

## Research Article

# Technical Communicators' Use of and Requirements for Special Language Reference Tools

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**Abstract—Background:** Technical communicators use special language information to describe technology products. Researching such information is part and parcel of their job and thus occupies a relevant share of their working time. **Literature review:** Numerous studies examine information needs and search techniques of various professionals, such as engineers or translators. However, very little is known about technical communicators' use of and requirements for information sources containing special language information. This article contributes to filling this research gap by discussing results of an empirical study. **Research questions:** 1. What types of nonhuman information sources do technical communicators use when researching special language information? 2. What properties do technical communicators expect from special language reference tools? **Research methodology:** We conducted a written online survey among technical communicators. In this article, we analyze and interpret survey data related to the two research questions. **Results:** Respondents use 14 major types of information sources for researching special language information. Half can be categorized as reference tools, while the other half are document-like. Respondents would like to have special language reference tools that are available electronically, can be adapted to their personal needs, and offer up-to-date information with good usability. **Conclusions:** Half of the information source types are document-like and can be used as text corpora. Thus, text corpus-management methods and tools should be promoted in technical communication practice and teaching. Technical communicators' requirements and wishes described in this article lay the groundwork for developing tailor-made special language reference tools.

**Index Terms—**Information behavior, information source, reference tool, special language, technical communicator.

This article focuses on researching information as an essential activity of technical communicators. In the following paragraphs, I discuss the core concepts related to our research topic and explain its relevance for the technical communication community.

For the purposes of this article, information is regarded “as a primitive concept that is so basic to human understanding that it does not require a [terminological] definition” [1, p. 76]. Therefore, this concept is not defined explicitly. Conversely, we can define technical communicator as an “expert who defines, creates, and delivers information products for the safe, efficient, and effective use of products ...” [2], [3, p. 2]. Furthermore, we use the description of Henning and Bemer, which puts the focus on technology products:

technical communicators ... produce documents in a variety of media to communicate complex and technical information. They employ theories and conventions of communication to develop, gather, and disseminate technical usable information among specific audiences such as customers, designers, and manufacturers. [4, p. 328]

Based on this occupational profile, technical communicators' work includes finding and processing various kinds of information, which can relate to “facts, concepts, objects, events, ideas, processes, etc.” [5, p. 4]. Thus, researching information is also an integral part of technical communication teaching, both in academic and nonacademic settings.

When technical communicators describe technology products pertaining to a certain expert domain, they often need information that belongs to a special language. I define special language as “natural language ... used in communication between experts in a domain ... and characterized by the use of specific linguistic means of expression” [6, p. 2]. In addition,

The specific linguistic means of expression always include domain-specific terminology ...

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## Practitioner Takeaway

- The article analyzes technical communicators' information behavior with regard to researching special language information: what types of information sources they consult and what properties they expect from dedicated tools.
- Half of the information source types are document-like. Such information sources lend themselves to exploitation by means of text analysis methods and text corpus management tools.
- Technical communicators and translators have similar requirements when it comes to researching special language information. Thus, dedicated tools for translators are likely to be useful for technical communicators, too.

and phraseology, and also can cover stylistic or syntactic features. [6, p. 2]

Complementary to special language, general language is defined as “natural language ... characterized by the use of linguistic means of expression independent of any specific domain” [6, p. 2]. Special language information needed by technical communicators can, for example, consist of terms, definitions, proper names, sample sentences, or encyclopaedic information [7, pp. 53–54], [8, p. 269]. For the purposes of this article, information sources that contain special language information are called *special language reference tools*. Terminology databases, specialized encyclopaedias, and special language dictionaries are well-known examples.

This article focuses on special language reference tools for the following reasons.

1. According to an earlier publication about the survey discussed in this article, special language reference tools are very relevant in the daily practice of technical communicators. First, the survey data “demonstrate that technical communicators are more or less regular users of special language reference tools” [8, p. 267] (see Fig. 1). Second, most respondents stated that they are “moderately satisfied or considerably satisfied” with the special language reference tools that they actually use. “At the same time, a considerable room for improvement remains given that almost nobody is extremely satisfied” [8, p. 267] (see Fig. 2). Third, respondents also reported how much of their working time they devote to researching special language information. It becomes clear from the data collected that the share of working time is relevant (see Fig. 3).
2. There is a large body of literature about translators and their use of information sources,

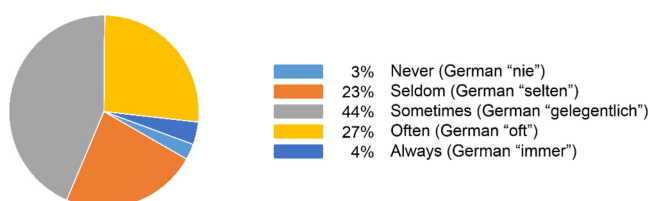


Fig. 1. “Respondents’ frequency of use of special language reference tools” [8, p. 267]. *Note:* Rounding errors result in a total percentage of 101 instead of 100. The total number of respondents analyzed was 263 [8, p. 285]; see also the Appendix (question Q1).

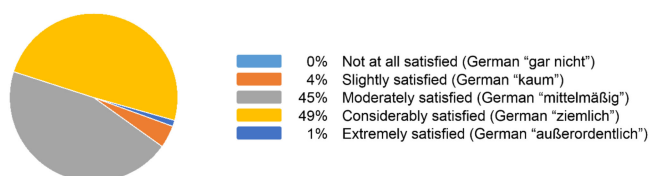


Fig. 2. “Respondents’ satisfaction with special language reference tools that they actually use” [8, p. 268]. *Note:* Rounding errors result in a total percentage of 99 instead of 100. The total number of respondents analyzed was 255 [8, p. 285]; see also the Appendix (question Q2).

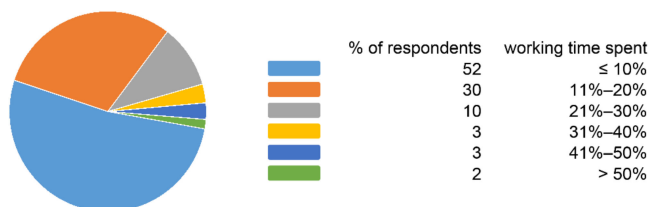


Fig. 3. “Percentage of working time spent researching special language information” [8, p. 268]. *Note:* The total number of respondents analyzed was 264 [8, p. 286]; see also the Appendix (question Q21).

although we are aware of hardly any studies that examine technical communicators; see the Literature Review. Translators and technical communicators have very similar profiles with

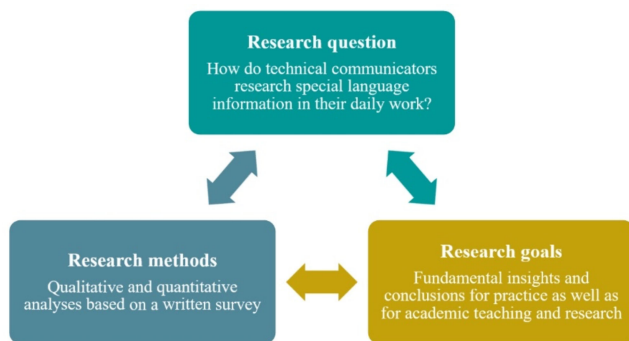


Fig. 4. Research framework for the empirical study, slightly modified from [8, p. 260], translated and adapted from [11, p. 6] and [7, p. 53].

regard to researching special language information [9, pp. 12–15]. Thus, the current knowledge at the interface between translation studies, terminology studies, and metalexigraphy [10, pp. 20–21] should be transferred to and exploited more systematically in technical communication research.

To close the research gap mentioned in point 2, a previous publication described an overarching three-stage research project about technical communicators' use of special language reference tools. The second stage, an empirical study, was implemented as a written online survey among technical communicators. (A later third stage would consist of developing or testing a prototype of a special language reference tool tailor-made for technical communicators [9, pp. 17–23].) Fig. 4 displays the research questions, research goals, and research methods for that empirical study. Altogether, 265 questionnaires were completed. This article covers four of the 36 survey questions of the written online survey that are essential for our research focus here; see the Research Questions and Research Goals section. Research results pertaining to several other survey questions have been previously published [7], [8], [11].

