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| RESEARCH ARTICLE

Translation of Zero-Expressions by Microsoft Copilot and Google Translate

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| ABSTRACT

A corpus of 318 English and Arabic zero-expressions used in general as well as specialized contexts as math, technology, law, military, economics, finance, and others was collected from Al-Maany Online dictionaries. The expressions were translated by Microsoft Copilot (MC) and Google Translate (GT) to find out the percentage of expressions correctly translated by both, the translation strategies used, and to explore the semantic, lexical, syntactic, and contextual inaccuracies that mistranslations reveal. It was found that 29% of the zero-expressions in the sample were correctly translated by both MC and GT. This percentage represents less than the correct translations of medical and Gaza-Israel War Terminology rendered by MC and GT. In 52% of the translations given by MC and 50% of the translations given by GT, the Arabic equivalent zero expressions consisted of a noun + a derived adjective صفري/ صفري/ صفرية الصفرية. In 31% of the data, MC gave definite equivalents (zero rating التصنيف الصفري) compared to 9% by GT. In 11%, GT rendered equivalents with an awkward word order (zero for zero approach صفر لنهج الصفر). In 12%, MC and GT gave similar Arabic equivalents with a reversed word order (zero fraction كسر الصفر (MC), صفر الكسر (GT). In 5%, MC and GT gave faulty Arabic equivalents with different derived forms (output zero إخراج الصفر (MC) & صفر المخرج (GT) instead of صفر مخرجات). The most common translation strategy used was word-for-word translation. Conceptual translation and modulation were not frequently used (zero position وضعية صفرية (MC), موضع الصفر (GT) instead of وضع الابتداء ; Zero duties واجبات صفرية instead of بدون رسوم). Zero expressions containing a polyseme were mistranslated (false zero صفر خاطئ (MC), صفر زائف (GT) instead of صفر غير حقيقي). Both MC & GT failed to give the underlying meaning of idiomatic phrases as الشمال صفر على which means has no value. Both gave a word-for-word translation zero on the north (MC) and zero to the north (GT), which are meaningless. Problems that AI has in translating zero-expressions are described and discussed in detail. The article concludes with some recommendations for AI specialists and translation pedagogy.

| KEYWORDS

Microsoft Copilot, Google Translate, Artificial Intelligence, AI translation, zero expressions, metaphorical expressions, translation errors, English and Arabic

| ARTICLE INFORMATION

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1. Introduction

In translation, English and Arabic metaphors and fixed expressions pose numerous problems for human translators. Due to the latest advancements in artificial intelligence (AI), AI tools, assistants and chatbots have been used to perform tasks in a variety of domains, including translation. A review of the literature revealed that the translation of metaphors by AI has received a lot of attention in the literature. A plethora of studies focused on metaphor translation by AI into English (Wang, & Chai, 2024); literary metaphor in the context of generative AI (van Heerden, & Bas, 2024); metaphorical language interpretation as a challenge to AI (Skrynnikova, 2024); challenges that face machine translation (MT) in translating metaphorical expressions (Matyakubova, 2024); corpus and metrics for evaluating the quality of MT translation of metaphorical language (Wang, Zhang, Wu, Loakman, Huang, & Lin, 2024); AI through the lens of metaphor in the light of the European Union Artificial Intelligence Act (Ye, & Li, 2024); interpreting novel literary metaphors by human translators and GPT-4 (Ichien, Stamenković, & Holyoak, 2024); can Google Translate (GT) catch

the meaning of metaphors (Zajdel, 2022); AI and metaphors (Veale, Shutova, & Klebanov, 2016); why metaphor and AI matter to each other (Barnden, 2008); cultural perspectives on the translation system of political text metaphors using AI (He & Jiang, 2024); the translation strategies and lexical features of metaphorical terms in German AI discourse (Siyu, 2025) and others.

Another group of studies focused on AI translation of proverbs, euphemisms, idioms and metaphors in Arabic such as comparison of Arabic and English proverb translation for intercultural interaction by AI (Hamdi, Hashem, Holbah, Azi & Mohammed, 2023); comparison of the translation accuracy of English and Arabic proverbs by Reverso, Systran, Yandex, Bing and Google Translate (Jibreel, 2023); comparison of Chat GPT and human translators in translating proverbs from English to Arabic (El-Saadany, 2024); assessment of the quality of human vs. AI Arabic-English translations of hidden proverbs in the Holy Qur'ān: (Fakhrabadi, & Sharifabad, 2023).

Further studies focused on the translation strategies used by AI models and human translators in translating euphemistic expressions from Arabic to English (Al-Wasy, & Mohammed, 2024); the semantic and contextual challenges that AI has in translating idiomatic expressions (Almaaytah, 2022); problems of translating English food idioms into Arabic by ChatGPT with solutions (Hamoud, 2024); analyzing the performance of Gemini, ChatGPT, and Google Translate in rendering English idioms into Arabic (Obeidat, Haider, Tair & Sahari, 2024); the impact of prompt formulation in AI Chatbots and the translation of idioms from English to Arabic and Arabic to English (Hakami, & Abomoati, 2024); translation evaluation of three MT systems, with special reference to idiomatic expressions (Musaad, & Al Towity, 2023); Arabic idiom detection by Deep Learning and Transformer-based models (Himdi, 2024); a corpus-based study of idiom translation by AI (Mughal, Seemab, Zaigham, Bhatti, & Khan, 2024); paraphrasing Arabic metaphors by neural MT systems (Alkhatib, & Shaalan, 2018); a conceptual approach to natural language processing of Arabic metaphors (Alkhatib, & Shaalan, 2017).

The literature review showed a lack of studies that explore the use of AI in translating zero-expressions in English and Arabic. Therefore, this study aims to explore the translation of zero-expressions from English to Arabic and Arabic to English by AI, namely Microsoft Copilot (MC) and Google Translate (GT); to evaluate the accuracy of translation equivalents to English and Arabic zero expressions given by MC & GT; to find out the percentage of English and Arabic zero expressions correctly translated by both MC & GT, by MC but not GT and by GT but not MC; the translation strategies used by both, and the semantic, syntactic, lexical & contextual translation inaccuracies.

This study is significant for translation students, instructors and professional translators who use AI in translating idiomatic and metaphorical expressions, in general, and zero-expressions, in particular, from English to Arabic and Arabic to English, as it shows the challenges and weaknesses that AI has in translating them. It will also provide feedback and insights on translation inaccuracies that is valuable for driving meaningful improvements in AI systems. Moreover, it highlights the importance of human judgment in conveying nuance, idiomatic meaning, domain-specific equivalents and things that AI still struggles with. It fosters a mindset of caution and critical thinking. Professional translators, as well as translation students, will benefit greatly from understanding the limitations of AI tools. By raising awareness, translators will be empowered to approach translation with a critical eye. The inaccuracies revealed by this study will develop the skills needed to adapt and refine AI-generated translations.

In addition, this study is part of a series of studies that focus on the translation of specialized terms and texts from English to Arabic and Arabic to English using AI such as AI translation of educational polysemes in full-text Arabic research articles by GT (Al-Jarf, 2025a); translation of the Gaza-Israel war terminology by MC and GT (Al-Jarf, 2025b); translation of medical terms by MC and GT (Al-Jarf, 2024c); Google's English-Arabic translation of technical terms (Al-Jarf, 2021; Al-Jarf, 2016a).

