Assessment of the Quality of Translation of Mechanical Engineering Research in the Book of "Daftar Istilah Teknik Mesin Inggris- Indonesia"

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Abstract. The rapid progress in science and technology has introduced new languages and terminology across various fields. Translators play a vital role in disseminating scientific knowledge, relying on their fluency and comprehension. Mechanical engineering, a field with unique terminology, lacks a comprehensive translation dictionary in Indonesia. This study uses a quantitative approach to assess the quality of term translations in mechanical engineering. Questionnaires were distributed to 20 lecturers specializing in renewable energy, mechanics, materials, and manufacturing. Various translation techniques, including natural borrowing, literal translation, pure borrowing, transposition, and established equivalence, were employed to examine the accuracy of mechanical engineering terms in Indonesian translations. Inaccurate translations can arise from differences in language structure, translator limitations, cultural disparities, linguistic complexity, or a lack of contextual understanding. The research categorizes results into three groups: accurate, less accurate, and inaccurate. Accurate translations are the most common, with fluid mechanics being a crucial area where precision and terminology clarity are essential. Achieving this requires effective collaboration between a translator with expertise in fluid mechanics and the contracting party.

Keywords: Accuracy Assessment; Mechanical Engineering; Terminology; Translation quality.

1 Introduction

Science and technology are developing rapidly at this time. This can be observed in the various inventions and new tools that are being developed. Furthermore, according to https://www.worldometers.info/books/ which uses UNESCO data, there are currently 2,249,928 books published worldwide. This trend will result in the emergence of a new language or terminology in each field indirectly. As a result, now translators play an important role in spreading scientific progress by translating it into the target language. The work of translators is very profitable and is an option for readers to understand scientific developments, especially for readers with limited foreign language skills [1].

Translating particular terms from a field into the target language is one of the difficulties translator's encounters. According to [2], translation is an effort to emphasise equal meanings when transferring written messages from the source language to the target language.

The outcome of the translation determines a translator's success. Therefore, fluency in both the source and destination languages is required of translators. One of his talents is comprehending the text's meaning in the original language and identifying synonymous keywords in the target language, allowing readers to read and comprehend the translations effortlessly. This includes translating specific terms. Terminologies with acceptable and comprehensible meanings in the target language are available to translators [1].

One area of study that has been researched on the translation of terminology is the field of mechanical engineering. This field has a special language that refers to definitions, tools, and ways of working. Currently, there is no dictionary translation of terms in the field of mechanical engineering that has been published in Indonesia. However, as far as the researchers know, there is one book that contains Mechanical Engineering terminology in English and Indonesian, namely "Daftar Istilah Teknik Mesin: Inggris- Indonesia" written by Harsokoesoemo [3]. In the book, there is a list of terms of mechanical engineering and automotive engineering which are sorted alphabetically and there are translations in Indonesian. This book can be a reference for teachers, students, practitioners, and even translators who are interested in translating specific languages in the field of mechanical engineering.

Four domains—published translations, professional translations, translations created for teaching translation practice courses, and translations examined in the context of translation research—are very important to the assessment of translation quality [4]. Finding a translation's advantages and disadvantages is the goal of translation assessment. The feedback and input that translators receive from the assessment will be helpful for future advancements. In the future, publishers will likewise endeavour to raise the calibre of their translations.

According to transliteration theorists, a translation is considered high quality if it satisfies the following criteria: 1) it is accurately conveyed in terms of content (i.e., the message must match that of the original text or source text); 2) it adheres to the norms of the target language; and 3) it is easily understood by the intended audience [5].

The assessment of the quality of translations in specific terminology in the field of mechanical engineering in the book "Daftar Istilah Teknik Mesin: Inggris- Indonesia" needs to be studied to see how accurate the results of the translation in the book are because the need for translation of specialized terms in Indonesia is huge. This research on translation quality assessment in terms of accuracy can help translators translate specialized terms, especially in the field of mechanical engineering.

2 Theoretical Framework

2.1 Translation

Although translation experts provide different interpretations, the underlying idea is always the same. Translation, as defined by [7], is the process of reproducing, in the target language, the closest natural counterpart of the message, initially in terms of meaning and then in terms of style. Translation, then, is the process of transferring meaning, message, and style from one SLT to the TLT. Style comes in last on the list of priorities. Here, the message is delivered along with the materials for replication (transfer). Here, Nida and Taber illustrated the translation process to identify the most semantically and stylistically similar translation outcomes from SL to TL.

