

# Research Status, Hotspots And Trends Of Post-Editing In China (1995-2023) Based On Bibliometric Analysis

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## **Abstract**

*In recent years, with the development of software technology and new algorithms, machine translation post-editing has become a hot topic in China. This study focused on one hundred and seventy journal articles within the machine translation post-editing field retrieved from CNKI in China spanning the years 1995 to 2023. The research analysis utilized CiteSpace bibliometric software to map out the knowledge landscape encompassing research authors, institutions, collaborative networks, and key thematic areas in post-editing research in China. The research results show that machine translation post-editing research in China can be divided into three stages: slow growth between 1995 and 2015, rapid growth between 2016 and 2020 and continuous growth between 2021 and 2023; The group of high-yield authors has not yet been formed, and the relationship between researchers in the field of post-editing are characterized by a small concentration and a large fragmentation; There is no close cooperation among research institutions, less cross-regional cooperation among research institutions, and uneven distribution of research groups and research institutions; The research field includes two categories : human-computer interaction translation research and type text special research ; the research frontiers include translation quality, translation technology, type text translation and the application of post-editing. This study aims to outline the current situation, hotspots and trends of post-editing research in China, and to provide new perspectives and methods for further in-depth research on post-translation editing in China.*

**Keywords:** *Research on China's Post-editing; Machine translation; Bibliometric analysis*

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## **I. Introduction**

In the era of globalization and informatization, the international information flow is becoming more and more rapid and frequent. Various forms of translation are the fundamental premise for the smooth flow of massive information and the core business of the global language service industry. In this context, post-editing of machine translation has been widely concerned by academic and industrial circles (Feng Quangong & Cui Qiliang, 2016). Machine translation is the first step in translation, and post-editing and machine translation can be said to be the same process (Qin Hao, 2020). As for the concept of post-editing, Cui Qiliang (2014) believes that the definitions of these concepts are put forward by people from different professional directions in different ages, and post-editing, machine translation and computer-aided translation are closely related to each other. With the progress of society, the connotation of these concepts is constantly changing. According to the definition of ISO / DIS 18587 : 2017, machine translation is “ MT, automated translation of text or speech from one natural language to another using a computer system ”. Post-editing is “to edit and correct MT output (ISO, 2017). J Allen (2001) thinks that the term Post-editing(PE) is by far most commonly associated as a task that is related to Machine Translation(MT). In basic terms, the task of the post-editor is to edit, modify and/or correct pre-translated text that has been processed by a machine translation system from a source language into (a) target language(s). Daniel Marcu put forward that “PE refers to the process of language experts editing machine translation output to generate artificial quality translation (Xiong Li & Bai Yangming, 2022). PE now requires

post-editors to have formal translation training and/or professional experience (Vieira et al., 2019). Feng Quangong and Cui Qiliang (2016) believe that post-editing, a process of editing and revising the original outputs of machine translation according to the purpose of the task, has already developed into an emerging profession in global language services industry.

The significance of post-editing in the translation process is unquestionable, highlighting the crucial need for exploration and organization within this domain. TAUS predicts that post-editing "may replace translation memory technology as the primary production environment in the translation industry in the next five years" (Wang Xiangling & Jia Yanfang, 2018).

### **A brief review of the literature**

The research on post-editing began in 1985, when Senez took the lead in discussing the application of post-editing in the European Community. In 1994, Krings completed the post-doctoral thesis of post-editing, which was published in 2001 and became the earliest monograph in the field of post-editing research. In the 21st century, with the rapid development of machine translation and global information technology, post-editing has attracted the attention of scholars at home and abroad (Hu Zhenming et al., 2022). According to the Web of Science, the author used "post editing" as the retrieval word and added "INTERACTIVE MACHINE TRANSLATION", "POST-EDTING" and "POST-EDITING EFFORT" as the keywords for literature retrieval. A total of eleven thousand two hundred and twenty-three papers in core journals were obtained, according to the results, Representative results include Is machine translation post-editing worth the effort? A survey of research into post-editing and effort authored by Koponen, M, Machine Translation and Self-post-editing for Academic Writing Support: Quality Explorations jointly published by O'Brien, S, Simard, M and Goulet, MJ's, all of which received high citation frequencies. It is evident that foreign post-editing endeavors have yielded significant and fruitful results.

In order to further explore the research status of post-editing in China, we make a comparative analysis of the current situation of post-editing in China and abroad. Based on the analysis of the one hundred and seventy literature on China's post-editing research, it is evident that there are four distinct characteristics: 1. Late Start Compared to Foreign Countries; 2.Lack of high-level journal literature. 3.Insufficient breadth and depth of research topics; 4. Few journal articles in interdisciplinary fields.

In comparison to foreign countries, China's research in post-editing began relatively recently. The pioneering work on post-editing was undertaken by Huang Heyan and Chen Zhaoxiong (1995) of the Computer Language Information Engineering Research Center of the Chinese Academy of Sciences, who studied the design and development of post-translation editing tools in the field of research engineering in 1995. There were only a few thirteen papers in the following 20 years (1995-2015). The landmark achievement is that Wei Changhong and Zhang Chunbai (2007) summarized the post-editing of machine translation in 2007 from the basic concepts, necessity, errors to be corrected, means of implementation and implementors.

Despite a notable rise in the volume of articles published by China's Post-editing since 1995, there remains a scarcity of high-level journal literature. Only thirty-seven articles are indexed in Peking University cores and twenty-seven in CSSCIs out of the total one hundred and seventy journal articles retrieved.

The range of research topics covered in the one hundred and seventy journal articles in CNKI is limited in scope. Specifically, ninety articles focus on post-editing, seventy-one on machine translation, seventeen on post-editing abilities, and six on editing strategies. Additionally, there are articles addressing human translation, error analysis, translation technology, scientific and technological texts, tourism texts, the era of artificial intelligence, pre-editing, error types, artificial intelligence, computer-aided translation, and Chinese-English translation. Notably, each topic has a maximum of five articles. It is apparent that post-editing lacks depth in various research areas.

In interdisciplinary fields, there are also very few journal articles, including one hundred and sixteen in Chinese language and writing disciplines, sixty-six in foreign language and writing disciplines, ten in computer software and computer application disciplines, six in higher education, four in literary theory, three in medical education and medical marginal disciplines, and two in news and media. The disciplines with only one article include jurisprudence, law and history, publishing, educational theory and education management, automation technology, library information and digital libraries, Internet technology, tourism, civil and commercial law, and industrial economy.