At least four groups within the technical communication community will benefit from the research results described in this article [11, p. 24], [12, p. 21].

1. Practitioners, i.e., technical communicators, can learn something about the information behavior in their profession and thus build upon experiences that go beyond their own individual work environments. With this article, we wish to encourage technical communicators to reflect about their style of work based on our research results.

2. Researchers in technical communication studies and in other disciplines can use our research results for their own purposes. For example, other studies about translators can be carried out with a similar research design and thus make a more detailed comparison between translators and technical communicators.
3. Teachers of technical communication, both in academic and nonacademic settings, can adapt their courses and activities accordingly. In particular, this applies to courses in which students need to research special language information.
4. Software developers can integrate our research results into their tools for technical communicators and improve them based on actual user needs; see also [8, pp. 279–280]. For example, they may wish to explore how to optimize authoring tools in combination with special language reference tools geared toward technical communicators.

The rest of this article is organized as follows. In the Literature Review section, I provide an overview of the relevant literature in several disciplines. The Research Questions and Research Goals and Research Methodology sections explain my research focus. The Results section contains an analysis and interpretation of the relevant survey data. Finally, I conclude and present a vision for the future in the Conclusion, Limitations, and Outlook section.

## LITERATURE REVIEW

Researching information is a part of technical communicators' daily work. Thus, it is also discussed in the specialist literature (see, for example, [13, pp. 24–27], [14, pp. 23–29], [15], [16, pp. 608–613], and [17]). However, this topic has been treated from a practical perspective only. Hardly any studies have investigated it academically, as a recent overview covering the years 1963–2017 confirms [18]. This article is related to two main strands of literature: on information behavior, which is a research topic within library and information science, and on translators' use of information sources, which is a research topic at the interface between translation studies, terminology studies, and metalexigraphy.

**Library and Information Science** With its focus on special language reference tools, this article is situated within the broad research topic of information behavior, as developed in library and

information science. With respect to Wilson's "nested model" of information behavior research, this article relates to two research topics within that model. First, it relates to information-seeking behavior, which is "concerned with the variety of methods people employ to discover, and gain access to information resources" [19, p. 263]. Second, it discusses issues of information search behavior, which is "concerned with the interactions between [the] information user (with or without an intermediary) and computer-based information systems" [19, p. 263] (see also [20] and [21]). Many other studies treat issues of information behavior from one perspective or another. They concern various audiences and processes related to technical communicators' work. For example, Daeuble et al. [22] and Lundin and Eriksson [23] concentrate on maintenance technicians and processes, respectively; others focus on engineers or scientists in corporate settings [24]–[30]. However, hardly any previous studies focus on technical communicators themselves. The only publication found treats purely computational issues [31] and is thus beyond the research focus of this article.

**Translation Studies, Terminology Studies, and Metalexigraphy** Technical communicators "as users of special language reference tools are comparable to professional translators" [9, p. 15]. Based on two user profiles, translators and technical communicators differ in two points only [32, pp. 154–155]. First, the activity of translation is characteristic of translators, but not of technical communicators. Second, translators are likely to have better language skills and to be more competent in researching information [9, p. 15]. Overall, the two user profiles are very similar:

The most obvious difference in implementation would be that a special language reference tool for technical [communicators] need not be bilingual or multilingual and that translation-specific data categories are not needed either. [9, pp. 16–17]

Therefore, this article draws on existing research about translators. Based on numerous previous publications, a state-of-the-art model of special language reference tools for translators has been developed and presented. (See [10] in German and [33] in English.) A schematic view of the English version is shown in Fig. 5.

This model is based on extensive earlier research at the interface between translation studies,

**Conceptual Data Model of Translation-Oriented Special Language Reference Tools (Terminological Resource Level)**

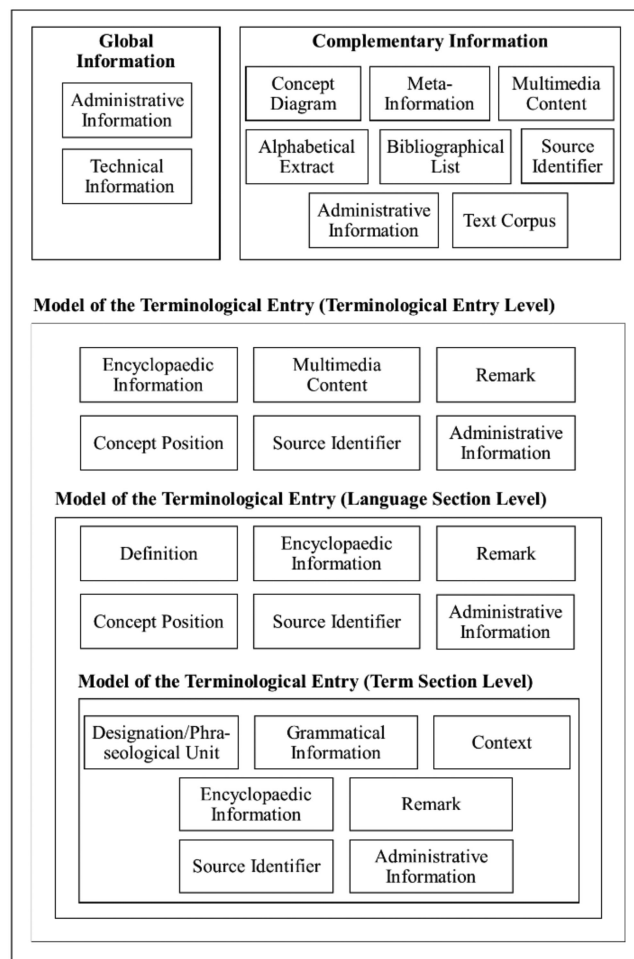


Fig. 5. Model of special language reference tools for translators [33, p. 8].

terminology studies, and metalexigraphy. (See, for example, [34]–[41].) Some publications contain specific recommendations for special language reference tools that are geared toward translators. (See, for example, the overviews in [10, pp. 67–69] and [33, pp. 5–6], as well as the more recent publications [42]–[46].)

## RESEARCH QUESTIONS AND RESEARCH GOALS

Based on the underlying empirical study, this article aims to answer two research questions.

**RQ1.** What types of nonhuman information sources do technical communicators use when researching special language information?

Humans as information sources are outside the scope of this article.

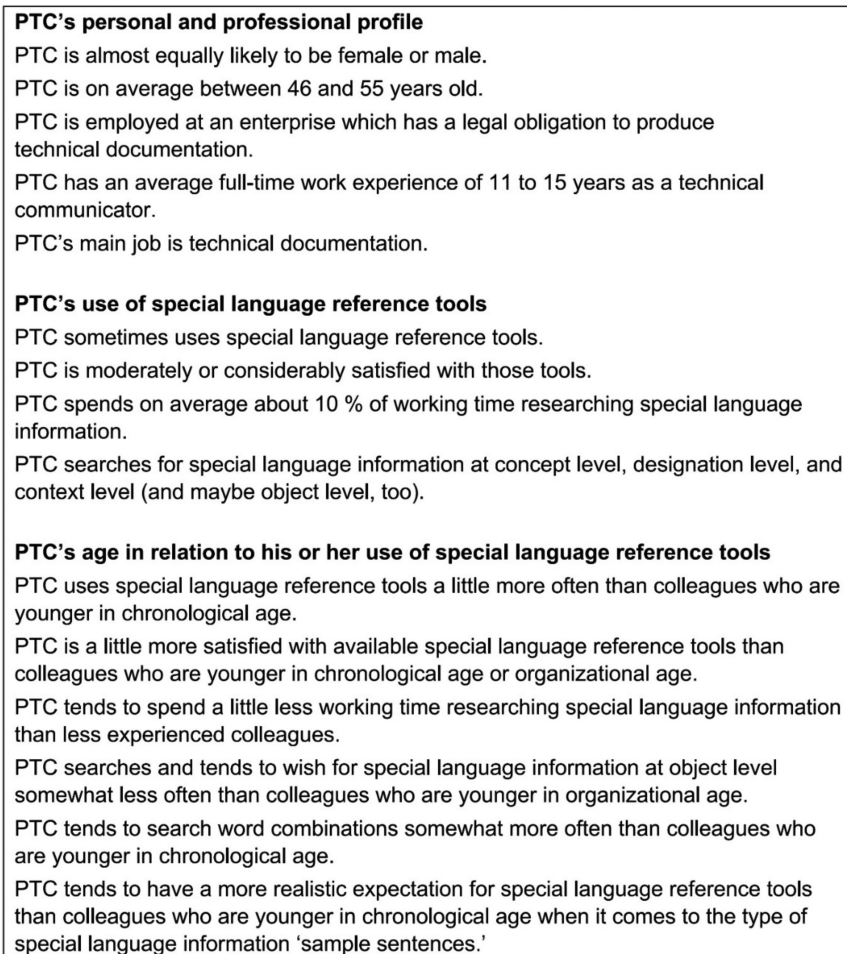


Fig. 6. Profile of a PTC based on the written online survey [8, p. 279].

