Applying Large Language Models in Legal Translation: The State-of-the-Art

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Abstract

While there is no denying that new AI technologies and tools are making a significant impact on translation, specialized translation remains problematic for automation especially in regard to terminology. Precise and consistent terminology use requires particular attention in the field of legal translation as a sensitive area affecting the whole of the society. Most recently, tools based on large language models have been gaining attention as potential game changers in the area of legal translation. How do such tools cope with the complexity of legal terminology and legal texts? Can they be trusted to perform the task of legal translation? To investigate this, a two-stage research methodology is applied: first, an analysis of papers published on the topic of large language models and legal translation by relying on quantitative bibliographic and bibliometric indicators, and second, a qualitative content analysis of the retrieved papers. The results show that despite the unparalleled interest into the application of generative AI in all spheres of life, to date there has been scarce research on its application in the field of legal translation. The results of this study therefore provide detailed insight into the state-of-the-art research on this novel topic, tracing the current and proposing future research trajectories. With a view of examining the potential of using LLMs in legal translation, it is instrumental to conduct further empirical studies from interdisciplinary perspectives including diverse legal texts and both low and high-resourced languages.

Keywords

legal translation, terminology, generative AI, NMT, bibliometric study

1. Introduction

The present-day impact of artificial intelligence on cross-linguistic communication is undisputed. Neural models have significantly improved the quality of machine translation (hereinafter: MT), while during the last decade various new technologies have emerged including generative AI large language models (hereinafter: LLMs). The main advantage of neural machine translation (hereinafter: NMT) is that it usually produces fluent texts in which errors, i.e. non-correspondence between the source text and the target text, are harder to find (Wiesmann, 2019, 124). At the same time, studies show that MT systems in general still underperform in domain-specific fields and in under-resourced languages (ElFqih & Monti, 2023), while the potential of LLMs in relation to specialized translation such as legal translation needs to be comprehensively examined. Despite this, some politicians have recently made headlines by unveiling plans of using ChatGPT, a general natural language processing model, to translate EU law and in consequence eliminating "an army of translators and a battalion of lawyers, costing millions of euros" and, what is more, speeding up the process of joining the European Union (Taylor, 2023). Such proclamations underline the growing pressure to actually use more generative AI models in the context of legal translation, regardless if such models had been previously sufficiently tested or not.

However, when contemplating the use of LLMs in the context of EU accession, there are multiple issues to be addressed. First of all, the importance of using appropriate and consistent terminology for the understanding of legal concepts by the community cannot be neglected, especially in light of the overwhelming amount of information, development of *deepfake* technology, and rising disinformation (Friesen, 2022; Shnurenko et al., 2020; Savoleinen, 2022). Indeed, recognizing and applying the most appropriate legal term is indispensable for finding, navigating, and understanding legal regulations. Therefore, each Member State must have clear and transparent acts that are sufficiently understandable to the members of the community, so that these acts can be applied in the most useful and appropriate way for the society's needs, and contribute to the well-being of the citizens. EU law likewise infers obligations as well as grants rights to both States and individuals. Bearing in mind that the terminology used in the *acquis* translation will become part of the national legal language and national law after the accession, terminological choices made at this stage can bear far-reaching ramifications. If individuals cannot enjoy the rights they are entitled to under EU law due to a Member State's faulty implementation of EU law, this not only undermines the principle of full effectiveness of EU law, but may lead to the State's liability for any damage so incurred to the citizens.[1] The mentioned faulty implementation may be the result of a translation or terminology error (Bajčić, 2010) which unmasks the unique characteristics of the context

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[1] In essence, the State is liable no matter which organ of the State is responsible for the failure in accordance with Article 169 of the Treaty. Likewise, Article 189 of the Treaty requires the Member States to take all the measures necessary for the correct implementation of directives in national law (Francovich, opinion, para. 76).

of applying technology to EU legal translation and the need to endorse an interdisciplinary approach to investigate the broader social context of this novel topic.

Considering the complexity of this topic and with an eye to exploring the trending research into applying language models or tools based on such models in legal translation, bibliometric and bibliographic analysis of papers in citation databases WoSCC and SCOPUS as well as content analysis of the retrieved papers are employed.[2] Scientific publications, and in particular scientific journals, are the most influential and important vehicle of information dissemination, gleaning insight into cutting-edge research and knowledge about current topics. As postulated by Bacon in 1620, the true goal of science is the improvement of human life, which can be achieved by means of knowledge founded on scientific cognition.[3] With this in mind, this paper examines the trending research into the use of LLMs in legal translation, investigating whether the importance of legal terminology and legal translation in the context of the development of AI are of greater scientific interest among researchers. Understanding the current state-of-the-art into this topic may support policy makers when developing strategies most fit to meet the new reality of a continuing growth of artificial intelligence which affects legal translation too. After sketching the main challenges of automated legal translation (Section 2), Sections 3 and 4 outline the methodology used to investigate the key trends and to determine the latest research related to the topic of using LLMs in legal translation (bibliometric study). The retrieved papers are then analysed in Section 5 by means of a qualitative content analysis. The main findings are summarized and interpreted in the broader social context of the research topic (Section 6), underscoring the need to conduct further research in order to better understand the potential of using LLMs in legal translation (Section 7).

2. Complexities of the field of legal translation for automation

The frequency of complex terminology and phraseology in the field of legal translation has been the main reason for a traditional lack of reliable tools for legal translators (Killman, 2023a, 504). In fact, terminology competence accounts for a key competence

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By analogy, if errors are made by an LLM in the process of generating legislative texts in the national language of a candidate country and/or (later) a Member State, the State will be held liable for any damage that consequently occurs to an individual. In so far, State liability is inherent to EU law which imposes obligations both on Member States and individuals but also gives rise to rights (para. 31), while neither the State nor the public authorities (legislator) enjoy immunity that is normally recognized in such cases. *Francovich v Italian Republic,* Opinion of Advocate General Cosmas, delivered on 11 July 1995, ECLI:EU:C:1995:232.

2 Bibliometrics is a science studying books, journals and other sources of information as formal documents with a view of improving scientific documentation and information on the communication activity by virtue of quantitative analyses (Jokić, 2005).

3 Francis Bacon described his ideas about the transformation of science in his work: The New Organon: or True Directions Concerning the Interpretation of Nature. More in Hebrang Grgić, 2016.

