

Ecological Translation Strategy Adjustment for the Translation of Chinese Printing and Dyeing Technology Standards into Foreign Languages under the "Belt and Road" Framework

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ABSTRACT With the continuous advancement of the Belt and Road Initiative, international cooperation in China's textile printing and dyeing industry is becoming increasingly frequent, making the translation of printing and dyeing technical standards for foreign audiences increasingly important. However, technical standard texts are highly specialized and standardized, presenting numerous challenges in their translation, including language conversion, cultural adaptation, and the transmission of communicative functions. Eco-translation studies, centered on the "translation ecological environment," emphasizes the translator's multidimensional adaptation and selection across linguistic, cultural, and communicative dimensions, providing a new theoretical perspective for the translation of textile printing and dyeing technical standards. This paper, using the "three-dimensional transformation" theory of eco-translation studies as a framework, systematically analyzes the practical significance, translation dilemmas, and strategic adjustment paths of translating Chinese printing and dyeing technical standards under the Belt and Road Initiative, thus providing theoretical reference and practical guidance for the international dissemination of Chinese textile technical standards.

INDEX TERMS belt and road Initiative, textile printing and dyeing technology standards, eco-translation studies, three-dimensional transformation, translation strategies

I. INTRODUCTION

THE Belt and Road Initiative has provided crucial opportunities for China's textile and dyeing industry to enter the international market. The textile and dyeing industry is an important component of China's manufacturing sector, possessing a complete industrial chain and a relatively mature technological system. The formulation and implementation of relevant technical standards play a vital role in regulating international trade cooperation and improving product quality recognition. However, the translation of technical standard texts is not a simple language conversion, but a complex systemic project involving the handling of professional terminology, adaptation to cultural context, and the realization of communicative functions. Currently, research on the translation of technical standards in domestic academia is still in its initial stage, with even less research specifically on translation strategies for the dyeing field. Eco-translation studies, proposed by Professor Hu Gengshen, posits that translation is a process of adaptation and adaptive selection by the translator within the

translation ecosystem. Its three-dimensional transformation theory provides a scientific methodological support for research on the translation of technical standards.

II. THE PRACTICAL SIGNIFICANCE OF TRANSLATING DYEING AND PRINTING TECHNOLOGY STANDARDS INTO FOREIGN LANGUAGES UNDER THE "BELT AND ROAD" INITIATIVE

A. PROMOTING THE INTERNATIONALIZATION OF CHINA'S TEXTILE INDUSTRY STANDARDS

Technical standards are a reflection of industrial competitiveness. Securing regulatory influence through the standardization process enables a nation to play a leading role in the establishment of global market benchmarks. The 'Belt and Road' initiative provides policy and market support for China's textile printing and dyeing standards to enhance their international regulatory standing. Accurately translating printing and dyeing technical standards into target language countries is conducive to promoting the integration of China's standard system with international standards,

broadening the market access channels for Chinese textiles in countries along the Belt and Road, providing normative guarantees for the deep integration of China's textile industry into the international division of labor, and thus accelerating the overall process of internationalization of China's textile industry standards [1].

B. PROMOTING TEXTILE TECHNOLOGY COOPERATION AMONG COUNTRIES ALONG THE BELT AND ROAD

The countries along the Belt and Road are rich in textile raw materials, but their technical levels vary, and they have an urgent need for advanced dyeing and printing technology [2]. High-quality translation of dyeing and printing technology standards can effectively reduce the problems caused by information asymmetry in technical cooperation and provide a unified standard for bilateral and multilateral textile technology exchanges. It is conducive to promoting the cross-border dissemination and sharing of technical knowledge, creating a textile technology cooperation network based on standards among the countries along the Belt and Road, and thus promoting the coordinated development of the regional textile industry [3].

C. ENHANCING CHINA'S DISCOURSE POWER AND INTERNATIONAL INFLUENCE IN DYEING AND PRINTING TECHNOLOGY

In the international technological competition landscape, the ability to set standards is a key indicator for evaluating a country's technological strength. By systematically promoting the translation of dyeing and printing technology standards into foreign languages, China can more actively put forward technical proposals in international standardization organizations and regional technical forums, and participate in the formulation of rules [4]. High-quality standard translations can improve the international credibility and recognition of China's dyeing and printing technology, gradually expand the coverage and influence of China's textile technology standards in the world, and provide strong support for building an international technological order that is conducive to the development of China's textile industry [5].