In summary, research in the field of post-editing in China started relatively late. Although the number of publications in this field has been increasing annually, indicating that research and development in this field are receiving attention from scholars, there is a lack of high-level journal literature. The research topics are also very limited, with few innovative studies and relatively few interdisciplinary research achievements.

In view of this, the author believes that it is necessary to sort out and summarize the research on post-editing in China. At present, there are already comprehensive reviews of post-editing research in China, such as Wang Xiangling and Jia Yanfang (2018), in which they show that: on the overall, international empirical

research on post-editing has been on the rise since 2000, with stable research results each year since 2009, and the research content and methods have become increasingly diverse. Qin Hao (2020) suggests that Post-editing is still at a basic stage, with many unresolved and multi-layered and diverse problems. According to Wang Huashu and Chen Nie'ao (2021), from the current research status, foreign institutions conduct more comprehensive and in-depth research, and have conducted specialized surveys on machine translation and post-editing, with a stronger focus. In comparison, research in China, while covering the basic application of machine translation in the language service industry, shows the increasing trend of the popularity of machine translation, but there is less specialized research. The investigations are not sufficiently in-depth when it comes to detailed issues such as how companies use machine translation and post-editing, recommendations and expectations for them, and which factors may encourage or hinder companies from using this technology.

Although many scholars in China have conducted comprehensive reviews on post-editing, there is a lack of summarization and visualization in the form of knowledge graphs. Only Xiao Zhiqing and Jin Ming (2022) explored the current status, issues, and prospects of research on China's machine translation post-editing.

Therefore, this article, using CiteSpace literature metrology analysis software, based on one hundred and seventy academic journal articles from the China National Knowledge Infrastructure (CNKI) database, conducts an exploration from the perspective of literature metrology on the publication time distribution, highly cited literature, main research authors, main research institutions, research hotspots and evolution, research fields and frontiers of post-editing research of machine translation in China from 1995 to 2023 from the perspective of bibliometrics. This study aims to outline the current situation, hotspots and trends of post-editing research in China, and to provide new perspectives and methods for further in-depth research on post-translation editing in China.

## **II. Research Design**

### **Data Sources**

The research data in this paper comes from the China Knowledge Network database. Taking "post-editing" as the search theme, it was found that research on post-editing in China first appeared in 1995. To ensure the authority and reliability of the data, the specific literature source was set as academic journals, with a time span from 1995 to 2023. After the search, one hundred and seventy journal articles were obtained, and the database retrieval was conducted on January 18, 2024.

### **Research Tools and Methods**

This study is based on bibliometrics methodology, using the visualization analysis software CiteSpace developed by the renowned American scholar Chaomei Chen as the analytical tool. CiteSpace is a versatile, multi-temporal, and dynamic citation visualization analysis software. It is a Java application that identifies and visualizes new trends and dynamics in scientific literature, focusing on the origins and evolution of a knowledge domain in a citation network map (Chen, 2006). It automatically identifies the research frontiers represented by citation nodes and co-citation clusters on the map as the knowledge foundation. Export the one hundred and seventy selected literature articles in Refworks format from CNKI, import them into CiteSpace 6.2.R6 software, set the time slicing to "From 1995 Jan To 2023 Nov", set the year per slice to 5, select publication time distribution, highly cited literature, research authors, research institutions, and keywords as objects for visualization research, analyze and summarize the current status of research on China's machine translation post-editing from 1995 to 2023.

### **Research Questions**

This study aims to address two questions:

- (1) What is the current status of machine translation post-editing in China?
- (2) What are the hot spots and trends in China's machine translation post-editing?

## **III. Data Sources**

### **Time Distribution of Publication**

CiteSpace can display two different views : cluster view and time zone view. The time zone view can show the structural relationships of nodes in the co-citation network that change over time (Cai Jiandong et al., 2012) . To explore the research outcomes of China's post-editing from 1995 to 2023, this study analyzed one hundred and seventy academic journal articles published between 1995 and 2023, as shown in Figure 1. Figure 1 reveals that the number of publications in 1995, 2007, 2009, and 2010 was only one each, while from 2012 to 2015, there were only two to three publications each year. After 2016, there was a sharp increase in the number of research papers on China's post-editing, with four publications in 2016, fifteen in 2018, thirteen in 2019, and

nineteen in 2020, indicating that China’s post-editing research has attracted attention and importance from domestic scholars. The number of publications doubled in 2021 and remained stable from 2021 to 2023, with thirty, thirty-five, and thirty-two publications each year respectively. From the perspective of development stages, research on China’s machine translation post-editing is divided into three stages slow growth (1995-2015), rapid growth (2016-2020), and continuous growth (2021-2023).