of legal translators and assumes a crucial role in the context of NMT as well (Weismann, 2019, 121). One of the first studies into NMT of legal texts showed results of insufficient quality, underlining terminology and terminology inconsistency as the most common errors in the tested NMT systems (DeepL Translator and MateCat) (Wiesmann, 2019, 140). The study by Wiesmann included texts from three major areas of legal activity (legislative area, area of legal practice, area of legal theory): an excerpt from a law, a legal essay, a power of attorney, a notarial real estate sale contract, a statement of claim and a civil court judgment that were translated from Italian into German. The length of the source texts varied (in terms of sentence length from four to 96 sentences) (Wiesmann, 2019, 128f.). Although some examples showed that little or no post-editing was required, the overall result of the Italian-German machine translation with DeepL Translator and MateCat was deemed "still insufficient" (Wiesmann, 2019, 148). These results and the described terminology errors are not surprising considering that legal translation is a field traditionally marked by many isomorphic complexities, such as high frequency of specialized legal terminology, ambiguity of terminology, or semi-technical terms that are difficult to recognize as legal terms. The latter terms are characterized by lower termness (Biel, 2023), so that their meaning can be discerned by taking into account intertextuality as one of the key features of legal texts. Intertextuality denotes the text's relation with other texts (Duro Moreno, 2012, cited in Killman, 2023a). In essence, to understand a legal term and to interpret it correctly, it is necessary to consider different texts in which it is used: statutes, law commentaries, case-law, textbooks, as all of them spin the conceptual web of meaning of the term in question. Such conceptual analysis is most relevant when dealing with newly constructed legal concepts or vague concepts which pose interpretation and translation challenges. Vague EU concepts are hence often defined in the settled case-law of the Court of Justice of the EU. Determining equivalence between such concepts in multiple languages is especially challenging. This underlines the fact that law is a cultural artefact resulting in sometimes zero or partial equivalence of specific legal concepts embedded in different legal cultures, and testifies to the importance of achieving terminological equivalence (in the multilingual context of EU law) which is not always confirmed in existing translations (Kerremans & Temmerman, 2016). Nevertheless, terminological equivalence is one of the basic criteria for creating multilingual term databases (*ibid*.) and must be taken into account in EU legal translation in order to guarantee uniform application and interpretation of the law.

Also, owing to the need to accommodate new social realities, new legal concepts are constructed calling for the creation of new terms which is quite problematic in the context of EU law and EU accession.[4] It can be assumed that such new terms are first created in working, that is, drafting languages (primary term formation) and subsequently in

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[4] EU law has introduced many new legal concepts which did not exist in either international law or national legal systems of the Member States (e.g. *right of establishment, qualified majority, concerted practice, undertaking, comitology*). It would be interesting to examine how MT copes with such concepts in a language of a third state (a non-EU member).

other EU languages (secondary term formation).[5] Consequently, such newly coined terms do not exist in the languages of candidate countries, such as Albanian, Serbian or Ukrainian. Therefore, creating new terms for concepts of EU law is among the main challenges for a country acceding to the EU, considering that this terminology will become part of the national legal language and national law after the accession. While NMT systems have lower output quality when translating rare or infrequent words (Killman, 2023a, 492), unseen words or out-of-vocabulary (hereinafter: OOV) words are especially difficult for MT resulting in major errors (mistranslation and terminology) (Huck et al., 2019). In addition to OOV words, NMT encounters difficulties with multiword terms (hereinafter: MWTs). Recognizing the head of the MWT and translating it correctly as a single unit is reportedly difficult (Cabezas-García & León-Araúz, 2023). This is problematic in the context of legal translation as EU legal texts are marked by a high frequency of MWTs, as well as abbreviations (Bajčić & Dobrić Basaneže, 2021; Dobrić Basaneže & Bajčić, 2023) which can also be challenging for NMT.

In short, empirical studies into the accuracy of machine-translated legal texts indicate that using MT for legal translation can be challenging owing to the intrinsic complexities of legal texts and legal terms (intertextuality, high frequency of ambiguous terms, low termness, new terms: OOV words, MWTs, abbreviations). Typical errors of NMT include case sensitivity, word repetitions, word omissions, word additions, words that make no sense in context, terminological inconsistency, wrong numbers (van Brussel et al., 2018, cited in Wiesmann, 2019, 124f.). Despite the remarkable progress made by neural models in automated translation, accurate terminology translation hence remains crucial for ensuring the reliability of NMT systems (Lee et al., 2021). In light of these considerations, it is interesting to examine how LLMs cope with the described challenges of legal translation. While NMT systems may be highly specialized and optimized for specific translation tasks, such as eTranslation fed with the European Commission's translation memory to best meet the needs of EU translation, LLMs offer a broader range of applicability.[6] They are characterized by the ability to quickly adapt to new tasks with minimal additional training, while also accounting for the context in the tasks, and may carry out tasks with one shot (one example) or few-shot (some examples), decreasing the need for task-specific training (Briva-Iglesias et al., 2024). This could prove advantageous from the viewpoint of legal translation.

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[5] Pursuant to the principle of equal authenticity, all EU official languages are equally valid and can be used for interpretation purposes (for a detailed overview see Bajčić, 2021).

[6] Leaving aside the potential use of LLMs for fulfilling tasks such as text summarization, term extraction, or quality evaluation, this study focuses on text-to-text LLMs for MT.

3. Aim, purpose and research questions

This paper aims to investigate the latest research related to the topic of using LLMs in legal translation by examining the bibliographic and bibliometric features of papers as well as trends and patterns related to scientific productivity in this context. In light of the importance of legal translation for the society at large, identifying the present research into the use of LLMs in legal translation will enable a better understanding of the state-of-the-art, sharpening both theoretical and practical insights into the advantages and risks of applying LLMs in legal translation and set the scene for further research by devising an innovative two-stage research methodology.

With this in mind, the following research questions are addressed:

1. What are the key features and trends related to the application of NMT/LLMs to legal translation during the analysed period in WoSCC and SCOPUS databases?
2. Is it possible to detect any changes in approaches to this topic during the observed period in WoSCC and SCOPUS databases?
3. In which countries (language-geographical indicators of published papers) (states, institution/s) were the relevant topics most explored in WoSCC and SCOPUS databases?

4. Methodology

To answer these questions, a study encompassing two stages of research was conducted. First, employing standard bibliographic and bibliometric indicators and tools, papers published in publications indexed in the two citation databases WoSCC and SCOPUS were analysed to gain insight into the number of papers, the most cited papers and authors, as well as the areas of research on the use of LLMs in legal translation. In the second stage, qualitative content analysis method was applied to papers retrieved from WoSCC and SCOPUS citation databases with a view of providing deeper detailed insight into the research topic and identifying current and future research trends. Hence, the study is based on linking quantitative indicators derived from bibliometric measures with the subsequent qualitative evaluation of the content analysis of papers (Wouters, 2020, 71) so to achieve more efficient results.

4.1. Bibliographic and bibliometric analysis

Besides foregrounding research multidisciplinarity and international representation, databases are the most relevant tool for finding, filtering and analysing research data as they incorporate comprehensive metrics and analytic tools for comparing and ranking

data within fields and in total (Mitrović, 2018; Moslavac, 2022). Additionally, the world's leading citation databases Web of Science Core Collection (WoSCC) and SCOPUS continuously upgrade metric tools for evaluation and comparison, thus offering a range of publicly accessible metrics. Although citation databases transparently contribute to the global communication processes in research, over the last few decades some authors have questioned whether demonstrating metric indicators of journals to measure the quality of research was justified, most notably considering the heterogeneity of research areas (Weingart, 2005; Wouters, 2020; Moslavac, 2022). Nonetheless, quality and research productivity are still measured by standards and criteria which condition the representation of journals in citation databases, while the publication of a paper in a well-represented and positioned journal (in a renowned database) speaks of the level of quality and guarantees visibility to a wider research community. Therefore, the authors employed bibliometric indicators and tools in tandem with the qualitative method of content analysis of papers to provide detailed insight into the trending research on applying LLMs in legal translation (Weingart, 2005; Li & Hu, 2022).