2. Definition of Terms

Originally borrowed from Arabic, zero in English is a number representing an empty quantity. Although zero was originally used in mathematics, nowadays, it is extensively used in general, as well as technical compounds, fixed expressions, and metaphors containing 'zero' used in many domains as in general use (zero-percent fat, absolute zero, sub zero, zero efficiency); in agriculture (zero correction, zero ground); biology (zero-loss circuit; zero dimension); business (zero thrust, zero administrative fees); computer (zero- access, zero binary, zero bit, zero matrix); economics (zero-economic growth; zero saving, zero crossing, measure zero, zero downtime, zero goal, zero indicator); education (zero connector); engineering (zero out, zero all); engines (zero subspace); environment (zero-waste strategy); finance (zero-sum game, zero anchor, zero base); hydrology (zero-interest bond, zero discount); journalism (zero date); law (zero-offset reflection, zero-width joiner, zero profit, zero saving); communications (zero- dispersion); linguistics (zero allomorph, zero plural); math (zero-sum; zero angle, zero product); medicine (audiometric zero, physiological zero, zero re-set); meteorology (zero-point energy; zero visibility); military (ground zero, ammo zero, zero fuel); petroleum (zero air, zero transformation, zero value); physics (zero-power-factor test, zero above, zero downtick); politics (distance zero, صفر المسارين); technology (Zero frequency, quad-zero route, zero-point vibrations, zero-level address, zero-energy house; zero-pollution criterion, zero error); transportation (zero function, zero visibility, zero crossing); United Nations terms (zero-point field, zero drift,

zero defect). Moreover, the expression, *zero-distance* has emerged in Arabic after October 7, 2023. Zero has been used in names of TV, and radio programs and podcasts (برنامج 'اللقاء من الصفر ,بودكاست صفر كربون) in some idioms as (صفر اليدين، صفر على الشمال).

3. Data Collection

A corpus of 318 (51 Arabic and 267 English) zero-expressions used in general as well as a wide variety of specialized contexts (math, computer, technology, law, medicine, oil, military, weather, history, biology, communication, journalism, economics, finance, physics, engineering, UN and so on) was collected from Al-Maany Online dictionaries (Arabic-Arabic, English-Arabic and Arabic-English) as *binary zero, zero-rating, zero-power, electrical zero adjuster, workpiece zero point, zero one distribution, ZBB zero base budget [UN]* and others.

Each zero expression was translated from English to Arabic and Arabic to English by MC and GT. The percentage of correct translation equivalents given by both MC & GT, by MC only but not GT and by GT only but not MC, the percentage of zero expressions with zero as a first constituent, and the percentage of zero expressions with zero as a second constituent of the compound were calculated. Then faulty equivalents given by MC and GT were classified into semantic, syntactic, and lexical errors. Faulty equivalents were classified into word order structure errors, mismatches between the English zero expression and its equivalent in part of speech and derived form, faulty definite and indefinite constituents, faulty compound structure (awkward word order, reversed word order, and identical wording), faulty translation of zero expression with polysemous lexemes and with idiomatic meaning, faulty lexical choice, and use of synonyms. The strategies that MC and GT used in translating each zero expression were classified into literal, partial, and conceptual translation, and modulation.

Percentages of errors in each of these categories were calculated for MC and GT separately. Results of the analysis of the MC and GT's translation error data are reported quantitatively and qualitatively.

For reliability and validity purposes, two colleagues specialized in translation and linguistics classified a sample of errors reflecting semantic, contextual, syntactic and lexical weaknesses. They went through the list of zero expressions in the sample and their equivalents and made judgments regarding the accuracy and classification of the translation equivalents. Classifications by all three evaluators were compared. There was a 95% agreement between the evaluators. Disagreements were solved by discussion.

4. Results

4.1 Percentage of Correct Translations of Zero Expressions by MC and GT

Data analysis showed that MC and GT gave correct equivalents to 29% of the zero-expressions in the sample. More correct Arabic zero expressions (66%) than English zero expressions (22%) were given. 14% were correctly translated by MC only but not GT and 13% were correctly translated by GT only but not MC as follows:

- Examples of Arabic zero expressions translated correctly by both: صفر مشاكل مع دول الجوار 'سياسة' *Zero problems with neighbouring countries" policy (GT), Policy of 'zero problems with neighbouring countries (MC);* نالَ صِفْراً فِي الامْتِحَانِ *He got a zero in the exam (MC), He scored zero in the exam nothing (GT);* المسافة صفر *Distance zero (MC & GT);* إلى صفر *To zero (MC& GT);* بدأ من الصفر *Started from scratch (MC & GT);* تحت الصفر *Below zero (MC & GT);* الحصيلة صفر *The result is zero (MC), The outcome is zero;* حوار من المسافة صفر *Dialogue from zero distance (GT); A dialogue from point zero (MC);* ساعة الصفر *Midnight (MC) Zero hour (GT);* العميل صفر *Customer zero (MC), Agent zero (GT)* تبريد صفر *Zero cooling (both);* سن صفر *Age zero (both).*

- Examples of English zero expressions translated correctly by both:
  sub zero تحت الصفر*;, zero anchor, zero angle; zero for zero principle* مبدأ الصفر مقابل الصفر*; zero tolerance* صفر تسامح*; above zero* فوق الصفر*; absolute zero* الصفر المطلق*; below zero* تحت الصفر*; branch-on-zero instruction* تعليمات التفرع عند *division by zero* القسمة على الصفر*; global zero* الصفر العالمي *; the figure zero* الرقم صفر *; zero carbon* صفر كربون *; zero chance* فرصة صفر *; zero- content* محتوى -صفر*; zero death* صفر وفاة *; zero; discharge* تصريف صفر*; zero growth* نمو صفر*; zero hour* ساعة الصفر*; zero population growth* نمو سكاني صفر*; zero-one distribution* توزيع صفر-واحد.

14% were correctly translated by MC only, but not by GT:

- *enter zero* إدخال الصفر*, from hero to zero* من بطل إلى صفر*, Réseau Zéro* شبكة الصفر*, slashed zero* صفر بخط مائل*, Triple Zero* ثلاثة أصفار*, zero base budget* موازنة صفرية*, Zero Breakdowns* انعدام الأعطال*, Zero Gap* فجوة صفرية*, Zero gravity* انعدام الجاذبية*, zero interest bound* الحد الصفري للفائدة*, zero knowledge about* معرفة صفر عن*, zero mark* علامة الصفر*, zero order* ترتيب صفري*, zero- percent fat* صفر بالمائة دهون*, zero re-set* إعادة التصفير*, ZERO TILLAGE* الزراعة بدون حرث *, zero zero condition* حالة الصفر المطلق*, zero-coupon bond* سند بدون كوبون *; Zero-cut crystal* بلورة صفرية القطع *, zero-loss circuit* دائرة

استراتيجية *zero-waste strategy* , معيار انعدام التلوث*Zero-Pollution Criterion*, آثار إزاحة صفرية *zero-offset traces* , ذات فقد صفري انعدام النفايات, *Zero-width joiner* موصل انضمام بعرض صفري, *size zero* مقاس صفر, *zero bound* حد صفري.

13% were correctly translated by GT only, but not by MC as in:

- *zero- dispersion* صفر تشتت, *zero- G* جاذبية صفر صفر جاذبية, *zero- grazing* صفر رعي, *Arbitrary zero*صفر عشوائي, *zero function* دالة الصفر, *zero-defect culture* زراعة بدون عيوب , *zero-sum game* لعبة محصلتها صفر, *zero binary* صفر ثنائي, *zero condition* = *zero state* حالة صفرية, *zero bit* صفر بت, *Non- zero* غير صفري, *zero bias* انحياز صفر تحيز/ انحياز, *zero fuel* صفر وقود, صفر انحياز, *zero-power-factor test* اختبار صفر زائف*False zero*, موضع الصفر *zero position*, صفر هواء *Zero air*, بُعد صفري*zero dimension*, عامل القدرة الصفري *zero balance* توازن صفر او صفر توازن /صفر توازن.