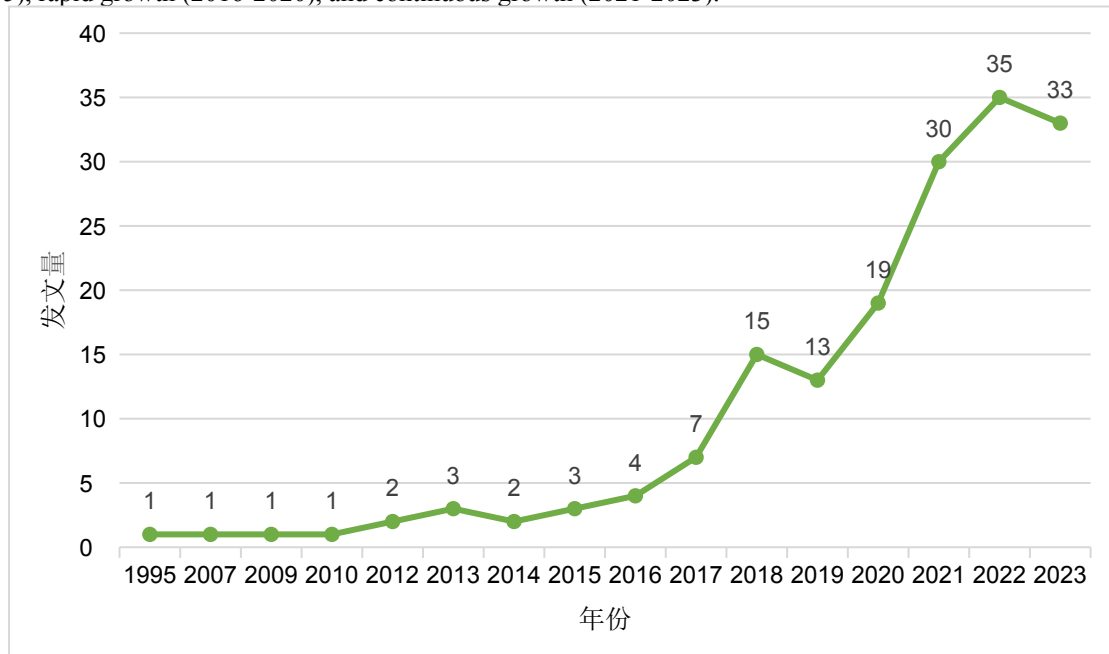


Figure 1. Distribution of publication time for China’s post-editing

### Highly Cited Papers

The frequency of article citation is an important indicator reflecting the recognition of the paper in the field by other researchers. The more times an article is cited, the stronger its dissemination, impact, and recognition (Dzikowski & Piotr, 2018).

Table 1. Top 10 highly cited papers

(Sequence Number)	Title of the thesis	Author	Name of publication	Year of publication	Citation frequency
1	On Post-editing of Machine Translation	Cui Qiliang	Chinese Translators Journal	2014	648
2	The Character of Error Types of Post-editing: Perspective of Machine Translation Based on Scientific and Technological Materials	Cui Qiliang; Li Wen	Chinese Science & Technology Translators Journal	2015	384
3	Research Focuses and Trends in Post-editing of Machine Translation	Feng Quangong; Cui Qiliang	Shanghai Journal of Translators	2016	298
4	A New Exploration of English-Chinese Machine Translation for Post-editing Automation	Li Mei; Zhu Ximing	Chinese Translators Journal	2013	201
5	Post-editing of Machine	Wei Changhong;	Chinese Science &	2007	189

	Translation	Zhang Chunbai	Technology Translators Journal		
6	To train post-editors in the background of the global language services industry	Feng Quangong; Zhang Huiyu	Foreign Language World	2015	148
7	Towards the construction of a three-dimension model of post-editing competence	Feng Quangong; Liu Ming	Foreign Language World	2018	114
8	Investigation on the Post-editing of Machine-translated News	Feng Quangong ; Li Jiawei	Technology Enhanced Foreign Language Education	2016	97
9	Case Studies of Postediting in Machine Translation of Scientific and Technological Texts	Yang Wendi; Fan Zirui	Shanghai Journal of Translators	2021	89
10	Research Focus and Trends of Machine Translation Post-editing	Wang Xiangling; Jia Yan-fang	Journal of Hunan University (Social Sciences)	2018	87

From Table 1, we can see that among the ten highly cited literatures, there are four on post-editing theories and development trends, three on case studies, one on empirical study, one on application of post-editing, and one on post-editing ability model construction. It shows that China's post-editing research focuses on post-editing theory, post-editing development trend and post-editing case analysis. The most highly cited literature introduces the concept of post-editing, analyzes the application of post-editing and the research status of post-editing, summarizes the driving force behind post-editing, studies the types of materials applicable to post-editing, and proposes practical guidelines for improving the quality and efficiency of post-editing (Cui Qiliang, 2014). The literature ranked second in terms of citations focuses on the working principle of post-editing, illustrates the types of errors in machine translation through case studies, and analyzes the characteristics of post-editing work (Cui Qiliang & Li Wen, 2015). The third-ranked literature mainly summarizes the research status of post-editing and predicts its development trend (Feng Quangong & Cui Qiliang, 2016).

**Main Research Authors**

Run CiteSpace, select author as the node type, to generate a co-authorship network map of Chinese researchers in post-editing (Figure 2), and based on the statistical results from CiteSpace software, present a table (Table 2) showing the publication volume of high-productivity Chinese researchers in post-editing from 1995 to 2023 and their first year of publication. Analyzing the publication volume of authors and their collaboration helps to identify key figures in the research field and understand the overall research status (Xiao Zhiqing & Jin Ming, 2022).



Figure 2. Co-occurrence map of China’s post-editing researchers, 1995-2023

Table 2. Number of publications and year of first publication by high-yield researchers of post-editing editors in China, 1995-2023

Sequence Number	Author	Number of Papers(Piece)	Year of the First Article
1	Feng Quangong	7	2015
2	Wang Xiang-ling	5	2018
3	Cui Qiliang	3	2014
4	Xiao Zhiqing	3	2021
5	Yin Jian	2	2023
6	Xiao Weiqing	2	2022
7	Hu Fumao	2	2021
8	Zhou Chun	2	2020
9	Du Juan	2	2022
10	Zhang Huiyu	2	2015
11	Chen Yi	2	2023
12	Lei Pengfei	2	2021
13	Wang Huashu	2	2021
14	Jia Yan-fang	2	2021

The font size of the author names in the network map is positively correlated with their publication volume. From Figure 1 and Table 1, it can be seen that Chinese researchers in post-editing have relatively low overall publication volume, with relatively high-productivity authors such as Feng Quangong, Wang Xiangling, Cui Qiliang, Xiao Zhiqing being representative figures in this research field. Furthermore, the connecting lines between the graph nodes can reflect the cooperative relationship between authors, and the thickness of the connecting lines is positively correlated with the degree of cooperation. Researchers in the field of post-editing have relationships that are characterized by small concentration and large dispersion. Some scholars have formed small academic communities among themselves. The cooperation between Feng Quangong and Zhang Huiyu, Cui Qiliang and others is particularly close. There are also collaborative relationships between between Han Yadong and Ye Na, Cai Dongfeng, Zhang Guiping, Maimai Teyimu, Garira and Ottoman, Armin Guri, Ibrahim, Turgen, Dai Panyu and Li Xuening. However, overall, the distribution of authors is relatively dispersed and isolated. The most representative author among them is Feng Quangong, who not only leads in the quantity of publications but also collaborates with multiple scholars in different fields to initiate academic research and create academic results. This includes co-authored works such as “Research Focuses and Trends in Post-editing of Machine Translation”with Cui Qiliang, “To train post-editors in the background of the global language services industry”with Zhang Huiyu, “Towards the construction of a three-dimension model of post-editing

competence” with Liu Ming, and "Investigation on the Post-editing of Machine-translated News" with Li Jiawei. These journal articles have also gained high download and citation rates on CNKI.