**RQ2.** What properties do technical communicators expect from special language reference tools?

Properties are features other than the content that is presented in special language reference tools. The relevant types of special language information (types of content) are discussed in detail in [8, pp. 269–271, 276–278].

Based on these two research questions, my research goal is two-fold as well. First, I wish to know what types of nonhuman information sources technical communicators actually use. The relevant research results can feed back into practice and academic research (see points 1 and 2 at the end of the introductory section of this article). Second, I wish to draw empirically founded conclusions for developing special language reference tools geared toward technical communicators (see points 2 and 4 at the end of the introductory section of this article). Both research goals are highly relevant for

teachers of technical communication (see point 3 at the end of the introductory section of this article).

## RESEARCH METHODOLOGY

This section describes the research methodology. First, I describe the participants of my study and the procedure of data collection. Then, I present the questionnaire used for the written online survey. Finally, I discuss the methods used for data analysis. Due to the nature of my research, no ethical review was needed. Survey data were collected anonymously, and participants were granted confidentiality of their data.

**Participants** A detailed respondents' profile can be found in an earlier publication [8, pp. 261–266] and is not duplicated here. In a nutshell, a prototypical technical communicator (PTC) responding to our survey has the profile corresponding to that in Fig. 6.

In addition, the respondents can be characterized by four additional traits. (See also the Appendix in the supplementary material.)

- **Country of work** (Q29, multiple answers possible): Asked about the country or countries in which they work, most respondents mentioned countries the associations of which had promoted the written online survey—Germany (around 48% of respondents), Austria (around 36%), and Switzerland (around 32%). All other countries mentioned, including many European countries, received only 3% or even less.
- **Highest level of education or training** (Q30): With around 69% of respondents, a clear majority have completed university studies (bachelor's degree or higher). For around 14% of respondents, an examination at the end of secondary school is the highest level of education, while it is an apprenticeship for 7%. The remaining 10% yielded very diverse data.
- **Content of education or training** (Q31, multiple answers possible): Respondents were also asked about the content of the highest level of education or training covered by question Q30. Most of them mentioned technology/engineering (around 57% of respondents), followed by languages/linguistics (around 32%) and economics (around 12%). Around 22% of respondents chose the option "Other," covering a wide range of different subjects.
- **Industries** (Q33, multiple answers possible): Respondents were asked about the industry represented by the companies that they work for. The various answer options for that question used wordings from the German version of the well-known NACE classification of economic activities [47]. In this article, equivalent wordings from the English version [48] are used. With exactly 50% of respondents, the "manufacture of machinery and equipment" [48, p. 176] takes the lead here. The "Manufacture of computer, electronic and optical products" [48, p. 164] ranks second, yielding around 17%. Third comes "manufacture of electrical equipment" [48, p. 171] with around 14%. "Computer programming, consultancy and related activities" [48, p. 254] shows a slightly smaller percentage (around 13%). In addition, more than 20 other industries were mentioned by 6% or fewer respondents.

**Data Collection** Our empirical study aimed at examining the community of technical communicators at large across industries and countries. Thus, a written online survey was distributed by email among the members of the

German, Austrian, and Swiss associations for technical communication (tekomp Deutschland, tekomp Österreich, and TECOM Schweiz). For tekomp Deutschland, a call for participation was issued within the association's newsletter directed to all members. For tekomp Österreich and TECOM Schweiz, all members were invited to participate in separate mailings. Shortly before the time of data collection (at the end of 2016), tekomp Deutschland and TECOM Schweiz had 8135 and 494 members, respectively [49, p. 17], and tekomp Österreich had 349 members (written communication from tekomp Österreich dated August 30, 2021). In total, 265 questionnaires were completed (out of around 450 started), subsets of which are examined in this article. The period of data collection was mid-February to late April 2017. (See [7, p. 52] and [11, p. 7].)

**Questionnaire** To ensure quality, the draft questionnaire underwent several feedback loops within the core research team, which consisted of two university teachers (including the author) and four students. Based on recommendations in standard literature (e.g., [50, pp. 8–9 and p. 165], [51, pp. 24–25], [52, pp. 191–192]), the draft questionnaire was pretested by four experts (three technical communicators and one usability expert) and further checked for plausibility by three other nonexperts. Based on that feedback, the draft questionnaire was revised. For example, answer options were deleted or moved, and the size of fields for free-text answers was changed. The final version of the questionnaire consisted of 36 questions. The Appendix gives an overview of all survey questions (see the supplementary material). Table I presents the details for those survey questions treated in detail in this article.

**Data Analysis** With regard to my research topic, "there is a big body of pre-scientific knowledge based on real-world experience" [9, p. 23]. To gain empirical data beyond the practice of researching information by individual technical communicators, we chose as methods "qualitative and quantitative analyses based on a written survey" ([8, p. 260], translated from [11, p. 6] and [7, p. 53]; see also Fig. 4). Depending on the survey questions of concern, quantitative, qualitative, or mixed methods were used to analyze and interpret the data. For RQ1, the underlying survey questions (Q8, Q9, and Q10) were mixed questions—that is, closed-ended questions supplemented by an "Other" option for free-text answers. Thus, a mainly quantitative approach with subsequent

TABLE I  
SURVEY QUESTIONS ANALYZED AND INTERPRETED IN THIS ARTICLE (ADAPTED FROM [8, PP. 285–286])

Question Number	Original Question	Translated Question	Question Type	Sample Size	Reference
Q8	<p>“Wenn Sie fachsprachliche Informationen im firmeneigenen elektronischen Netzwerk recherchieren, welche Informationsquellen verwenden Sie?” [11, p. 16 (in part)], [7, p. 54 (in part)]</p> <p>Answer options:</p> <ul style="list-style-type: none"> <li>• Firmeneigene Terminologiedatenbanken</li> <li>• Unternehmensspezifische Richtlinien</li> <li>• Bestehende Dokumente (Bedienungsanleitungen, Kurzanleitungen, Stücklisten, Risikobeurteilungen, Ersatzteillisten, Konformitätserklärungen, Montagevorschriften, Schulungsunterlagen, Prospekte, Kataloge, ...)</li> <li>• Fachwörterbücher</li> <li>• Allgemeine Wörterbücher</li> <li>• Fachlexika und Fachencyklopädien</li> <li>• Allgemeine Lexika und Enzyklopädien</li> <li>• Fachliteratur (Fachzeitschriften, Fachbücher, ...)</li> <li>• Dokumentation von Mitbewerbern (diverse Anleitungen, Stücklisten, Produktbeschreibungen, ...)</li> <li>• Dokumentation von Zulieferfirmen (diverse Anleitungen, Produktbeschreibungen, Prospekte, ...)</li> <li>• Normen</li> <li>• Rechtsvorschriften</li> <li>• Ich recherchiere nicht im firmeneigenen elektronischen Netzwerk.</li> <li>• Sonstige (bitte angeben)</li> </ul>	<p>When researching special language information in the company-owned electronic network, what types of information sources do you use?</p> <p>Answer options:</p> <ul style="list-style-type: none"> <li>• Company-owned terminology databases</li> <li>• Company-owned guidelines</li> <li>• Existing documents (instruction manuals, getting started guides, (spare) parts lists, risk assessments, declarations of conformity, mounting instructions, training documents, product flyers, catalogues, ...)</li> <li>• Special language dictionaries</li> <li>• General language dictionaries</li> <li>• Specialised encyclopaedias</li> <li>• General encyclopaedias</li> <li>• Expert literature (specialist journals, textbooks, ...)</li> <li>• Documentation by competitors (instruction manuals, parts lists, product descriptions, ...)</li> <li>• Documentation by contractors</li> </ul>	Mixed, including “Other” for free-text answers	258	[11, p. 16], [7, p. 54]; see “Results” as well as “Conclusions, Limitations, and Outlook” in this article