The bibliographic and bibliometric analysis is based on a comparative two-level procedure. The first level is comprised of bibliometric features of papers evidencing the number of papers, types of authorship, represented languages and scripts, as well as states and universities. The second level is comprised of bibliometric parameters of scientific areas and categories of papers represented in journals. The data were retrieved and processed in Microsoft Excel and stored as a dataset in the institutional repository of the Faculty of Law, University of Rijeka (PravRi). The compiled list encompasses papers from different areas dealing with the topic of legal translation and LLMs. Both theoretical and practical features of papers were considered in the evaluation of papers. The following features of papers and publications were analysed: a) representation of (national, regional or international) publications in the relevant databases, b) monitoring the growth of literature in the field of NMT/LLMs and legal translation, c) pinpointing subtopics of NMT/LLMs and legal translation papers, e) the "visibility" of the results published in journals from the so-called scientific periphery (e.g. journals published in national languages) and f) internationalisation.

4.2. Planning, collection and analysis of data

The entire search process in the citation databases WoSCC and SCOPUS was automated by virtue of a set algorithm, starting from document location (indexing) and bibliographic description (metadata analysis), to the extraction of bibliographic references. The analysis of bibliographic references taken from WoSCC and SCOPUS was carried out in March 2024, covering the years of publication of papers from 2021 to 2024. Using advanced search, the query in both databases included identical keywords LLMs (and

term variants generative AI models, large language models), machine translation and legal translation combining the fields of topic, title or author.

In view of the fact that the two databases have different classification options, the search results were filtered differently in each database, namely, according to "subject area" in SCOPUS and "research area" in WoSCC. The results of both searches are described in the following paragraphs.

The search in SCOPUS and WoSCC was conducted using the same query and limited to the time period from 2021 to 2024 in light of the recency of generative AI models and in order to exclude results that are not relevant to our research question.[7] Selecting the most adequate keywords for the search was not easy due to an evident lack of stabilized terminology in the context of generative artificial intelligence and automated translation. Because of this, rather than using only the keywords "LLMs" or "Large Language Models", we also included "Machine Translation" and "Generative AI Models" to receive more representative, comprehensive and contextualized results and to be able to review the state-of-the-art research on the possibilities and liabilities of using generative AI models (in contrast to NMT) in the field of legal translation. Therefore, the keyword "Legal Translation" was also included in the query.[8] By conducting the search using the query keywords in the databases WoSCC and SCOPUS we retrieved a higher number of papers, and after additional filtering of the query by limiting the publication period to 2021 – 2024, and to the type of document (paper, book chapter, book, proceedings paper, proceedings), a total of 111 papers was retrieved in WoSCC and 107 papers in SCOPUS. The sole criterion to be fulfilled by papers was that they entailed bibliographic references, that is, a list of cited literature. Reviews, book/journal reviews, notices, etc. were not included in the sample.

4.3. Content analysis method

As quantitative evaluation provided transparent insight into the numbers of published papers indexed in the citation databases WoSCC and SCOPUS, the next step was to apply the qualitative method of content analysis of the retrieved papers (De Bellis, 2009). The latter enabled the retrieved papers' content to be analysed in a systematic and simple manner using the qualitative (non-frequency) method. This method attempted to detect

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[7] Query in WoSCC: (TITLE-ABS-KEY (llms) OR TITLE-ABS-KEY (generative AND ai AND models) OR TITLE-ABS-KEY (large AND language AND model) OR TITLE-ABS-KEY (machine AND translation) AND TITLE-ABS-KEY (legal AND translation)) AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "ARTS"); Query in SCOPUS: (TITLE-ABS-KEY (llms) OR TITLE-ABS-KEY (generative AND ai AND models) OR TITLE-ABS-KEY (large AND language AND model) OR TITLE-ABS-KEY (machine AND translation) AND TITLE-ABS-KEY (legal AND translation)) AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "ARTS")).

[8] Extended query: (TITLE-ABS-KEY (llms) OR TITLE-ABS-KEY (generative AND ai AND models) OR TITLE-ABS-KEY (large AND language AND model) OR TITLE-ABS-KEY (machine AND translation) AND TITLE-ABS-KEY (legal AND translation)) AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "ARTS")).

the extent to which the concepts of legal translation and LLMs and other related concepts were represented in the analysed papers and in what contexts, as well as to identify various known variants and synonyms of the key terms (Tkalac Verčič et al., 2011; Krippendorff, 2003). Clearly posed research question and conclusions were taken as the yardstick for discerning topic-appropriate, relevant from non-relevant papers and investigating whether important information was given in these papers both with regard to the practical application, and future research in a consistent, objective and impartial manner and based on the reputation of the author and the publication in which the paper was published. For the purpose of identifying the direction of the development of LLMs and legal translation, the analysed literature was screened and grouped in line with three principal research questions (see Table 1):

Table 1. Groups of screened and analysed papers from WoSCC and SCOPUS

group	group	group
The key features and trends related to the application of NMT/LLMs to legal translation during the analysed period in WoSCC and SCOPUS	Changes in approaches to NMT/LLMs and legal translation during the observed period in WoSCC and SCOPUS	Language-geographical indicators of published papers (states, institution/s) where the relevant topics were most explored in WoSCC and SCOPUS

In order to collect the relevant data from the publications a database was compiled containing all the relevant information pertaining to the publications, journals, authors, etc.

5. Results

The results of the described research methods: bibliographic and bibliometric indicators and tools and the subsequent content analysis of the retrieved papers from WoSCC and SCOPUS are presented according to the posed research questions.

5.1 Research question 1: The key features and trends related to the application of NMT/LLMs to legal translation during the analysed period in SCOPUS and WoSCC databases

a) SCOPUS
The 107 retrieved papers from SCOPUS were filtered according to the most relevant subject areas from the perspective of our research question: *Social Sciences* (56), *Computer Science* (52), *Arts and Humanities* (49) (see Graph 1) etc.

Graph 1. Papers in SCOPUS by subject area
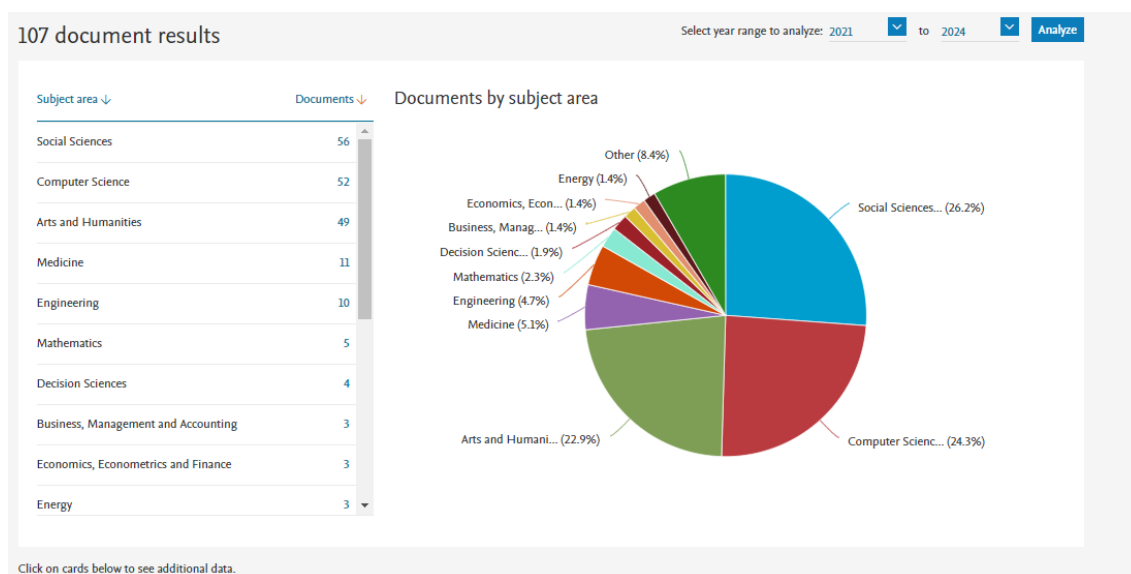
Among papers under subject area *Computer Science* (52) 19 deal with the legal domain, and legal texts, and legal documents. The highest number of papers were published in 2023 (8). The topics tackled include: terminology translation errors in MT; MT and legal language; raising legal translators' awareness about post-editing.