According to [8], translation is basically a form modification. The form of a language refers to the individual words, phrases, clauses, sentences, and paragraphs. This term is used to refer to a language's surface structure. This is a linguistic structure that is observable in both written and oral communication. During translation, the form of TL is transformed into the form of TL. This simply suggests that Larson is more focused on making the transition from SL to TL form.

The definition of translation, according to [2], is conveying a text's meaning into another language in the same manner that the author intended. According to common sense, this should be easy as people should be able to communicate effectively in both their native language and another. On the other hand, if you are using a different language to pretend to be someone you are not, you may view it as complicated, contrived, and dishonest. As a result, the desire exists in various sorts of texts (legal, administrative, dialect, local, and cultural) to translate as many SL (Source Language) words into TL (Target Language).

This definition places a focus on transferring the author's intended meaning from the source language text to the target language text. Like Nida and Taber, Newmark is concerned with meaning.

2.2 Translation Quality Assessment

The examination and measurement of a translated text's correctness, style, and meaning in relation to the original text constitute the assessment of translation quality. To make sure that translations serve the intended purpose and successfully translate content from the source language to the target language, it is critical to evaluate the quality of the translations.

[4] developed a translation quality assessment model that can be used as a reference in assessing translation results. The criteria for each element of the standard being measured, the number of assessors is recommended to be odd and at least 3 people. The three aspects mentioned regarding the quality of translation which are assessed from accuracy, acceptability, and readability have different weights.

Three requirements must be met by a high-quality translation: readability, acceptance, and correctness. According to [5], translation accuracy is the degree to which the target language can accurately transmit the substance of the source language text. Additionally, according to [2], the pragmatic and referential accuracy of a translation determines how accurate it is. When a translation effectively conveys the substance of the source language text into the target language, it is said to be pragmatically accurate. Referential correctness, on the other hand, refers to how accurate and error-free the translated source language text is.

[9] states that acceptability is also referred to as prevalence, that is, a certain expression or term is considered common and natural in a particular community. This means that while an expression or term may be considered common in one community, it is not common in another. Because of its relative nature, testing the acceptability of a translation is done by asking members of a particular community to rate whether or not the translation is considered common in their community.

[10] explain that text readability is how the text can be read and understood easily. There are several factors that affect the readability of a text, namely the average sentence length, the number of new words, and the grammatical complexity of the language used. [5] adds the factors of vocabulary and sentence structure. The factors of the use of new words, the use of foreign and regional words, the use of foreign language sentences, the use of incomplete sentences, the average length of sentences, the flow of thoughts that are not coherent and illogical, and the use of complex sentences will also determine the high level of readability of a text.

[6] examined the translation of a satirical manuscript entitled "The 100-Year-Old Man Who Climbed Out of the Window and Disappeared". Translation quality with a score of 2.82 is included in the category of accurate, acceptable, and has a good level of readability.

The current researchers assess the quality of the translation of terms in the field of mechanical engineering from the aspects of acceptability, readability, and accuracy using the theory of Nababan, Nuraeni, & Sumardiono [4] as the basis for the assessment. These three aspects are important in the translation of technical terms in particular and in mechanical engineering in general.

3 Research Method

A quantitative study design is used in the "English-Indonesian Glossary of Mechanical Engineering" book as a means of evaluating the term translation quality in the field of mechanical engineering. According to positivism, which is a philosophical perspective, phenomena in research can be categorized as comparatively fixed, concrete, observable, and quantifiable, and there is a causal relationship between symptoms. This is known as quantitative research. After the data has been gathered, it is quantitatively analyzed using descriptive statistics to determine whether or not the hypothesis has been proven [11]. In order to assess the quality of the translation of mechanical engineering terms, the research used samples of translation data as reference material for the distribution of questionnaires, which were then completed by mechanical engineering specialists. This research began with collecting data using a questionnaire method. Questionnaires are a method of collecting data through forms containing written questions submitted to a person or group of people in order to obtain answers or responses and information needed by researchers [12]. The data collected was terminology in the field of Mechanical Engineering contained in the data source, then the researchers made a translation quality assessment table in terms of accuracy, readability, and acceptability. The questionnaire was distributed to 20 lecturers of the Mechanical Engineering study program from various fields of study, such as renewable energy, mechanics, materials, and manufacturing.