TABLE I  
(CONTINUED)

Question Number	Original Question	Translated Question	Question Type	Sample Size	Reference
		(instruction manuals, product descriptions, product flyers, ...)			
		<ul style="list-style-type: none"> <li>• Standards</li> <li>• Legislation</li> <li>• I do not research in the company-owned electronic network.</li> <li>• Other (please specify)</li> </ul>			
<b>Q9</b>	<p>“Wenn Sie fachsprachliche Informationen im Internet recherchieren, welche Informationsquellen verwenden Sie?”</p> <p>[11, p. 16 (in part)], [7, p. 54 (in part)]</p> <p>Answer options:</p> <ul style="list-style-type: none"> <li>• Firmeneigene Terminologiedatenbanken</li> <li>• Unternehmensspezifische Richtlinien</li> <li>• Bestehende Dokumente (Bedienungsanleitungen, Kurzanleitungen, Stücklisten, Risikobeurteilungen, Ersatzteillisten, Konformitätserklärungen, Montagevorschriften, Schulungsunterlagen, Prospekte, Kataloge, ...)</li> <li>• Firmenexterne Terminologiedatenbanken</li> <li>• Fachwörterbücher</li> <li>• Allgemeine Wörterbücher</li> <li>• Fachlexika und Fachencyklopädien</li> <li>• Allgemeine Lexika und Enzyklopädien</li> <li>• Fachliteratur (Fachzeitschriften, Fachbücher, ...)</li> <li>• Dokumentation von Mitbewerbern (diverse Anleitungen, Stücklisten, Produktbeschreibungen, ...)</li> <li>• Dokumentation von Zulieferfirmen (diverse</li> </ul>	<p>When researching special language information on the internet, what types of information sources do you use?</p> <p>Answer options:</p> <ul style="list-style-type: none"> <li>• Company-owned terminology databases</li> <li>• Company-owned guidelines</li> <li>• Existing documents (instruction manuals, getting started guides, (spare) parts lists, risk assessments, declarations of conformity, mounting instructions, training documents, product flyers, catalogues, ...)</li> <li>• Non-company-owned terminology databases</li> <li>• Special language dictionaries</li> <li>• General language dictionaries</li> <li>• Specialised encyclopaedias</li> <li>• General encyclopaedias</li> </ul>	Mixed, including “Other” for free-text answers	262	[11, p. 16], [7, p. 54]; see “Results” as well as “Conclusions, Limitations, and Outlook” in this article



TABLE I  
(CONTINUED)

Question Number	Original Question	Translated Question	Question Type	Sample Size	Reference
	<p>Anleitungen, Produktbeschreibungen, Prospekte, ...)</p> <ul style="list-style-type: none"> <li>• Normen</li> <li>• Rechtsvorschriften</li> <li>• Ich recherchiere nicht im Internet.</li> <li>• Sonstige (bitte angeben)</li> </ul>	<ul style="list-style-type: none"> <li>• Expert literature (specialist journals, textbooks, ...)</li> <li>• Documentation by competitors (instruction manuals, parts lists, product descriptions, ...)</li> <li>• Documentation by contractors (instruction manuals, product descriptions, product flyers, ...)</li> <li>• Standards</li> <li>• Legislation</li> <li>• I do not research on the Internet.</li> <li>• Other (please specify)</li> </ul>			
<b>Q10</b>	<p>“Wenn Sie fachsprachliche Informationen in gedruckten Medien recherchieren, welche Informationsquellen verwenden Sie?”</p> <p>[11, p. 16 (in part)], [7, p. 54 (in part)]</p> <p>Answer options:</p> <ul style="list-style-type: none"> <li>• Unternehmensspezifische Richtlinien</li> <li>• Bestehende Dokumente (Bedienungsanleitungen, Kurzanleitungen, Stücklisten, Risikobeurteilungen, Ersatzteillisten, Konformitätserklärungen, Montagevorschriften, Schulungsunterlagen, Prospekte, Kataloge, ...)</li> <li>• Fachwörterbücher</li> <li>• Allgemeine Wörterbücher</li> <li>• Fachlexika und Fachencyklopädien</li> <li>• Allgemeine Lexika und Enzyklopädien</li> <li>• Fachliteratur (Fachzeitschriften, Fachbücher, ...)</li> </ul>	<p>When researching special language information in printed media, what types of information sources do you use?</p> <p>Answer options:</p> <ul style="list-style-type: none"> <li>• Company-owned guidelines</li> <li>• Existing documents (instruction manuals, getting started guides, (spare) parts lists, risk assessments, declarations of conformity, mounting instructions, training documents, product flyers, catalogues, ...)</li> <li>• Special language dictionaries</li> <li>• General language dictionaries</li> <li>• Specialised encyclopaedias</li> </ul>	Mixed, including “Other” for free-text answers	260	[11, p. 16], [7, p. 54]; see “Results” as well as “Conclusions, Limitations, and Outlook” in this article

TABLE I  
(CONTINUED)

Question Number	Original Question	Translated Question	Question Type	Sample Size	Reference
	<ul style="list-style-type: none"> <li>• Dokumentation von Mitbewerbern (diverse Anleitungen, Stücklisten, Produktbeschreibungen, ...)</li> <li>• Dokumentation von Zulieferfirmen (diverse Anleitungen, Produktbeschreibungen, Prospekte, ...)</li> <li>• Normen</li> <li>• Rechtsvorschriften</li> <li>• Ich suche nicht in gedruckten Medien nach fachsprachlichen Informationen.</li> <li>• Sonstige (bitte angeben)</li> </ul>	<ul style="list-style-type: none"> <li>• General encyclopaedias</li> <li>• Expert literature (specialist journals, textbooks, ...)</li> <li>• Documentation by competitors (instruction manuals, parts lists, product descriptions, ...)</li> <li>• Documentation by contractors (instruction manuals, product descriptions, product flyers, ...)</li> <li>• Standards</li> <li>• Legislation</li> <li>• I do not search for special language information in printed media.</li> <li>• Other (please specify)</li> </ul>			
Q23	<p>“Welche Eigenschaften wünschen Sie sich für ein optimales Nachschlagewerk?” [11, p. 22], [7, p. 56] (z. B. elektronisch verfügbar, an eigene Bedürfnisse anpassbar, ...)</p>	<p>What properties should an ideal reference tool have? (e.g., available electronically, can be adapted to your own needs, ...)</p>	Open-ended	237	[11, p. 22], [7, p. 56], [53]; see “Results” as well as “Conclusions, Limitations, and Outlook” in this article

interpretation was appropriate. For RQ2, the underlying survey question (Q23) was open-ended. In this case, a mixed approach combining qualitative and quantitative analysis with subsequent interpretation was the method of choice.

## RESULTS

In this section, the survey data are analyzed and interpreted. The structure follows the order of research questions described in the Research Questions and Research Goals section.

### Types of Information Sources Used: In Detail

RQ1 (What types of nonhuman information sources do technical communicators use when researching special language information?) can be answered by

analyzing and interpreting the responses to survey questions Q8, Q9, and Q10. Fig. 7 gives an overview of the results. The data are displayed in descending order based on the total number of responses that reflect the various types of information source (except for the special case “no such research,” which comes last). To enable a detailed analysis and interpretation, Fig. 7 divides the data into the following two dimensions and subdimensions.