16% of the data in the sample, both MC and GT gave identical faulty translations of the English zero expressions in the sample with the same word order, and lexical choice as in:

- *zero indicator* مؤشر الصفر; *zero change* تغيير صفري; *zero complement* مكمل صفري; *zero discount* خصم صفري; *zero downtick* انخفاض صفري; *zero group* مجموعة صفرية; *zero weight* وزن صفري; *zero level* مستوى صفري; *zero connector* الرابط صفر موصل صفري; *zero ground* أرضية صفرية; *zero-hours* ساعات الصفر; *multiple zero* صفر متعدد; *zero- based review* مراجعة قائمة على الصفر; *zero-deposit import* استيراد بدون إيداع; *zero interest* فائدة صفرية; *zero kill* قتل صفري; *zero deflection* انحراف صفري ; *zero downtime* وقت تعطل صفري; *zero energy* طاقة صفرية; *zero value* قيمة صفرية; *zero voltage* جهد صفري; *zero-length string* سلسلة بطول صفري; *zero efficiency* كفاءة صفرية; *zero duties* واجبات صفرية; *zero compression* ضغط صفري; *zero signal* إشارة صفرية; *zero visibility* رؤية صفرية; *zero elimination* إزالة صفرية ; *zero-economic growth* نمو اقتصادي صفري; *zero lift* رفع صفري; *zero pressure* ضغط صفري; *zero printing* طباعة صفرية; *zero probability* احتمال صفري; *zero contamination* تلوث صفري; *zero emission* انبعاث صفري; *zero center* مركز صفري; *zero component* مكون صفري; *zero-interest bond* سند بدون فائدة صفري; *zero-point vibrations* اهتزازات نقطة الصفر ; *zero date* تاريخ صفري; *zero draft* مسودة صفرية; *zero-power reactor* مفاعل طاقة صفرية.

Examples of variations in the lexical items in word order or definiteness are:

- *zero defects* صفر عيوب*(MC),* خالي من العيوب *(GT); absolute zero* الصفر المطلق *(MC);* صفر مطلق *(GT); biological zero* الصفر البيولوجي *(MC),* صفر بيولوجي *(GT); zero inflation* تضخم صفر *(MC),* صفر تضخم *(GT); Partial Zero*الصفر الجزئي *(MC),* صفر جزئي*(GT); Phonetic zero* الصفر الصوتي *(MC),* صفر صوتي *(GT); physiological zero* الصفر الفسيولوجي *(MC),* صفر فسيولوجي*(GT); Allow zero* السماح بالصفر *(MC),* صفر مسموح به *(GT); Zero-Dimensional System* نظام ذو بعد صفري *(MC),* نظام صفري الأبعاد *(GT); Zero point* نقطة الصفر *(MC)* نقطة الصفر *(GT); down to zero* إلى الصفر *(MC),* وصولاً إلى الصفر *(GT) and others.*

4.2 Types of Translation Inaccuracies of Zero Expressions by MC & GT

The types of semantic, contextual, lexical and syntactic inaccuracies that both MC and GT gave are reported in detail in the sections below.

1) *Faulty Structure of Equivalent Arabic Compounds*

In 83% of the English zero expressions, zero is the first constituent (element) of the compound, whereas in 17%, zero is the second constituent (element) of the compounds as in (*absolute zero, biological zero, division by zero, phonetic zero, physiologic zero, the figure zero, sub zero, allow zero, absolute zero, above zero, below zero, branch-on-zero instruction, slashed zero, triple zero, size zero, ground zero, false zero, arbitrary zero, measure zero, machine zero, audiometric zero, deck zero, center zero, time zero)*

In 52% of the Arabic translations given by MC and 50% of the Arabic translations given by GT, the Arabic equivalent compounds consisted of a noun + a derived adjective ending in /iy/ صفري/الصفري (M). صفرية(F.)**/**الصفرية This form is not commonly used by Arabic native speakers and sounds unnatural as in:

- *zero interest* فائدة صفرية ; *zero kill* قتل صفري ; *zero lift* رفع صفري ; *zero change* تغيير صفري لا تغيير ; *zero complement* مكمل صفري; *zero contamination* تلوث صفري; *zero date* تاريخ صفري; *zero deflection* انحراف صفري ; *zero discount* خصم صفري; *zero downtick* انخفاض صفري; *zero downtime* وقت تعطل صفري; *zero draft* مسودة صفرية; *zero energy* طاقة صفرية; *zero group* مجموعة صفرية; *zero pressure*ضغط صفري; *zero printing* طباعة صفرية; *zero value* قيمة صفرية ; *zero voltage* جهد صفري; *zero weight* وزن صفري; *zero-length string* سلسلة بطول صفري; *zero-power reactor* مفاعل طاقة صفرية; *zero probability* احتمال صفري; *zero efficiency* كفاءة صفرية; *zero center* مركز صفري; *zero level* مستوى صفري ; *zero duties* واجبات صفرية ; *zero compression* ضغط صفري; *zero connector* موصل صفري; *zero ground* أرضية صفرية.

2) *Faulty Definite/Indefinite Equivalents by MC & GT*

In about one third (31%) of the zero-expressions in the data, MC gave definite equivalents الصفري/الصفرية/الصفر (whether in the first or the second element of the compound) compared to 9% given by GT. Examples of definite equivalents given by MC are:

- *zero rating* التصنيف الصفري*; zero profit* الربح الصفري*; zero time* الوقت الصفري*; zero-level address* عنوان المستوى الصفري*; zero inflation* التضخم الصفري*; zero-offset reflection* انعكاس الإزاحة الصفرية*; zero-based budgeting* الموازنة المبنية على الصفر*; zero setting* الضبط على الصفر إعداد التصفير*; zero defect* صفر العيب /صفر العيوب*; zero- zero capability* القدرة الصفرية*; zero lower band* النطاق السفلي للصفر مركز الصفر*; zero allomorph* صفر الشكل الخفي *; zero rating* تصنيف الصفر الصفرية*; zero energy reactor* مفاعل طاقة الصفر*; zero anchor* صفر نقطة الارتكاز*; zero potential* الجهد الصفري*; zero interest bound* صفر الناقل*; complement zero* الصفر المكمل*; zero power reactor* مفاعل القدرة الصفرية*; audiometric zero* الصفر السمعي*; zero- line* الخط الصفري*; zero-address instruction* العنوان الصفري*; zero-access addition* إضافة الوصول الصفري*; zero hour* الساعة الصفر*; the zero modification in the past tense of "cut"* تعديل الصفر في الماضي لكلمة قطع*; zero-hours* ساعات الصفر*; elimination zero* القضاء على الصفر*; suppression zero* كبت الصفر*; deck zero* سطح الصفر*; center zero* المركز صفر مركز الصفر*; zero- speed* نظام سرعة الصفر*; zero word* الكلمة الصفرية*; leading zero* صفر الآلة*; zero fraction* كسر الصفر*; zero stroke* ضربة الصفر*; zero-access storage* تخزين صفر الوصول*; zero zero operation* العملية الصفرية الصفرية*; zero rate* سعر الصفر.

Examples of definite equivalents الصفر/الصفري given by GT are:

- *ammo zero* صفر الذخيرة*; center zero* المركز صفر/صفر المركز*; deck zero* صفر المجموعة*; elimination zero* صفر الحذف*; enter zero* دخول الصفر*; from hero to zero* من البطل إلى الصفر*; size zero* الحجم صفر*; suppression zero* صفر الكبت*; the zero modification in the past tense of "cut"* التعديل الصفري في زمن القطع الماضي*; Zero; Breakdowns* صفر الأعطال*; zero fraction* صفر الكسر*; Zero frequency* تردد الصفر*; Zero Gap* فجوة الصفر*; Zero Goal* هدف الصفر*; zero option* خيار الصفر*; zero order* ترتيب الصفر*; Zero out* مخرج الصفر*; zero output* مخرج الصفر*; zero rating* يالتقييم الصفري تصنيف صفر*; Zero reporting* تقرير الصفر

By contrast, in many identical equivalent compounds with zero as the first element, MC gave definite Arabic equivalents الصفر/الصفري, whereas GT gave indefinite equivalents صفر/صفري for the same zero expression. Examples of definiteness/indefiniteness parallel equivalents are:

- *zero angle* صفر الزاوية *(MC),* صفر زاوية *(GT); zero balance* الصفر الميزان *(MC),* صفر توازن *(GT); zero binary* صفر- الثنائي *(MC),* صفر ثنائي *(GT); zero bit* صفر البت *(MC),* صفر بت *(GT); zero bound* الحد الصفري *(MC),* حد صفري *(GT); Zero carrier* الناقل الصفري *(MC),* حامل صفري *(GT); zero condition & zero state* الحالة الصفرية *(MC),* حالة صفرية *(GT); zero- dispersion* صفر- التشتت *(MC),* صفر تشتت *(GT); zero- G* صفر- الجاذبية *(MC),* صفر جاذبية *(GT) instead of* جاذبية صفر *; zero- grazing* صفر- الرعي *(MC),* صفر رعي *(GT); Zero inflation* التضخم الصفري *(MC),* تضخم صفري *(GT); zero interest bound* الحد الصفري للفائدة *(MC),* صفر حد فائدة *(GT); zero- power* صفر-الطاقة *(MC),* صفر قوة *(GT); zero profit* الربح الصفري *(MC),* ربح صفري *(GT) instead of* انعكاس *(MC),* انعكاس الإزاحة الصفرية *(GT); zero-offset reflection* التصنيف الصفري *(MC),* تصنيف صفري *(GT); zero rating* صفر أرباح *; zero- access* صفر الوصول *(MC),* صفر إزاحة صفرية *(GT); a zero plural* جمع الصفر *(MC),* جمع صفر *(GT) instead of* لا جمع له *; zero-level address* عنوان وصول *(GT); zero shot* اللقطة الصفرية *(MC),* طلقة صفرية *; zero mark* علامة الصفر *(MC),* علامة صفرية *; zero- zero capability* القدرة الصفرية الصفرية *(MC),* قدرة صفرية *(GT); zero* المستوى الصفري *(MC),* عنوان مستوى صفري *(GT); zero- zero ejection seat* مقعد القذف الصفري الصفري *(MC),* مقعد طرد صفري *(GT); zero word* الكلمة الصفرية *(MC),* كلمة صفرية *(GT); zero- zero potential* الجهد الصفري *(GT) Zero time* الوقت الصفري *(MC),* وقت صفري *(GT); zero mils* الأميال الصفرية *(MC),* ميل صفري *(GT).* جهد الصفر *(MC),*

Likewise, in some compounds with zero صفر/الصفر as the second element, MC gave definite Arabic equivalents whereas GT gave corresponding indefinite equivalents as in:

- *audiometric Zero* الصفر السمعي *(MC),* صفر قياس سمعي *(GT); biological zero* الصفر البيولوجي *(MC),* صفر بيولوجي *(GT); complement zero* الصفر المكمل*(MC),* صفر المكمل *(GT); non- zero* غير الصفر *(MC),* غير صفري *(GT); phonetic zero* الصفر الصوتي *(MC),* صفر صوتي *(GT); physiological zero* الصفر الفسيولوجي *(MC),* صفر فسيولوجي *(GT); suppressed-zero instrument* أداة الصفر المكبوتة *(MC),* آلة صفر مكبوت *(GT); division by zero* القسمة على الصفر *(MC),* القسمة على صفر *(GT).*

However, in a few similar Arabic equivalent compounds with zero as the second element, MC gave an indefinite equivalent (صفر), whereas GT gave a definite equivalent as in:

- *ammo zero* ذخيرة صفرية *(MC),* الذخيرة صفر *(GT); zero tolerance* صفر تسامح *(MC),* عدم التسامح *(GT); Zero frequency* تردد صفري *(MC),* تردد الصفر *(GT); zero option* خيار صفري *(MC),* خيار الصفر *(GT); zero hour* الساعة الصفر *(MC),* ساعة الصفر *(GT); Zero Gap* فجوة صفرية *(MC),* فجوة الصفر *(GT); Zero power-level* مستوى طاقة صفري *(MC),* مستوى الطاقة صفري *(MC); Zero rate* سعر الصفر بنسبة صفر *(MC),* معدل الصفر *(GT); Zero Goal* هدف صفري *(MC),* هدف الصفر *(GT); zero elimination* إزالة صفرية *(MC),* إزالة الصفر *(GT).*

3) ***Translations with an Awkward Word Order***

In 11% of the data, GT gave equivalents with an ungrammatical, awkward, and scrambled word order, compared to less than 1% by MC as follows:

- Examples of equivalents given by GT are: *audiometric zero* صفر قياس سمعي*; complement zero* صفر المكمل*; count zero* صفر العد /*interrupt* صفر المقاطعة*; enter zero* دخول الصفر*; sum-game- zero* صفر مجموع اللعبة*; the zero modification in the past tense of "cut"* التعديل الصفري في زمن القطع الماضي*; zero allomorph* صفر شكل متماثل*; reactor* صفر مفاعل طاقة*; zero for* صفر المعرفة *zero approach* صفر لنهج الصفر*; zero goal* هدف الصفر*; zero interest bound* صفر حد فائدة *; zero knowledge about* عنه*; zero- line* صفر خط*; zero load* صفري حمل*; zero lower band* صفر نطاق أدنى/صفر نطاق سفلي *; zero potential* جهد الصفر*; zero power reactor* صفر مفاعل طاقة*; zero power-level* مستوى الطاقة صفري*; zero rest-mass* صفري كتلة ساكنة*; zero sum* المحصلة صفر/مجموع صفري /صفر مجموع *; zero zero* صفر صفري*; zero-access addition* إضافة وصول صفري *; zero-address instruction* تعليمات عنوان صفري *; zero-cut crystal* بلورة مقطوعة صفريًا*; zero-offset traces* إزاحة صفرية آثار.

- Examples of equivalents with an awkward word order given by MC are: *zero-address instruction* تعليمات عنوان الصفري*; zero divisor* مقسوم صفر*; zero-sum game* لعبة مجموع صفر*; zero flag* علم صفرية.

4) ***Faulty Equivalents with a Reversed Word Order***

In 12% of the zero-expressions in the sample, MC and GT gave similar Arabic equivalents with a reversed word order, whether 'zero' is the first or second element of the compound.

- Examples with zero as a first element of the compound are: *zero- speed* نظام سرعة الصفر *(MC),* صفر سرعة *(GT); zero elevation* ارتفاع صفري *(MC),* صفري الارتفاع *(GT); zero energy reactor* مفاعل طاقة الصفر *(MC),* صفر مفاعل طاقة *(GT); zero fraction* كسر الصفر *(MC),* صفر الكسر *(GT); zero power reactor* مفاعل القدرة الصفرية *(MC),* صفر مفاعل طاقة *(GT); zero sum* مجموع الصفر *(MC);* صفر مجموع *(GT): zero balance* رصيد صفري *(MC),* صفر رصيد *(GT); zero adjustment* تعديل الصفر *(MC),* صفر تعديل *(GT); zero air* هواء الصفر *(MC),* صفر هواء *(GT); zero fuel* وقود الصفر *(MC),* صفر وقود *(GT); Réseau Zéro* شبكة الصفر *(MC),* صفر شبكة *(GT); zero knowledge about* معرفة صفر عن *(MC),* صفر المعرفة عنه *(GT); zero load* حمل صفري *(MC),* صفري حمل *(GT); zero interest bound* الحد الصفري للفائدة *(MC),* صفر حد فائدة *(GT); zero bit* البتة الصفرية *(MC),* صفر بت *(GT); zero bound* حد صفري *(MC),* صفر حد *(GT); Zero defect* عيب صفري/عيوب صفرية *(MC),* صفر العيب /صفر العيوب *(GT), zero-cut crystal* بلورة صفرية القطع بلورة مقطوعة صفريًا *(MC),* *(GT);*

Examples with zero as a second element of the compound (17%) are:

- *Triple Zero* ثلاثة أصفار *(MC),* صفر ثلاثي *(GT); center zero* مركز الصفر *(MC),* صفر المركز *(GT); time zero* زمن الصفر *(MC),* صفر قياس *(GT); output zero* إخراج الصفر *(MC),* صفر المخرج *(GT); aleph- zero* صفر- أليف *(MC),* صفر أليف *(GT); measure zero* زمني *(GT); suppression zero* كبت الصفر *(MC),* صفر الكبت *(GT);* الصفر *(MC),* صفر قياس

- In many cases, MC and GT gave equivalents with different word orders إزاحة بدون انعكاس (MC) and انعكاس الإزاحة الصفرية (GT) for zero-offset reflection; *temperature zero & zero temperature* for صفر الحرارة ; *distance zero & zero distance* for المسافة صفر.