The three most cited papers were published in 2021 and 2022 on the following topics: computer-mediated communication; machine translation; multilingual communication; translation in legal and healthcare settings; translation-mediated communication; brain-computer interfaces (BCIs); explaining decisions; language models; neural machine translation; NLP; transformers; transparent embedding models.

1. Vieira, Lucas; O'Hagan, Minako & O'Sullivan, Carol (2021). Understanding the societal impacts of machine translation: a critical review of the literature on medical and legal use cases. *Information, Communication & Society*, 24(11), 1515–1532. (73 citations)

2. Portillo-Lara, Roberto; Tahirbegi, Bogachan; Chapman, Christopher; Goding, Josef & Green, Rylie (2021). Mind the gap: State-of-the-art technologies and applications for EEG-based brain–computer interfaces. *APL Bioengineering*, 5(3). (30 citations)

3. Zini, Julia & Awad, Mariette (2022). On the explainability of natural language processing deep models. *ACM Computing Surveys*, 55(5), 1–31. (27 citations)

56 results under subject area *Social Sciences* were filtered using the keyword "legal translation" and narrowed down to 14 papers that deal with the comparison of human and machine translation; evaluation of machine translation; post-editing versus translating. Only one paper dealing with the use of LLMs in legal translation was retrieved (under Social Sciences). The paper in question authored by Aline Larroyed (2023) investigated the use of ChatGPT in the context of patent translations.

In terms of our research question, relevant results were found under the research area *Arts and Humanities* (49): 26 articles, 13 conference papers, 3 book chapters. Screening the abstracts, we discovered that the papers deal with the evaluation and/or quality of machine-translated texts; comparisons of human and machine translations, or post-editing and translating. Of the 49 papers, 19 were associated to the keyword "legal translation". They too put the spotlight on topics of assessing the quality of MT or comparing MT and human translation (e.g. Briva-Iglesias, 2021; Vigier-Moreno & Pérez-Macías, 2022; Giampieri, 2023; Killman, 2023) and on comparison of MT systems with high or low-resourced language combinations (Bago et al., 2022; Sosoni, O'Shea, & Stasimioti, 2022).

b) WoSCC

We also conducted a search in WoSCC database using the same keywords filtering the results according to the same time period (since 2021) and retrieved 111 papers. The papers were classified into the following research areas: *Social Sciences Interdisciplinary* (48), *Humanities Multidisciplinary* (42), *Ethics* (25), *Computer Science Interdisciplinary Applications* (15), *Linguistics* (13) etc.

Graph 2. Papers in WoSCC by subject area

There were overlaps in results (identical papers retrieved), however overall, less papers were found in the field of legal translation. In regard to the area of law, within the analysed period only two papers were detected in WoSCC (from the US and the UK). Generally, more results concerned papers dealing with LLMs (than in SCOPUS), albeit not in relation to legal translation or translation. Some focused on using ChatGPT for tourism (Carvalho & Ivanov, 2023), ChatGPT for game jams (Grow & Khosmood, 2023), or tackled bias of large language models (e.g. Gadiraju et al., 2023). Most papers that mentioned LLMs such as ChatGPT, dealt with their application in the medical field, and in the context of bioethics. The four most cited papers were published in 2023 and 2024 on

the following topics: ChatGPT; generative language models; LLMs; Tourism Chatbots; AI in tourism; Intelligent automation; informed consent privacy; fine-tuning; ethics; bioethics; medical education and healthcare professionals.

1. Carvalho Inês & Ivanov, Stanislav (2024). ChatGPT for tourism: applications, benefits and risks. *Tourism Review,* 79(2), 290–303. DOI: 10.1108/TR-02-2023-0088 (63 citations).

2. Cohen, Glenn (2023). What should ChatGPT mean for bioethics?. *The American Journal of Bioethics,* 23(10), 8–16. DOI: 10.1080/15265161.2023.2233357 (30 citations).

3. Porsdam Mann, Sebastian; Earp, Brian; Møller, Nikolaj; Vynn, Suren & Savulescu, Julian (2023). AUTOGEN: A personalized large language model for academic enhancement—Ethics and proof of principle. *The American Journal of Bioethics,* 23(10), 28–41 (18 citations).

4. Rahimzadeh, Vasiliki; Kostick-Quenet, Kirstin; Blumenthal Barby, Jennifer & McGuire, Amy (2023). Ethics education for healthcare professionals in the era of ChatGPT and other large language models: Do we still need it?. *The American Journal of Bioethics,* 23(10), 17–27. DOI: 10.1080/15265161.2023.2233358 (14 citations).

c) Results of the content analysis

By analysing the content of the retrieved papers, we identified the key topics and directions of research in the field of automated legal translation (in regard to NMT and LLMs) which predominately focuses on quality (evaluating the NMT quality or comparing the quality of MT and human translation). The study conducted by Vigier-Moreno and Perez-Macias (2022) evaluated English translations of a Spanish remand order produced by three different NMT systems (DeepL, eTranslation, and Google Translate), using TAUS evaluation guidelines. Vigier-Moreno and Perez-Macias's quality analysis of four NMT-produced English translations of a Spanish remand order was conducted according to four broad categories: accuracy, fluency, terminology, and style. They discovered considerably more errors of terminology and accuracy than fluency and style, regardless of the NMT system. Such a result is also consistent with NMT quality findings of previous studies (e.g. Wiesmann, 2019; Giampieri, 2023), demonstrating that the greatest number of errors pertains to terminology, and that a number of translations offered by the NMT systems under study were too literal (e.g. Vigier-Moreno & Pérez-Macías, 2022, 85). Terminology mistakes and non-compliance with the conventions of legal language were also underscored as a major issue in Giampieri (2023). She conducted a comparative analysis of the machine-translated text using DeepL MT vis-à-vis corpus evidence on the example of selected contract clauses. The conducted corpus analysis of the terms and phrases generated through automatic translation revealed several inaccuracies regarding fixed phrases and non-compliance with typical legal writing conventions leading her to conclude that in light of the fact that MT cannot be considered "authentic", i.e. resembling real language in use, "MT is currently not the best language resource to tap into when tackling legal texts" (Giampieri, 2023, 132). As regards the text type used

for assessing the quality of MT, it appears that most studies included in our review focus on shorter texts, most notably contracts (Giampieri, 2023) or remand orders (Vigier-Moreno & Perez-Macias, 2022). Killman's study (2023) concerned MT translations of parts of judgments, while the specific legal text type in Cui et al.'s experiment (2023) was not indicated.