- Information sources in electronic form, displayed on the left side of the horizontal axis and henceforth called “electronic dimension.” This dimension is represented by Q8 (subdimension “company-owned electronic network”) and Q9 (subdimension “Internet”).
- Information sources in printed form, displayed on the right side of the horizontal axis and henceforth called “printed dimension.” This

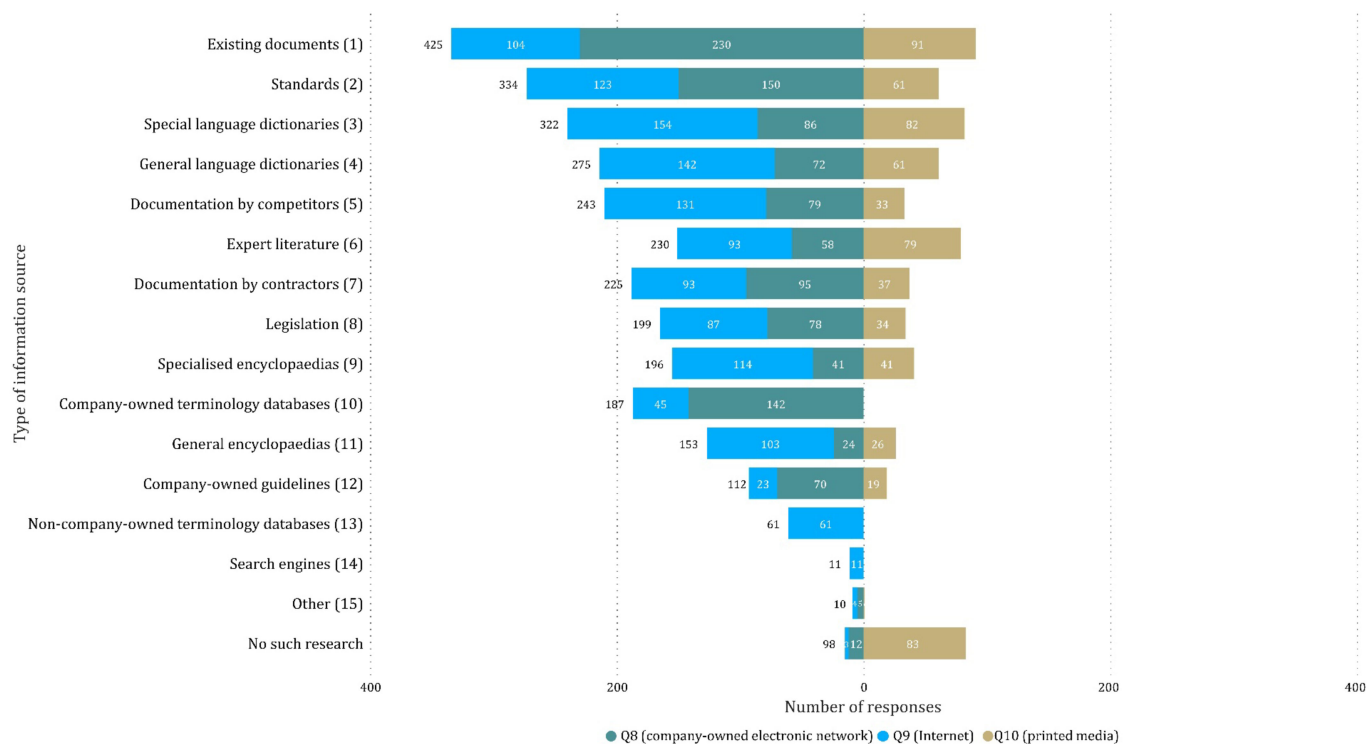


Fig. 7. Types of information sources used for researching special language information in company-owned electronic networks, on the internet and in printed media (in number of responses, multiple answers were possible). *Note:* Numbers inside bars (in white) represent the individual dimensions and subdimensions. Numbers outside bars (in black) represent the sum of all (sub)dimensions. The total number of possible responses is 780, the sum of the sample sizes for Q8, Q9, and Q10. In other words, if all respondents had chosen the relevant (sub)dimension, each individual horizontal stacked bar could sum up to a maximum of 780 counts in total.

dimension is represented by Q10 (“printed media”).

I discuss the results in detail, roughly in the same descending order in which data are presented in Fig. 7.

1. With 425 of 780 possible responses, “existing documents” (1) is by far the most commonly used information source type. It includes company-owned documents such as instruction manuals, getting started guides, (spare) parts lists, risk assessments, declarations of conformity, mounting instructions, training documents, product flyers, and catalogs. The individual numbers are not surprising: most such documents are created in-house (Q8, 230 responses), while many fewer are published online (Q9, 104 responses; see also [54, p. 9 and p. 11]). Interestingly, such documents in printed form are almost as important as electronic versions on the internet. Thus, for the printed dimension, “existing documents” received the highest number of responses across all information source types (Q10, 91 responses).
2. With 334 of 780 possible responses, the information source type “Standards” (2) comes

- second. Given the high relevance of national, regional, and international standards for technical communicators’ daily work, this is not surprising. Around 82% of responses for this information source type (273 of 334) are about accessing standards electronically, either in-house (Q8, 150 responses) or on the internet (Q9, 123 responses). The remaining 18% of responses concern the consultation of standards in printed form (Q10, 61 of 334 responses).
3. Traditional reference tools show a two-fold picture.
  - a. With 322 and 275 of 780 possible responses (a ratio of 1.17 to 1), the information source types “special language dictionaries” (3) and “general language dictionaries” (4) rank third and fourth, respectively. This order is to be expected: for researching special language information, reference tools focusing on special language are more relevant than reference tools dealing with general language. We can also observe that the electronic subdimension “company-owned electronic network” shows many fewer responses (Q8, 86 and 72) than the electronic subdimension “Internet” (Q9, 154 and 142). This difference

is probably due to the abundance of such information sources on the internet. Thus, it would not make any sense for companies to compile internal dictionaries involving a lot of cost and effort when there are appropriate alternatives that everyone can use for free. It is interesting to note that the printed dimension is almost as important (Q10, 82 and 61 responses) as the electronic subdimension "company-owned electronic network." In this regard, "special language dictionaries" (3) achieved the second-highest number of responses in the printed dimension across all information source types, after "existing documents" (see point 1 above).

General language dictionaries that respondents mentioned in the "Other" option for free-text answers (electronic subdimension "Internet") included "Duden" [55] (a popular online spelling dictionary for German), "dict.cc" [56] and "LEO" [57] (online dictionaries for various language combinations), as well as "Frag Cäsar" [58] (an online dictionary of German synonyms). No other general language dictionaries or special language dictionaries were reported.

- b. A second pair of traditional reference tools consists of the information source types "specialized encyclopedias" (9) and "general encyclopedias" (11). These information source types received 196 and 153 of 780 possible responses, respectively. The numbers show that they are clearly less important than "special language dictionaries" (3) and "general language dictionaries" (4). This finding might result from the fact that, in general, fewer encyclopedias are freely available on the internet (Q9, 114 and 103 responses). Furthermore, companies are even less likely to develop internal encyclopedias than dictionaries of some sort (Q8, 41 and 24 responses). It is remarkable that the total numbers of responses here (196 and 153) show a ratio that is similar to the one described in item a), that is, 1.28 to 1. Again, the difference in these numbers can be explained by the different degrees of specialization of the two information source types. In parallel to item a), the printed dimension shows numbers (Q10, 41 and 26 responses) that are very close to the electronic subdimension "company-owned electronic network."

"Wikipedia" [59] was mentioned by respondents as a general encyclopaedia in the "Other" option for free-text answers (electronic subdimension "Internet"). No other general encyclopedias or specialized encyclopedias were reported.

Overall, traditional reference tools are used less often than "existing documents" or "standards." This result is to be expected because special language information needed by technical communicators can be very specific. Thus, it is available in company-owned information sources or domain-specific standards rather than in universally applicable dictionaries or encyclopedias.