III. THE ECOLOGICAL TRANSLATION DILEMMA IN THE TRANSLATION OF DYEING AND PRINTING TECHNOLOGY STANDARDS

A. LANGUAGE TRANSLATION IMBALANCE CAUSED BY HIGHLY SPECIALIZED TECHNICAL TERMINOLOGY

The technical standard texts of printing and dyeing belong to highly specialized normative corpora, including many professional categories such as dye chemistry, fiber materials, process parameters, and testing methods. The terminology is dense and the conceptual system is complex. The language conversion imbalance is quite serious in the process of translation [6]. On the one hand, some printing and dyeing professional terms do not have corresponding words in the

target language or the existing translations are inconsistent. If the translator forcibly replaces them with ordinary words, it is easy to cause the technical connotation to be distorted or to produce ambiguity. On the other hand, the definition sentences, conditional sentences and quantitative expressions that appear in a large number of technical standard texts require a high degree of accuracy in translation. Any semantic error will cause the understanding deviation at the standard implementation level. In addition, the connotation boundaries of terms are different in different national technical systems, and the same concept is expressed differently in different standard systems, which increases the difficulty of terminology equivalent conversion [7]. To present this problem intuitively, the table below lists the corresponding differences of common terms in the printing and dyeing field in Chinese and English standard texts.

B. COMMUNICATIVE FUNCTION DEFICIENCIES CAUSED BY CROSS-CULTURAL CONTEXT DIFFERENCES

Although technical standard texts have characteristics such as standardization and objectivity, their entire process of production and use is inseparable from a certain cultural environment. The compilation logic and expression habits of Chinese printing and dyeing technical standards are deeply influenced by the local technical culture tradition. The technical cognitive framework, normative expression conventions and quality evaluation systems of countries along the "Belt and Road" are quite different from those of China. Due to the asymmetry of cross-cultural context, the communicative function of the translated text in the target language context will be affected [8]. In essence, the technical culture presuppositions contained in the source text cannot be activated by the target language readers to generate corresponding background knowledge, thus greatly reducing the actual guiding significance of the standard clauses. In addition, some culturally specific quality descriptions and process expressions are prone to pragmatic failure in the process of cross-cultural conversion. Although readers can understand the literal meaning, they cannot grasp its operational connotation in production practice [9]. The table below compares the typical differences between Chinese standards and some standards of countries along the "Belt and Road" in the dimension of cultural expression.

C. ADAPTATION BARRIERS CAUSED BY THE ASYMMETRY OF THE TARGET LANGUAGE STANDARD AND NORMATIVE SYSTEM

The reasons for the formation of technical standard systems in various countries are multifaceted, including institutional background and historical accumulation. Different standard systems have systematic differences in text structure, clause level, parameter system and testing methods. When translating Chinese printing and dyeing technical standards into foreign languages, it is inevitable to encounter situations where there is a structural contradiction with the standard

TABLE 1. Comparison of English and Chinese translations of core terms in dyeing and printing technology standards

Chinese terminology	Common English translations	International standard translation	Difference type
Color fastness	Color fastness/Dyeing fastness	Color Fastness (ISO)	Inconsistent spelling and word choice
Pretreatment process	Pre-treatment/Pretreatment process	Pretreatment process	Inconsistent writing rules
reactive dyes	Reactive dye / Active dye	Reactive dye (ISO)	Differences in terminology selection
level dyeing	Level dyeing / Evenness of dyeing	Levelness	Conceptual connotation correspondence deviation

TABLE 2. Comparison of Cultural Expression Dimensions of Dyeing and Printing Technology Standards between China and Countries along the Belt and Road

Comparison Dimensions	Chinese Standards Characteristics	Characteristics of national standards along the route	Interpersonal influence
Results-oriented vs. process-oriented	Primarily focused on outcome-based indicators, with concise wording.	Pay attention to the step-by-step explanation of the operating procedure.	The target audience has a vague understanding of the execution path.
Color description system	Reference national standard color card number	Refer to national or international color standards	Color correspondence deviation
Quality grade description	Use grading terms such as “superior grade” and “first grade”.	Use alphanumeric rating system	The connotations of levels are difficult to directly correspond to
Implicit background knowledge	Based on industry practice, the premise is omitted in the description.	Tendency to explicitly state all conditions	The technical preset cannot be activated by the target language reader.

system of the target language [10]. When a certain technical parameter or testing process in the source language standard does not have a corresponding normative framework in the target language standard system, the translator will be in a dilemma. A literal translation will cause difficulties in understanding for the target language readers, while a free translation will destroy the normativeness and seriousness of the standard text. In addition, when some countries introduce foreign technical standards, they require the translation to

conform to the standard text format norms of their own country, which puts forward higher requirements for the ability of the translator to reconstruct the text [11]. The following table summarizes the main differences between Chinese standards and ISO international standards and the standards of typical countries along the Belt and Road in terms of normative system.