Our search retrieved only one paper dealing with LLMs' use in legal translation. The paper by Larroyed (2023) deals with utilizing ChatGPT in patent translation. Her study assessed the quality of a sample of 20 green energy patents translated from English into Portuguese. Similarly to the above analysed studies, a relatively small sample was used to conduct the experiment as only the initial 120 to 150 words of the claims were considered. The findings indicate that NMT designed specifically for patents and trained on patent corpora (Patent Translate) outperforms ChatGPT in the domain of patents as it translated technical terms and specialized vocabulary more accurately (Larroyed, 2023, 1016). This finding is in keeping with research into the benefits of developing high-quality language resources such as parallel corpora for the purpose of legal translation (e.g. Bago et al., 2023). On the other hand, GPT-4 showed potential in terms of language structure and overall textual coherence (Larroyed, 2023). An important point seems to be that GPT-4's ability to learn and adapt to new terminology in real time will likely improve its performance over time (Larroyed, 2023, 1016). A similar conclusion was reached by Briva-Iglesias et al. (2024).[9] Their study focused on the translation of a contract (of 537 words) evaluating the MT quality of two state-of-the-art LLMs against a traditional NMT system across four language pairs. It used both high and low-resourced languages: Spanish, Catalan, Turkish and Brazilian Portuguese.

5.2. Research question 2: Changes in approaches to NMT/LLMs and legal translation during the observed period in SCOPUS and WoSCC databases

The results illustrate that a small number of papers was published during the analyzed period in publications indexed in both databases. The highest number of papers in both databases was published in 2022 and 2023.

a) SCOPUS

A total of 107 papers was published in SCOPUS as follows: 14 in 2021, 35 in 2022, 39 in 2023 and 19 in 2024. Initially, the studies (starting from 2021) focused mainly on *Social Science* (11), *Arts and Humanities* (7) and *Computer Science* (5). In 2021, keywords of the papers dealt with *Machine Translation* (7) and *Deep Learning* (2). In 2022, research in the field of *Machine Translation* continued in the subfield of legal translation. In 2023, the trending research in the field of *Machine Translation* continued, but a new area of *Computational*

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[9] This paper was not retrieved from WoSCC or SCOPUS.

Linguistics emerged. Most of the papers were published in scientific journals and conference proceedings, whereas a small number of papers was published in other types of publications. Despite the fact that the number of retrieved papers is limited, it can be concluded that there has been an increase in interdisciplinary approaches and a growing reliance on the methods of computer science. This is understandable as to fully grasp and assess how LLMs and NMT can be applied to legal translation, one needs to consider multidisciplinary issues.

Out of 107 papers, 32 deal with the topic of legal translation, legal texts, legal documents, legal language and AI and the law. In the field of law only two papers were identified in 2021 (Zemni, Bouhadiba & Zitouni, 2021; Briva-Iglesias, 2021), whereas the highest number of papers was published since 2022 (10), 2023 (10), 2024 (9).

b) WoSCC

A total of 111 papers was published in the WoSCC database, of which 16 in 2021, 26 in 2022, 53 in 2023 and 17 in 2024. Initially, the studies (starting from 2021) focused mainly on *Humanities Interdisciplinary* (7), *Social Science Interdisciplinary* (7) and *Linguistics* (4). Most of the papers were published in scientific journals, and a small number of papers was published in other types of publications. In 2023, the topic of *Social Sciences Interdisciplinary* (26), *Ethics* (15) *Humanities Interdisciplinary* (11) and *Computer Science Interdisciplinary Applications* (10) increased. Out of 111 papers, only two are related to the topic of legal translation and LLMs, published in 2023 and 2024:

1. Rezaeikhonakdar, Delaram (2023). AI Chatbots and Challenges of HIPAA Compliance for AI Developers and Vendors. *Journal of Law, Medicine & Ethics*, 51(4), 988–995, DOI: 10.1017/jme.2024.15.
2. Sousa-Silva, Rui (2024). 'We Attempted to Deliver Your Package': Forensic Translation in the Fight Against Cross-Border Cybercrime. *International Journal for the Semiotics of Law-Revue Internationale de Sémiotique Juridique*, 1–27.

As already mentioned, legal translation studies have recently focused on evaluating MT performance in the field of law. Indeed, most of the reviewed studies were conducted in relation to quality and accuracy (Killman, 2023; Vigier-Moreno & Perez-Macias, 2022; Giampieri, 2023), or in relation to comparisons of human and machine-translated/post-edited texts (e.g. Cui et al., 2023). The study by Cui et al. compared the effort of human translation and that of post-editing in relation to text types, covering advertising, news, legal, and literary texts, on the English-Chinese language pair. By using eye-tracking and key-logging experiment and a follow-up questionnaire survey, they demonstrated that post-editing of NMT output generally involves less effort than human translation, thus corroborating that MT does improve translators' productivity and translation quality. However, the results also indicated more cognitive effort by the participants in post-editing than in human translation for the legal text type (Cui et al., 2023). What is more, the mistakes made by MT concerned terminology (ibid.).

5.3. Research question 3: Language-geographical indicators of published papers (states, institution/s) where the relevant topics were most explored in WoSCC and SCOPUS databases

a) SCOPUS

By analysing the indexed publications in SCOPUS, it can be observed that the largest number of papers were published in English (97 papers), followed by a smaller number in Spanish (5) and French (4) and Portuguese (1). If we look at these papers in the context of the represented countries, the biggest percentage of papers comes from the United States (12), United Kingdom (12), Spain (11), Germany (10), Italy (10), France (6), etc.

Graph 3. Papers in SCOPUS by country or territory
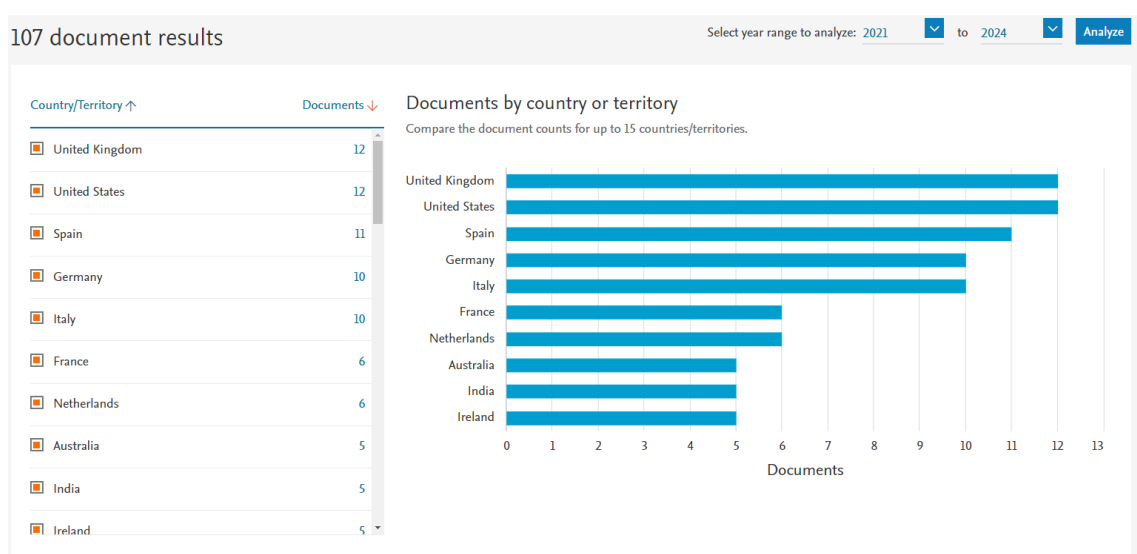
Comparing the countries with author and university affiliation, the biggest percentage of papers is affiliated with the University of North Carolina at Charlotte (4), Dublin City University (4), The University of Edinburgh (3), etc.

