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A Corpus-based Comparative Study on Readability of Maritime News from China Institute of Navigation and The Nautical Institute

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Abstract: ***The shipping industry has always been an essential part of the global economy. As the global economy recovers and cross-cultural exchanges become more frequent, the international promotion of maritime news has become increasingly important. Currently, English remains the primary international language, and English-language maritime news reports play a key role in promoting China's shipping industry abroad. However, there is a lack of comparative readability studies on maritime news in China. Therefore, this study examined maritime news published on the English websites of China Institute of Navigation and The Nautical Institute. Using corpus software WordSmith and AntConc, along with statistical software SPSS, it compared the text complexity and linguistic features of news from both institutes based on readability theory. The study found that China Institute of Navigation's news suffers from lower readability due to longer sentence length, inconsistent modal verb usage and lack of passive voice, while The Nautical Institute's news gains lower readability due to excessive lexical diversity and longer word length. This study aimed to compare the readability of maritime news from the two institutes, summarize methods and suggestions for improving readability in maritime news around the world. It is believed that this research will provide insights and references for English writing in Chinese maritime news, thereby enhancing the information dissemination of China's shipping industry.***

Keywords: Corpus, Readability, China Institute of Navigation, The Nautical Institute, Maritime news**.**

1. Introduction

The shipping industry has always been an essential part of the global economy. As a major importer and exporter, the development of the shipping industry is crucial for China. With the recovery of the global economy and the rapid growth of international maritime trade, the importance of maritime news in international communication has dramatically increased. Currently, English remains the primary international language. Therefore, English-language maritime news plays a special role in the external communication of China's shipping industry.

However, there is a lack of research on maritime news in China, though some Chinese scholars have conducted related studies: Feng (2012) conducted a comparative study on frequently occurring synonyms in an English maritime news corpus, analyzing them in terms of cohesion, collocation, semantics, and semantic prosody. Guo (2014) used relevant computer programs and software to analyze the lexical characteristics of English maritime news, focusing on vocabulary size, word length, word frequency, lexical density, and coverage. Zhang (2015) used qualitative and quantitative methods to study the use of determiners in maritime news. Liu (2015) created a small corpus of maritime news headlines from official websites of maritime organizations and major classification societies. Using relevant software, he conducted a layer-by-layer analysis of the stylistic elements: aspect, vocabulary, syntax, and rhetoric, summarizing the stylistic features of English maritime news headlines. Li (2017) built her own corpus and, combining theories of syntactic analysis by Quirk and other linguists, summarized the syntactic features of maritime English news headlines in terms of sentence length, sentence structure, tense, voice, and ellipsis.

In summary, most Chinese research on maritime news focused on translation, with little attention given to the readability of the news itself. According to the 2022 review of Chinese journalism research (CJJC, 2023), the main purpose of news is to convey information, and news with high readability can effectively communicate information to readers, ensuring they understand and absorb the content. It is known that the writing of British maritime news reports is well-known and deserves study. Therefore, this study analyzed text readability, comparing authoritative maritime news of navigation institutes from China and Britain, with the aim of identifying strengths and deficiencies of both institutes, and providing insights for improving English writing in China's maritime news, thus enhancing the dissemination of information in China's shipping industry.

2. Theoretical Framework

Readability, also known as legibility, refers to how easily a text can be read and understood. According to Dale and Chall (1949: 23), text readability is defined as the degree to which a text is easy to read and comprehend, which serves as a core metric for assessing text difficulty.

Betts (1949: 42-59) identified several key factors influencing text complexity: the number of vocabulary types, word length, lexical density, and sentence length. He concluded that difficult texts usually contain more word types, polysyllabic words, higher lexical density, and more complex sentences, while simple texts have fewer word types, shorter words, lower lexical density, and simpler sentences. It is known that factors such as word length, sentence length, and lexical density can be quantified through statistical operations and formulas to determine text complexity, thereby establishing readability.