5) ***Mismatch between Source Expression and Equivalents in the Derived Form and Part of Speech***

In 5%, MC and GT gave faulty Arabic equivalents with different derived forms as in:

- *output zero* إخراج الصفر *(MC) &* صفر المخرج *(GT) instead of* صفر مخرجات.
- *zero balance* الصفر الميزان *(MC) &* صفر توازن *(GT) instead of* توازن صفر / صفر توازن.
- *zero bias* صفر التحيز *(MC) &* صفر انحياز *(GT) instead of* تحيز صفر/ صفر انحياز.
- *zero divide* قسمة صفرية *(MC) &* قسم صفري *(GT) instead of* القسمة على صفر.
- *zero matching* التطابق الصفري *(MC)&* مطابقة صفرية*(GT) rather than* صفر مطابقة.
- *zero output* ناتج صفري *(MC) &* مخرج الصفر *(GT) instead of* محصلة صفر أو ناتج صفر.
- *zero position* وضعية صفرية *(MC) &* موضع الصفر*(GT) instead of* وضعية الصفر/وضع الابتداء depending on the area of specialization.
- *zero product* منتج صفري *(MC) &* ناتج صفري *(GT) instead of* الناتج صفر.
- *zero-width joine* موصل انضمام بعرض صفري *(MC),* وصلة عرض صفرية *(GT) instead of* موصل عرضه صفر.

MC and GT gave equivalents that do not match the source zero expression in part of speech. In zero expression that contain a verb, the Arabic equivalents given MC and GT contain action nouns, not a verb as in:

- *allow zero (verb)* السماح بالصفر *(MC) &* صفر مسموح به *(GT) instead of* يسمح بالصفر
- *enter zero (verb)* إدخال الصفر *(MC) &* دخول الصفر *(GT) instead of* أدخل صفر

6) ***Use of Word-for-Word Translation instead of Conceptual Translation***

The main translation strategy followed by MC and GT was word-for-word translations, which followed a linear word order that mimicked the structure of the English compound, although Arabic compounds do not have the same word order. This is evident in the examples in all previous sections.

Data analysis revealed that 43% of the zero expressions in the sample require conceptual translation which involves adapting the Arabic equivalents to preserve the intended meaning and adapt the lexemes to fit the linguistic and cultural norms of Arabic. Conceptual translation aligns with natural language use and ensures that the meaning is contextually and culturally accurate. Despite that, MC and GT gave literal, word-for-word equivalents which are not used by Arabic speakers. In some zero expressions with a specialized meaning used in a particular context, conceptual translation is mandatory as in the following examples:

- *Arbitrary zero* الصفر التعسفي *(MC),* صفر عشوائي *(GT) instead of* صفر فرضي.
- *zero- speed* نظام سرعة الصفر *(MC),* صفر سرعة *(GT) instead of* صِفْر- نِظام صِفْر/ نظام انعِدام السُّرْعَة وانعِدام الارتفاع (عسكرية).
- *zero- coupon/Zero coupon* كوبون صفري *(MC),* صفر قسيمة *(GT) instead of* صِفْر المَردود / بدون عائد /دون كوبون/ سند خصم.
- *zero duty* مهمة صفرية *(MC),* واجبات صفرية *(GT) instead of*(مالية) إستيراد بدون إيداع تأمين/ بلا رسوم جمركية/ رسم لاغ.
- *zero-address instruction* تعليمات عنوان الصفري *(MC),* عليمات عنوان صفري *(GT) instead of* أمر بلا عناوين.
- *zero for zero approach* نهج صفري *(MC),* صفر لنهج الصفر *instead of* مبدأ الصفر مقابل الصفر.
- *zero position* وضعية صفرية *(MC),* موضع الصفر *(GT) instead of* /نفط (تقنية) وضع الابتداء.
- *zero zero operation* العملية الصفرية الصفرية *(MC),* تشغيل صفري *(GT) instead of* خلل شديد في العملية.
- *zero rating* التصنيف الصفري *(MC),* تصنيف صفري *(GT) instead of* /عدم إعفاء من الضريبة على القيمة المضافة إعلامية الخضوع للضريبة (تقنية).
- *zero-access storage* تخزين وصول صفري *(MC),* تخزين بدون وصول *(GT) instead of* /تخزين ذو التخزين قصير الأجل (عسكرية) توصيل لحظي (عسكرية، الحاسوب).
- *ground zero* نقطة الصفر *(MC),* صفر أرضي *(GT) instead of* /نقطة انفجار/ نُقْطَة الصِّفْر الأساسية/ مسقط شاقولي.
- *Zero reporting* عدم الإبلاغ *(MC),* تقرير الصفر *(GT) rather than* التبليغ عن عدم حدوث حالات.
- *zero elimination* إزالة صفري *(MC),* إزالة الصفر *(GT) instead* (تقنية) حذف الأصفار.
- *Zero printing* طباعة صفرية *(MC),* طباعة صفرية *(GT) instead of* (تقنية) طباعة على نظافة.
- *Zero-Point Vibrations* اهتزازات نقطة الصفر *(MC),* اهتزازات نقطة الصفر *(GT) instead of* (تقنية) بعد **بلا** اهتزازات.
- *Zero date* تاريخ صفري *(MC & GT) instead of* تاريخ محدد لصرف الأرباح.
- *zero draft* مسودة صفرية *(MC & GT) instead of* (سياسية) /مسودة أولى (مالية) مسودة.
- zero-bracket amount مبلغ بقوس صفري (MC), مبلغ قوس صفري (GT) instead of (قانونية) شريحة غير خاضعة للضريبة
- zero downtick انخفاض صفري (MC & GT) instead of تكرار الصفقات بذات السعر
- Zero-deposit import إيداع **بدون** استيراد (MC & GT) instead of تحويل عملة استيراد **بدون**
- Zero-power reactor مفاعل طاقة صفرية (MC & GT) instead of /مفاعل صفري الاستطاعة مفاعل القدرة المنخفضة

7) *Word-for-word Translation vs Modulation*

43% of the zero expressions in the data require modulation, i.e. using a phrase that is different in the source and target languages, rather than a word-for-word translation, to convey the same idea. Instead of using صفر every time a compound contains 'zero', Arabic uses some negation particles as دون، بلا، لا بدون، or negation lexemes as in Table 1 that mean void, without, lacking and the like. Modulation makes the language sound more natural and makes the translation more fluid. It helps avoid awkward or overly literal translations while staying true to common language use. It is clear, concise, and fits perfectly in both formal and informal contexts. These alternatives (with negative particles or lexemes) fit the context well without relying on the rigid use of صفري .