The basis of the questionnaire used by researchers uses the theory put forward by [4] and researchers only use one aspect, namely accuracy. The following is the instrument for assessing the level of translation accuracy:

Table 1. Instrument for Assessing the Level of Translation Accuracy

Translation Category	Score	Qualitative Parameters
Accurate	3	The meaning of source language words, technical terms, phrases, clauses, sentences, or texts is accurately transferred into the target language; no distortion of meaning occurs at all.
Less accurate	2	Most of the meanings of source language words, technical terms, phrases, clauses, sentences, or texts have been accurately transferred into the target language. However, there are still distortions of meaning or double-meaning translations (taksa) or omitted meanings, which disrupt the integrity of the message.
Inaccurate	1	The meaning of source language words, technical terms, phrases, clauses, sentences, or texts are inaccurately transferred into the target language or deleted.

The data used for this study consisted of 271 word-shaped data and 77 phrase-shaped data. This data was analyzed based on the results of the questionnaire, whether it falls into the category of accurate, less accurate, or inaccurate. Furthermore, based on the primary data obtained, researchers conduct data analysis. Data analysis in this study is the answer to the problem formulation. Data analysis was done manually, namely by analyzing the collected data and calculating the level of readability, acceptability, and accuracy based on the results of the questionnaires obtained.

4 Results and Discussion

In interlanguage communication, translation is seen as a decision-making process that involves solving comparable problems at the micro and macro levels. This process is strongly influenced by the translator's value system and point of view. In other words, the translator's ideology cannot be separated from the methods and techniques they choose in translating. The quality of translation will be greatly influenced by these three factors.

Knowing how the use of translation techniques, methods and ideologies affect the quality of translation is one of the objectives of this study. This objective is based on the idea that a translator will keep trying to translate something well by using various translation approaches, whether consciously or unconsciously. Unfortunately, the effectiveness of a translation technique does not necessarily correlate directly with the quality of the final translation. If this happens, the translator must have made an inappropriate choice.

The three sides of a coin can be an analogy for translation quality. The accuracy of message transfer is the first side. The acceptability of the translation is discussed on the second side, and its readability is discussed on the third side. These three sides indicate the integrity and quality of a translation.

There are certain translations whose message or content is identical to the original text but expressed in a way that does not follow the rules, customs, or culture of the target language. Also, even if a translation is widely accepted, its message may differ from the original text in the source language. In addition, it often happens that a translation is easily understood by the intended reader even though it has the correct message, but the readability level is low. The accuracy of the transferred message, the degree of acceptability, and the degree of readability of the translation are all described here as forms of assessing the quality of the translation.

The source data in this study amounted to 348. Of these, 292 are accurate translations, 45 data belong to less accurate translations, and 11 data belong to inaccurate translations. The target data belonging to the three categories are described below.

3.1 Accurate Translation

A translation is considered accurate if the meaning is not altered in any way. In other words, the target language accurately conveys the meaning of the source language words, phrases, clauses and sentences. In this study, it was found that the mechanical engineering terms were mostly accurately translated into Indonesian by the translators. The data in the form of words amounted to 234 data. The data were translated using several translation techniques, namely natural borrowing, literal translation, pure borrowing, transposition, and established equivalence. The following are examples of data in the form of words that are accurately translated by the author of *Daftar Istilah Teknik Mesin Inggris-Indonesia*:

Data No.	Bahasa Sumber	Bahasa Sasaran
002	fluids	Fluida, zalir
003	flow	Alir, aliran
004	law	hukum
005	geometry	geometri
007	plate	pelat
008	pipe	pipa
009	layer	lapisan
010	viscous	kental
011	velocity	kecepatan
015	stress	tegangan
018	liquid	Cair, zat cair
019	gas	gas

Table 2. Examples of accurate translations in word form

021	cohesive	kohesi
022	force	gaya
023	molecule	molekul
024	hydrostatic	hidrostatik
025	buoyancy	Gaya apung
026	deflection	Defleksi, simpangan

