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The Future of Human Translators in the Era of Artificial Intelligence Translation Technologies

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***Abstract*—This study explored the future of human translators in the era of Artificial Intelligence (AI) translation technologies. Data were collected through semi-structured interviews, enabling an in-depth examination of translators' insights regarding their evolving roles and the challenges they face in adapting their skills to remain competitive with AI. The results showed that 93% of participants envisioned their future flourishing through collaboration with AI. However, the themes emerging from the data analysis revealed that 97% of participants expressed fears of losing autonomy, job security, professional identity, and creative control unless human translators develop their skills. Additionally, 93% were concerned about diminishing human skills and values, while 90% expressed concerns about translation quality assurance. The findings revealed that 87% of participants faced challenges related to technical complexity and usability, while 83% reported difficulties in accessing technology training resources. To overcome these challenges, the study recommends developing proficiency in AI-powered translation applications and enhancing collaboration with AI. The study contributes to translation studies and technology by emphasizing the importance of adopting collaborative approaches to translation teaching and practice to remain competitive with AI. The study concludes that human translators are indispensable, particularly for enhancing cultural relevance and maintaining ethical standards when using AI translation tools.**

***Index Terms*—artificial intelligence, human translators, machine translation, translation studies, translation technologies**

I. Introduction

The rapid advancement of artificial intelligence (AI) in the field of translation has initiated extensive debates in academia about the future of human translators. AI translation models have revolutionized translation practices, and cross-border communication (Algouzi & Alzubi, 2023). By combining linguistic and computational theories, automated translation systems are trained to replicate several human cognitive processes, including attention, memory, and perception, which are crucial for producing accurate translations (Cordingley, 2024). Previous studies (Hancock et al., 2020; Kenechi, 2024; Yousif & Khalaf, 2024) indicated that machine translation (MT) enhances global interactions by dismantling language barriers, facilitating smooth communication with international partners. MT assists in translating documents, contracts, marketing materials, and product descriptions effectively. As AI translation platforms continue to evolve, improvements in translation quality, speed, and accuracy are expected to occur regularly (Yang, 2022). Additionally, Kenechi (2024) found that innovations such as multimodal translation and personalized services are reshaping the field, offering users real-time translations that are contextually accurate. However, the rise of AI-driven translation systems presents new challenges for human translators, emphasizing the importance of continuous professional development and adaptation within the profession (Lin, 2023). As AI continues to advance, concerns have emerged about whether human translators will be replaced or if their expertise will remain crucial for maintaining translation accuracy and cultural relevance in this context, previous studies (Kenechi, 2024; Kirov & Malamin, 2022; Mohammed et al., 2024; Wang, 2023) explored the relationship between human expertise and AI technology in the translation industry, aiming to address benefits and barriers, particularly in translation quality assurance. In this respect, critics argue that a significant performance gap still exists between AI translations and human translations (Awadh, 2024; Bo, 2023; Guerberof-Arenas & Toral, 2022; Ibrahim & Alkhawaja, 2023).These studies reveal that while AI tools have become increasingly efficient at handling large volumes of text with speed and accuracy, they often fall short in capturing cultural complexities, creative aspects, emotional depth, and contextual meaning, i.e., areas where human translators excel. Therefore, the present study aimed to explore the benefits and challenges of AI translation tools, the difficulties human translators face, and the strategies they can apply to adapt their skills to remain competitive in an era dominated by AI technologies. To achieve this purpose, the study investigated how human translators envision their future as AI technologies continue to advance. The study addresses a gap in literature, marked by scarce research on the evolving roles of human translators in the age of AI and how technology influences the dynamic collaboration between machine and human translation. Thus, the study contributes to both translation studies and translation technology by providing new insights into the shifting roles of human translators amid AI advancements.

II. Literature Review

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A. Machine Translation Theories and Practices

Machine translation is an automated system that utilizes computational linguistic analysis to process source documents and generate target texts without human intervention (Hutchins & Somers, 1992). Machine translation (MT) systems do not rely on a single theory but instead combine various approaches and models. In this respect, Hutchins and Somers (1992) examined two main perspectives in MT: linguistic and computational theories. Early MT systems incorporated several linguistic theories, such as Chomsky's (1965) transformational and generative grammar, Catford's (1965) contrastive analysis, Halliday's (1985) functional grammar, Nida and Taber's (1974) theory of dichotomy of oppositions, Newmark's (1981) semantic-communicative translation theory, and Jakobson's (2000) functions of language. Additionally, theories like Reiss and Vermeer's (1984) Skopos theory influenced MT development. Previous research (Koponen et al., 2019; Ranathunga et al., 2023; Zhang & Zong, 2020) found that computational concepts contributed to the development of several systems, such as rule-based machine translation (RBMT), statistical machine translation (SMT), example-based machine translation (EBMT), and hybrid systems. Rule-based machine translation (RBMT) relies on predefined linguistic rules and dictionaries to govern grammar and syntax, but it faces challenges with idiomatic expressions and language variation. Statistical machine translation (SMT) uses statistical models trained on large parallel corpora to identify patterns between source and target languages, but it requires substantial resources. Neural machine translation (NMT) uses artificial neural networks to model translations, producing fluent output without the need for explicit rules or statistical alignments. Furthermore, MT systems often rely on memory systems, which store multilingual archives containing segmented, aligned, parsed, and classified texts. Another theory used in MT is Cognitive Translation Theory (CTT), which is derived from cognitive linguistics. Additionally, previous studies examined other MT systems, such as hybridization, which combines two or more MT systems to enhance the translation process. For example, Huang et al. (2020) found that a hybrid system could integrate corpus-based rules or combine different corpus-based approaches. The study found that computational linguistics and natural language processing are combined to create a hybrid field that bridges traditional linguistics and artificial intelligence. Thus, hybrid MT systems are used in applications such as speech translation, cross-lingual information retrieval, and computer-aided translation.

