations in the target text (TT) (Table 5).

Table 5. Typologies of Cultural Translation Concepts

No.	Typologies	Main characteristics
1	Preservation	Preservation (transliteration, transposition, borrowing) of the CSI phonetic form of the source language (SL) or its adaptation.
2	literal translation	literal translation, which involves borrowing the structure of the lexical item rather than the phonetic form, as seen in retention.
3	Neutralization	Description: Explanation of cultural words, phrases, and rhetorical expressions in their own words Detailing: use of a generic or more general ST element (hypernym) instead of a more specific one in TT Generalization: replacing a specific element of the ST (hyponym) with a more general item in the TT.
4	Hyperonization	Extension refers to the expansion of culture-specific items (CSIs) from the source text (ST) in the target text (TT) to reveal their implicit meaning and remove ambiguity. It involves the deliberate addition of certain words or explanations to the translation, making the target text longer than the original. By contrast, condensation involves reducing the amount of information in the target text compared with the source text.
5	Intracultural Adaptation (IA):	The CSI source text is replaced by another term in the source language that is more familiar and acceptable in TC.
	Substitution	Using a TLC word/phrase/concept that is familiar and roughly equivalent to an SLC word/phrase/concept.
	Omission	Excluding ST CSI from the target text or removing elements considered unimportant and redundant from the translation

Source: *Compiled by the authors based on (Amenador & Wang, 2022).*

As shown in Table 5, culture-specific item (CSI) translation strategies are assessed according to two key criteria: the preservation of the distinctive cultural elements of the source culture and appropriate adaptation to the target culture. In other words, effective translation should ensure that the cultural significance of the original content is retained without compromising comprehensibility and relevance for the target audience (Amenador & Wang, 2022).

Based on the data analysis above, any discussion of AI translation in support of Henan local cultural

development should reconsider the uniqueness of Henan Province. Henan is rich in natural landscapes as well as historical and cultural sites along the Yellow River. It is also a significant region for cultural tourism, and government support has contributed to both pedagogical development and the cultivation of respect for and appreciation of Chinese cultural heritage among students (Fu, 2022).

On the other hand, Henan culture encompasses a vast collection of classical texts associated with ancient Chinese capitals. Despite the challenges involved in their

translation and interpretation, these texts serve as a valuable repository of historical and cultural knowledge. Ancient Chinese differs significantly from modern Chinese in terms of morphology and syntax. Therefore, a foundational understanding of classical Chinese is essential for the development of AI translation methods adapted to word segmentation and linguistic analysis of ancient Chinese texts (Table 6).

Table 6. Difficulties in Segmentation of Ancient Chinese Words for AI Translation

No.	Main types	Main courses	Delphi ranking
1	The ambiguity of words	Many ancient Chinese words have more than one meaning.	4.9
2	Ambiguity meaning	No regulatory standard	4.7
3	A large number of little-used words	Huge vocabulary of a few common words	4.5
4	The constant arrival of new words	Due to the flow of ancient Chinese words, many unregistered words have appeared	4.3

Source: Compiled by the authors based on (Zhao et al., 2021).

As shown in Table 6, most participants agreed that the richness of Chinese vocabulary reflects the nation's long-standing historical legacy and cultural heritage. Some ancient words have also reappeared in contemporary contexts with new cultural functions. AI translation systems often struggle to process these different layers of ancient Chinese cultural meaning, especially when large language models are developed without sufficient input from specialists in ancient Chinese language and culture. During the translation process, there is also a risk of losing culturally specific nuances because the target language may lack equivalent terms capable of fully capturing the original meaning (Zhao et al., 2021).

3.2 The Real Needs of the Development of Local Cultural Industries: Beyond the Re-creation of "Translation"

All three participants of the culture industry for AI translation agree that it is not as simple as "text correspondence," and their core needs constitute a progressive level in the following.

3.2.1 Accuracy Requirements (Basic Level)

Proper nouns, historical facts, and procedural steps must be accurate and carefully evaluated when constructing and expanding language models. Therefore, AI-generated translations require strict review.