TABLE 3. Comparison of Chinese dyeing and printing technology standards with international and typical Belt and Road countries' standards and norms

Comparison Projects	Chinese Standard (GB/T)	ISO international standard	Typical national standards along the route
Text structure hierarchy	Chapter—Section—Article—Section Four Levels	The terms are flat and have fewer layers.	Depending on the country, some adopt a double-layer structure.
Parametric unit system	Using SI units as the primary standard, while also incorporating commonly used industry units.	Strictly adhere to the SI unit system	Some countries retain the imperial system or their own national system.
Test method reference	Reference national standard method number	Reference ISO method number	Citing national or regional standard methods
Sample preparation specifications	Formulated based on the characteristics of domestic raw materials	For internationally common raw materials	Combining local raw materials and processing conditions

IV. STRATEGIES FOR TRANSLATING DYEING AND PRINTING TECHNOLOGY STANDARDS FROM AN ECOLOGICAL TRANSLATION PERSPECTIVE

To present the overall logic and operational path of the above three-dimensional strategy adjustment more intuitively, this paper integrates the core steps and ultimate goals of language dimension, culture dimension and communication dimension adjustment into the following flowchart (see Figure 1).

A. LANGUAGE DIMENSION ADJUSTMENT: CONSTRUCTING A MECHANISM FOR EQUIVALENT CONVERSION OF PROFESSIONAL TERMINOLOGY

Ecological translation studies language dimension adjustment means that translators should select language forms

according to the characteristics of the target language during translation, so as to achieve the greatest possible semantic equivalence. As far as the translation of printing and dyeing technology standards is concerned, the main task of language dimension adjustment is to create a systematic professional terminology equivalence conversion mechanism designed as a dynamic feedback loop. Translators should rely on authoritative corpora and bilingual technical dictionaries to form a stable correspondence. To ensure common-sense utility, this mechanism must incorporate a periodic audit phase where translated standards are cross-referenced with the latest ISO updates and industry white papers every 24 months. This ensures the ‘unified glossary’ remains a living document, allowing for the deprecation of obsolete terms and the integration of emerging technology