Applying theories in practice, research (Hassan et al., 2018; Kamaluddin et al., 2024; Naveen & Trojovsky, 2024) found that several AI translation platforms incorporate CTT in their systems. For instance, Google Translate uses a Neural Machine Translation (NMT) model that encodes entire sentences to improve accuracy, while DeepL employs neural networks based on cognitive models to replicate human translation processes. Microsoft Translator and Facebook use transformer models to provide high-quality translations, with Facebook translating directly between languages without relying on English. Additionally, platforms like TransPerfect, and Lingo utilize Example-based Machine Translation (EBMT), while Smartling and Language Services Associates (LSA) employ hybrid and post-editing models. Furthermore, Trzaskawka (2020) and Wang et al. (2019) found that different translation models impact the features of each platform. For example, Google Translate supports text, website, document, and real-time speech translation across many languages. Microsoft Translator offers similar services with integration options for Microsoft Office and apps. DeepL provides document translation and API integration for various language pairs. Yandex Translate includes text, document, and website translation along with dictionary look-up and pronunciation features. Furthermore, Previous research (Läubli & Orrego-Carmona, 2020; Moneus & Sahari, 2024; Wang, 2023; Yang, 2022) found that automated translation tools have led to the rise of AI translation applications that aim to compete with human translators. These applications include ChatGPT, Bing Chat, Perplexity AI, Chat Sonic, Gemini, and Sider AI. For example, ChatGPT is a multimodal model capable of processing both images and text, demonstrating human-level competence on academic and professional benchmarks. Bing Chat offers personalized recommendations and insights, while Sider AI provides a comprehensive platform for chatting, writing, reading, and translation.

B. Impacts and Barriers of AI-Powered Translation

Machine translation is essential for enhancing communication across different languages and cultures. Previous studies (Algouzi & Alzubi, 2023; Hancock et al., 2020; Trzaskawka, 2020; Yousif & Khalaf, 2024) found that MT facilitates global interactions by overcoming language barriers, enabling effective communication with international partners, and promoting cross-cultural understanding. However, previous studies highlight several challenges that AI-powered translation platforms need to address. For example, Naveen and Trojovsky (2024) found that AI tools struggle with ambiguous words, polysemous terms, idiomatic expressions, cultural references, figurative language, and language variations such as humor, metaphor, homonyms, and symbolism. In this regard, findings from a cross-sectional study by Sahari et al. (2023) indicated that although ChatGPT is effective for translating straightforward content, it often falls short when faced with intricate nuances that necessitate human intervention. In a different study, Nimbalkar (2021) found that disambiguation is a common challenge in translation, as languages often contain words or phrases with multiple meanings depending on the context. Ambiguity can arise from homonyms, polysemous words, and cultural references. The study suggested that resolving these ambiguities could be achieved through collaboration between machines and human translators. Naveen and Trojovsky (2024) found that stylistic variations in language, such as genre, formality, and target culture, create challenges for machine translation systems in maintaining these distinctions. Overcoming these challenges requires advancements in natural language processing, machine learning, and access to diverse training data. MT systems may struggle with cultural references unless they have appropriate cultural and contextual knowledge. Cultural references,

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such as names, proverbs, slang, and culture-specific concepts, often pose translation challenges due to the lack of direct counterparts in other languages. Accurate translation of these references requires localization, which adjusts the translation to fit the target culture. In other words, language is closely tied to culture and sociolinguistic norms, making cultural contextual appropriateness essential in translations. Therefore, AI systems must consider factors like regional dialects, and cultural subtleties to produce translations that align with the target language's cultural standards. Wang (2023) suggested that collaboration between humans and AI could enhance translation quality. Similarly, Moneus and Sahari (2024) explored the differences between human and AI translations within the legal sector, indicating that there would be no significant disparity between translations done by humans and those done by AI due to post-editing processes. The study concluded that while AI translation tools improve efficiency, human translators are essential for handling complex language, terminology, and context accurately.