**Graph 4.** Papers in SCOPUS by documents by affiliation
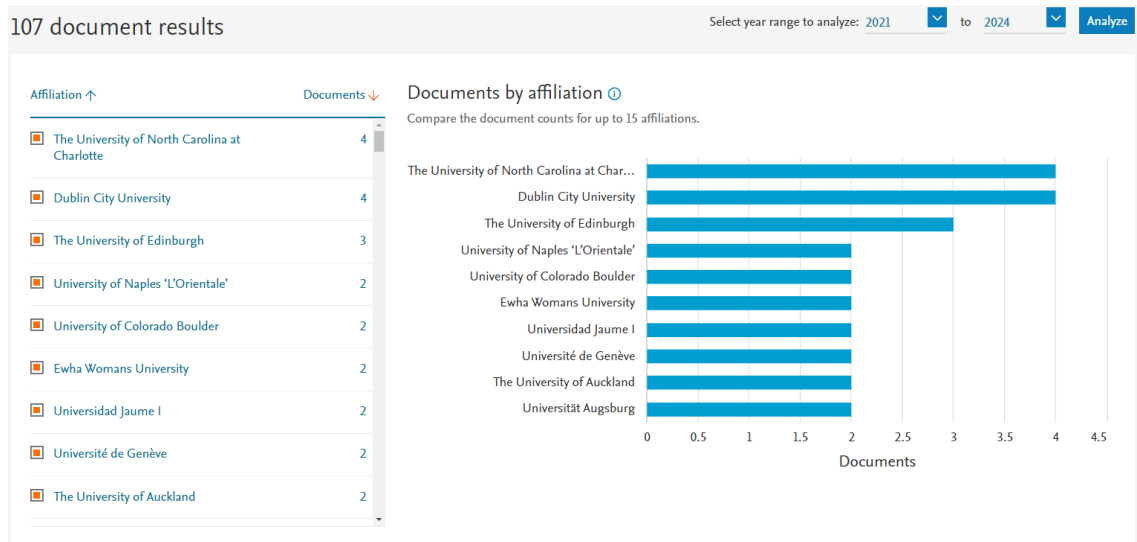
On the other hand, analysing the 19 papers within *Computer Science* and the area of law, it is evident that most authors come from Italy (5), the United States (3), Australia (2), United Kingdom (2), Algeria (1), Columbia (1), Germany (1), the Netherlands (1), etc.

**Graph 5.** Papers in SCOPUS by country or territory under *Computer Science*
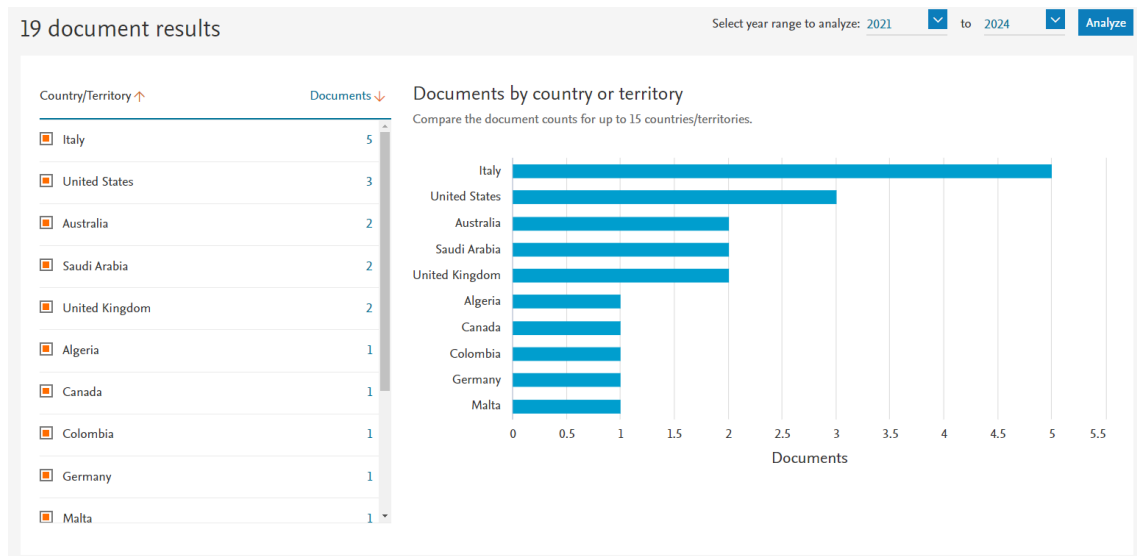
Authors of most papers under *Social Science* and of papers dealing with law and legal translation come from the following institutions: University of Naples 'L'Orientale' (2), Alma Mater Studiorum Università di Bologna (2), AWS AI Labs (1), etc.

Graph 6. Papers in SCOPUS by affiliation under *Social Science*
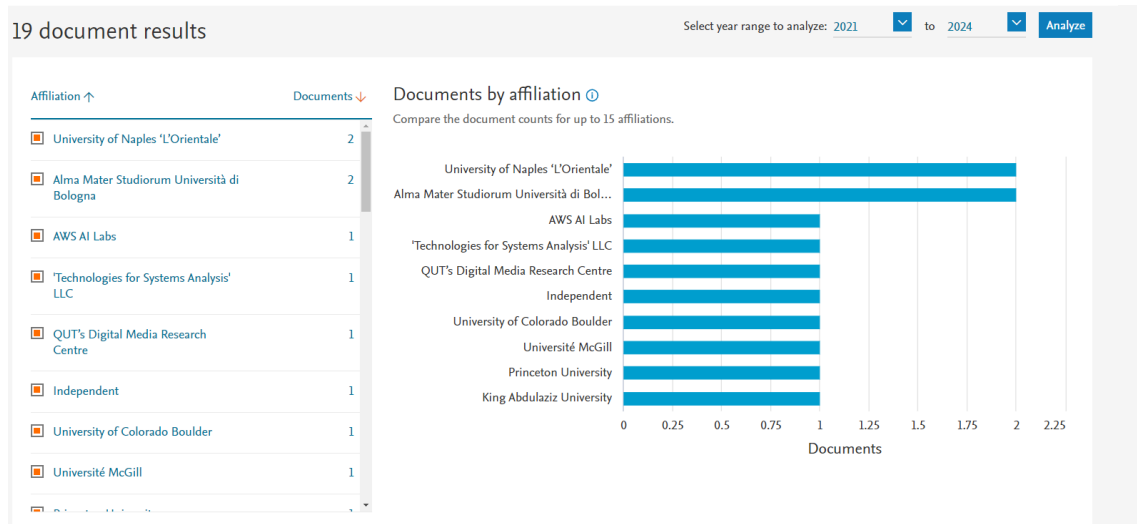
Analysing the 49 papers under *Arts and Humanities* it was identified that most authors come from Spain (10), USA (6), France (4), etc. Authors dealing with the topic of legal translation within this group (19 papers) come from the United States (4), Ireland (3), Spain (3) etc.