Table 1: Examples of Negation Particles and Lexemes Used in the Translation of Zero Expressions[1]

Devices	Examples
بدون without:	*zero duties* بدون رسوم*; zero interest* بدون فوائد *; zero-deposit import* استيراد بدون تحويل عملة*; zero-defect culture* زراعة **بدون** عيوب.
دون without:	*zero tillage* دون حراثة*; zero coupon* بدون عائد/ دون كوبون
بلا without:	*zero degree tooth/ zero degree tooths* سِنٌ بلا حَدَبات*; zero downtime* بلا إنقطاع*; zero profit* بلا ربح*; zero-balance account* حساب بلا رصيد *; zero-dimensional system* نظام بلا بعد

[1] https://www.almaany.com/ar/dict/ar-en/zero/

لا no:	*a zero plural* لا جمع له*; ammo zero* لا توجد ذَخِيْرَة متبقية لديّ*; non- zero* لا صفري *; non-zero-sum game* مباراة لا تَسامُح/انعدام *zero tolerance*; لا تصحيح *zero correction*; لا يوجد أعطال *zero breakdowns*; لا صفرية المكسب التحمل
عدم not	zero rating عدم الخضوع للضريبة/ إعفاء من الضريبة على القيمة المضافة
انعدام lack of:	*zero beat* انعدام الضربات *; zero bias* إنعدام الانحياز*; zero boost* إنعدام ضَغْط مخلوط /إنعدام الضغط المعزز الوقود والهواء بالمُحَرِّك*; zero carrier* انعدام الموجة الحاملة *; zero deflection* انعدام الانحراف *; zero- dispersion* انعدام التشتيت*; zero efficiency* انعدام الكفاءة /عدم القدرة على الإنتاج *; zero frequency* انعدام التردد*; zero gravity* انعدام الجاذبية /انعدام الوزن*; zero load* انعدام الحمل *; zero potential* انعدام الجهد *; zero signal* انعدام الإشارات*; zero torque* إنعدام عزم دَوَران المُحَرِّك/ *zero visibility* انعدام الرؤية *; zero-economic growth* انعدام النمو الاقتصادي*; zero-waste strategy* استراتيجية انعدام النفايات*, Zero Breakdowns* انعدام الأعطال*; Zero gravity* انعدام الجاذبية*,*
خالي does not contain/free	*zero-percent fat;* من الدهون **خال***; zero-percent fat* نسبة الدهون صفر **خال***; zero defect* عيوب **لا** /**خالي** من العيوب
منعدم void of	*zero discharge* طَرْح منعدم*; zero-offset reflection* انعكاس منعدم الحيد
المعدومة	zero rest-mass كتلة السكون المعدومة
Negative Lexemes	zero-length string سلسلة فارغة *zero fuel* نفاد الوقود تمامًا *zero- content* فارغ المحتوى

In all the zero expressions in the sample that require modulation, MC used modulation in translating 6% of these zero-expressions only as in *zero-address instruction* تعليمات ذات عنوان صفري*; zero-deposit import* استيراد بدون إيداع*; zero reporting* عدم الإبلاغ*; zero gravity* انعدام الجاذبية*; zero-waste strategy* استراتيجية انعدام النفايات*; zero-pollution criterion* معيار انعدام التلوث*; zero breakdowns* انعدام الأعطال. Likewise, GT used modulations in translating 4% of those expressions only such as *zero-deposit import* استيراد **بدون** *; zero-energy house* طاقة **بدون** منزل*; zero-access storage* وصول **بدون** تخزين*; zero-defect culture* عيوب **بدون** زراعة*; zero defects* إيداع خالي من العيوب. The vast majority of the zero expressions that require modulation were translated word for word. Zero expressions that were correctly modulated by MC and GT are those that are very common and are frequent in daily use, and those with a transparent meaning.

Other examples of faulty translations that require modulation are:

- Zero Reference تقرير صفري (MC), مرجع الصفر (GT) instead بدون مرجع
- Zero beatصفر- النبض (MC), صفر نبض (GT) rather than انعدام الضربات
- Zero allowance صفر السماح (MC), صفر بدل (GT) instead of عدم السماح بأي شئ
- Zero reporting عدم الإبلاغ(MC), تقرير الصفر (GT) instead of التبليغ عن عدم حدوث حالات/صفر بلاغات
- Zero duties واجبات صفرية instead of بدون رسوم
- Zero crossing عبور صفري (MC), تقاطع صفري (GT) instead of لا تقاطع

In some other cases, the same zero expression has several equivalents with multiple modulations because each expression is used in several contexts and domains as in the following examples taken from Almaany dictionary:

- Zero duty مهمة صفرية (MC), واجبات صفرية (GT) instead of رسم لاغ/ بلا رسوم جمركية/ إستيراد بدون إيداع تأمين
- Zero coupon كوبون صفري (MC), صفر قسيمة (GT) instead of سند خصم/بدون عائد/دون كوبون/صفر المردود
- *zero-coupon bond* سندات خصم /فوائد **بلا** سند/ قسيمة **بدون** فوائد/ سند.
- *Zero- rating* الخضوع للضريبة /**عدم** **إعفاء** ضَرِيبِيّ.
- *zero death* **انعدام** الخَطَر:قُدْرَة الطّائرة المُقاتِلة على كَشْف الأهداف المُعادية مِن مَدًى بعيد بدِقَّة كبيرة في الزَّمَن الحقيقيّ ممّا .
- *Zero suppression/zero suppress*.الاصفار /**كبت** الأصفار عديمة الأهمية أثناء الطبع الحاسوب /**حذف** الأصفار الزائدة /**إزالة** الأصفار /**إلغاء**
- *zero growth*/الصفر عند النمو **لانمو**.
- *zero energy* طاقة /صفر الطاقة /**بلا** الطاقة /**انعدام** .
- *zero-waste strategy* استراتيجية النفايات /استراتيجية النفايات **اللانفايات** /**المعدومة**.

8) *Faulty Translation of Zero expressions with Polysemous Lexemes*

In 31% of the data, the zero expressions contain a polysemous lexeme with multiple equivalents in Arabic, whether it is used in one domain or numerous domains and contexts. Here, both MC & GT failed to select an Arabic equivalent that matches the actual meaning of the polysemous lexeme regardless of the syntactic structure of the total equivalent compound in Arabic as in the following example: المادة صفر *material zero* (MC) vs *article zero* (GT); zero balance صفري **رصيد** (MC) & صفري **توازن** (GT); *elimination zero* على الصفر **القضاء** *(MC),* صفر **الحذف** *(GT); trailing zero* صفر **اللاحق** *(MC),* صفر **متأخر** *(GT); zero adjuster* الصفري **الضابط** *(MC),* صفر **ناتج** صفري *(GT); zero output* **حامل** صفري *(GT); zero carrier* **الناقل** الصفري *(MC),* صفر **بدل** *(GT); zero carrier* **السماح** صفر *(MC),* **مُعدّل** *(GT); Zero allowance* **مخرج** الصفر *(MC),* **تعبئة** صفرية *(GT); Zero Padding* **حشو** الصفر *(MC),* وضعية صفرية *(GT); zero position* موضع الصفر *(MC),* **معدل** الصفر *(GT); zero-rated* **نسبة** الصفر *(MC),* **إعداد** التصفير *(GT); zero setting* **ضبط صفري** *(MC),* الضبط على الصفر *(GT) instead of ; zero shift* **التحول** الصفري **إزاحة** صفرية *(MC),* **حالة** صفرية **ضربة** صفرية *(GT); zero state* الصفرية الصفرية **العملية** *(MC),* صفري **تشغيل** *(GT).*

Further examples of faulty lexical choice in the translation of zero expressions with polysemes are:

- False zero صفر خاطئ (MC), صفر زائف (GT) instead of صفر غير حقيقي
- Size zero مقاس صفر (MC), الحجم صفر (GT) instead of مقاس صفر
- Zero above فوق الصفر (MC), صفر أعلى (GT) instead of فوق الصفر
- Zero compression ضغط صفري instead of اختزال الأصفار
- Zero connector موصل صفري instead of الرابط صفر
- Zero kill قتل صفري instead of يحذف الأصفار
- Zero offset تعويض صفري (MC), إزاحة صفرية (GT) instead of غياب التعويض
- Zero- power الطاقة صفر- (MC), صفر قوة (GT) instead of صفر طاقة
- Zero saving إعداد صفري (MC), توفير صفري (GT) instead of صفر ادخار/انعدام الادخار
- Zero slashing حالة صفرية (MC), قطع صفري (GT) instead of شطب الأصفار
- Zero suppression دفع صفري (MC), كبح صفري (GT) instead of إزالة الأصفار / حذف الأصفار عديمة الأهمية أثناء الطبع الحاسوب/ إلغاء الأصفار/
- Zero waste نفايات صفرية (MC), هدر صفري (GT) instead of صفر نفايات
- Zero zero condition حالة الصفر المطلق(MC), شرط صفري instead الصفر المطلق