Experts in the field of mechanical engineering, especially the informants of this research, who are lecturers of mechanical engineering study programs, gave the opinion that they are more accustomed to reading references in English, rather than Indonesian. This makes them absorb more mechanical engineering terms from English in their teaching process. Therefore, the translation techniques that are mostly used are natural borrowing and pure borrowing. Data numbers 002, 005, 007, 008, 021, 023, 024, and 026 were translated using the natural borrowing technique. By experts, the translation results are considered accurate because the translations are widely used in scientific writing and classroom delivery. Meanwhile, data number 019 was translated using pure borrowing and has become a common word in daily life, namely *gas*. Other terms are translated using literal translation, namely in data numbers 003, 004, 009, 010, 011, 015, and 018. These terms are commonly used in Indonesian writing even though the translation uses literal translation techniques. Usually, these terms are general terms, which are used not only in the field of mechanical engineering but also in other general fields. Meanwhile, data number 022 is an example of data translated using the conventional equivalence technique, and data number 025 is using amplification technique.

The data in the form of phrases amounted to 58 data. The data were translated using two translation techniques, namely single and multiple translation techniques. The single translation techniques used are calque, literal translation, established equivalence, amplification, and natural borrowing. Meanwhile, the multiple translation techniques used are a combination of literal translation + natural borrowing, calque + transposition, literal translation + pure borrowing, literal translation + transposition, conventional equivalence + natural borrowing, literal translation + calque, and conventional equivalence + transposition. The following are examples of data in the form of phrases that are accurately translated by the author of *Daftar Istilah Teknik Mesin Inggris-Indonesia*:

Table 3. Examples of accurate translations in phrases

Data No.	Bahasa Sumber	Bahasa Sasaran
001	Fluid mechanics	Mekanika fluida
017	Static deformation	Deformasi statik/perubahan bentuk statik

124	Open channels	Saluran terbuka
134	Specific weight	Berat spesifik, berat jenis
145	Bending moment	Momen lentur
153	Dynamics pressure	Tekanan dinamik
163	cross-section	potongan
167	Inlet flow	Aliran masuk

The dominant single translation techniques used in translating the above phrase are calque technique and literal translation. If each word in the phrase has the same translation technique, it means that we only need to use one technique to translate the phrase. Examples of data translated using the calque technique are data numbers 001 and 018. For example, the phrase *fluid mechanics* and *static deformation* is translated into *mekanika fluida* and *deformasi statik/perubahan bentuk statis*. The techniques translated by literal translation are found in data numbers 124, 163, and 167. Each word in the phrase is translated literally by the translator and it is considered accurate by the experts because it does not deviate from the meaning of the source language, for example, the phrase *open channels* is translated into *saluran terbuka*. *Open* is translated as *terbuka*, and the *channel* is translated as a *saluran*.

In addition to the single translation technique, the translator also uses multiple translation techniques to translate the terms in "Fluid Mechanics". The dominant technique used is the combined technique of literal translation and natural borrowing. This technique is used when the word in the phrase is translated using different techniques. Examples of data using this technique are data numbers 145 and 153. An example is the phrase *bending moment*. The word *bending* is translated literally which means *lentur*, while the word *moment* is translated by natural borrowing into *momen*. Since there are different translation techniques for each word, it is necessary to combine more than one technique. The translation results are considered accurate because they have been commonly used by experts in learning, writing articles, and laboratory practice.

3.2 Less Accurate Translation

Less accurate translation is a situation where the translation from one language to another does not accurately reflect the meaning and nuances of the original text. This can happen for several reasons, including differences in language structure between the two languages, the translator's inability to capture complex or idiomatic meanings, or the translator's error or inaccuracy in understanding and transferring the message intended by the original author.

Less accurate translations can produce incorrect or vague information, lose the flavor, feel, and style of the original text, or even cause confusion or misunderstanding for the reader using the translation. Accurate translation requires a deep understanding of both languages involved, the cultural context, and the ability to transfer the message effectively from one language to another.

The data in the form of words amounted to 29 data. The data were translated using two variations of translation techniques, namely single translation technique and multiple translation technique. For single translation techniques, the techniques used are literal translation, transposition, common equivalence, natural borrowing, and pure borrowing. The following is an example of data in the form of words that are translated inaccurately by the translator of the book Fluid Mechanics:

Data No.	Bahasa Sumber	Bahasa Sasaran
040	density	Kerapatan, densitas
045	compressible	Termampatkan, kompresibel
075	equilibrium	keseimbangan
080	incompressible	tak termampatkan
083	resistance	tahanan
085	steady	tunak
113	streamline	Garis alir

Table 4. Examples of less accurate translations in word form

The most dominant translation technique used to translate the above data is the literal translation technique. This technique, also known as literal translation or word-for-word translation, refers to a translation method or approach that focuses on word-for-word translation from the source language to the target language. However, it is important to remember that literal translation does not always result in a precise or meaningful translation in the wider context. Every language has differences in structure, idioms and cultural conventions, so understanding the deeper context and adjusting the translation are important factors in good translation. In practice, the literal translation is often used as the first step in the translation process, followed by revision and adjustment to better fit the context and intended meaning in the target language.