**Graph 7.** Papers in SCOPUS by country under *Arts and Humanities*
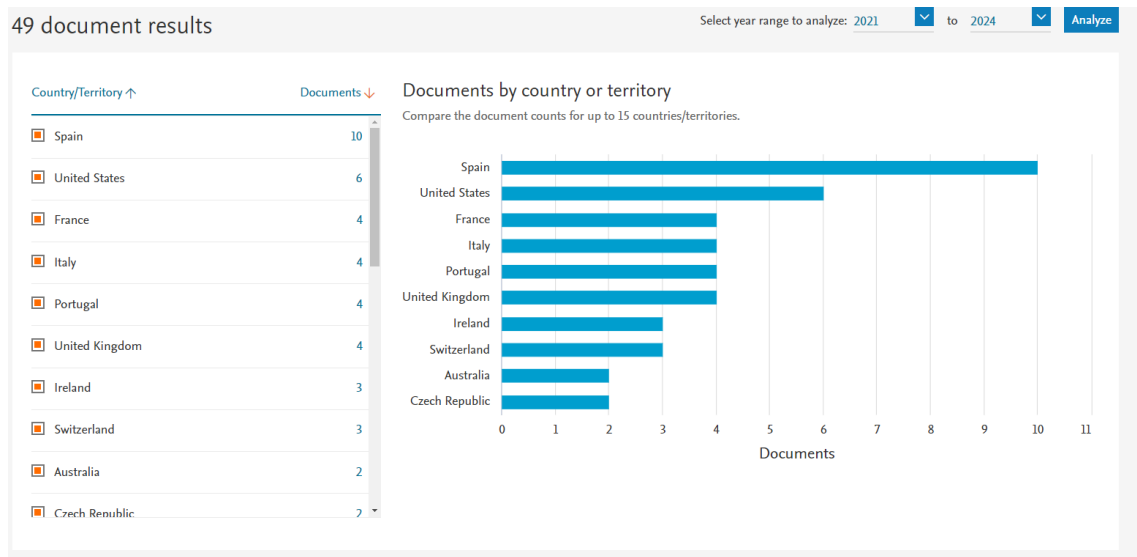
b) WoSCC

Furthermore, the analysis of the publications indexed in the WoSCC database shows that the highest number of papers were published in English (101 papers), followed by a smaller number of papers published in Spanish (3) and one paper in Croatian, Dutch, Italian, Polish, Russian and Slovenian, respectively.

Graph 8. Papers in WoSCC by language

The papers were most frequently published by authors from Great Britain (12), Spain (11), USA (10), Germany (10), Italy (7), Portugal (5), the Netherlands (5), France (5), China (4). One paper was detected by authors from India, Malta, Macao, Estonia, Hungary, Lithuania, but also Norway and Sweden, etc.

Graph 9. Papers in WoSCC by country or territory
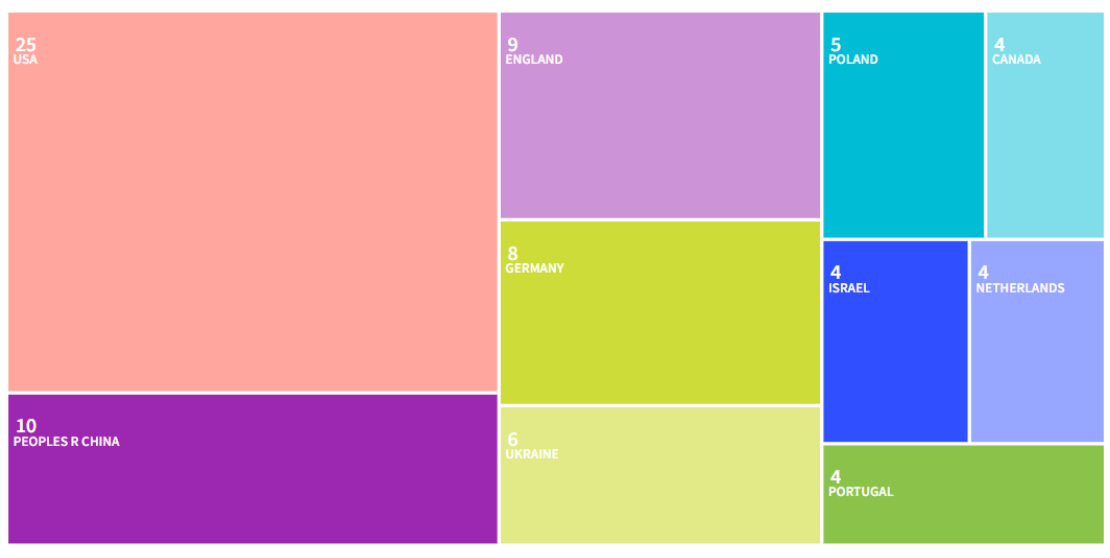
Comparing authors and affiliations of universities and institutions, the highest number of papers is affiliated with e.g. Guangdong University of Foreign Studies (3); Institute problems artificial intelligence (3); National University of Singapore (3); Ministry of education science of Ukraine (3), University of Oxford (3), Harvard University (2).

Graph 10. Papers in WoSCC by affiliation

6. Discussion of results

The results of this study demonstrate that only a small number of papers was published during the analysed period on the research topic in publications indexed in WoSCC and SCOPUS databases. Initially, the conducted studies put the emphasis on the area of Computer Science, with the highest number of papers published during 2022 and 2023. Most papers were published in scientific journals, and a smaller percentage in other types of publications. 2023 marked an increase in the number of papers featuring Machine Translation and Computational Linguistics (SCOPUS) and Social Sciences Interdisciplinary (WoSCC), which points to a growth in interdisciplinary studies and the development of collaborative research networks, as elaborated in Subsection 5.2. It should be noted that the highest number of papers were published in English, and significantly less in other global languages, namely, only one paper per language. Prevalently, papers were published in Western European and American journals of different universities, and a small number of papers in publications from the so-called scientific periphery (e.g. journals that are published in national languages). The results by all means underscore the novelty of the research topic and an evident lack of research into this area, providing for only a small number of results in certain areas of the world and in smaller peripheral academic communities, which can impact the perception and awareness of different stakeholders in the society about the importance of this topic.

As illustrated by the qualitative analysis, from the outset of studies into automated legal translation, terminology mistakes have been singled out as a recurring issue overshadowing the use of automated tools to translate legal texts. Indeed, the conducted

studies seem to underline the overarching importance of a) terminology competence of translators (e.g. Wiesmann, 2019; Giampieri, 2023) and b) quality datasets and specialized corpora for a better performance of NMT in the specialized field of legal translation (e.g. Bago et al., 2023). Owing to the key findings of empirical studies, today we are aware that NMT systems produce fluent translations with errors that are apparent. As mentioned, these errors frequently include repetitions, omissions or additions of words, or choice of words that make no sense in context, or use terms inconsistently. Likewise, there is evidence that NMT still struggles with MWTs, abbreviations and OOV words. Knowing the types of errors enables more efficient and quicker post-editing, and must be taken into account in the training of future translators. These findings provide evidence that legal translation in general remains challenging for NMT in light of the specific features of legal texts and legal terms, in keeping with earlier research (Wiesmann, 2019). It is expected that spotlighting quality as the key research topic in automated data-driven legal translation will continue, while studies into MT or LLM quality estimation will be conducted by relying on generative AI tools.