C. Human Translators' Roles and Challenges in the Era of AI Technologies

Previous studies found that machine translation has reshaped the roles of human translators, requiring skills in post-editing, machine learning, and familiarity with AI tools. New roles for translators such as localization specialists, cultural mediators, and data curators, have emerged. Läubli and Carmona (2020) found that despite AI's accuracy, it demands for human post-editing. In the experimental study by ÖnerBulut and Alimen (2023), student translators involved in post-editing, pre-editing, and error annotation tasks began to see themselves as future experts in machine translation- related role. Similarly, findings from Zayed and Nuirat's (2024) study indicated that human translators use strategies like expansion, omission, and word choice to improve ChatGPT's translations. In this regard, Wang (2023) concluded that high-quality translations in the AI era rely on effective human-AI collaboration, with human translators focusing on specialized tasks and refining machine translations for accuracy and cultural relevance. Sheng and Kong (2023) found that human translators manage political, ideological, and subjective factors more effectively than AI, which struggles with tasks like annotating. The need for human judgment and flexibility in AI translation technologies remains crucial. Another important role for human translators is serving as cultural mediators. In this respect, Carvalho et al. (2023) highlighted that idiomatic expressions often carry cultural significance that machine translation tools struggle to capture. The authors argued that idiomatic expressions frequently hold cultural significance and meanings that may not translate directly into other languages. In this light, Naveen and Trojovsky (2024), and Zhang and Zong (2020) found that AI translation tools cannot grasp the emotional connotation or cultural context of words, as AI lacks the ability to understand subjective human experiences. Machine translation cannot fully understand emotional implications, a complex cognitive response that human translators can better handle (Khare et al., 2024). In this respect, previous studies (Guerberof-Arenas & Toral, 2022; Ibrahim & Alkhawaja, 2023; Pastor & Noriega-Santiáñez, 2024) revealed that human translators are valued for their creativity, as they effectively capture language nuances, tone, and cultural context of the original text. This is especially important in literary translation, where they convey not only meaning but also emotional and stylistic elements. Unlike machines, human translators use personal experience and cultural awareness to adapt idiomatic expressions, humor, and cultural references for the target audience. Therefore, previous studies emphasize the role and identity of the translator in transferring culture. Vermeer (1996) characterizes the translator as bi-cultural, highlighting the importance of understanding both the source and target cultures. Similarly, Snell-Hornby (1992) refers to the translator as a cross-cultural specialist, emphasizing the translator's role in bridging cultural gaps between languages. Hewson and Martin (1991) describe the translator as a cultural operator, underlining the translator's responsibility to navigate cultural differences effectively.

However, previous studies (Cordingley, 2024; Mohammed et al., 2024; Soysal, 2023; Yousif & Khalaf, 2024) revealed that human translators face various challenges, including technological literacy, loss of autonomy, job security, and adaptation to technological change. In this regard, Kirov and Malamin (2022) concluded that AI is likely to lead to job losses, with many translators viewing AI as a threat that will take over routine tasks, leaving them with roles focused on editing machine-translated texts and training AI. Bowker (2020) revealed that human translators face difficulties in mastering translation software and understanding machine translation systems to ensure accuracy. Another challenge for human translators is competition from AI, which offers faster and cheaper translations. In this respect, Cadwell and O'Brien (2022) argued that to remain competitive, translators must emphasize their unique skills, such as cultural competence, and the ability to interpret literary texts, areas where AI often struggles with. Furthermore, findings from Moorkens (2022) highlighted that human translators encounter notable challenges related to confidentiality and professionalism. Similarly, O'Hagan (2020) argued that the increasing use of AI in translation poses a threat to job security and professional identity, compelling translators to distinguish themselves through specialized expertise and ethical practices. Additionally, Cadwell et al. (2022) argued that overcoming these challenges needs sharing and collaboration within networks of professional translators. In this regard, Cordingley (2024) found that despite the advancements in machine translation, human translation is still essential for complex content that requires human input to ensure accurate communication.

D. The Future of Human Translators in the Era of AI Technologies

The review revealed differing opinions on how translation technology will affect the demand for human translators, emphasizing the complexity of this relationship. Previous studies (Bo, 2023; Moorkens, 2022; Reijers & Dupont, 2023) highlighted ethical concerns in AI translation, such as the impact on translators' professional identity, copyright, and

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privacy. Findings from these studies pointed to certain concerns, including job displacement and the diminishing value of human expertise in cultural contexts. In this regard, ÖnerBulut and Alimen (2023) found that educators stressed the need for collaborative translation classrooms, where students can integrate human value into machine translation workflows. Liu (2024) indicated that achieving more accurate translations will advance through a partnership between AI and human translators. In a different study, Tuma and Hamood (2023) showed that human translators can improve productivity by refining machine-generated translations to meet clients' needs. It highlighted that integrating machine translation can help translators work more efficiently. Similarly, Yu (2024) revealed that translators skilled in machine tools and translation strategies will thrive in the future. Similar findings by Soysal (2023) emphasized that Translation Studies (TS) can improve AI translation systems by providing insights into context, and ethical considerations. Leveraging TS expertise can help AI developers enhance translation quality. In this regard, Lin (2023) concluded that the future will involve a collaboration between human translators and AI, combining their strengths for best results. Furthermore, Madkour and Al-Askr (2024) found that adapting teaching strategies in translation classroom is essential to meet industry demands and ensure future translators have the necessary skills for success. Regarding the translator's role in observing ethical standards, previous research placed significant responsibility on human translators. In this regard, Reijers and Dupont (2023) stated, "[…] we consider translation as an inherently ethical activity" (p. 13). Kenechi (2024) found that while machine translation is changing the translation industry by increasing productivity and diminishing human translators' roles, human expertise and creativity remain vital, particularly for tasks involving language, culture, and ethics. Thus, the future of translation is anticipated to emphasize increased collaboration between humans and machines, with each contributing their strengths to achieve the best outcomes.

