

Analysis of Functional Equivalence in the English-Chinese Translation of Petroleum Exploration Texts

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Abstract

As a highly technology-intensive industry, the petroleum sector relies on effective translation of Petroleum exploration-related texts not only to facilitate technical exchange but also to support the energy industry's transition toward green development. Such texts are characterized by professional terminology, objectivity, and conciseness. However, significant differences between Chinese and English linguistic patterns pose considerable challenges in translation. Guided by the theory of functional equivalence, this paper analyzes lexical and syntactic aspects of petroleum exploration texts and proposes translation techniques such as contextual analysis, sentence segmentation, and syntactic restructuring. The study aims to provide reference for the translation of similar technical documents.

Keywords

Petroleum exploration-related texts; Functional Equivalence Theory; Translation techniques

1. Introduction

In today's world, the technological development and advancement of the petroleum industry serve as a "cornerstone" in safeguarding national economic development. The translation of petroleum-related technical texts, acting as a bridge for technical exchange across different linguistic and cultural contexts, is becoming increasingly vital. However, significant differences in thinking patterns and textual logic between English and Chinese pose considerable challenges. Additionally, the petroleum industry is characterized by its high density of terminology and abbreviations, the industry-specific meanings of common terms, highly interdisciplinary nature, and strong scientific rigor. These features present significant hurdles for translators in the process of Chinese translation.

2. Functional equivalence theory

Functional equivalence theory, as one of the classic core theories in translation studies, advocates that translations should accurately convey the meaning of the source language through natural and appropriate language, enabling target readers to experience a reading response similar to that of source language readers. Based on functional equivalence theory, this paper analyzes the linguistic features of petroleum exploration texts—including industry-specific terminology, objective content, and concise abbreviations—and addresses challenges in translation such as accurately translating general vocabulary, transforming nominalized structures, and adjusting word order within sentences. It proposes translation techniques such as contextual analysis, the use of specialized tools, sentence segmentation, and word order rearrangement, aiming to provide reference for fellow translators. This paper primarily discusses two issues: first, the linguistic characteristics of petroleum exploration texts; and second, an examination of translation challenges at the lexical and syntactic levels from the perspective of functional equivalence.

3. Language Characteristics of Petroleum Exploration Texts

3.1. Industry Specialization

Similar to other petroleum technical texts, the industry-specific nature of petroleum exploration texts is primarily reflected at the terminology level. The seismic survey texts discussed in this paper demonstrate a high density of specialized terminology, covering a broad range of fields and exhibiting a strongly interdisciplinary character. The terminology covers a wide range of disciplines including geophysics, geology, and petroleum engineering.

There are some professional terms such as "borehole," "casing points," "dipole source," "direct seismic energy," "drillstring signal," "formation dip," "salt dome," and the like. To accurately translate such industry-specific terms, translators may consult printed technical dictionaries such as the English-Chinese Dictionary of Petroleum Technology (Third Edition) or refer to standardized petroleum and natural gas textbooks planned by petroleum universities, such as *Introduction to Seismic Exploration and Principles and Practice of Seismic Data Interpretation*. Additionally, translators should note that during the petroleum exploration phase, seismic survey texts may contain general vocabulary that carries industry-specific meanings within this domain, reflecting a semantic divergence between common language and specialized terms.

Take "resolution" as an example. In general contexts, it means "a formal decision often made by voting," "the act of solving a problem," or "determination to do something." However, in the specific context of petroleum seismic surveying, its meaning is "分辨率", which refers to the ability of seismic data to distinguish between two adjacent subsurface geological features. Another example is "the first break." In seismic surveying, it denotes "地震波的初至时间", which refers to the time point on a seismic record when the energy of a seismic wave—originating from a source

(such as explosives or a vibroseis truck) and arriving first at a specific geophone (receiver)—begins to be recorded. It represents the travel time along the shortest path from the source to the geophone.