### Main Research Institutions

Choose node type “Institute”, draw a co-occurrence network map of high-yield research institutions (Figure 2) through the CiteSpace visualization analysis software, and export the data to Excel to calculate the number of publications and the first publication year of high-yield research institutions (Table 2). During the statistical process, it was found that some research institutions publish articles through secondary units. Therefore, the number of publications of secondary units belonging to the same research institution is combined before sorting.



Figure 3. Co-occurrence map of high-yield research institutes for post-editing in China, 1995-2023

Table 3. The number of publications and the year of first publication in China’s post-editing high-yield research institutions, 1995-2023

Organization Name	Number of Papers	Year of the First Article
College of Foreign Languages, Shandong University of Science and Technology	5	2023
Zhejiang University	4	2016
School of Foreign Languages, Hebei University of Technology	3	2018
Shandong University	3	2022
University of Shanghai for Science and Technology	3	2017
Graduate School of Translation and Interpretation, Beijing Foreign Studies University	3	2021

The font size of the institution names in the map is positively correlated with their publication output, and the connections represent cooperative relationships between institutions. From Figure 3 and Table 3, it can be seen that relatively productive research institutions include the College of Foreign Languages, Shandong University of Science and Technology, Zhejiang University, etc., with publication numbers all above four (including four), whereas more research institutions have publication numbers of only two to three articles. The map density is 0.0063, indicating that overall there are no close collaborative relationships among Chinese research institutions in the field of translation editing. There is relatively little cross-regional cooperation among research institutions, with Zhejiang University at the center collaborating with the Localization Service

Committee of China Translation Association, the University of International Business and Economics and Shanghai Jiao Tong University. Furthermore, each school has different research focuses, with Zhejiang University focusing on the development trend of post-editing and the construction of post-editing related models, while Shandong University of Science and Technology emphasizes the post-editing of scientific and technological texts.

**Keywords**

**Research Hotspots**

From the perspective of knowledge theory, keywords with high centrality and frequency represent issues that researchers collectively focus on during a certain period, namely research hotspots. Centrality, as a measure of the magnitude of node power, reflects the importance of the node in the network. The higher the co-occurrence frequency of keywords, the higher the centrality of the node, indicating the greater importance of the node in that field (Wang Juan et al., 2016). As shown in Table 4, the keywords with high occurrence frequencies in China’s research literature on post-editing include “post-editing” “machine translation” “pre-editing” “human translation” “translation technology”, etc., which also reflect the focus and changes in the field of China’s post-editing in the process of advancement and development.

**Table 4. Frequency, centrality and year of keyword co-occurrence**

Sequence Number	Frequency	Centrality	Year	Keyword
1	131	1.33	1995	Post-editing
2	91	0.44	1995	Machine translation
3	9	0.00	2009	pre-editing
4	8	0.01	2009	human translation
5	7	0.00	2017	translation technology
6	5	0.00	1995	artificial intelligence
7	5	0.03	2018	translation quality
8	4	0.00	2019	tourism text
9	4	0.05	2020	translation
10	4	0.00	2020	scientific text
11	4	0.01	2015	teleology
12	3	0.01	2019	error type
13	3	0.00	2019	comparative analysis
14	3	0.00	2018	translation strategies
1	3	0.03	2021	terminology
2	3	0.00	2016	news translation

Through the keyword co-occurrence map, we can see the high-frequency keywords in this field. The size of the squares in the graph represents the frequency of the keywords, with larger squares indicating higher frequencies; if different keywords appear in the same article, there will be a connection between them, and the thicker the connection, the closer the relationship between the keywords. By running CiteSpace software and selecting Keywords as the node type, the keyword co-occurrence map can be obtained through algorithmic analysis ( Figure 4 ).



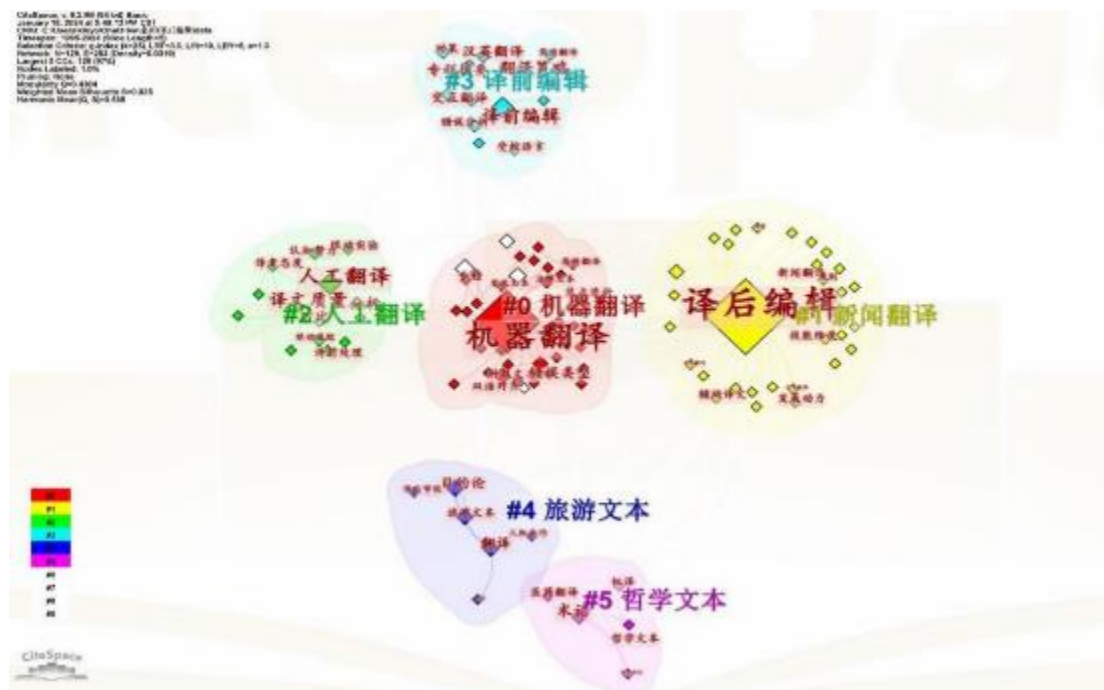


Figure 4. Co-occurrence mapping of keywords in China's post-editing research, 1995-2023

In Figure 4, there are a total of one hundred and twenty-nine main nodes and two hundred and sixty-three connections, with a density of 0.0319. This indicates that research on machine translation post-editing is highly centralized, forming the two main cores of “post-editing” and “machine translation”. Keywords such as “pre-translation” “human translation” “translation technology” “artificial intelligence” “translation quality” “translation strategy” “error types” “comparative analysis”. “terminology” “news Translation” “scientific and technical texts” and “scopos theory” are all connected to these two main cores, highlighting the focus of research in the field of translation editing. Additionally, the research covers various directions, leading to higher frequencies and centrality. Meanwhile, these keywords are interconnected, closely related, with various research branches and interdisciplinary nature. However, they also each form smaller research systems. For example, the two keywords of “translation” and “tourism text” are only connected with one of the main cores. For example, the keywords “translation” and “tourism text” are only connected with one of the main cores, “post-editing”.