However, it is at this moment difficult to draw conclusions about the most typical translation errors of LLMs based on the sheer scarcity of research on their application to legal translation to date. The little available data has been extracted from studies based on limited samples of legal texts such as contracts and patent claims. The results do unveil a potential of large generative AI models in producing accurate translations and in particular their ability to learn and adapt to new terminology in real time. While the models performed worse in the case of low-resourced languages such as Turkish, the GPT-4 translation in Turkish was nevertheless marked by more terminology consistency than Google Translate (Briva-Iglesias et al., 2024). Indeed, high terminology consistency was also confirmed by Larroyed's study. Despite this, translating larger samples of legal texts, such as legislative acts which are more often the source of interpretation difficulties, needs to be further investigated in order to be able to draw conclusions about their "terminology competence" and parity with NMTs and specialized corpora in this regard. More evidence is also needed about the performance of LLMs in translating longer texts. Likewise, the absence of terms for new concepts could affect the quality of performance of LLMs in particular in languages of EU candidate countries. In addition to assessing how LLMs cope with OOV words (and other complexities of legal texts and legal terms discussed in Section 2), future research should try to account for their performance in terms of translating MWTs and abbreviations, and with an eye to achieving terminological equivalence (across multiple languages including less-resourced ones).

As a preliminary study, this research has certain limitations in regard to the assessment of research productivity in general, and in regard to covering only two citation indexes and thereby excluding potentially relevant, special research databases and open-access journals. In addition, due to a lack of standardized and uniform terminology in this area, and the existence of term variants, extensive (manual) editing was necessary

which might lead to errors. For this reason, we decided to expand the search by including the term *machine translation* in addition to *LLMs* in order to obtain insight into the broader context of automated legal translation studies. Nevertheless, the insight gained into the current state-of-the-art research merits attention, especially considering the increasing application of AI systems and tools, but far less empirical research validating these applications in different areas.

7. Conclusion

Bibliographic and bibliometric research undisputedly contributes to the global communication processes in research and, coupled with qualitative methods of content analysis of papers provides detailed insight into a certain research question (Weingart, 2005). By applying the described two-stage research methodology, attempt was made to draw a big picture of applying generative AI models in the field of legal translation. Despite the fact that the number of papers on AI has more than doubled since 2010 (Masley et al., 2023), the results of this study point to a low number of papers published during the last three years on the application of generative AI models in the field of legal translation, most notably papers dealing with the broader social context of this topic. Slightly more papers were published in SCOPUS (21), of a total of 107, in comparison to WoSCC (2) - a total of 111. The majority of papers were published in English in Western European countries, the United States and Australia by authors affiliated with renowned universities. In contrast, only a handful of papers were published by authors from peripheral academic communities in other languages. Moreover, the existing research investigates the application of generative AI models in the field of legal translation prevalently from the viewpoint of a single discipline. However, the analysis of the most relevant papers published in the databases WoSCC and SCOPUS underscores the importance of interdisciplinary approaches so to enable a holistic view of this complex topic, which warrants further research in particular by smaller academic communities. This is overtly articulated by a multitude of examples from the political and social life, demonstrating that legal translation in the context of tools based on LLMs is not just about choosing the most appropriate translation tool and/or legal term. Legal terms and regulations must be comprehensive not just to lawyers and translators, but also to the citizens as ultimate quality controllers. Understanding and using appropriate legal terms impacts the citizens' decision-making in everyday life, empowering them on the path to the realization of their rights, and finding and navigating credible legal information.

At the same time, there is no denying that millions of users rely on LLMs at this moment to generate human-level text (e.g., GPT-4, ChatGPT, Luminous, Bard, Bing) or images (e.g. Stable Diffusion, DALL·E 2) (Hacker et al., 2023). It is therefore hardly surpris-

ing that politicians are calling for an ever-increasing reliance on technology. As mentioned in the introduction, LLMs' seem to appeal to EU candidate countries faced with the task of translating millions of pages of EU legislation. Such open calls for action testify to the mounting pressure (political or of other kind) to utilize generative AI models for the purpose of legal translation, despite the fact that the results of our study point to a scarcity of research into using generative AI models to translate the law. The little available data has been extracted from studies based on limited samples of legal texts such as contracts and patent claims. Translating larger samples of legal texts though, such as legislative acts, needs to be further investigated, in particular with regard to the translation of EU law in the context of EU accession which poses unique translation challenges. In light of the political, legal and institutional importance of EU law translation, it is critical to validate the initial translations of EU law into a national language of a candidate country. In the context of EU law caution is called for in view of the fact that translation and terminology errors could lead to a faulty implementation of EU legislation, most notably of a directive that is transposed into national law, and consequently to the State's liability for damage incurred to an individual due to the incorrect or faulty implementation of the directive in question (Bajčić, 2010, 92f.). After all, obtaining redress from the Member State by individuals when their rights are infringed by a breach of EU law is indispensable for full effectiveness of EU law (paras. 33–34, Francovich C-6/90 and C-9/90).

In addition, the increasing number of studies on quality estimation in the field of legal translation indicate that terminology remains problematic in automated legal translation, thus rendering terminology competence and domain knowledge indispensable for successful post-editing and for the translator's interaction with systems of automated translation in general. Moreover, current research points to the importance of increasing in-domain training datasets and information on legal concepts, underscoring the role of parallel legal corpora in achieving better quality of NMT in the legal context (Bago et al., 2023; Krimpas & Valavani, 2023).

Therefore, departing from the findings of this study we propose the following lines of future research on the use of large language models in legal translation:

- increasing relevant and credible training datasets and information on legal terminology with a view of fine-tuning LLMs (e.g. by RAG technique) for the task of legal translation. It can be assumed that LLMs, due to their adaptability, could profit from training datasets derived not just from corpora, but also from legal databases, and so improve their translation performance especially in institutional settings such as the EU.
- conducting empirical studies (from the perspective of institutional translation) to examine how LLMs translate OOV words, MWTs and abbreviations, and with an eye to achieving terminological equivalence and intra-textual terminological consistency (in high and less-resourced languages);

- examining confidentiality and privacy issues related to using generative AI models (from the perspective of legal studies) as well as the reliability of data generated by such models (in terms of replicability and stability);
- bolstering empirical research by qualitative methods so to ensure a better understanding of information skills (information, legal and AI literacy) of citizens needed to critically evaluate the quality of legal terms generated by AI models, as citizens are increasingly relying on information generated by AI.

A common thread to these research avenues is the need to endorse interdisciplinary holistic approaches in order to illuminate the potential risks of as well as improve future applications of generative AI models. The methodology devised in this paper can be harnessed to investigate other novel research topics and trends, especially those marked by inter- and crossdisciplinarity.

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