According to the data collection and analysis, the management of language service enterprises has played a strategic role in the implementation of China's Belt and Road Initiative, which aims to enhance regional integration and promote trade and investment among participating countries. To improve terminology

management and standardization, the International Organization for Standardization (ISO) has issued more than 50 international standards in the field of translation. These standards contribute to greater consistency in terminology use across translation projects, thereby improving the overall quality and development of China's language services. They can also support the quality of AI translation if cultural industries pay sufficient attention to integrating these standards into AI training processes and the improvement of large language models.

AI translation algorithms require substantial memory resources. Increasing vocabulary size can significantly improve the performance of large language model systems. However, excessive dictionary expansion may lead to system errors, which can be mitigated through effective word segmentation techniques. Languages such as Kazakh, Kyrgyz, and Uzbek belong to the Turkic language family and are characterized by agglutinative morphology. This linguistic feature poses a challenge for large language model systems, as a large proportion of words from the source corpus must be included in the translation dictionary. Various text segmentation approaches have therefore been developed to address this issue.

3.2.2 Explanatory Requirements (Core Level)

Cultural vocabulary, historical background, and customs must be translated or annotated just right so that the target audience can understand. This requires the translator's cultural intermediary ability.

To establish a sustainable cultural industry and maintain public interest, translation policies, standards, and related courses should actively support the development of diverse types of large language models and language corpora for different fields of the cultural industry. Key measures include the establishment of specialized research institutions, the formulation of supportive policy frameworks, and the provision of professional staff training (Jia, 2018).

3.2.3 Narrative and Experiential Needs (High Level)

Publicity copywriting and guided tour commentary need to build an engaging narrative and create an immersive experience. The translation needs to be literary, colloquial, and emotionally appealing.

The challenges of cultural translation, especially in relation to emotional connotations, national mentalities, and the translation of taboo topics, which are explored in the works of Footitt, Crack, and Tesseur (2018). Considering the complexity of certain languages, particularly Chinese (formerly referred to as Cathay), neurolinguistic services have yet to achieve satisfactory results in the field of cultural studies. Conveying the philosophical worldview of Henan local culture requires nuanced understanding and interpretive skills that remain uniquely human at this stage.

Therefore, when evaluating translation quality with respect to emotional connotation, it is important to highlight the differences in output depending on the

translation service used. The brevity of sentence structures can, on the one hand, enhance readability and accessibility for the target audience. On the other hand, it may significantly diminish the depth and aesthetic richness of Chinese civilization.

3.2.4 Brand and Identity Construction Needs (Overall Strategy)

Translation is an important tool for shaping local cultural brands and conveying unique identities. It requires a consistent style and strategic cultural positioning, which is inseparable from the overall planning of people.

According to the interview, most participants agree that the algorithms employed by existing translation services are predominantly optimized for widely spoken European languages (e.g., English and French); they are weak for the ancient Chinese language and Turkish language. Additionally, the cultural contexts of these languages are relatively transparent and familiar to international audiences, facilitating broader understanding. In contrast, Chinese translation requires a distinct and culturally sensitive approach, necessitating the development of specialized methodologies.

3.2.5 Participatory and Inheritance Needs (Fundamental)

The ideal translation process should drive local young people to participate and become a way of cultural learning and inheritance. This is a social function that cannot be achieved by purely technical tools.

Despite the availability of many professional translators, the growing volume of content requiring translation has created a need for more efficient mechanisms. Nevertheless, the reliability of AI translation remains a subject of ongoing debate. To ensure translation quality, it is generally recommended to adopt a hybrid approach that combines AI technologies with skilled human post-editing.

4. DISCUSSION

This section aims to go beyond specific technical limitations, provide suggestions, and conduct in-depth reflection and dialectical culture development requirement analysis from the following three levels.

4.1 The First Level of Critical Reflection on “Human-computer Collaboration” Mode: The Losing Subjectivity and the Risk of Alienation

The “human-computer collaboration” model advocated in this article ostensibly balances translation efficiency and quality, but at the practical level, it involves complex power relations and a crisis of cultural subjectivity.