Later, after analyzing factors involved in various readability formulas, Dechant and Smith (1977) found that subjective linguistic features of a text, in addition to traditional data

analysis, are closely related to readability. This expanded the scope from solely statistical analysis to combination with linguistic analysis. However, relying on human assessment for text readability is highly subjective, with standards and results prone to discrepancies (Wu et al., 2020: 81-97). Therefore, corpus-based quantitative research on text complexity and linguistic features effectively combines both approaches to yield more accurate results.

In conclusion, the core of readability research lies in text complexity and linguistic features, specifically how these factors influence readability (Zhou & Zheng, 2020: 55-63). Therefore, this study divided readability into text complexity and linguistic features, conducting corpus-based quantitative research to achieve more accurate results.

3. Research Design

The research objectives and tools used in this study were introduced in this section.

3.1 Date Collection

In order to conduct a comprehensive and objective analysis of the readability of maritime news in China and abroad, this study selected The Nautical Institute (abbreviated as TNI below) and the China Institute of Navigation (abbreviated as CNI below) with consideration of their influence and credibility: CNI, established in 1979, is China's only authoritative organization covering all aspects of navigation and water transport, dedicated to improving maritime research conditions and innovating basic maritime theories, providing crucial support for building a strong shipping nation; TNI is an international professional body in the maritime field and serves as the only globally recognized institution authorized to issue Dynamic Positioning Operator (DPO) certificates and accredit training institutions. Both of them are significant academic organizations in their respective countries, playing crucial roles in advancing maritime technology, education, academic exchange, and standards development.

The study randomly selected 100 news reports (including headlines) from each organization's website to create small corpora. For ease of follow-up research, the corpus from The Nautical Institute is named "TNI" (the same as abbreviation) and the corpus from the China Institute of Navigation is named "CNI" (the same as abbreviation). Guided by readability theory, the specific research questions for the corpus-based comparative study of maritime news readability between TNI and CNI are listed as follows:

1)What is the respective text complexity of maritime news reports published by TNI and CNI?

2)What are the differences in the linguistic features of maritime news reports published by TNI and CNI?

3)What suggestions and insights could this study provide for improving English writing in China's maritime news?

3.2 Research Tools

Based on readability theory, this study examined aspects such as lexical diversity, word length, lexical density, sentence length, use of modal verbs and passive voice to answer the questions listed in 3.1 The following software tools were utilized:

1) WordSmith 9.0: WordSmith offers powerful retrieval functions, allowing the study of lexical complexity, lexical variation, lexical density, and word length from four dimensions; moreover, the generated Wordlist includes statistics on average word length, average sentence length, and letter count, making this tool highly suitable for this study.

2) AntConc 4.0: AntConc's word retrieval function is able to list all sentences and fragments containing the searched words, facilitating the analysis of the context in which these words appear; most importantly, compared to WordSmith, its user interface is simpler and more user-friendly.

3) TreeTagger: TreeTagger is able to annotate parts of speech for words in continuous text. In this study, it was used to code the parts of speech in the two self-built corpora of news reports to analyze lexical features, including the distribution of adjectives, verbs, nouns, and modal verbs in each corpus; In addition, this tool is simple, convenient, and efficient to use.

4) SPSS 26: SPSS (Statistical Package for the Social Sciences) is a widely used statistical analysis software. Its independent samples t-test is applied to compare the means of two independent groups (e.g., experimental and control groups) to determine if there exist significant differences. In this quantitative research, when similar results are encountered, SPSS is used for independent samples t-test to further verify and compare the results.

4. Results and Discussion

After processing and analyzing the corpus, the comparative study on the readability of the TNI and CNI focused on text complexity and linguistic features, according to readability theory.