III. Methodology

The present study employed a qualitative research method to examine the future of human translators in the context of artificial intelligence translation technologies. The study also investigated their pedagogical beliefs, ethical concerns, and expectations regarding the use of artificial intelligence in translation. The sample consisted of non-randomly selected female translators who taught translation during the third term of the academic year 2024.

A. Research Questions

1.What are the main challenges human translators face when adapting to AI-powered translation tools, and how can they overcome them?

2. How can human translators adapt their skills to remain competitive in an industry increasingly dominated by AI translation technologies?

3. How do human translators envision their professional future in the era of AI translation technologies?

B. Participants

The current study adopted a qualitative research approach, focusing on a focused group of female translators who also teach translation. The study aimed to explore their perceptions and concerns about the future of human translators considering advancements in AI technologies. Using purposive sampling, the study included thirty female translators affiliated with public universities in Saudi Arabia.

C. Instruments

The researcher used semi-structured interviews, validated through a pilot study, to gather data with NVivo software for analysis. The interview had two sections: the first collected demographic information through closed-ended questions, and the second explored participants' views on the future of human translators, the impact of advancements of AI on their skills, and concerns surrounding AI use in translation.

D. Data Collection Procedures

NVivo (version 15) software was used for data analysis, enabling comprehensive text analysis and theme identification within the collected data. Initial data codes were created to capture participants' experiences with AI-mediated translation, which were then organized into potential themes, highlighting significant patterns regarding the impact of AI technologies on human translators.

IV. Results

A. Demographic Results

Demographic data revealed that 60% of participants were Saudis, while 40% were foreigners. In terms of age, 57% were between 31-50 years old, 26% were between 51-65 years old, and 17% were between 25-30 years old. Regarding language, 60% spoke Arabic as their native language, and 40% spoke English as their first language. In terms of teaching experience, 57% had 5-10 years of experience, 33% had over 10 years, and 10% had less than 5 years. Regarding technology proficiency, 43% had over 10 years of experience, 40% had 5-10 years, and 17% had less than 5 years. All participants (100%) reported integrating technology into their teaching, and 90% taught translation courses, while 10% taught EFL courses. Figures 1-6 display the results.

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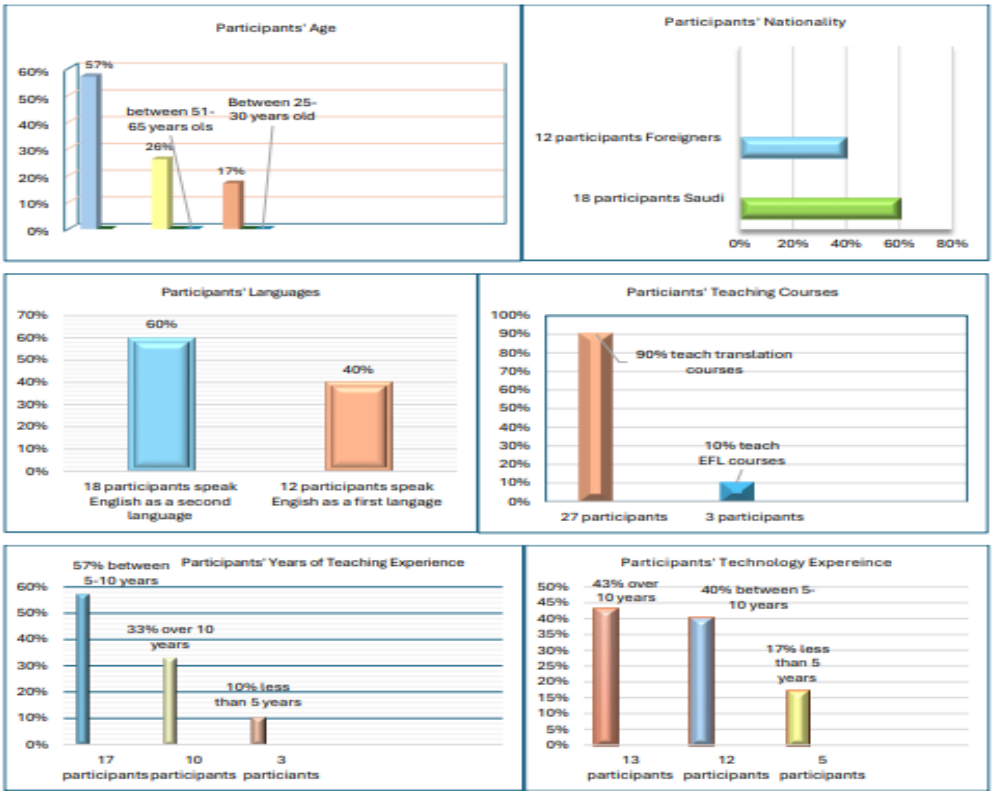

Figures 1-6. Participants' Demographic Results

B. Interviews Emerging Themes

The analysis of the interview, conducted using NVivo, identified six emerging themes: (a) AI translation will continue to prevail in the future, (b) new AI translation applications will be developed, (c) human translators will face more challenges for maintaining their roles, (d) enhancement of collaboration between AI and human translators, (e) ethical concerns about using AI will increase, (f) enhancing human roles for developing standards for quality translation. Table 1 illustrates these themes.