4. The external information source types "documentation by competitors" (5) and "documentation by contractors" (7) include documents such as competitors' or contractors' instruction manuals, product descriptions, or parts lists. These information source types received 243 and 225 of 780 possible responses, respectively. Thus, compared to company-owned "existing documents" (see point 1 above), they play a secondary role. In the case of "documentation by competitors," the electronic subdimension "company-owned electronic network" is much less important than the electronic subdimension "Internet" (Q8, 79 responses; Q9, 131 responses). By contrast, for "documentation by contractors," the numbers are almost equal (Q8, 95 responses; Q9, 93 responses). This finding corresponds with practical experience that a company's business relationship with its contractors is of course closer than that with its competitors. Consequently, more information from contractors is available in-house. Compared to "existing documents" (see point 1), the printed dimension is considerably less important for both information source types (Q10, 33 and 37 responses).
5. With 230 of 780 possible responses, the information source type "expert literature" (6) includes, for example, textbooks and specialist journals. In most cases, expert literature is consulted electronically (Q8, 58 responses; Q9, 93 responses). Around 25% of responses about using "expert literature" (58 out of 230) belong to the electronic subdimension "company-owned electronic network"; typically, such information sources are external, though. At the same time, the printed dimension shows

the third-highest result across all information source types (Q10, 79 responses), after “existing documents” (see point 1) and “standards” (see point 2).

6. The information source type “legislation” (8) shows 199 of 780 possible responses. Although the printed dimension was selected considerably less often in this case (Q10, 34 responses), the electronic subdimensions “company-owned electronic network” and “Internet” have produced roughly similar numbers (78 and 87). This is somewhat surprising: for technical communicators in Germany, Austria, and Switzerland, the relevant national laws are freely available online in dedicated national information portals [60]–[62], as well as in the relevant European Union information portal [63]. Despite that, a remarkable share of respondents state that they consult laws within their company’s electronic network. Probably, this information either duplicates public information or is provided via external corporate services for internal consultation purposes.
7. “Company-owned terminology databases” (10) and “noncompany-owned terminology databases” (13) are particular information source types because they exist, by definition, only in electronic form [6, p. 15]. More specifically, from the respondents’ perspective, the former type can be available in both electronic subdimensions, while the latter exists only in the electronic subdimension “Internet.” They received 248 of 780 possible responses (187 and 61, respectively). Thus, only around 32% of responses covered terminology databases. This finding goes hand in hand with the practical experience that many companies still manage terminology without dedicated terminology databases. Furthermore, the data show that “company-owned terminology databases” are available internally about three times more often (Q8, 142 responses) than externally (Q9, 45 responses). This result, too, seems to confirm well-known anecdotal evidence from daily practice. (I am aware of only two such terminology databases that are publicly available: [64] and [65].)
8. With 112 of 780 possible responses, “company-owned guidelines” (12) constitutes the information source type with the second-lowest number. Most often, such guidelines are used within company-owned electronic networks (Q8, 70 responses), while the electronic subdimension “Internet” and the printed dimension play a much less important role (Q9, 23 responses; Q10, 19 responses). These results correspond to practical experience that most style guides are available internally only. As stated in point 7 above, “company-owned terminology databases” (10) shows much higher numbers. Thus, it seems to be more common for companies to provide special language information via terminology databases than via overarching documents that describe relevant requirements and recommendations.
9. “Search engines” (14) received only 11 responses in total. It is the only information source type that emerged during data analysis and interpretation because of more than 10 mentions in the “Other” option for free-text answers. Google [66] was the search engine mentioned most often in the “Other” option for free-text answers. This finding corresponds with general search engine statistics. In 2017, Google had a market share of more than 90% in Germany [67], Austria [68], and Switzerland [69].
10. The free-text option “Other” (15) produced only 10 responses in total with a wide range of answers. Examples of answers for the electronic subdimension “company-owned electronic network” (Q8) are “patent databases,” “Intranet,” and “ERP system.” Examples of answers for the electronic subdimension “Internet” (Q9) are “patent databases” and “online translator.” The only answer for the printed dimension (Q10) is “thesauri.”
11. Finally, the “no such research” option also produced interesting results. The data show that clearly more respondents do not research special language information in the printed dimension compared to the electronic dimension.

Around 30% of respondents do not research (any more) in printed media. Conversely, 70% of respondents still research in printed media after all. Thus, contrary to popular opinion, printed media still play a major role. [7, p. 54]

### Types of Information Sources Used: Summary

Overall, much more research is conducted electronically than in printed media. The relevant total number of responses is 565 for the printed dimension (Q10), while it is double that number or more for the electronic subdimensions “company-owned electronic network” (Q8, 1130) and “Internet” (Q9, 1288), respectively.

TABLE II  
EXPECTED PROPERTIES OF SPECIAL LANGUAGE REFERENCE TOOLS

Total Sample Size [237]	Category	Answer Cluster	Subcategory
	Availability (medium) [216]	—	Electronic medium [201] Printed medium [4]
	Features [130]	Features (search) [91]	Tailor-made search [41] Search based on filters or criteria [23] Full-text search [18]
		Features (other than search) [60]	Extensibility [24] Cooperation [16] Bookmarks [11] Commenting [11]
	Quality [78]	Content quality [52]	Current information [32] Domain-specific information [13]
		Quality of use [38]	Usability [30] Presentation of information [11]

In Q8, Q9, and Q10, respondents could also choose “no such research.” In other words, they could state that they do not research special language information at all in company-owned electronic networks, on the internet, or in printed media. There was not a single respondent who chose “no such research” for both subdimensions within the electronic dimension [7, p. 54].

### Expected Properties of Special Language

**Reference Tools: In Detail** RQ2 (What properties do technical communicators expect from special language reference tools?) can be answered by examining the responses to question Q23 (see above). Question Q23 is discussed in this article. Question Q22, which was treated in earlier publications ([11, p. 23], [7, p. 56], [8, pp. 269–271]), is complementary to question Q23. Together, the answers for questions Q22 and Q23 were supposed to provide a profound picture of respondents' thoughts about ideal special language reference tools.

The question was open-ended—that is, respondents could enter their answers in a free-text field. Therefore, I used theoretical coding and qualitative content analysis to analyze and interpret the data. As a first step, the questionnaire data were analyzed conceptually. Then, the conceptualized data were coded into appropriate categories, answer clusters, and subcategories. These were

then enriched by quantitative information and interpreted in the final step [70, pp. 386–421]–[72]. Table II summarizes the results. Within the table, the numbers in square brackets are the absolute numbers of respondents who stated something about the relevant category, answer cluster, or subcategory. The individual numbers do not always add up to the sums at the next higher level because respondents were not limited to specific categorizations in the free-text field. Therefore, they could address more than one answer cluster or (sub)category, similar to multiple answers in closed-ended questions. Moreover, several answers required indirect assignments during data analysis.

In the following discussion, I focus on topics that respondents mentioned most often. Based on this quantitatively oriented initial selection, the relevant (sub)categories and answer clusters are described and linked to existing research results. Also, follow-up considerations are presented. Depending on the specific answer concerned, there are two options to assign (sub)categories and answer clusters based on a conceptual analysis.

1. An answer can be assigned clearly and directly. For counting and calculation purposes, such a direct assignment is assigned the value 1.0.
2. In some cases, though, only an indirect assignment is appropriate. For example, if someone's answer for the “availability (medium)” category is *if available electronically*, it is not entirely clear whether it should be interpreted as

TABLE III  
SAMPLE ANSWERS FOR THE “AVAILABILITY (MEDIUM)” CATEGORY

<ul style="list-style-type: none"> <li>available electronically (intranet or Internet) <i>elektronisch verfügbar (über Intra- oder Internet)</i></li> <li>available on the Internet <i>übers Internet verfügbar</i></li> <li>available electronically and in paper <i>elektronisch verfügbar und als Papierausgabe</i></li> </ul>	<ul style="list-style-type: none"> <li>available as a digital PDF file <i>als digitales PDF verfügbar</i></li> <li>digital <i>digital</i></li> <li>Should be available online (password-protected). <i>Soll online mit Passwort zur Verfügung stehen.</i></li> </ul>
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an actual wish or as a hypothetical possibility. For counting and calculation purposes, such an indirect assignment is assigned the value 0.5.