4.1 Text Complexity

Research (Betts, 1949) indicated that the main factors affecting text complexity include the number of vocabulary types, word length, lexical density, sentence length, and so on. Complex texts generally contain more word types, longer words, higher lexical density, and more complex sentences, whereas simpler texts are the opposite. In light of this, the study examined the text complexity of news reports from TNI and CNI in terms of lexical diversity, word length, lexical density, and sentence length.

4.1.1 Lexical Diversity

Tokens refer to all the words that appear in a text, while types refer to the number of unique words. The type-token ratio (TTR) measures the richness of vocabulary in a text and serves as an indicator of lexical diversity (Baker, 1995: 223-243). However, due to variations in text length and the repetition of function words, the lexical diversity of different

texts should be compared through the standardized type-token ratio (STTR). Studies show that a higher type-token ratio indicates richer vocabulary usage in a text (Baker, 2001: 241-266). With the help of WordSmith 9.0, the types, tokens, and STTR of the two corpora were calculated (as shown in Table 1).

Table 1: TTR & STTR in two corpora

	Tokens	Types	TTR	STTR
TNI	174,948	7,613	4.38%	28.33%
CNI	141,951	5,519	3.93%	25.45%

Table 1 finds that the STTR of TNI is 28.33%, higher than CNI's STTR of 25.45%. This result illustrates that TNI's maritime news reports have slightly higher lexical diversity and richer vocabulary usage than CNI's. In other words, TNI owns a greater number of unique word types than CNI, indicating higher text complexity (Betts, 1949).

4.1.2 Word Length

Word length affects readers' reading speed and difficulty, making it an important factor for examining the complexity of news texts. This study examined the mean word length in maritime news reports from TNI and CNI. Typically, maritime news reports tend to use longer words due to their technical terms (e.g., compound words), making them more challenging for readers. Using WordSmith 9.0, the study calculated the average word length in both corpora, finding that the mean word lengths of TNI and CNI are 3.61 and 3.84, respectively, which are very close. This indicates that both institutes prefer using longer words in their reports, enhancing the professional tone while increasing text complexity. In order to comprehend the specific distribution of word lengths in each corpus, the study further examined the frequency of words with different letters (see Figure 1).

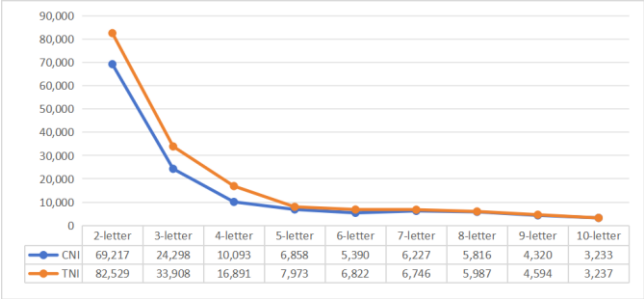

Figure 1: Distribution of letters in two corpora

Figure 1 illustrates that in both TNI and CNI, words from two to four letters appear most frequently (each exceeding 10%), while the frequency distribution of other word lengths is similar in both corpora. Notably, there exists a significant difference (around 6%) in the frequency of two-letter, three-letter, and four-letter words between the two corpora. According to Rayner and Duffy's study (1986: 191-201), readers adjust their eye movement speed based on word length, which shows that readers spend the least time on short words (i.e., fewer than four letters), whereas longer words slow down eye movement and cause more fatigue. Thus, shorter words help reduce text complexity and enhance readability. Overall, CNI owns shorter word length and simpler words, making its texts more readable compared to TNI.

4.1.3 Lexical Density

Lexical density is a measure of the amount of information in a text, reflecting its complexity (Baker, 1995). Additionally, a higher percentage indicates a greater proportion of content words, fewer function words, higher information load, and increased difficulty in comprehension (Huang, 2014). It is known that the main content words are nouns, verbs, adjectives, and adverbs. Therefore, this study used AntConc 4.0 to analyze the TreeTagger-coded texts to measure the frequency of content words in both corpora: specifically, regular expressions were used in the "Word List" to search for patterns such as V[A-Z] to find results like "VV", "VVP", "VVZ", "VB", "VVN", "VVD", "VVG", and "VBZ". By excluding miscellaneous items, we could count all verbs; similarly, this method allowed us to determine the number of content words and lexical density for both corpora (see Table 2).