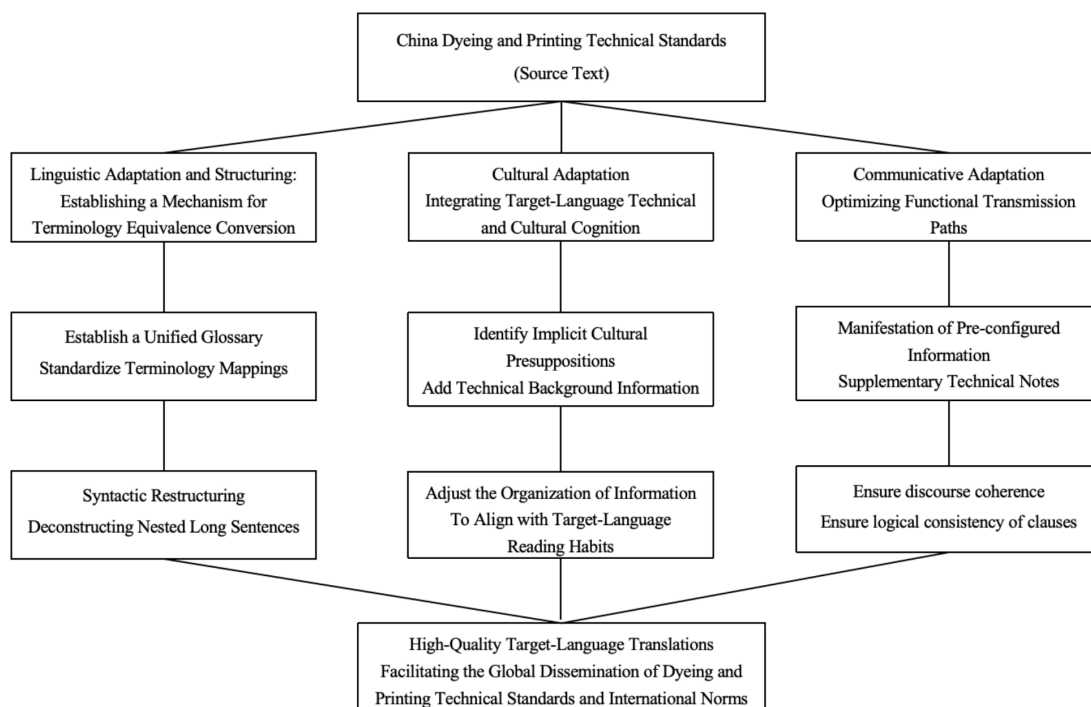


FIGURE 1. The process of adapting translation strategies for dyeing and printing technology standards from the perspective of “three-dimensional adaptation” in eco-translation studies

descriptors (e.g., bio-based dyes), thereby maintaining the system’s long-term standardization. For technical terms that do not have corresponding words in the target language, or where local Chinese norms conflict with international usage, a hierarchical selection protocol is applied. The standard translations of the International Organization for Standardization (ISO) take absolute precedence to ensure maximum global interoperability. However, if a Chinese term represents a unique domestic process (e.g., traditional ethnic printing methods), the translator must prioritize the source-term’s technical accuracy by using the ‘ISO-Term (Primary) / Local-Descriptor (Supplementary)’ format. This structured selection process moves beyond simple ‘standardization’ by providing a clear decision-making path when multiple valid but conflicting norms exist [12].

Secondly, the definition sentences, conditional sentences, quantitative qualifiers and other structures that often appear in the printing and dyeing technology standard text should be considered in addition to ensuring semantic accuracy, as well as the syntax rules and usage habits of the target language. When translating long nested sentences commonly found in Chinese technical standards into English or other target languages, they often need to undergo syntactic reorganization to break down complex subordinate clause relationships into parallel short sentences in order to conform to the reading logic of target language readers. The formal elements of language adjustment, such as numbers, units, and symbols, also need to be standardized. Translators should strictly follow the symbol norms of the target language standard text to ensure that the expression of measurement units is consistent with international conventions,

thereby laying a linguistic foundation for the standardized dissemination of technical standards [13].

B. CULTURAL DIMENSION ADAPTATION: INTEGRATING TARGET LANGUAGE, TECHNOLOGY, AND CULTURAL COGNITIVE SCHEMAS

Ecological translation studies and cultural adaptation believe that while completing the language level conversion, translators should also consider the cultural differences between the source language and the target language, and actively incorporate the cultural cognitive framework of the target language into the translation decision. When translating the dyeing and printing technology standards, the focus of cultural adaptation is to understand the technical and cultural traditions and cognitive schemas of the target language country, and on this basis, to make adaptive adjustments to the cultural load content in the source language text. In terms of specific dyeing and printing technology standards, the description of the process and the evaluation of quality will contain local technical practice experience. Some expressions are obvious to Chinese technicians, but they will become obstacles to understanding for target language readers. In the process of cultural adaptation, translators should identify these implicit cultural presuppositions and use methods such as adding technical background information and supplementing operational context to present the technical and cultural connotations that are not explicitly expressed in the source language text, so that target language readers can correctly form technical cognition [14].

At the same time, different countries have different ways of narrating technical standards and different value orienta-

tions. The technical specifications of several countries along the Belt and Road Initiative—specifically those adopting the Eurocode framework or localized versions of European EN standards—often place more emphasis on prescriptive, step-by-step procedural descriptions. In contrast, Chinese GB/T standard texts traditionally prioritize performance-based, result-oriented indicators. This distinction is not universal across all partner nations but is most pronounced when Chinese standards interact with regulatory environments that mandate detailed process-traceability as a prerequisite for quality certification. When adjusting cultural dimensions, translators can make corresponding adjustments to the information organization of the text according to the standards preferred by the target language culture, so as to ensure that the translated information content remains unchanged, but to make the translation more in line with the reading expectations and acceptance habits of the target language readers. In addition, in places related to technical descriptions with strong cultural color, such as color standards and quality grades, translators should pay special attention to the differences in the target language culture’s understanding of these concepts, and prevent misunderstandings of technical information due to contradictions in cultural schemas [15].