First, technological empowerment may easily be alienated into technological dependence with the emergence of various new technological trends. When “AI preliminary translation + expert review” becomes the standard process, practitioners’ cognitive frameworks

may be “anchored” by the initial output of AI, which can be trained by translators while also training translators in return. The focus of translation experts’ work may shift from “creative translation” to “error correction and revision,” and their own cultural intuition and original expression may be invisibly framed by the “standardized” options provided by AI, which generally form its own translation strategies and styles. In the long run, human translation ability may not be enhanced, but weakened in the “comfort zone” created by various fast and efficient output modes, leading to the behavioral dilemma of “cognitive outsourcing.” Second, the subjectivity of local culture may be diluted by the “synergy” conducted by AI itself. When the translation process is disassembled into the technical output of AI and the fragmented corrective supplements of human behavior, the process of meaning reproduction in local cultural products, which should be based on a deep understanding of cultural integrity, may also become fragmented and distorted. The requirements of local cultural development, especially when divided and reorganized by the technical field and AI formation, may become familiar in diverse languages but “unfamiliar” in terms of their real cultural uniqueness, thereby losing their original coherent connotation and subjectivity.

For example, Delabastita (1989) investigated the role of translation within the film industry. Audiovisual media, particularly film and television, have become integral components of global cultural exchange. Translation in this domain occupies a distinct and influential position within the broader translation industry. In this context, several levels of translation relationships have been identified. These include the performance level, which involves decision-making among multiple translation options, and the competence level, which is determined by a combination of professional and contextual standards. However, the risk is that, when AI translation is applied to globally popular films, their cultural industry products, derivative products, and peripheral products may be labeled by AI-generated translation definitions themselves and remembered by audiences in that form.

Another example is Shenzhen, which has launched an initiative aimed at enhancing the city’s infrastructure and overall image by establishing an international language environment. This strategy supports the attraction of tourists, business development, investment, and immigration. The growing influx of international visitors and immigrants has led to an increased demand for professional and commercial translation services. At this level of translation, any automatic and distorted AI translation may deeply damage the city’s image among both local citizens and foreigners. Therefore, experts pay more attention to the quality of linguistic landscape translation, and the local government has also emphasized the quality of public sign translation, recognizing its direct impact on the city’s international image (Zhu et al., 2018).

4.2 The Second Level of the Expansion of Theoretical Boundaries: From “Instrumental Limitations” to “Existential Differences”

The operation of AI is based on revision and correlation after automatic translation, whereas human cultural understanding is based on translators' experience and interpretive competence. Much knowledge in local culture exists as “personal” experience and tacit skill. For example, AI can learn texts that describe “fire,” but it can never truly “know” fire itself. This difference means that, in cultural translation, AI is designed and functions as a form of simulated “other,” rather than as the resonance of a “subject.” Therefore, AI should not be expected to “solve” local cultural translation problems by means of technical iteration alone. Instead, the technological function of AI should be repositioned. AI translation is not, and should not be regarded as, a “bionic translator”; rather, it should be understood as a powerful tool for cultural computing and auxiliary presentation. Its core value may not lie in producing the final translation, but in providing unprecedented support for human translators, ranging from the instant retrieval of parallel texts and the visualization of cultural concept networks to the simulation of acceptance predictions for different translations in target cultural products.

This means that the translation field should shift its focus from “translation automation” to “translation enhancement,” and move the focus of translation practice from “making AI translate better” to “how to use AI to enable humanistic wisdom to work better.” For example, Tungkeunkunt characterized China's soft power policy as a strategic component of the country's broader foreign policy initiatives based on the requirements of local cultural development. Thailand serves as a prominent example of China's soft power implementation through governmental and cultural campaigns. The historical Sino-Thai relationship facilitates the development of bilateral tourism, which is actively supported by the Thai government. In this context, translation services have become increasingly important, particularly in meeting the growing demands of Chinese tourists. As part of its cooperative efforts, China is promoting Chinese language education in Thailand by incorporating Mandarin into the national curriculum, establishing a network of Confucius Institutes, encouraging the opening of Chinese-language businesses, and employing sales personnel with basic proficiency in Mandarin (Tungkeunkunt, 2016). This mode of communication reminds translation researchers that, when discussing translation between countries, AI translation should be used with great caution. Any error produced by automatic AI translation may lead to over-interpretation and misreading. When diplomatic and cultural translation is involved, AI translation can only be regarded as a participant in part of the work, not as a substitute.