Table 2: Statistics of content words in two corpora

Content words	CNI	TNI
VV	7,680/11.1%	13,656/16.1%
MD	642/0.9%	1,338/1.5%
JJ	6,944/10.0%	7,718/9.1%
NN	8,043/40.5%	26,880/31.7%
RB	1,856/2.6%	3,877/4.5%
Total	45,165/65.29%	53,469/63.06%

From Table 2, it finds that the proportion of content words in both corpora is quite similar (65.29% and 63.06%). According to Laviosa (1998), the average lexical density of English texts is about 54.95%. Thus, both CNI and TNI exceed this average, indicating that the maritime news reports from both institutes are substantial and complex.

With the aim of further accurately comparing the lexical density of the two corpora, SPSS's independent sample t-test was conducted to determine whether there are significant differences between the lexical density in the two corpora based on the previous table. The independent sample t-test results are shown in Table 3:

Table 3: Independent sample t-test in lexical density

	F	Sig	t	df	Sig. (2-tailed)
Equal Var	-009.	.926	-.256	10	.803
Unequal Var			-.256	9.896	.803

As shown in Table 3: the F-value = 0.10, and the significance (Sig) = 0.926> 0.05, indicating that equal variances can be assumed, and the data is taken from the equal variance group (Liu, 2017). The calculated t-value = -0.256, the degrees of freedom (df) = 10, and the Sig. (2-tailed) value = 0.803, which means the p-value = 0.803 > 0.05. Statistically, a smaller p-value (less than 0.05) indicates a significant difference between the two groups, while a larger p-value (more than 0.05) suggests no significant difference (Woods et al., 1986). Therefore, the p-value does not reach a significant level, indicating no significant difference between the lexical density of CNI and TNI. This result further supports the conclusion listed in Table 2, showing that the proportion of content words and lexical density in the CNI and TNI corpora share quite a similarity.

4.1.4 Sentence Length

Similar to word length, sentence length is also related to text complexity and thus affects the readability of news texts. While sentence length does not fully equate to text complexity, the length of sentences in the entire corpus can reflect the

complexity of the text to some extent (Xiao, 2012). The study used the "Word List" function of WordSmith 9.0 to calculate the average sentence length of CNI and TNI. The results (see Table 4) shows that CNI owns 1,739 sentences with an average length of 73.35 words, while TNI has 2,964 sentences with an average length of 53.28 words, indicating that CNI's sentences are significantly longer than TNI's. Typically, as the average sentence length increases, the complexity of sentences also increases (Troia, 2009), which can burden readers to some extent. Therefore, the CNI text is more complex and less readable compared to TNI.

Table 4: Sentences and average sentence length in two corpora

Corpus	Sentences	Average s length
CNI	1,739	73.35
TNI	2,964	53.28

In the reporting of maritime news, TNI tends to use shorter sentences and fewer complex sentences, making the articles more concise and allowing readers to quickly grasp the main points. In contrast, CNI prefers using longer, compound, and complex sentences, resulting in more thorough and rigorous narration. Here are representative sentences from the two corpora:

1) We will be able to tailor-make training and assessment so that it is much more focused on the individual and the needs of the individual. (TNI)

2) We will join with industry leaders and universities as we spotlight key issues surrounding well-being, professional development and crew competencies. (TNI)

3) We will shift from unilateral marine pollution prevention and control to a comprehensive environmental protection regulation system that integrates water and air, so as to promote shipping industry to high-quality development which is green, low-carbon, intelligent; third, working together to build consensus, following the new trend of development, and ensuring the stability and smooth flow of global industrial and supply chain. (CNI)