Analyzing the interconnection of keywords in Figure 4, research in the field of post-editing can be divided into two categories: first, studies on human-computer interaction translation, with keywords such as “post-editing” “machine translation” “human translation” “translation quality” “pre-editing” “comparative analysis” “translation strategy” “translation technology” “artificial intelligence”. Second, specialized research on text types, with keywords including “post-editing” “machine translation” “translation” “teleology” “error types” “tourist texts” “scientific texts” “news translations” “news translations”, and so on.

CiteSpace's keyword clustering function can clarify the hotspots and development trends in a specific research field (Duan Chunyu & Cai Jiandong, 2016). Two important parameters for measuring the rationality of clustering structure are the cluster modularity value Q and the average silhouette value S. Generally, the Q value is within the range of [0, 1), and  $Q > 0.3$  signifies a significant community structure. When the S value is 0.7, the clustering is highly efficient and convincing. If the S value is above 0.5, the clustering is generally considered reasonable (Chen Yue et al., 2015). The keyword clustering results of China's post-editing research from 1995 to 2023 show a Q value of 0.4304 and an S value of 0.835, indicating that the clustering structure of this research topic is reasonable.



**Figure 5. Keyword clustering map of China's post-editing research, 1995-2023**

The clustering map (Figure 5) shows that China's post-editing research from 1995 to 2023 has formed six clusters, namely: # zero machine translation, # one news translation, # two human translation, # three pre-editing, # four tourism text, # five philosophical text. From zero to five, the smaller the number, the more keywords are included in the cluster. To explore the relationships between the clusters, the clusters were re-integrated, resulting in two main research paths: machine translation and post-editing, and type text translation.

Machine translation and post-editing include clustering # zero machine translation, # two human translation, and # three pre-editing. Since 1995, many scholars in China have conducted research on post-editing based on machine translation, starting from the perspective of translation technology to consider how to improve post-editing. By introducing the working principle of post-editing, Cui Qiliang and Li Wen (2015) introduces the working principle of post-editing, uses case studies to discuss error types in machine translation pairs, and analyzes the characteristics of post-editing work. Wang Huashu and Li Zhi (2019) investigated the cognition, usage, and learning status of Chinese translators on translation technology. They found the current status and existing issues in technology application and provided practical suggestions to address these problems, hoping to offer insights and references for the development and teaching of translation technology. This study identified errors in machine translation results, to some extent providing data and foundations for research on post-editing technology. Luo Jimei and Li Mei (2012) compared machine-translated texts with human-translated texts, describing the typical errors of machine translation in terms of vocabulary, syntax, and translation processing. They proposed supplementing the establishment of formal rules and constraining the lexical categories to provide feedback for machine translation systems. Post-editing does not exclude pre-editing. Both are important means to improve the quality of machine translation. Sufficient pre-editing can effectively reduce the workload of post-editing personnel. Therefore, broadly speaking, pre-editing is also an integral part of post-editing (Feng Quangong & Gao Lin, 2017). The application of controlled language in pre-editing and the exploration of pre-editing techniques based on controlled language for English-Chinese/Chinese-English translation can be important topics for post-editing research. At the same time, in the process of using post-editing in translation practice, Chinese scholars have gradually begun to consider empirical comparative research and teaching research on post-editing, such as the comparison of post-editing distance, function and efficiency. For instance, Wang Xiangling and Jia Yanfang (2018) put forward an empirical comparative study of human translation and post-editing. Wang Xiangling and Wang Tingting (2019) compared thirty-one student translators in the process of translating English into Chinese in technical texts using human translation and machine translation post-editing, showing differences in translation speed, translation quality, and translator attitudes, conducting empirical research through keystroke recording, questionnaire surveys, and other research methods, and looking ahead to post-editing talent cultivation, post-editing competence definition, post-editing course design, and post-editing talent cultivation.

Translation of type texts includes # one news translation, # four tourism text and # five philosophical text. Post-editing is widely used in translation practice, but currently, post-editing is mainly applied to applied texts such as economic texts, scientific text, informative text and tourism texts. On the one hand, due to the different requirements for translation quality in texts of different genres, applied texts mainly consist of informative texts with fewer metaphors and cultural-loaded words. Generally, they only need to convey information directly and faithfully. Post-editing can not only improve efficiency, but also further ensure the quality of translation. On the other hand, with the development of globalization, exchanges in economy, science and technology, and trade between countries are the most frequent. Economic texts, technical texts, etc., have a relatively large share in the translation market, which has led to the current situation where post-editing is more commonly applied to applied texts.

### Research Trends

The burst keywords indicate that the research topic has received significant attention during a certain period. It signifies a research direction that was emerging at that time and holds great potential and value. By exploring the evolution path of these key terms, one can to some extent reveal the development trends of a certain research field and uncover potential valuable research directions (Xiao Wan & Zhang Shuyu, 2016).

In order to further observe the evolution trend of the research themes of China's post-editing from 1995 to 2023 in different periods, a timeframe map of key terms in post-editing research was drawn using CiteSpace based on keyword co-occurrence(Figure. 6 ). Each research node in the map represents the hot keywords of China's post-editing research. The span and density of the lines connecting the research nodes clearly depict the research trends and thematic changes in post-editing research. Analysis of the map shows that post-editing has been increasingly attracting attention from domestic scholars, especially since 2009, as indicated by the gradual increase in hot keywords. Before 2015, there were relatively fewer coordinates in the time zone map, with sparse and scattered nodes. Since 2016, the number of nodes has significantly increased and become more dense, indicating a research boom in post-editing studies starting from 2016. By 2016, not only has the number of key terms continued to increase, but the research fields covered by these key terms have also become more diversified.