**C. COMMUNICATIVE DIMENSION ADJUSTMENT:
OPTIMIZING THE FUNCTIONAL DELIVERY PATH OF
TECHNICAL STANDARD TEXTS**

Communicative adjustment in eco-translation studies is whether the translation can achieve the communicative purpose of the source text, that is, whether the translated text can produce a similar communicative effect in the target language context. The primary communicative function of technical standard texts is to regulate technical behavior, convey operational instructions, and define quality boundaries; therefore, communicative adjustment plays a particularly important role in the translation of

dyeing and printing technical standards. In terms of textual function, the normative instruction function of dyeing and printing technical standards requires the translated text to produce clear operational guidance for the target language reader. During communicative adjustment, translators must differentiate between universal technical logic shared by global professionals and administrative or region-specific procedural requirements unique to the Chinese standards system. While basic operational logic is often shared, the ‘implicit background knowledge’ causing barriers refers specifically to context-dependent regulatory frameworks, specific domestic certification benchmarks, and localized experimental environment presets that are not part of the international standard repertoire. By making these system-specific administrative nuances explicit through technical annotations, the translator ensures that even a professional reader can correctly implement clauses that would otherwise seem contextually isolated. From a discourse perspective, the realization of the communicative function transcends basic syntactic restructuring. While linguistic adaptation focuses on the intra-sentential accuracy and grammatical equivalence of individual clauses, communicative adjustment addresses inter-sentential logic and the macrotextual flow. This distinction ensures that the ‘three-dimensional’ framework remains distinct: the linguistic dimension provides the grammatical building blocks, whereas the communicative dimension organizes these blocks into a cohesive instructional narrative that aligns with the pragmatic expectations of the target user. To further clarify the specific role of the three-dimensional adaptation strategy in the translation of dyeing and printing technical standards, the following diagram compares the translation status before and after adaptation from three dimensions: language, culture, and communication, to intuitively reflect the actual intervention effect of each strategy.

TABLE 4. Comparison of the Three-Dimensional Adaptation Strategies of Eco-Translatology Before and After Application in the Translation of Dyeing and Printing Technical Standards

Dimension	Before adjustment (foreign language difficulties)	After adjustment (effect of strategy intervention)
Language dimension (terminology conversion, syntactic structure, symbol standardization)	× Confused terminology translations, multiple translations for the same word. × Forced substitution when no corresponding term exists, resulting in distorted meaning or ambiguity. × Straightforward translation of nested long sentences, inconsistent with target language reading logic. × Inconsistent use of units of measurement.	✓ Establish a unified glossary and standardize correspondences. ✓ Prioritize the use of ISO standardized translations, adding annotations for transliteration/interpretation in blanks. ✓ Reorganize syntax and break down nested structures. ✓ Strictly adhere to target language notation standards.
Cultural dimension (cultural presuppositions, narrative style, quality description)	× The implicit pre-existing local technological and cultural biases prevent target language readers from activating their background knowledge. × The concise, result-oriented language used in Chinese presentations conflicts with the target language’s process-oriented preferences. × Culturally charged terminology such as color hierarchy can lead to schema conflicts and misinterpretation by target language readers.	✓ Identify implicit presuppositions and add background information. ✓ Supplement operational context descriptions and make the technical and cultural connotations explicit. ✓ Adjust the information organization according to the target language’s cultural preferences. ✓ Avoid cultural misinterpretation by target language readers.

V. CONCLUSION

The Belt and Road Initiative has provided an unprecedented historical opportunity for the international dissemination of China’s textile printing and dyeing technology standards,

and eco-translation studies has provided a systematic theoretical approach to solving the challenges of translating technical standards into foreign languages. This paper elucidates the strategic adaptation approaches for translating

textile printing and dyeing technology standards into foreign languages from three dimensions: language, culture, and communication. It attempts to improve the professionalism, cultural relevance, and communicative competence of translated technical standards through multi-dimensional translation adaptation and selection methods. As the internationalization of China's textile printing and dyeing industry continues to increase, the standardization and systematization of technical standard translation work still need to be further promoted. The academic community should also further strengthen research on translation practices for specific language pairs and specific technical fields to provide richer academic achievements for the global dissemination of China's technical standards.

AUTHOR CONTRIBUTIONS

Miao Wang designed, collected and analyzed the data, and drafted the manuscript. Miao Wang conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Miao Wang participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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