Therefore, as far as translating technical texts is concerned, translators must avoid pursuing formal equivalence at the expense of contextual understanding or interpreting terms in isolation. Such an approach would not only compromise the professionalism, rigor, and scientific logic of the translation, rendering it ineffective in fulfilling communicative functions, but could also adversely impact subsequent processes such as identifying trap structures, characterizing oil and gas reservoirs, optimizing well placement, and recognizing or monitoring geological hazards.

3.2. Objectivity of Texts' Content

The objectivity of texts' content represents another distinctive feature of petroleum exploration texts. Seismic surveying is a large-scale applied discipline integrating cutting-edge technology, complex theoretical calculations, and comprehensive geological interpretation. When presenting seismic data and scientific principles, such texts strictly adhere to measured data and objective facts. Furthermore, Chinese technical writing often employs verbs when describing factual content, enhancing dynamism and forcefulness of expression. In contrast, English technical writing prioritizes conciseness and objectivity, avoiding excessive use of subject-verb structures while maintaining high information density. Consequently, English seismic texts frequently utilize nominalized structures to present facts objectively and neutrally. For example: "Accurate placement of drilling hazards can allow drillers to construct the well." In this typical nominalized structure—Noun + of + Noun—the syntactic core is the noun "placement." Based on logical semantics, the underlying subject-predicate relationship should be restored as "to accurately position drilling hazards".

3.3. Conciseness of Acronyms

Petroleum exploration texts strive to convey maximum information with minimal wording, avoiding repetitive and lengthy industry terminology to optimize linguistic communication efficiency. Abbreviations are widely employed in English technical documents due to their conciseness and precise meaning. The fundamental characteristics of abbreviations are: Firstly, upon initial appearance in the text, the full form must be provided followed by the abbreviation in parentheses; Secondly, abbreviations are extensively reused in subsequent content; Thirdly, they adhere to the principle of "define upon first use, maintain consistency thereafter." Examples include: "bottomhole assembly (BHA)"; "Logging-While-Drilling (LWD)"; "Polycrystalline Diamond Compact (PDC) Bits"; "Seismic-While-Drilling (SWD)"; "the Rocky Mountain Oilfield Test Center (RMOTC)"; "Vertical Seismic Profile (VSP)", etc.

4. Case Analysis

4.1. Lexical Level

In seismic measurement texts from petroleum exploration phases, commonly used vocabulary from everyday language often acquires analogous or entirely new meanings. If technical translators approach such terms superficially—interpreting them based solely on their general usage—the resulting translation will not only fail to establish logical connections and coherence within the context but also fall short of achieving the "dynamic equivalence" required by functional equivalence theory. This could prevent target-language readers from accurately comprehending the intended meaning of the original text. Therefore, translators must not only possess a solid foundation in vocabulary but also carefully analyze the contextual setting in which a term appears. By consulting specialized references such as the English-Chinese Dictionary of Petroleum Technology and online resources like TermOnline, they can select the most contextually appropriate meaning and achieve the most natural and accurate equivalence at the lexical level.

Case 1

ST: Inaccurate time-to-depth conversion leads to erroneous prediction of the depths at which geological features—formation tops, faults and overpressured zones.

TT: 不准确的时深转换会导致对地质特征（如地层顶面、断层及高压带）深度的错误判断。

Analysis: In everyday life contexts, "formation" commonly refers to "the process of constituting or developing." However, in petroleum exploration texts, this interpretation often fails to establish a logical connection with geological characteristics. In such cases, simply pursuing superficial lexical equivalence between the source and target text is insufficient. Instead, the most accurate and contextually appropriate meaning must be selected to faithfully convey the original intent. Consulting the English-Chinese Dictionary of Petroleum Technology (Third Edition) reveals that "formation" is a specialized term in the petroleum industry, meaning "地层"——a general term for all layered rocks (primarily sedimentary rocks, but also including volcanic rocks and related deposits) formed during specific periods of Earth's geological history.