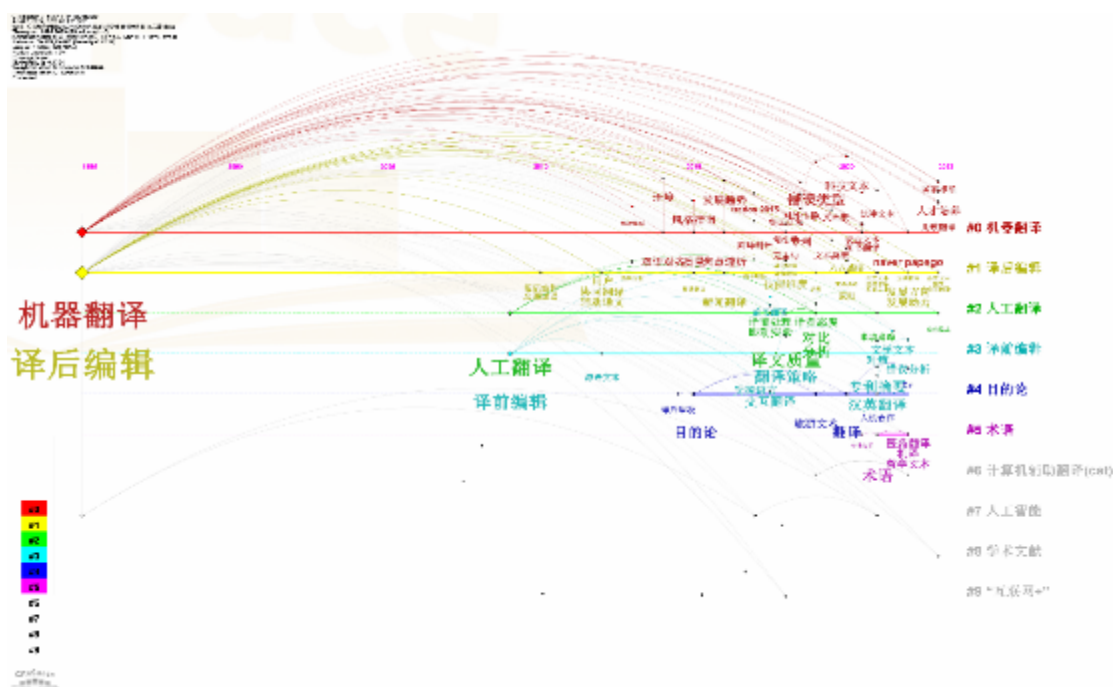


Figure 6. Time zone map of keywords for post-editing research in China, 1995-2023

According to the algorithm of the Citespace software, the burst words are sorted by their appearance time to obtain Table 4. The table displays the top sixteen keywords with the highest frequency of occurrence, arranged in the order of their appearance.

Table 4. Years of keyword bursts in China's post-editing research from 1995 to 2023

Sequence Number	Keyword	Year of emergence
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1	Post-editing	1995
2	Machine Translation	1995
3	Artificial Intelligence	1995
4	Pre-editing	2009
5	Human Translation	2009
6	Teleology	2015
7	News Translation	2016
8	Translation Technology	2017
9	Translation Quality	2018
10	Translation Strategies	2018
11	Tourism Text	2019
12	Error Types	2019
13	Comparative Analysis	2019
14	Translation	2020
15	Scientific Text	2020
16	Terminology	2021

As shown in Table 4, the burst words are categorized into three stages according to the time zone distribution map, namely exploratory period (1995-2008), the stable development period (2009-2015), and the rapid development period (2016-2023).

1 From 1995 to 2008, China's post-editing research was still in the stage of initial exploration. During this period, there were only two publications, but three burst keywords emerged: “post-editing”, “machine translation” and “artificial intelligence”. In 1995 Huang Heyan and Chen Zhaoxiong (1995) proposed the design of an intelligent post-editor and its implementation algorithm, aiming to significantly reduce manual deletion of mistranslations and insertion of correct translations, thereby improving the efficiency of post-editing. These three burst keywords were first introduced in this article.

2 From 2009 to 2015, China's post-editing research entered a period of stable development. During this stage, the burst keywords are “pre-editing” “human translation” and “scopos theory”. The first two burst keywords appeared in 2009 when Lin Haimei (2009) proposed that that machines lack the ability to process social knowledge that is unique to humans, resulting in machine-translated text quality far inferior to human translations. Pre-editing and post-editing interventions in machine translation can be used to improve the quality of machine-translated text. In addition, the literature also puts forward an important point: the purpose of machine translation is to reduce the burden and improve the efficiency of human translation, to replace humans in some scenarios and tasks, but not to completely replace human translation. Human-machine cooperation is more realistic and practical than pursuing fully automatic high-quality translation. Therefore, the urgent issue to be addressed at present is to train editors specialized in intervening in machine translation, especially post-editing personnel. The third burst keyword appeared in 2015 proposed by Hu Jiawei and Jiang Cheng (2015). The article puts forward an important point: at present, in order for the text generated by machine translation to reach the publishing standard, a large amount of post-editing work by translators is still needed. Relying solely on machine translation is not possible to achieve a translation that is both “faithful, expressive, and elegant”. Therefore, to balance translation speed and quality, the post-editing stage after machine translation is indispensable. Only by organically combining human and machine can effectively improve both the translation speed and quality.