9) *Synonyms in Parallel MC and GT Translations of the Same Zero Expression*

In 17% of the error data, MC and GT gave synonymous lexemes for the same zero expression. These are marked in bold type in the following examples. In many cases, the lexeme in the English zero expression has two or more synonymous equivalents in Arabic as in ***above zero*** **فوق** الصفر *(MC),* **أعلى** صفر *(GT); zero* ***base*** **صفر الأساس** *(MC),* **قاعدة** صفر *(GT); zero* ***fill*** **تعبئة** صفرية *(MC),* **كبح** *(MC),* **قمع** صفري ***suppress*** *Zero ; (GT) instead of* صفر اثبات /لا اثبات **برهان** صفري *(MC),* **إثبات** صفري ***proof*** *(GT); zero* **ملء** صفري *(GT); zero* ***tick*** صفرية **نبضة** *(MC),* صفرية **دقّة** *(GT); zero* ***waste*** صفرية **نفايات** *(MC),* صفري **هدر** *(GT); zero-****power****-factor test* اختبار عامل **الطاقة** الصفرية *(MC),* اختبار عامل **القدرة** الصفري *(GT); zero-****sum*** *game* صفر**مجموع** لعبة *(MC),* صفر**محصلتها** لعبة *(GT); zero-zero* ***ejection*** **قذف** الصفر الصفري *(MC),* طرد صفري *(GT).*

In *zero base* ***budget*** صفرية **موازنة** *(MC),* أساسية **ميزانية** صفر *(GT); zero-based* ***budgeting*** المبنية على الصفر **الموازنة** **الميزانية** *(MC),* الصفرية *(GT),* **موازنة** *&* **ميزانية** *are* regional varieties. In *zero-****coupon****/Zero* ***coupon*** صفري **كوبون** *(MC),* صفر **قسيمة** *(GT); zero-****coupon*** *convertible* قابل للتحويل **بدون كوبون** سند *(MC),* صفرية **بقسيمة** قابل للتحويل *(GT); zero* ***code*** الصفري **الكود** *(MC),* صفر **رمز** *(GT),* one equivalent is a loan (borrowed) word and the other is a native Arabic word.

It seems that the exact Arabic equivalent to each zero expression with a polysemous lexeme is not standardized in which case, AI (MC & GT) treated and translated the compound as consisting of single discrete words, not as a unit with a specific meaning.

10) *Translation of Zero Expressions with an Idiomatic Meaning*

Very few Arabic idioms were translated correctly by both MC and GT. The Arabic expression عاد صِفْر اليدين was translated as *returned empty-handed* by (MC) & *He returned empty-handed* by (GT). Some other Arabic idiomatic expressions were translated correctly with variations in word choice as in صفعة من المسافة صفر *a slap from point zero* by MC & Slap from zero distance by GT; سياسة صفر مشاكل مع دول الجوار *zero problems with neighbours' policy* by MC & *zero problems with neighbouring countries policy* by GT.

Despite that, both MC and GT failed to give the underlying meaning of Arabic zero-expressions with an idiomatic meaning as صفر على الشمال which means *has no value*. Both gave the literal translation *zero on the north* (MC) and *zero to the north (GT)* which are meaningless and do not convey the underlying meaning used in common usage.

Some Arabic idiomatic expressions were translated correctly by GT only as: صفر المسارين Zero Tracks; بودكاست صفر كربون *Zero Carbon Podcast*; برنامج 'اللقاء من الصفر *Meeting from Scratch Program*. On the contrary, MC failed to capture the underlying meaning of the same idiomatic expressions and gave faulty English equivalents that are either semantically or syntactically deviant: صفر المسارين *Zero of both tracks;* بودكاست صفر كربون *Carbon Zero Podcast;* برنامج 'اللقاء من الصف *The program Meeting from scratch*. MC gave a faulty definite equivalent whereas GT gave a correct indefinite equivalent as from hero to zero من البطل إلى الصفر (MC), من بطل إلى صفر (GT) .

5. Discussion

Findings of the current study showed that MC and GT gave correct equivalents to 29% of the zero-expressions in the sample in the current study compared to 48% of the Gaza-Israel War Terminology, and 68.6% and 74.5% by MC and GT of the medical terms respectively (Al-Jarf, 2025a; Al-Jarf, 2024b). This means that zero-expressions are more difficult for AI to translate. As a result, MC and GT provided Arabic equivalents to zero expressions that have semantic, contextual, lexical and syntactic errors. GT, in particular, seems to follow a linear left-to-right word-for-word order in translating zero expressions. It treats compounds as consisting of unrelated constituents as in the case of Arabic equivalents with an awkward word order where GT translated each independently of the other. MC mostly provides Arabic equivalents that are definite (الصفر/الصفري). The most common translation strategy that both MC and GT follow in translating zero expressions from English to Arabic is word-for-word, literal translation. Both have difficulty giving Arabic equivalents that match the natural Arabic compounds in lexical choice, word order, definiteness/indefiniteness, and in the overall general or specialized meaning.

The semantic, contextual, lexical and syntactic errors found in MC and GT's English-Arabic translation of zero expressions in the current study are consistent with findings of other prior studies in the literature using a variety of AI tools in translating metaphorical and idiomatic expressions, proverbs in numerous language pairs. For example, In Spanish, Systran, Deepl, and Google Translate could not make use of the contextual cues in the English text that were important for disambiguating the meanings of metaphors and polysemes and produced suitable linguistic units in Spanish (Boieblan, 2022). In Chinese-English MT, Yang & Zhang (2024) found language ambiguities. Polysemes, homographs, idioms, and proper nouns were challenging for MT. In Croatian, polysemes with multiple meanings in various text genres constituted a main problem for MT (Tudor, 2017). Similarly, MT had problems with English-Georgian translation of words with different meanings (Akhobadze, 2019). In Kannada language in India, the occurrence of polysemes in sentences led to ambiguity and it was often a nuisance in MT translation to English due to the incorrect interpretation of the sentences. MT could not identify the part of speech of the polysemes correctly (Desalli, Anirudh, Prajwal Pai, Rajeshwari & Kallimani, 2020). In Hindi, Word Sense Disambiguation was one of the main challenges that MT faced because it selected the wrong equivalent verb (Mall & Jaiswal, 2017). In Indonesian-English translation of sentences, MT had difficulties handling homonym and polyseme ambiguities (Abdullah, Sarno, Purwitasari & Akhsani (2023).

Furthermore, word-for-word (literal translation) strategy that MC and GT followed in translating zero expressions in the current study are similar to the literal translation strategies used by MC ad GT in translating medical terms (Al-Jarf, 2024b), educational polysemes in full-text Arabic research articles (Al-Jarf, 2025a), Gaza-Israel war terminology (Al-Jarf, 2025b), Google's English-Arabic translation of technical terms (Al-Jarf, 2021), and translation of English technical terms to Arabic by Google Translate (Al-Jarf, 2016a).

The word-for-word (literal translation) strategy that MC and GT followed in translating zero expressions in the current study is similar to the literal translation strategies utilized by translation students in translating numeral-based English and Arabic formulaic expressions (Al-Jarf, 2023b), ibn (son) and bint (daughter) fixed expressions (Al-Jarf, 2023a), dar (house) and bayt (home) expressions (Al-Jarf, 2022a), time metaphors in English and Arabic (Al-Jarf, 2023c), common names of chemical compounds (Al-Jarf, 2022d), color-based metaphorical expressions (Al-Jarf, 2019), om- and abu-expressions (Al-Jarf, 2017a), English and Arabic binomials (Al-Jarf, 2016b) and English neologisms (Al-Jarf, 2010).