4.3 The Third Level of the Deepening of Structural Contradictions: The Potential Conflict Between the Logic of Cultural Industry and Local Conservation

It is inevitable and positive to incorporate local culture into the path of industrial development. However, it must also be critically recognized that there is a deep tension between the inherent logic of the cultural industry, including commercialization, standardization, localization, and communication, and the original logic of local culture, including locality, uniqueness, vitality, and geographical specificity. The introduction of AI translation has, in a certain sense, accelerated the process of the “industrial packaging” of cultural products. In order to facilitate AI processing and improve “communication efficiency,” local cultural content may be consciously “preprocessed.” This may involve simplifying complex narratives, eliminating ambiguous poetic expressions, and replacing obscure local terms with general concepts. This process itself may constitute a form of “gentle violence,” causing culture to be pruned to adapt to technological pipelines and consumer markets. To address this issue, post-editing by human translators has been proposed as a corrective measure. The application of such hybrid processing has been shown to enhance overall translation quality significantly.

Therefore, the adaptive path should be emphasized. This path must maintain a form of cultural vigilance between technological matters and human behavioral matters. In other words, the ultimate goal of human-computer collaboration should not only be to help local cultural products enter the global market more smoothly, but also to use technological tools to improve and deepen the local roots and unique values of local culture and its cultural industry development. This means that, when building a local cultural corpus and designing a workflow, it is necessary to consciously incorporate those cultural “deep codes” that may be “non-commercially attractive” but remain vital, such as traditional cultural ballads, mythical histories, and ecological knowledge backgrounds. It is also necessary to explore how to use digital technologies, such as AR, XR, and blockchain, to preserve and present these difficult-to-translate “deep regional geographical and cultural characteristics,” rather than merely pursuing automatic cross-language text conversion through AI translation.

5. CONCLUSION

The challenge of translation quality and intercultural communication extends beyond the translation of Henan culture, which is rich in Chinese characters. In practice, it has been demonstrated that a comprehensive and multidimensional approach to the historical and cultural context of a given region is essential for achieving deep cultural understanding. Words and languages serve not only as fundamental tools for communication and

psychological expression, but also as essential carriers of Chinese cultural heritage. In Chinese, words are composed of characters that function as symbolic representations within the language system. Effective text processing, therefore, requires careful analysis of each word. Unlike many other languages that exhibit morphological variation, Chinese presents significant challenges for machine processing. Based on this deep understanding of the contradiction between technical limitations and the development needs of the cultural industry, this study does not propose the simple rejection, abandonment, or unconditional embrace of technology within a spatial cognitive structure. Instead, it proposes a phased and systematic adaptive path of "human-computer collaboration."

5.1 Short-term Strategy of Process Reengineering: The "Enhanced Review" from Linear to Circular

It is necessary to move beyond the linear process of "AI translation → direct use" and establish a circular process of "AI pre-translation → cultural expert issue labeling → key revision by translators → cultural calibration by translators → AI-based terminology and style consistency check." This process uses AI at both the beginning and the end of the workflow. In this model, AI serves as a "super first-draft generator" and a "terminology-checking assistant," while human translators act as "cultural quality inspectors" and "creative directors," focusing on the creative and evaluative work that machines cannot complete.

5.2 Medium-term Strategy of Infrastructure Construction: The "Corpus of Local Cultural Characteristics" and Customized Tools

In collaboration with the government, academia, and industry, a multilingual and multi-modal corpus of local cultural characteristics and knowledge maps will be systematically constructed. It contains traditional classics, local chronicles, oral history, expert translations, multimedia explanations, etc. Based on this corpus construction, it is possible to revise the AI translation model, which will be dedicated to a certain cultural field (e.g., "Chinese ancient architecture terminology" and "Opera translation"), to improve its performance in specific fields.

5.3 Medium-term Strategy of Infrastructure Construction: The "Corpus of Local Cultural Characteristics" and Customized Tools

The core of the solution is to cultivate composite "cultural translators" who understand local culture and its industry development trends, are proficient in diverse languages, and can apply AI translation technologies. Their role goes beyond that of traditional translators: they are managers of cultural content, users of AI technology, and planners of cross-cultural communication. University education and vocational college training need to adjust the curriculum systems of translation programs by adding modules on cultural literacy and AI technology application. This would help cultivate the "cultural translators" urgently needed for the development of the global cultural industry. Future research should focus on the translation of specialized or "niche" texts that contain domain-specific or localized terminology. Such texts require tailored approaches to maintain both linguistic accuracy and cultural relevance.

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