4) We will comprehensively deepen reform and opening up, vigorously boost market confidence, organically combine the implementation of the strategy of expanding domestic demand with deepening the supply-side structural reform, serve to ensure stable growth, employment and price, highlight the need to ensure smooth flow, expand investment, stabilize the market, adjust the structure, ensure safety, and prevent risks, accelerate the advancement of the modern comprehensive transportation system, and strive to make China a strong transport country. (CNI)

In comparison, it is clear that when expressing "We will", CNI tends to use many short clauses to form a complex sentence, integrating multiple pieces of information into one long sentence, which often includes relative clauses with "which" and "that", and complex sentences with participial phrases like "working" and "following". Conversely, TNI prefers a simpler structure with one main and one subordinate clause, breaking down what would be a long sentence into shorter, more manageable sentences.

4.2 Linguistic Features

As one of the primary factors influencing text readability, the study of linguistic features is crucial (Zhou & Zheng, 2020). However, linguistic features encompass various research directions, including vocabulary, syntax, voice, pragmatics, rhetoric, and so on. It is said that the linguistic characteristics of news reporting are mainly reflected in the dissemination and reception of information: modal verbs help convey more accurate tones and attitudes, enhancing the objectivity and credibility of the text, and play a vital role in expressing the author's intent (Odhiambo, 2020). Additionally, passive voice in news texts can highlight the most critical parts or subjects of news events while helping maintain objectivity and neutrality in news writing (Sawsan et al., 2018). Therefore, this study focused on analyzing the use of modal verbs and passive voice in the news reports of TNI and CNI, examining how these linguistic features impact their readability, respectively.

4.2.1 Use of Modal Verbs

In news reporting, semantics are typically constructed and conveyed through the mood system and modal system (Shang, 2012). Especially, in maritime shipping, modal verbs are commonly used to express the official requirements and expectations of shipping organizations. This study utilized the corpus tool AntConc 4.0 to analyze the use of modal verbs in CNI and TNI, exploring their semantic characteristics. Table 2 has provided an overall search of modal verbs (md). A detailed search for specific modal verbs such as "will", "should", and "might" has also been conducted. The results are shown in Table 5:

Table 5(a): Statistics of model verbs in CNI

Md	CNI Frequency	Ratio
will	406	0.58%
can	51	0.07%
may	14	0.02%
should	109	0.15%
would	9	0.01%
must	48	0.06%
could	8	0.01%
might	0	0%

Table 5(b): Statistics of model verbs in TNI

Md	TNI Frequency	Ratio
will	428	0.50%
can	352	0.41%
may	125	0.14%
should	119	0.14%
would	96	0.11%
must	80	0.09%
could	68	0.08%
might	57	0.06%

Table 5 shows that among the modal verbs in both corpora, "will" has the highest proportion, accounting for 0.58% in CNI and 0.5% in TNI. As a modal verb, "will" indicates personal willingness or speculation and is often paired with "we" in official contexts to express the authoritative organization's expectations for the future and its firm determination (Du, 2023). For example:

1) **We will** be providing expert speakers and specialists ensuring research and theory gets translated into something

meaningful for our maritime community. (TNI)

2) **We will** make solid progress in themed education, focusing on the construction of major transport infrastructure projects, supporting the implementation of national strategies, vigorously promoting the development of multimodal transport, and improving the quality of transport services. (CNI)