The high frequency of translation inaccuracies occurring in AI translation of zero expressions in the current study are due to several factors. In searching for an Arabic equivalent, AI relies on (i) its built-in knowledge and resources to translate terms such as linguistic databases that include examples of common terminology in both English and Arabic; (ii) domain-specific contexts that use patterns observed in areas like computer science or mathematics; (iii) translation patterns that help AI adapt to the nuances and intricacies of the target language; (iv) searching the web if needed; and (v) a sophisticated language model trained on extensive linguistic patterns across multiple languages. AI translations usually come directly from its trained linguistic capabilities. This training helps AI recognize grammar, idioms, and vocabulary, enabling AI to generate translations without directly referencing external dictionaries or corpora in real-time. AI relies on its own internal data and training to generate translations. Sometimes there are gaps and inaccuracies in these which lead to mistranslations. Moreover, many AI translation models are trained on large corpora of bilingual texts that include technical jargon. The phrase "صفري/صفرية" seems to appear frequently in contexts such as science,

finance, or engineering, reinforcing its use as the default choice for translating "zero." In addition, AI translation models rely on patterns in their training data. If the data lack diverse examples of "zero expressions," the AI model may not be able to handle such phrases effectively.

The frequent use of "صفري/صفرية" as a translation for "zero", and literal word-for-word translation rather than conceptual translation or modulation stems from several systematic tendencies and challenges inherent to MT systems. First, the word "zero" is inherently linked to the Arabic word "صفر," which denotes the numeral 0. MT systems often default to this equivalent for simplicity and clarity when handling numeric or technical expressions. Secondly, MT systems prioritize literal translations over conceptual ones, particularly when interpreting expressions that combine "zero" with abstract ideas like "interest," "lift," or "downtime." This results in rendering "zero interest" as "فائدة صفرية" instead of a more idiomatic equivalent like "عدم وجود فائدة" (absence of interest). MT systems often default to directly translate words like "zero" without accounting for their conceptual meaning. For example, "zero profit" (الربح الصفري) sounds correct linguistically, but conceptually it might not align with how profit or financial loss is expressed in Arabic. They often default to literal translations when faced with idioms or abstract phrases. While literal translation preserves the form of the original zero expression, it often misses its intended meaning. AI translation lacks conceptual adaptation and may focus solely on word-for-word rendering rather than conveying the underlying idea. In cases like القدرة الصفرية الصفرية for "*zero capability*", duplication occurs due to misunderstanding how "zero" interacts with other words to create the intended meaning.

The use of definite equivalents (with "ال") الصفر/الصفري/الصفرية versus indefinite equivalents (without "ال") صفر/ صفري/ صفرية in the equivalents highlights key differences in how MT systems like MC and GT operate. MC might default to definite equivalents containing الصفر/الصفري, whereas GT might default to indefinite forms صفر/صفري as a simpler approach, especially when the context is ambiguous, as indefinite nouns are less restrictive. Adding "ال" often conveys a specific and formal meaning, which MC might perceive as necessary for clarity in certain technical or specialized expressions like "الضغط الصفري. GT, on the other hand, might prioritize versatility by using the indefinite form. This choice leaves room for adaptation depending on the broader context of the sentence, which it doesn't always have access to.

Arabic native speakers naturally tend to use expressions like صفر ارباح أو لا أرباح أو بدون ربح instead of الربح الصفري which are more idiomatic and reflective of Arabic linguistic norms. Arabic tends to use concise, straightforward phrasing when expressing absence or lack of, which aligns with "صفر أرباح" or "لا أرباح." The literal rendering of "zero" as "الربح الصفري" feels unnatural and rigid in everyday speech or even formal writing. Arabic often emphasizes verbs or negation ("لا" or "بدون") to express absence or nonexistence, which is why "لا أرباح" (no profits) or "بدون ربح" (without profit) fits better linguistically and culturally. AI usually opts for literal translations to ensure clarity (like "الربح الصفري"), but sometimes it misses adapting the phrase to match the way speakers express the concept naturally.

Lack of context seems to be another reason. Since the zero expressions were translated in isolation, i.e., without specifying a clear context or domain in which they are used, MT systems may struggle to interpret the conceptual intent behind phrases like "*zero downtime*" or "*zero pressure*." The literal approach to translation can help avoid ambiguity but sacrifices nuance, such as saying "لا يوجد وقت تعطل" (no downtime) or "انعدام الضغط" (absence of pressure). Zero expressions have multiple meanings in English, such as representing absence, balance, or even starting points. Without clear context, MT systems may misinterpret them. Expressions that are idiomatic or culturally specific, like "zero expressions," may have meanings that depend heavily on their context. MT models might struggle with these nuances, leading to incorrect or overly literal translations. The word "zero" in English signifies a numeric value, absence, or metaphorical meanings (e.g., null, none, base level). Without specific context, MT systems may misinterpret or oversimplify it. Technical terms like "zero-offset reflection" or "zero-based budgeting" require specialized knowledge in fields like finance or science. If translation systems lack expertise or relevant examples in their training data, they may produce awkward or incorrect equivalents.

Furthermore, Arabic may conceptualize certain ideas differently from English, such as omitting direct references to "zero" in favor of expressions like "عدم" (absence) or "انعدام" (lack of). AI systems lack the cultural insight that helps make these adaptations sound natural. Arabic, like other languages, has its own set of idiomatic expressions and cultural references. English to Arabic translation requires more than linguistic equivalence—it needs cultural adaptation, which MT systems can struggle with. Arabic may not use "zero" in the same idiomatic way English does. For example, "*zero defect*" (صفر العيوب) isn't a natural phrase in Arabic culture, as Arabic might express it differently, such as "صفر عيوب" (complete quality).

6. Recommendations

Improving MT systems to address problems requires a multifaceted approach that includes the following: (i) Since MT systems often fail to grasp the context behind zero expressions, leading to mistranslations, the incorporation of contexts to understand whether "zero" refers to absence, neutrality, or numeric value will guide translations. (ii) To avoid literal translations of idioms and phrases that fail to resonate with Arabic native speakers, databases of idiomatic and natural language use can be built for English and Arabic languages. This can help MT systems offer translations that reflect common usage, such as "لا أرباح" for "zero profit" instead of "الربح الصفري." (iii) Expanding and diversifying the AI training datasets, including examples of both formal and informal language usage of zero expressions, as well as domain-specific zero expressions. These may help solve the problem of inadequate or unbalanced training data that leads to recurring translation errors. (iv) Since MT Systems lack the ability to learn from mistakes in real-world translations, implementing feedback mechanisms where human users can report mistranslations, would help MT systems improve over time. (v) combining MT with human editing, especially for complex texts or technical content, can help MT systems handle the nuanced or highly specific translations of zero expressions,. (vi) Developing multilingual corpora that focus on conceptual translation examples and teaching AI how to adapt meaning rather than just words, might overcome this problem and combat MT systems' default to literal translations of abstract concepts as zero expressions. (vii) AI systems can be equipped with rules for definite article {al-} ال التعريف use that aligns with the stylistic preferences of Arabic to overcome the overuse of the definite article (ال التعريف) that results in unnatural phrasing.

The above enhancements require collaboration among linguists, AI developers, and native speakers to ensure that MT systems meet linguistic and cultural expectations. To improve accuracy in such cases, translations yielded by AI need human intervention to account for the conceptual and idiomatic meaning of "zero" in each context.

Moreover, this study fosters an attitude of caution and critical thinking**.** Translation students, professional translators and researchers should use AI in translating zero expressions and other fixed or idiomatic expressions with caution. To understand the concept, they may first check the definition in an English and/or Arabic paper, online or mobile bilingual or monolingual dictionary (Al-Jarf, 2022c; Al-Jarf, 2022e; Al-Jarf, 2020; Al-Jarf, 2014). They need to revise the translation given by AI, fix the word order, pay attention to the definite article, and ensure the constituents of a compound adhere to the Arabic word order and match the source expression in part of speech, derived form, gender, number and so o. They can use a variety of technologies and translation memories to store their glossaries and translations for future reference (Al-Jarf, 2017b; Al-Jarf, 2009).

Finally, AI translation researchers should continue to test AI's ability to translate a variety of genres and other idiomatic and fixed expressions from English to Arabic and Arabic to English such as binomials, color-based metaphors, *common names of chemical compounds,* time metaphors, ibn (son) and bint (daughter), dar (house) and bayt (home), and om- and abu-expressions and different types of neologisms in the future.

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