TABLE 1
EMERGING THEMES FROM PARTICIPANTS' INTERVIEWS

Interview Emergent Themes	*n* (=30)	Percent
AI translation will continue to prevail in the future	29	97%
New AI translation applications will be developed	29	97%
Human translators will face more challenges in maintaining their roles	28	93%
Enhancement of collaboration between AI and human translators	28	93%
Ethical concerns about using AI will increase	25	83%
Enhancing human roles for developing standards for quality translations	24	80%

As displayed in Table 1, 97% of participants believed that AI machine translation will continue to prevail in the future, and that new AI translation applications will be developed. Additionally, 93% of participants perceived that human translators would face more challenges in maintaining their roles, and that collaboration between AI translation and human translators will enhance. 83% observed that human translators have ethical concerns about using AI, while 80% felt that the enhanced human translators' roles will help them remain vital for high-quality translations. Many participants expressed concerns about the future of human translators as AI translation technologies continue to advance. One participant noted, "I perceive the role of human translators as becoming more consultative and advisory," suggesting that translators will need to select effective AI systems and ensure output aligns with the intended message, tone, and cultural contexts. Another participant noted that "[…] the role of human translators may evolve into that of specialized experts in post-editing," emphasizing the need for human intervention in refining machine-generated translations, particularly for accuracy, idiomatic expressions, and implicit meanings. However, a third participant stated, "AI and machine translation

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technologies will augment, rather than replace human translators." Another participant added, "These advancements will enhance repetitive tasks, but human translators will still be essential in providing the deep understanding of language and the context that machines currently struggle with." Additionally, participants emphasized the importance of collaboration between AI and human translators. One participant stated, "Human translators will collaborate with AI, ensuring the highest standards of quality and cultural relevance." However, some participants expressed concerns about staying competitive with AI. One participant stated, "The rapid pace of technological advancement can be overwhelming for human translators." Some noted that the fear of job displacement could be addressed by emphasizing AI's complementary role, with training and continuous professional development helping translators adapt to evolving tools. Another participant stated, "Human translators will focus on tasks that demand creativity, and cultural adaptation." Other participants shared their use of AI tools like Trados Studio and Linguee, stating, "These tools are helpful, but they require human translators to develop training for achieving efficiency." The results also showed that human translators are expected to focus on value-added roles requiring cultural expertise.

C. Answering the Research Questions

Q1. What are the main challenges human translators face when adapting to AI-powered translation tools, and how can they overcome them?

The results revealed six invariant constituents in the context of the challenges human translators face. These constituents are: (a) loss of autonomy and creative control, reported by 93%; (b) concerns about job security and professional identity, perceived by 93%; (c) diminishing human roles and values, represented by (90%); (d) difficulties in maintaining translation accuracy and quality, reported by 90%; (e) difficulties in handling technical complexity, perceived by 87%; and (f) lack of accessible and comprehensive AI training resources, reported by 80%. Table 2 displays these results.

TABLE 2
INVARIANT CONSTITUENTS OF HUMAN TRANSLATORS' CHALLENGES

Invariant Constituents of Human Translators' Challenge in AI Era	*n*(=30)	Percent
Loss of autonomy and creative control	28	93%
Concerns about job security and professional identity	28	93%
Diminishing human roles and values	27	90%
Difficulties in maintaining translation accuracy and quality	27	90%
Difficulties in handling technical complexity	26	87%
Lack of accessible and comprehensive AI training resources	24	80%

As displayed in Table 2, the invariant constituent of loss of autonomy and creative control emerged as the highest-ranked among the invariant constituents of the theme of human translators' challenges in the era of AI. In this context, one participant reported, "Translators may feel a loss of creative control and autonomy when relying on AI tools that generate translations based on translation datasets." Reporting their concerns about job security and professional identity, one participant stated, "A main challenge is overcoming the fear of job displacement due to the increasing reliance on AI in the translation industry, and this fear increases by emphasizing the dominance of AI." Another participant added, "The rise of AI translation may lead to concerns about job security and the erosion of professional identity among human translators, particularly, in terms of the speed that machine translation is performed." Additionally, another participant commented "Human translators fear the potential loss of traditional skills, particularly in tasks that rely on deep cultural and linguistic understanding." Concerning the challenge of maintaining translation quality and accuracy, one participant stated, "AI translations may not always meet the quality and accuracy standards required, especially for complex texts or those with cultural references." Another participant noted, "Quality assurance becomes crucial, as AI-generated translations need careful review to ensure accuracy and cultural appropriateness." Furthermore, the participants reported other challenges, including technical complexity and usability, providing accessible and comprehensive training resources. In this regard, one participant stated, "Providing accessible training resources is challenging particularly, when financial aid is constrained." Another participant noted, "The real challenge we face is adapting to the fast pace of technological change." In this context, another participant added, "Change is disturbing, and it is accompanied by resistance, which hinders adaptation." Thus, the participants agreed that human translators encounter challenges such as adapting to the rapid pace of AI technological advancements. However, the participants believed that human translators could overcome such challenges, suggesting some solutions that emerged in data analysis. Table 3 displays these solutions.