Case 2

ST: Oil and gas operators also need to identify and isolate nonsealing faults because they provide conduits for pressure and fluid migration.

TT: 油气作业商还必须识别并封隔非封闭性断层，因为这类断层会形成压力和流体运移的通道。

Analysis: In everyday contexts, the term "migration" refers to the movement of animals seasonally from one region to another or the relocation of human populations due to environmental changes. If this term were translated strictly through word-for-word correspondence in the given sentence, it would fail to align with the

context of the petroleum industry. According to TermOnline (www.termonline.cn), the term is a specialized expression in oil and gas geological exploration, meaning "运移". It describes the dynamic geological process whereby hydrocarbons, after being generated in source rocks, are driven by forces such as buoyancy or pressure differentials through complex migration pathways until they accumulate in traps or are dispersed.

4.2. Syntactic level

In practical translation, different types of texts exhibit distinct syntactic preferences. Technical English frequently employs non-finite verbs. This genre aims to convey concepts and describe phenomena completely and accurately while using the most concise language possible to contain the maximum amount of information. To achieve this, it often becomes necessary to modify or qualify certain nouns. Consequently, technical English makes extensive use of non-finite verb structures—such as present participles, past participles, and gerunds. These structures not only clarify relationships between sentence elements but also help avoid complex subordinate constructions, resulting in more compact rhythm and concise expression.

ST: In this technique, a seismic receiver, deployed at known depths in a borehole using a wireline, records the traveltime of the first direct arrival, sometimes called the first break, propagating from a source on the surface down to the receiver.

TT: 在该技术中，一个通过电缆布设在钻孔内已知深度的地震检波器，会记录从地表震源向下传播至检波器的首次直达波的传播时间——这个时间量时被称为初至时间。

Analysis: This sentence exemplifies a typical characteristic of petroleum exploration texts: the nesting of multiple modifiers to achieve high-density information integration. The integrated information specifically includes: technical methods, equipment deployment, and signal propagation paths. The sentence core is: a seismic receiver records the traveltime of the first direct arrival. The prepositional phrase in this technique functions as an adverbial modifier describing the applicable context.

Structural analysis reveals:

Subject phrase: a seismic receiver;

Modifier 1 (past participle): deployed at known depths in a borehole;

Modifier 2 (present participle): using a wireline (instrumental adverbial modifying Modifier 1);

Object phrase: the traveltime;

Modifier 3 (prepositional): of the first direct arrival;

Parenthetical: sometimes called the first break (appositive explanation);

Modifier 4 (present participle): propagating from a source on the surface down to the receiver.

Given the conventions of Chinese technical writing, all modifiers should precede the nouns they qualify, while the parenthetical explanation maintains its position immediately following the term it modifies.

5. Conclusion

This paper provides an in-depth examination of equivalence at both lexical and syntactic levels in petroleum exploration texts, proposing corresponding translation techniques. These include contextual analysis, consultation of specialized dictionaries and online resources such as TermOnline, sentence segmentation, word order restructuring, and other methods. In translating petroleum exploration texts, one should not pursue formal equivalence alone but must flexibly select one or more of these strategies according to the specific contextual nuances of the text. Doing so not only ensures precise and professional expression of technical terminology but also fully considers the reading habits and cognitive patterns of the target-language readers. This approach facilitates a reading response in the target audience that mirrors that of the source-language readers, thereby fulfilling the communicative purpose of the original text.

It is worth emphasizing that petroleum exploration texts are characterized by complex syntactic structures—such as extended sentences and frequent use of non-finite verb phrases—as well as rigorous scientific logic. Maintaining syntactic equivalence thus constitutes a critical task in the translation process. By identifying the core sentence structure, analyzing syntactic components and their logical relationships, consulting relevant technical literature for contextual logic, and applying techniques such as segmentation and syntactic reorganization, translators can achieve more accurate transmission of the original meaning. This enables the translated text to be presented in a more natural and idiomatic manner, ensuring better comprehension and acceptance by the target readers.

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