*“Availability (Medium)” Category:* This category is mentioned most often. It refers to the form in which special language reference tools are made available. Out of all the respondents who answered question Q23 (henceforth “Q23 respondents”), around 91% stated something in relation to this category. Out of these respondents, around 93% would like to have special language reference tools that are available electronically (“electronic medium” subcategory). Only around 2% would like to have a printed version in addition to the electronic one (“printed medium” subcategory). No respondents stated the wish to have the printed version only. (The last two percentages mentioned sum to less than 100% because the answers of several respondents could be assigned only indirectly to the “availability (medium)” category.) Sample answers for the “availability (medium)” category are presented in Table III. (Note that in Tables III–VII, translated English answers appear first, followed by the original German answers in italics. Any spelling, grammatical, or editorial mistakes in the original German answers have been corrected for ease of use.)

These results concur with previously published results of our empirical study: 100% of respondents research special language information in electronic information sources, while 70% do so in printed media [7, p. 54]; see also point 11 of the Types of Information Sources Used: In Detail section above. We can conclude from the big discrepancy for printed media (2% versus 70%) that some information sources are available in printed form only. Respondents, however, would prefer accessing them electronically too.

At this point, I should note that the frequency of mentioning the “availability (medium)” category

could be biased. For respondents, it should be as easy as possible to differentiate between Q22 and Q23. Therefore, Q23 included the sample properties *available electronically* and *can be adapted to your own needs*. On the one hand, doing so might have resulted in respondents again referring to the availability in electronic form. However, it could also have resulted in the opposite—i.e., respondents reflected on the availability in electronic form but did not explicitly mention it. Despite this limitation, the wishes of respondents about electronic and printed media can be interpreted clearly. This interpretation is backed by the second property mentioned in the question (*can be adapted to your own needs*), which was reported by not more than 11% of respondents. This percentage does not directly indicate an overrepresentation.

*“Features” Category:* This is the second most common category. It describes which functions that respondents expect from special language reference tools. Out of all Q23 respondents, around 55% stated something in relation to this category. A detailed analysis of this category reveals that it consists of two major answer clusters: “features (search)” and “features (other than search).” Around 70% of the above-mentioned respondents (38% of all respondents to Q23) stated something about the “features (search)” answer cluster. For the “features (other than search)” answer cluster, the corresponding percentage is about 46% (25% of all respondents to the question).

Upon a closer look, the “feature (search)” answer cluster includes three relevant subcategories. Out of the respondents who stated something about this answer cluster, around 45% wish for a tailor-made search. However, they do not mention any specific requirements in this context. Around 25% gave answers that are more specific and would like to have a search based on filters or criteria. Around 20% of the “feature (search)” respondents expect a

TABLE IV  
SAMPLE ANSWERS FOR THE “FEATURES” CATEGORY, “FEATURES (SEARCH)” ANSWER CLUSTER

“Tailor-Made Search” Subcategory	“Search Based on Filters or Criteria” Subcategory	“Full-Text Search” Subcategory
<ul style="list-style-type: none"> <li>intelligent search functions <i>intelligente Suchfunktionen</i></li> </ul>	<ul style="list-style-type: none"> <li>can be filtered according to industries on which information is searched <i>filterbar nach Branche, für die Informationen gesucht werden</i></li> </ul>	<ul style="list-style-type: none"> <li>(electronic) full-text search <i>Volltextsuche (elektronisch)</i></li> </ul>
<ul style="list-style-type: none"> <li>ideal search options <i>optimale Suchmöglichkeiten</i></li> </ul>	<ul style="list-style-type: none"> <li>fully searchable <u>according to various criteria</u> <i>vollkommen durchsuchbar nach verschiedenen Kriterien</i></li> </ul>	<ul style="list-style-type: none"> <li>fully searchable according to various criteria <i>vollkommen durchsuchbar nach verschiedenen Kriterien</i></li> </ul>
<ul style="list-style-type: none"> <li>wide range of search options <i>umfangreiche Suchmöglichkeiten</i></li> </ul>	<ul style="list-style-type: none"> <li>search via categories, i.e. from broader to narrower, etc. <i>Suche über Kategorien – also von grob nach fein etc.</i></li> </ul>	<ul style="list-style-type: none"> <li>searchable (full-text search) <i>durchsuchbar (Volltextsuche)</i></li> </ul>
<ul style="list-style-type: none"> <li>better search options <i>bessere Suchmöglichkeiten</i></li> </ul>	<ul style="list-style-type: none"> <li>Filter according to industries, in order to limit search results (electrical engineering, mechanical engineering, etc.) <i>Filter nach Industriebereich, um Suchergebnisse einzuschränken (Elektrotechnik, Maschinenbau etc.)</i></li> </ul>	<ul style="list-style-type: none"> <li>full-text search function <i>Volltextsuchfunktion</i></li> </ul>
<ul style="list-style-type: none"> <li>It should have a good search function, so that I do not lose too much time until I have found what I need. <i>Es müsste über eine gute Suchfunktion verfügen, damit ich nicht zu viel Zeit verliere, bis ich das Gesuchte auch finde.</i></li> </ul>	<ul style="list-style-type: none"> <li>search and/or filtering options according to usage in various industries or to historical validity (e.g. former or current usage) <i>Such-/Filtermöglichkeiten nach Branchenverwendung/zeitlicher Gültigkeit (z. B. historische Verwendung oder aktuell)</i></li> </ul>	<ul style="list-style-type: none"> <li>full-text search with the option “Near” in the PDF document <i>Volltextsuche mit Einstellung „Near“ im PDF-Dokument</i></li> </ul>

full-text search function. Table IV presents sample answers for the “features (search)” answer cluster.

Note that some answers touched upon more than one subcategory. The wording *fully searchable according to various criteria* quoted above is a case in point. The first part of this wording is assigned to the “full-text search” subcategory, while the “search based on filters or criteria” subcategory reflects the second part of the wording [70, pp. 388–393].

The three subcategories of the “features (search)” answer cluster indicate that respondents would like to have much more than a pure keyword search (search based on terms). On the one hand, they wish for various search criteria such as industry,

domain, or temporal validity. On the other hand, they would also like to have a full-text search that enables them to access the entire language content. One takeaway from these results is that, contrary to popular opinion, common internet search engines cannot fully meet the search needs of respondents. This is true even if the content searched for was freely available, which does not apply to company-owned reference tools and documents anyway. However, such information sources are of essential importance for many respondents [7, p. 54]; see the section titled Types of Information Sources Used: In Detail above.

The “features (other than search)” answer cluster includes four major subcategories. Out of the



TABLE V  
SAMPLE ANSWERS FOR THE “FEATURES” CATEGORY, “FEATURES (OTHER THAN SEARCH)” ANSWER CLUSTER

“Extensibility” Subcategory	“Cooperation” Subcategory	“Bookmarks” Subcategory	“Commenting” Subcategory
<ul style="list-style-type: none"> <li>easily extensible <i>leicht erweiterbar</i></li> </ul>	<ul style="list-style-type: none"> <li>participation, possibility of sharing <i>Partizipation, Möglichkeit zu teilen</i></li> </ul>	<ul style="list-style-type: none"> <li>creation of favourites and/or domains <i>Anlegen von Favoriten bzw. Themenfeldern</i></li> </ul>	<ul style="list-style-type: none"> <li>can be supplemented by personal notes <i>ergänzbar mit persönlichen Notizen</i></li> </ul>
<ul style="list-style-type: none"> <li>possibility of creating a personal word list <i>Möglichkeit, eine eigene Wörterliste zu erstellen</i></li> </ul>	<ul style="list-style-type: none"> <li>possibility of interaction (feedback/discussions on terms) <i>Möglichkeit der Interaktion (Rückfragen/Diskussionen zu Fachausdrücken)</i></li> </ul>	<ul style="list-style-type: none"> <li>adding bookmarks to quickly find information looked up earlier <i>setzbare Lesezeichen, um das Nachgeschlagene schnell wieder zu finden</i></li> </ul>	<ul style="list-style-type: none"> <li>creating notes/remarks <i>Möglichkeit für Notizen/Anmerkungen</i></li> </ul>
<ul style="list-style-type: none"> <li>company-specific additions possible <i>firmenbezogen ergänzbar</i></li> </ul>	<ul style="list-style-type: none"> <li>some kind of a WikiTechCom <i>eine Art WikiTechCom</i></li> </ul>	<ul style="list-style-type: none"> <li>creating a personal database (“favorites”) <i>Anlage „eigener“ Datenbank („Favoriten“)</i></li> </ul>	<ul style="list-style-type: none"> <li>has a commenting function for user <i>mit Kommentar-Funktion für Nutzer</i></li> </ul>

respondents who stated something about this answer cluster, around 40% wish for an “extensibility” feature to add customized content to special language reference tools. Around 27% ask for a “cooperation” feature, which would enable them to work on content together with others. Around 18% of the “features (other than search)” that respondents would like to have is a “bookmarks” feature for saving favorites or assigning similar content-related tags. In addition, 18% wish for a “commenting” feature, which would enable users to add meta-level remarks to existing content. Table V presents sample answers for the “features (other than search)” answer cluster.