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TABLE 3
ADDRESSING HUMAN TRANSLATORS' CHALLENGES

Invariant Constituents of Solutions To Human Translators' Challenges	*n*(=30)	Percent
Enhance creativity and cultural understanding	29	97%
Encourage a collaborative approach between human translators and AI	28	93%
Provide continuous technology training	28	93%
Develop specialized skills in areas that demand human expertise	27	90%
Implement a rigorous quality assurance process	27	90%
Apply strict data privacy and security standards	26	87%

As illustrated in Table 3, the participants made some suggestions to help human translators overcome the challenges they face in the era of AI. These solutions include: (a) enhance creativity and cultural understanding, reported by 97%; (b) encourage a collaborative approach between human translators and AI, represented by 93%; (c) provide continuous technology training, reported by 93%; (d) develop specialized skills in areas that demand human expertise, perceived by 90%; (e) implement a rigorous quality assurance process, reported by 90%; and (f) apply strict data privacy and security standards, represented by 87%. In this context, one participant noted,

"Translators should focus on highlighting their unique contributions, such as creativity, cultural understanding, and the ability to manage complex translations." Another participant reported, "By positioning themselves as indispensable partners in the translation process, human translators can ensure their continued relevance and success alongside AI technologies." Additionally, one participant stated, "Translators should be encouraged to stay informed about new developments in AI translation technologies through continuous education, attending conferences, and participating in professional networks." Another participant stated, "Professional development programs that provide opportunities for human translators to deepen their culture knowledge and technical expertise can help bridge the gap between human translators and AI." Another participant commented, "I believe there are two crucial solutions that human translators can use, namely, apply strict data privacy and security standards, and implement a rigorous quality assurance process, which can enhance their critical roles as quality assurance controllers." Furthermore, the participants agreed that using advanced AI technologies such as MateCat, DeepL, iTranslate, Reverso, Lingee, TripLingo, and neural machine translation models like OpenAI's GPT-4, helps in producing efficient translations. The participants believe that AI will play a significant role in the future of translation by enhancing the capabilities of human translators rather than replacing them.

Q2. How can human translators adapt their skills to remain relevant and competitive in an industry increasingly dominated by AI translation technologies?

The results revealed six invariant constituents of the theme of the skills that human translators need to remain competitive in the era of AI. These constituents are: (a) terminology database management skills, reported by 97%; (b) mastery of advance linguistic competence, represented by 97%; (c) comprehensive cross-cultural competence, reported by 93%; (d) strong interpersonal skills for effective collaboration with clients, reported by 90%; (e) critical evaluation skills for assessing translation accuracy, quality, and strategies, perceived by 87%; and (f) effective workflow organization skills for enhancing translation project management and organization performance, reported by 83%. Table 4 illustrates these results.

TABLE 4
INVARIANT CONSTITUENTS OF HUMAN TRANSLATORS' SKILLS IN AI ERA

Invariant Constituents of Human Translators' Skills In AI Era	*n*(=30)	Percent
Terminology database management skills	29	97%
Mastery of advanced linguistic competence	29	97%
Comprehensive cross-cultural competence	28	93%
Strong interpersonal skills for effective collaboration with clients	27	90%
Critical evaluation skills for assessing translation accuracy, quality, and strategies	26	87%
Effective workflow organization skills for enhancing translation project management and organization performance	25	83%

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As displayed in Table 4, terminology database management skills emerged as the highest-ranked among the invariant constituents, represented by 97%. In this context, one participant stated, "Human translators will need to develop proficiency in terminology database management, to effectively collaborate with these technologies to enhance their work and understand how AI systems operate." Another participant added, "Developing terminology database management skills is crucial for human translators because it ensures consistency, accuracy, and efficiency for using specific terms across multiple projects." Regarding the invariant constituents of linguistic competence, one participant noted, "Human translators need linguistic competence to ensure accuracy, variations, and cultural appropriateness of translations that AI systems often struggle to achieve." Another participant commented, "While AI can manage straightforward translations, it frequently misses idiomatic expressions, tone, and context-specific meanings, and therefor, human translators with strong linguistic skills can identify and correct these shortcomings." Additionally, the participants shared their comments on collaboration and interpersonal skills that human translators need to adapt. One participant stated, "Human translators need strong collaboration and interpersonal skills to collaborate effectively with diverse teams, including AI developers, project managers, and clients, for ensuring that the translation process aligns with client expectations and project goals." Another participant added, "[…] strong interpersonal skills enable translators to manage expectations, and build trust." A third participant commented,

"Interpersonal skills are vital for managing relationships with clients, ensuring that their needs and preferences are met." Furthermore, commenting on translators' critical evaluation skills, one participant stated, "Human translators need critical evaluation skills to assess the accuracy and quality of machine-generated translations, as AI systems can often produce errors or miss important contextual references." Another participant noted, "Critical evaluation allows translators to identify when AI output falls short and make necessary corrections to ensure that the final translation is both accurate and culturally appropriate." Additionally, the participants agreed that cultural competence, and workflow organization skills are crucial for human translators to adapt in the era of AI technologies. In this respect, one participant stated, "Cultural competence ensures that translators can provide contextually accurate translations that resonate with the target audience." Another participant added, "Cultural competence is especially important as global communication becomes increasingly diverse and localized content is in high demand." A third participant noted, "Workflow organization skills allow translators to efficiently manage and integrate AI tools into their translation processes, balancing human input with machine-generated output." Thus, the participants believed that cultural competence and workflows organization skills help translators to improve projects, enhance productivity, and maintain high-quality translations, ensuring that both linguistic accuracy and cultural relevance are preserved.