3 From 2016 to 2023, the burst keywords appeared prominently after 2016, including “news translation” “translation technology” “translation quality” “translation strategies” “tourism texts” “error type” “comparative analysis” “translation” “scientific texts” “terminology”. The research scope involved by the keywords is also very extensive, but the number of academic journals in each research direction is limited, indicating that the depth of research in each domain is insufficient. The burst keyword “news translation” emerged in 2016, with the article proposing: at this time, there have been significant interdisciplinary and cross-disciplinary research results in the field of post-editing. Given the timeliness requirements of news translation, using the post-editing mode can greatly improve the efficiency of translators, facilitating the rapid dissemination of news translations (Feng Quangong & Li Jiawei, 2016). Chinese scholars have begun to pay attention to the application and development of post-editing in a specific field. In 2017, the keyword “translation technology” appeared, mainly reflected in Cui Yanqiu (2017) proposed that translation technology not only includes the use of computer-aided translation software, but also the principles of machine translation, information retrieval, the use of Internet resources, translation project management, establishment of translation memory databases, machine translation post-editing, editing and typesetting, etc. It is suggested to carry out group cooperative translation teaching based on the CAT network collaborative platform, improve translation quality and efficiency through the collaborative effect of high-level peers and parallel texts. The burst keyword of “translation technology” is also reflected in Dorothy Kenny's important point in 2017: in the process of reflecting on translation technology, there are two very common positions: The Internet is filled with a utopian world without language barriers; in the translation field, some scholars predict that machine translation will

soon turn most translation work into post-editing work (Pym, 2014). It can be seen that the translation circle has realized that post-editing has evolved into an increasingly important work mode in the context of machine translation. In 2018, the burst keywords were “translation quality” and “translation strategy”, with a total of fifteen articles published, making remarkable progress in the number of publications. The burst keyword “translation quality” is reflected in the proposals by Yin Hanjun and Chu Xiangqun (2018) that the quality of machine-translated texts no longer meets people’s needs, and the balance between translation speed and translation quality is particularly important in the preprocessing and post-editing of translations. They also analyzed the necessity, feasibility, and related strategies of pre-processing and post-editing of translations. The burst keyword of “translation strategy theory” has been proposed and researched by many scholars, including: Zhao Yang (2018) discussed the two types of interactive translation, pre-editing and post-editing, which played an important role in improving the quality of machine-translated texts. From the three major aspects of vocabulary, syntax, and grammar, corresponding pre-editing and post-editing strategies are proposed, focusing on vocabulary modification, sentence structure adjustment, and grammar adjustment as the main pre-editing actions, as well as the corresponding post-editing checks, providing a certain reference for the practice of machine translation. Wang Han and Shi Gengshan (2018) proposed the use of machine translation to improve efficiency, adopting post-editing to control quality, which to a large extent achieved the complementary advantages of the two. Taking the artist resume translation practice at Tianjin Grand Theatre as an example, the article summarized the post-editing strategies that can be applied in resume translation, including checking translatable untranslated elements, adjusting word order, correcting mistranslations, and formatting conversion. It was concluded that adopting a post-editing mode for artist resumes can significantly improve translation efficiency and ensure translation quality. At this time, the human-machine interactive translation mode has gradually attracted attention from the translation academia. The keywords that emerged in 2019 are “tourism text”, “error types”, and “comparative analysis”. The concept of “tourism text” as presented by Zong Zhaorong and Hong Changchun (2019) emphasized that any translation behavior is determined by its purpose. As an “informative” + “inductive” tourism text, it not only needs to provide tourists with precise information but also requires tourists to generate the same emotions and cultural resonance in the translated text, stimulating their enthusiasm for tourism. During the post-editing process, editors need to carefully review the machine-translated text and handle it from three aspects: vocabulary selection, syntactic structure, and aesthetic requirements, to meet the needs of tourists. The burst keyword “error type” is reflected in the fact that Li Wei (2019), on the basis of outlining the current research status of the post-editing mode in China, discussed the application of post-editing mode in film and television text translation, analyzed common error types in machine translation processes, and summarized the general principles that film and television text translation should follow, aiming to provide references and guidance for future film and television text translation. In order to provide reference and reference for future film and television text translation. The burst keyword “comparative analysis” is reflected in the fact that Zou Rufeifei (2019) selected university web pages as a specific text type, conducted a comparative analysis between neural network translation systems and human translation, analyzed their handling in terms of word selection, sentence structure adjustment, cultural differences, and aimed to provide reference directions for post-editing by users of neural machine translation in the future. In 2020, the keywords “translation” and “scientific and technological text” burst, Cai Qiang and Dong Dongdong (2020) selected 200 Chinese abstracts of SCI and EI scientific papers in the field of non-ferrous metals from the China National Knowledge Infrastructure (CNKI) database of Jiangxi University of Science and Technology (2015-2017). They conducted Google Chinese-to-English machine translation on these abstracts and analyzed the translations manually, while also comparing them with the original English abstracts. The results show that errors in Google’s Chinese-to-English machine translation of technical texts mainly lie in vocabulary, syntax, logic, and the frequency of errors decreases successively. Zhou Wenge and Xiao Shijie (2020) took the machine translation of Chinese-to-English technical texts provided by the online automatic translation tool Google as the research object, analyzing the unavoidable main issues such as semantic selection, context, and segmentation in machine-translated texts. Based on this, they proposed post-editing techniques to improve the quality of machine translation and elucidated the necessity of combining machine translation with human editing modes. It can be seen that scientific texts have become an important research subject in the field of post-editing in China. In 2021, the burst keyword “term” appeared, which was proposed by Zhang Ruike (2021). The paper selected a Chinese abstract of an ocean fisheries paper and its Google Translated English version, which were handed over to master’s students majoring in marine biology and translation respectively for post-editing, with the research focusing on examining the editing situation at the terminology level. It can be seen that at this stage, the research frontier of post-editing in China is mainly reflected in translation quality, translation technology, type-text translation and the application of post-editing.

#### **IV. Results And Discussions**

##### **Research Findings**

This study utilizes CiteSpace literature analysis software to analyze one hundred and seventy academic journal articles from the China National Knowledge Infrastructure (CNKI) database. From a bibliometric perspective, it explores the publication time distribution, highly cited literature, research authors, research institutions, research hotspots and their evolution, research fields, and frontiers of China's machine translation post-editing research from 1995 to 2023, and draws the following conclusions:

1. From the perspective of evolutionary trends, China's machine translation post-editing research can be divided into three stages: slow growth (1995-2015), rapid growth (2016-2020), and sustained growth (2021-2023).
2. The research content of highly cited literature in China's machine translation post-editing mainly includes post-editing theories and development trends, and case studies, but both the breadth and depth of research are insufficient.
3. A high-yield author group has not yet formed in the field of China's machine translation post-editing, with Feng Quangong being the most prominent scholar at the forefront. Relationships among researchers in the post-editing field exhibit a small degree of concentration and large dispersion.
4. There is no close cooperative relationship among research institutions in China's machine translation post-editing. Cross-regional cooperation among research institutions is limited, with post-editing research relatively concentrated on certain scholars or institutions, resulting in uneven distribution among research groups and institutions.
5. China's machine translation post-editing research has a higher degree of concentration, with research in the field falling into two categories: human-computer interaction translation research and specialized translation research for type text.
6. The forefront of China's post-editing research is mainly reflected in translation quality, translation technology, translation of various types of texts, and the application of post-editing.