The following modal verb is "should", accounting for 0.15% and 0.14%, respectively. As a modal verb, "should" indicates obligation or duty. According to Halliday's classification of modal values (2010), both "will" and "should" fall into the medium-value category. The use of medium-value modal verbs can express probability and polite suggestions, which helps to soften the tone and make it more acceptable to the audience. Additionally, the use of medium-value modal verbs signifies the speaker's respect for the listener, suggesting a more equal social status between the speaker and the listener, making the speaker appear more modest. On one hand, the phrases "we will" and "we should" allow readers to feel that the maritime organization is not speaking from a high position but is instead on the same level as the readers, emphasizing the importance of sharing responsibilities and achieving goals together. These phrases help to bridge the gap between the organization and the readers, enhancing their trust in the organization. On the other hand, "we will" and "we should" are used to describe the continuous improvement of current work, highlighting the organization's expectation of cooperation and support from the readers during the process of innovation, showcasing the spirit of constant improvement and excellence. All of these analyses demonstrate that both CNI and TNI strive to respect their readers, reduce the distance between them, and present a humble and modest image.

However, as shown in Table 5, excluding "will" and "should," the frequency of modal verbs used in CNI is significantly lower than in TNI. For example, the high-value modal verb "must" is used less frequently in CNI compared to TNI (0.06% and 0.09%, respectively). The modal verb "must" places the maritime organization in a leadership position, reflecting its high level of commitment and attention to maritime affairs. By positioning the organization as the actor, it expresses the necessity of policy implementation with a firm attitude, demonstrating its capability to fulfill commitments and responsibilities according to established plans and goals, thereby enhancing the credibility of organizational decisions. Similarly, low-value modal verbs such as "can", "may", and "might" are used much less frequently in CNI (0.07%, 0.02%, 0%) than in TNI (0.41%, 0.14%, 0.06%). This indicates that TNI employs a more explicit subjective orientation, with a more informal tone that reflects a closer interpersonal relationship, showcasing the organization's approachability and modesty. In contrast, CNI tends to reduce the use of low-value modal verbs to minimize personal inclination. As maritime news in English serves as an external communication text, the use of low-value modal verbs plays a positive role in building friendly relations, conveying cooperation intentions, and gaining understanding from target audiences, making low-value modal verbs indispensable.

In conclusion, news reporters aim for objectivity, accuracy, and authority in their reporting while also seeking to bridge the gap with readers without overly imposing their subjective will (Cao, 2013: 115). Therefore, CNI lacks the use of high and low-value modal verbs compared to TNI, resulting in less effective semantic communication and lower readability.

4.2.2 Use of Passive Voice

Voice in English is categorized into active and passive. In the active voice, the subject performs the action, making the expression more direct. In the passive voice, where the subject receives the action, it is typically used to describe processes and outcomes, thus providing a more objective perspective. In journalism, the passive voice is sometimes employed to minimize the insertion of the reporter's personal feelings, allowing readers to view the content more objectively (Sawsan et al., 2018: 157-172). This study utilized PatternBuilder for TreeTagger to generate a regex for passive voice detection \S+_VB\w*\s(\S+_R\w*\s)*\S+_VVN\s, which was then applied in AntConc 4.0 to search for all types of passive voice in both CNI and TNI. The results are illustrated in Figure 2:

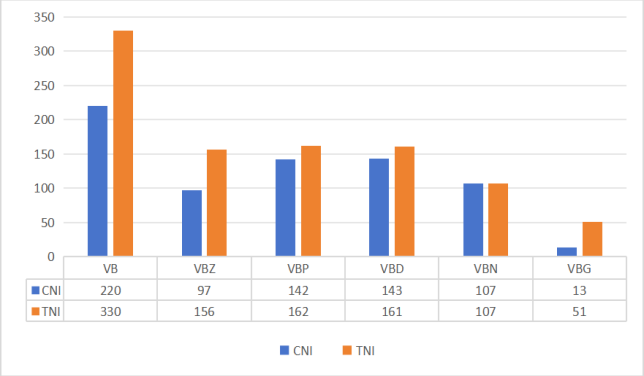

Figure 2: Distribution of all types of passive voice in two corpora

Figure 2 displays the distribution and differences in various passive voice. It can be seen that each type of passive voice used in CNI is much less than that in TNI. However, it failed to provide a clear comparison in the use of passive voice between CNI and TNI, as individual sentences may contain multiple passive structures. Therefore, in order to more accurately compare the two corpora, SPSS's independent samples t-test was conducted to examine whether there are significant differences in the frequency of passive voice usage between the two corpora. The detailed results are shown in Table 6:

Table 6: Independent sample t-test in distribution of all types of passive voice

	F	Sig	t	df	Sig. (2-tailed)
Equal Var	633.932	.000	-14.092	1,687	.000
Unequal Var			-15.271	1,547	.000

From Table 6, it can be seen that the F-value = 633.932, and the significance (Sig) = 0.000 < 0.05, which indicates that equal variances are not assumed, and the data is taken from the unequal variances group. The calculated t-value = -15.271, with a degree of freedom (df) of 1,547, and the Sig. (2-tailed) value = 0.000, which means the p-value = 0.000 < 0.05, indicating a significant difference in the frequency of passive voice usage between CNI and TNI. Thus, CNI uses passive

sentences much less frequently than TNI (the same result as Figure 2).

The use of the passive voice usually better conveys objectivity, accuracy, and authority. In English, these stylistic features are frequently achieved through the passive voice which is particularly emphasized in certain genres, such as news and scientific texts, where linguistic precision is crucial. Consequently, the frequency of passive voice usage is generally higher in maritime news. Additionally, the passive voice can significantly diminish the influence of the subject by focusing more on the result rather than the agent of the action, thereby engaging readers with the intended content (Xiao et al., 1984). Thus, readers may need to exert more effort to comprehend CNI news compared to TNI news. In other words, CNI's relatively lower usage of the passive voice results in lower text readability.

5. Conclusion

This paper constructed two corpora, each containing 100 maritime news reports, from the official websites of the China Institute of Navigation and The Nautical Institute. With the help of corpus analysis tools AntConc 4.0, WordSmith 9.0, and statistical software SPSS 26, the study conducted a readability analysis based on text complexity and linguistic features such as lexical diversity, word length, lexical density, sentence length, modal verbs, and passive voice. The study found that:

1) In terms of text complexity, TNI uses more diverse vocabulary and owns a higher number of word classes than CNI, resulting in greater complexity; CNI, on the other hand, uses shorter words and more concise vocabulary, reducing reader fatigue and lowering text complexity compared to TNI. Additionally, TNI prefers short sentences and avoids complex structures, while CNI uses longer, compound, and complex sentences, which provide a more comprehensive narrative but increase reading difficulty; both CNI and TNI have much higher lexical densities than the average English text, indicating consistent complexity.

2) Regarding linguistic features, both CNI and TNI frequently use medium-value verbs like “will” and “should”, aiming to connect with readers and express shared responsibility and goals, thereby enhancing reader trust in the navigation organizations. However, CNI uses high-value (must) and low-value (can, may, might) modal verbs significantly less than TNI, which largely limits CNI's ability to assert authority and credibility through high-value modals and to build rapport and convey cooperative willingness through low-value modals, leading to less effective communication and lower readability in CNI. Additionally, CNI uses passive voice far less frequently than TNI. The passive voice effectively draws readers' attention to the intended information while maintaining objectivity and neutrality; therefore, CNI's lesser use of passive voice results in lower text readability.

Through the comparison of text complexity and linguistic features in the two corpora, this study concluded and offered the following recommendations to improve the readability of maritime news reports all over the world: 1) Reduce the use of complex and overly long sentences, ensuring smooth and concise writing while conveying complete semantics. 2) While primarily using medium-value modal verbs, moderately increase the use of both high and low-value modals to enhance the credibility of organizational decisions while balancing authority with approachability and humility. 3) Use passive voice more frequently in news reporting to emphasize key themes, minimize the influence of the subject, and maintain objectivity and neutrality. It is believed that above methods could facilitate enhancement of the information dissemination capability of China's shipping industry.

Declaration of Conflicting Interests

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