Q3. How do human translators envision their professional future in the era of AI translation technologies?

The results revealed seven invariant constituents. These constituents include: (a) fears of losing their jobs, reported by 97%; (b) developing proficiency in AI-powered translation models, represented by 97%, (c) observing ethical implications of machine translation, reported by 93%; (d) enhancing collaboration with AI, perceived by 93%; (e) developing post-editing and quality assurance, reported by 90%; (f) enhancing cultural adaptation and localization, perceived by 87%; and (g) developing translation-research-based practices, reported 83%. Table 5 displays these results.

TABLE 5
INVARIANT CONSTITUENTS OF ENVISIONING THE FUTURE OF HUMAN TRANSLATORS

Invariant Constituents of Human Translators' Envision of Their Future In AI Era	*n*(=30)	Percent
Fears of losing their jobs	29	97%
Developing proficiency in AI-powered translation models	29	97%
Observing ethical implications of machine translation	28	93%
Enhancing collaboration with AI	28	93%
Developing post-editing and quality assurance	27	90%
Enhancing cultural adaptation and localization	26	87%
Developing translation-research based practices	25	83%

As shown in Table 5, fears of losing their jobs, emerge as the highest-ranked invariant constituent in the context of how human translators envision their future. In this respect, one participant stated, "My fears stem from the speed of AI-powered systems, and their ability to process large volumes of text quickly and cost-effectively. "Another participant added, "AI-powered translation could replace human translators, particularly for straightforward tasks such as technical manuals or basic content localization." A third participant reported, "The fear stems not only from automation but also from the growing misconception that AI can fully replicate the expertise of skilled linguists." Another participant noted, "Despite these fears, it is crucial to emphasize the complementary role of AI as a tool to assist rather than replace human translators, ensuring quality and accuracy." Furthermore, the participants asserted that human translators need to develop

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their proficiency in AI tools, through enhancing collaborative tasks. In this regard, one participant stated, "I see human translators increasingly collaborating with AI tools, using them as assistants rather than substitutes." Another participant commented, "[…] developing technology proficiency will ensure successful future for human translators as they will be able to continuously improve translation accuracy." In this respect, the participants also shared their comments on the issues of developing quality assurance, and enhancing contextual knowledge, and creativity. One participant reported, "Human translators will act in the future as editors and quality controllers, ensuring that AI-generated translations are accurate, conveying the content of the source language texts in a way that satisfy the target language readership." Another participant added, "Human translators will increasingly assume roles that require sophisticated cultural insight and specialized knowledge, and that human translators will complement AI, adding their human unique abilities to create translations that resonate cultural contexts on a deeper level." Furthermore, most of the participants (93%) agreed that the main role for human translators in the era of AI is to observe ethical implications of using machine translation. In this respect, one participant stated, "Human translators can observe the ethical implications of translations, ensuring that automated systems are not biased, or misleading." Another participant added, "I see the role of human translators as ethical guides who prevent the dissemination of harmful content that an AI system might not identify." In other words, human translators can bridge the gap between technological capabilities and human values, providing oversight and expertise that enhance the overall quality and integrity of translations. Additionally, the participants reported that human translators need to develop translation-research based practices to maintain their roles in the era of AI. In this regard, one participant noted, "Research-driven practice helps translators stay informed about evolving linguistic trends, audience expectations, and ethical considerations, ensuring their work remains both accurate and culturally appropriate." Another participant reported, "Emphasizing research-based approaches not only strengthens translation accuracy but also reinforces the human translator's role as a skilled professional capable of handling complex, culturally based content that machine translation tools often struggle to process effectively." Thus, the participants believed that human translators would remain indispensable in the creation of universally accepted guidelines that enhance the reliability and accuracy of translations.