## **Research Thinking**

This article, using CiteSpace literature metrology analysis software, based on one hundred and seventy academic journal articles from the China National Knowledge Infrastructure (CNKI) database, conducts an exploration from the perspective of literature metrology on the publication time distribution, highly cited literature, main research authors, main research institutions, research hotspots and evolution, research fields and frontiers of post-editing research of machine translation in China from 1995 to 2023 from the perspective of bibliometrics. This study aims to outline the current situation, hotspots and trends of post-editing research in China, and to provide new perspectives and methods for further in-depth research on post-translation editing in China.

In the age of digitalization and industrialization in the field of translation, post-editing relying on machine translation has emerged as a prevailing practice within the translation industry. This post-editing approach has introduced novel prospects for language service providers and has broadened the horizons of research in translation technology. While machine translation, computer-aided translation, post-editing, and other technologies are poised for significant advancements in the future, the extent to which they can supplant human translation, particularly concerning high-level cognitive abilities like metacognition and critical thinking, remains uncertain (Hu et al., 2020). The mode of combining machine translation with post-editing is rapidly developing. It fully utilizes the speed (efficiency) of machine translation and also fully utilizes the accuracy (quality) of human translation. This mode meets the needs of the rapidly growing translation market, promotes the development of translation technology, and facilitates communication and collaboration between academia and industry. It enriches the composition of the language service industry chain (Cui Qiliang, 2014).

Based on the research trends of the past thirty years, researchers in machine translation and post-editing in China are paying more attention to research directions, applications, breadth and depth of research, interdisciplinary and cross-disciplinary collaboration in research fields. The article proposes the following suggestions for the current issues in research on machine translation and post-editing in China:

First, on the research direction level, there is relatively little teaching design and implementation concerning post-editing abilities and talent cultivation in the field of translation. Research on post-editing teaching and talent cultivation is still at the theoretical discussion level. Therefore, related industries and academia in China should adapt to the trend of informatization development and contribute to promoting the construction of theoretical models for post-editing in China's machine translation and talent cultivation (Wang Xiangling et al., 2021). Market entities in the translation industry, such as language service and language technology providers, should further carry out various forms of professional education and training for post-editing. Language service demanders, namely client companies and individuals, should also rationally view and gradually accept the translation production model of machine translation followed by editing. The translation academic community should not only focus on improving the literacy of relevant subjects in machine translation but also strengthen the development and construction of post-editing school-based online courses. They can collaborate with companies to create online courses for post-editing, achieving resource

complementarity and win-win cooperation between schools and enterprises to meet the demand for post-editing talent in the global language service industry (Xiao Zhiqing & Jin Ming, 2022).

Secondly, Secondly, post-editing in China is mostly applied to non-literary texts, with a relatively narrow application scope; there is a need to strengthen the feasibility research of post-editing in the translation of literary books. Despite the progress that AI has made in natural language processing and sentiment analysis, AI-driven literary language translation has not yet reached the ideal state of human beings (Weng Yiming & Wang Jinping, 2020). Currently, using the machine translation post-editing mode to translate textual books in the humanities and social sciences is becoming an innovative attempt. Exploring the feasibility of applying this mode to more literary translation genres or fields (such as online novels, historical letters) is worthwhile (Xiao Zhiqing & Jin Ming, 2022). Machine translation based on natural language processing and neural networks is still immature in handling the polysemy and ambiguity of human language as well as human emotions, consciousness, and other aspects. In the future, machine translation technology should continue to evolve in these directions to achieve the continuous iteration and improvement of machine translation technology (Yu Jingliang, 2022).

Third, the interdisciplinary nature of post-editing research is not obvious, and a situation of interdisciplinary cooperation has not been formed; scholars and institutions in the fields of computer natural language processing and translation studies should work together to break down disciplinary barriers and seek interdisciplinary cooperation, enabling scholars and translators from different disciplines to engage in real-time online discussions (Fan Mengxu, 2020). In this way, the interdisciplinary nature of post-editing research in China is carried out, forming a situation of interdisciplinary cooperation

Fourth, the cognitive research on the post-editing process is limited in empirical research results due to reasons such as experimental techniques; further empirical research on cognitive processing in post-editing should be conducted. Currently, post-editing research in China is relatively lagging behind, mainly descriptive and applied (Feng Quangong & Cui Qiliang, 2016). In the future, the translation academia should integrate speculative research with empirical research and delve deep into cognitive research on the post-editing process. This includes efforts such as studying cognitive aspects of various metaphor post-editing processes, attention resource allocation in post-editing, comparative empirical research on translation speed, translation quality, and translator attitudes between human translation and post-editing, as well as automation of error recognition and handling in post-editing

## V. Conclusions

With the rapid development of neural network machine translation technology, machine translation post-editing is gradually becoming the mainstream translation production model in the Chinese language service industry, and related post-editing research is also flourishing (Xiao Zhiqing & Jin Ming, 2022). This study, utilizing the CiteSpace software for literature quantitative analysis, examines one hundred and seventy academic journal articles retrieved from the China National Knowledge Infrastructure (CNKI) database. It investigates the distribution of publication times, highly cited literature, research authors, institutions, topics, and trends within Chinese machine translation post-editing research spanning from 1995 to 2023 through a bibliometric lens. The findings reveal that, while the Chinese academic community in translation has made some advancements in post-editing research, there are notable deficiencies in research topics, subjects, and methodologies compared to the foreign post-editing research initiated in the mid-1980s. Through data analysis, researchers in China's machine translation post-editing are emphasizing research orientations, applications, depth, breadth, interdisciplinary collaboration, and cross-disciplinary cooperation within research domains. The manuscript offers pertinent recommendations to address the prevailing challenges in China's machine translation post-editing research.

This study has potential for improvement. The accuracy of data verification is inadequate, resulting in minor errors in the findings. Optimization of data collection and verification processes is recommended for future enhancement. Post-editing research has emerged as a critical and leading-edge topic within contemporary translation technology studies. Moving forward, the translation academic community can expand research topics and subjects, enhance research methodologies, and deepen both theoretical and applied investigations in machine translation post-editing.

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