As is the case with the translation of some of the terms mentioned in Table 3, the data is considered less accurate because the translation is not commonly used by experts in the field of mechanical engineering. The words *density, substance,* and *resistance* were translated literally by the translator of the Fluid Mechanics book. However, experts argue that the translation is less accurate even though the literal translation is correct. Experts tend to use natural borrowing techniques to translate these terms *densitas, bahan,* dan *tahanan.* Finally, the word *steady* is translated using the established equivalence technique into *ajeg* or *tetap.* Literally, the translation of the word is correct. However, experts tend to translate it as steady or fixed.

The data in the form of phrases amounted to 16 data. The data were translated using two translation techniques, namely single and multiple translation techniques. The single translation techniques used are literal translation, common equivalence, natural borrowing, transposition, calque, amplification, and description. Meanwhile, the multiple translation techniques used are a combination of literal translation + natural borrowing, literal translation + conventional equivalence, literal translation + pure borrowing, and literal translation + transposition. The following are examples of data in the form of phrases that are translated inaccurately by the translator of the book Fluid Mechanics:

Table 5. Examples of less accurate translations in phrases

Data No.	Bahasa Sumber	Bahasa Sasaran
093	Shear thinning	Penipisan geser
148	Restoring moment	Moment pemulih
183	Core flow	Aliran teras

The dominant single translation technique used in translating the above phrases is a literal translation. Examples of data translated using the literal translation technique are data numbers 093 and 183. Each word in the phrase is translated literally by the translator, but according to mechanical engineering experts, the translation result is not accurate because it is not commonly used in the learning process or in scientific works. From all these less accurate translations, it can be concluded that the translators and experts have almost the same translation results, but the experts provide terms that are more commonly used in Indonesian.

3.3 Inaccurate Translation

Inaccurate translation occurs when a text or conversation in one language is translated into another language with significant errors or inaccuracies. This can happen for a variety of reasons, including translator limitations, cultural differences, language complexity, or lack of contextual understanding. One common reason for inaccurate translations is the structural and idiomatic differences between the language of origin and the target language. Each language has different grammar rules, including word order, use of tenses, and sentence structure. If a translator does not have a good understanding of both languages, the translation may result in incorrect or ambiguous meanings. This also happens when translating fluid mechanics terms. Because terms in the field have certain meanings that are closely related to the field of science, sometimes translators translate them in general terms, resulting in inaccurate translation results. The data in the form of words amounted to 8 data. The data were translated using two variations of translation techniques, namely single translation technique and multiple translation technique. For single translation technique, the techniques used are literal translation and conventional equivalence. Meanwhile, the dual translation technique used is conventional equivalence + transposition. An example is the word *head*. The term is translated literally, but not according to the context. The word is translated as *kepala*.

4 Conclusion

Accurate translation in fluid mechanics reflects exactly the meaning and terminology used in the original source text. Translators who have a good understanding of the technical terms and concepts in fluid mechanics will be able to produce accurate translations, maintain terminological consistency, and express ideas precisely. Inaccurate translation in fluid mechanics can occur when there is a mismatch in understanding technical terms, inappropriate use of terminology, or inability to convey concepts clearly. This can result in loss of important information, confusion or misinterpretation in the translation. Inaccurate translation in fluid mechanics can change the meaning or deviate far from the original text. This can be caused by errors in understanding fundamental concepts, incorrect terminology, or missing relevant cultural nuances. Inaccurate translation can result in incorrect or unclear information, which can hinder the correct understanding of fluid mechanics.

It is important to avoid inaccurate translation in fluid mechanics as the precision and clarity of terminology and concepts are crucial in this field. Accurate translation will help ensure that the ideas and information contained in the original text are correctly understood by readers using the target language. A good collaboration between a translator skilled in fluid mechanics and the commissioning party will help achieve accurate and effective translation results.

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