V. Discussion and Findings

The findings revealed that AI-powered translation will continue to dominate the future, and that new AI applications will be developed, as perceived by 97% of participants (Table 1). These results are in harmony with previous findings. For example, previous studies (Kamaluddin et al., 2024; Läubli & Orrego-Carmona, 2020; Moneus & Sahari, 2024; Trzaskawka, 2020; Wang et al., 2019) indicated that the emergence of automated translation tools has given rise to AI translation applications that claim to rival human translators. These applications include ChatGPT, Bing Chat, Perplexity AI, Chat Sonic, Gemini, and Sider AI. Other findings from the present study revealed that human translators will face challenges in terms of loss of autonomy and creative control, job security and professional identity, as perceived by 93%. Challenges also include diminishing their roles and values, maintaining translation accuracy and quality, managing technical complexity, and lacking accessible and comprehensive AI training resources, as perceived by 87% and 83% respectively (Table 2). These results are in alignment with previous findings. For example, O'Hagan (2020) found that the increasing use of AI in translation poses a threat to job security and professional identity, compelling translators to distinguish themselves through specialized expertise and ethical practices. Kirov and Malamin (2022) found that AI is likely to lead to job losses, with many translators, focusing on roles that target editing machine-translated texts. ÖnerBulut and Alimen (2023) found that translators will become experts in post-editing, pre-editing, and error annotation tasks. Bowker (2020) found that human translators face difficulties in mastering translation software and understanding machine translation systems. Cadwell and O'Brien (2021) found that translators must emphasize their unique linguistic and cultural skills to remain competitive in the era of AI. Additionally, Moorkens (2022) found that human translators must maintain the privacy of sensitive information while delivering high-quality work. Furthermore, findings from the present study showed that translators can address these challenges through enhancing creativity and cultural understanding, and developing collaboration with AI, as perceived by 97% and 93%, respectively (Table 3). These findings align with previous research findings. Cadwell et al. (2022) showed that overcoming challenges needs collaboration within networks of professional translators. Yu (2024) revealed that translators skilled in machine tools and translation techniques will excel in the future. Soysal (2023) emphasized that Translation Studies (TS) can improve AI translation systems by providing knowledge into context, and ethical considerations. Furthermore, the present study findings showed that human translators need to adapt their skills to remain competitive in the era of AI, including terminology database management skills, linguistic and culture competences, as reported by 97%, and developing collaboration and interpersonal skills, as perceived by 93%, and improving workflow organization skills, as reported by 83% (Table 4). These results are in harmony with findings from previous studies. For example, Zayed and Nuirat (2024) found that human translators use strategies that AI cannot apply such as expansion, omission, and transposition. Sheng and Kong (2023) found that human translators manage political, ideological, and subjective factors more effectively than AI. Other findings from the present study indicated that although human translators envision threats to professional future, however, they believe that they are indispensable, observing ethical implications of utilizing machine translation, as perceived by 93%, and enhancing creativity, cultural adaptation, and localization, as reported by 87% (Table 5). These findings are in alignment with that of previous studies. For instance, Bo (2023), Moorkens (2022), and Reijers and Dupont (2023) showed that ethical

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concerns in AI translation such as copyright, and privacy impact translators' roles. Kenechi (2024) revealed that while AI-powered translation is changing the translation industry by diminishing translators' roles, human expertise and creativity are still vital, particularly for tasks involving language, culture, and ethics. Lin (2023) found that the future of translation will involve a collaboration between human translators and AI, combining their strengths for highest efficiency.

VI. Recommendations and Conclusion

The current study has several implications. First, it emphasizes the significant influence of AI translation tools on the future of human translators, revealing the challenges they encounter in the age of AI. Secondly, the study reveals the strengths and limitations of AI tools in comparison to human translations, emphasizing the value of technological advancements while advocating collaboration between humans and AI to improve translation quality and efficiency. AI-powered tools facilitate language accessibility, foster multicultural understanding, and promote global cooperation. However, they often struggle with ambiguous language, polysemous terms, idiomatic expressions, cultural references, and figurative language. Addressing these limitations could be achieved through collaboration, where human translators can help clarify and refine ambiguous outputs, ensuring better accuracy. Thirdly, the study uncovers the emergence of new professional roles for human translators, including cultural mediators, localization experts, and data curators, as AI tools lack the capacity to grasp subjective human experiences. These evolving roles require translators to engage more deeply with creativity and cultural contexts, producing translations that resonate with target audiences while maintaining linguistic competences. Consequently, human translators remain essential for creativity and effective cross-cultural communication, particularly in sectors where cultural awareness and narrative coherence are crucial, such as literature and art. Another implication points to the need for human translators to adopt research-driven practices to sustain their relevance in the AI era. Human translators need to remain competitive and informed about linguistic development, audience preferences, and ethical considerations through continuous research that ensures that translations maintain accuracy and cultural appropriateness. This proactive approach not only enhances individual skills but also contributes to the broader field of translation studies, promoting best practices and ethical standards across the industry.

Based on the research findings, the study recommends cultivating expertise in AI-driven translation tools while promoting a more integrated partnership with AI. The study also recommends stressing the necessity of collaborative methods in translation education and practice to stay competitive alongside AI developments. The study finds that human translators remain essential, especially when it comes to preserving cultural nuance and upholding ethical standards in the use of AI translation systems.

However, the study is limited to a small sample size of thirty female participants who teach and practice written translation. This allowed for in-depth qualitative analysis of their perceptions regarding the impact of AI on their professional future. However, male participants were not included due to social constraints. Therefore, future studies should involve a larger, more diverse group of participants, including both female and male translators and teachers from various universities worldwide.

To wrap up, this study explored how human translators perceive their future in connection with advancing AI technologies, aiming to fill a gap in the literature where research on human translators' evolving roles in the AI era remains limited. The study investigated the benefits and barriers of AI-powered translation, the challenges that human translators face, and the strategies they employ to adapt their skills and remain competitive in a rapidly evolving industry. Thus, by exploring the dynamic relationship between human expertise and machine capabilities, this research contributes to both translation studies and translation technology, providing insights into how emerging technologies are transforming translation practices. The findings underscore the importance of human expertise in maintaining linguistic diversity, cultural appropriateness, and creative expression in the era of AI-driven translation.

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