For all four subcategories of the “features (other than search)” answer cluster, the same message becomes obvious: respondents are aware that even the most sophisticated off-the-shelf special language reference tool cannot cover all individual needs. Therefore, they would like to be able to add and modify content on their own, to interact with others, and to create personal notes or remarks for their individual use. I have already developed similar requirements for “dynamic translation-oriented terminology and

full-text database[s]” geared toward translators [10, pp. 316 and 117–146]. Although the “cooperation” subcategory can only be implemented using a web-based solution, the other three subcategories would also be feasible in local systems.

What is particularly striking about the “bookmarks” and “commenting” subcategories is that such features for electronic reference tools were described in academic literature two or three decades ago [17, p. 17], [73, p. 384]. Also, such features were present in well-known electronic general encyclopedias such as *Brockhaus* or *Encyclopaedia Britannica* since at least 2000 [74]–[76]. However, it is remarkable that they are no longer present in the current editions of these general encyclopedias. For some reason, such features have not found their way from earlier editions on optical storage media (CD/DVD) to the more recent web-based editions. Thus, we can interpret respondents’ answers in at least two ways. Either they are not aware of such features at all but wish for them, or they know about such features—for example, based on earlier practical experience—but miss them from current

## Dokument

[englisch document], eine mit einem **Anwendungsprogramm** erstellte Datei, die nicht ausführbar ist (.exe), sondern die in einem bestimmten Format gespeichert wird. Ein Dokument kann – anders als eine ausführbare Datei – mit einem Anwendungsprogramm geöffnet und verändert werden; technisch handelt es sich bei einem Dokument um eine **Datendatei**. Ein Dokument kann strukturierte Datensätze, Texte, Tabellen und Bilder und Multimedia-Elemente in beliebiger Kombination enthalten; der Begriff »Dokument« umfasst also mehr als reine Textdateien, auch wenn er im üblichen Sprachgebrauch auf Texte beschränkt ist.

Dokumente können heute in der Regel ohne große Probleme von einer Plattform (Betriebssystem) auf eine andere übertragen werden, solange die zugehörigen Anwendungsprogramme in beiden Welten vorhanden sind.



Fig. 8. Screenshot from an entry in [74] – “Persönliches Fenster” (“personal window”). *Note:* The entry “Dokument” (“document”) has been intentionally selected.

information sources. For illustration purposes, Fig. 8 shows a “Persönliches Fenster” (“personal window”) as presented in the 2007 *Der Brockhaus Multimedia Premium* [74]. In that window, users could, for example, enter personal notes, create bookmarks, or add internet links. In contrast, the current web-based edition of *Brockhaus* does not offer such a feature. Fig. 9 shows a screenshot of the relevant entry.

Similarly, the 2000 *Encyclopaedia Britannica CD* [75] offered users options to create notes on individual entries and to define local bookmarks. It also enabled them to organize those notes and bookmarks in a separate feature called “research assistant.” Fig. 10 shows an excerpt of the user guide for [75], which explains the “Note” feature. Again, a current web-based edition of the same *Britannica* does not offer such a feature. Interestingly, a newer version retrieved about one month later does have a “Discuss” feature that allows users to enter comments for discussion with others and is available after setting up an account. Fig. 11 shows screenshots of an illustrative entry.

*“Quality” Category:* This category ranks third and describes the requirements that respondents reported for the content and use of special language reference tools. Of all Q23 respondents, around 33% mentioned this category. The “quality” category can be split into two major answer clusters: “content quality” and “quality of use.” Around 67% of the above-mentioned respondents (22% of all respondents to Q23) stated something about “content quality.” For “quality of use,” the corresponding percentage is 49% (about 16% of all respondents to the question).

The “content quality” answer cluster includes two major subcategories. Out of the respondents who stated something about this answer cluster, around 62% wish that the content offered is always up to date (“current information” subcategory). Exactly 25% of the “content quality” respondents mentioned the “domain-specific information” subcategory. In other words, they reported how specific or general the content offered should be. Table VI presents sample answers for the “content quality” answer cluster.

## Dokument (Informatik)

**Dokument** [mittelateinisch »beweisende Urkunde«, eigentlich »das zur Belehrung über etwas oder zur Erhellung von etwas Dienliche«, zu lateinisch docere »lehren«] *das*, -(e)s/-e,

*Informatik*: eine nicht ausführbare **Datei**, die mit einem Anwendungsprogramm (insbesondere mit einem Textverarbeitungsprogramm) erstellt wurde und in einem bestimmten Format gespeichert wird.

**i** Informationen zum Artikel  Verbergen

### Quellenangabe

*Brockhaus*, Dokument (Informatik). <http://brockhaus.at/ecs/enzy/article/dokument-informatik> (aufgerufen am 2021-07-12)





-  Artikel drucken
-  Plastischer Reader
-  Permalink
-  Zitieren

Fig. 9. Screenshot from an entry in [77]. *Note*: The entry “Dokument” (“document”) has been intentionally selected.

TABLE VI  
SAMPLE ANSWERS FOR THE “QUALITY” CATEGORY, “CONTENT QUALITY” ANSWER CLUSTER

“Current Information” Subcategory	“Domain-Specific Information” Subcategory
<ul style="list-style-type: none"> <li>• being constantly updated <i>laufend aktualisiert</i></li> </ul>	<ul style="list-style-type: none"> <li>• as detailed as necessary and as general as possible <i>so detailliert wie nötig und so allgemein wie möglich</i></li> </ul>
<ul style="list-style-type: none"> <li>• continuous automatic enlargement <i>mit ständiger automatischer Erweiterung</i></li> </ul>	<ul style="list-style-type: none"> <li>• general as well as specific fields of application <i>universelle als auch spezifische Anwendungsbereiche</i></li> </ul>
<ul style="list-style-type: none"> <li>• up-to-date with regard to technical terms [concepts], in particular from information technology <i>auf dem aktuellen Stand bezüglich technischer Begriffe, speziell solcher aus der Informatik</i></li> </ul>	<ul style="list-style-type: none"> <li>• I would like to have an industry-specific ... reference tool. <i>Ich wünsche mir ein branchenspezifisches ... Nachschlagewerk.</i></li> </ul>

For the “content quality” answer cluster, it is not surprising that continuously updated content ranks first (“current information” subcategory): it is the daily business of language professionals, such as translators or technical communicators, to process information coming from numerous sources. They know that it is difficult if not impossible to have an overview of technical or special language changes in all these information sources at any point in time. Therefore, the wish for automatic updating is highly plausible. It is more difficult to interpret the “domain-specific information” subcategory because the individual

answers can be very general. Furthermore, some answers are not entirely clear, for example, the precise meaning of “industry-specific” or “specific fields of application.”

The “quality of use” answer cluster also includes two major subcategories. Of the respondents who stated something about this answer cluster, around 79% would like to have a special language reference tool that is easy to use (“usability” subcategory). Around 29% of the “quality of use” respondents mentioned the “presentation of information” subcategory. Mostly, they wish for a

## Creating Notes

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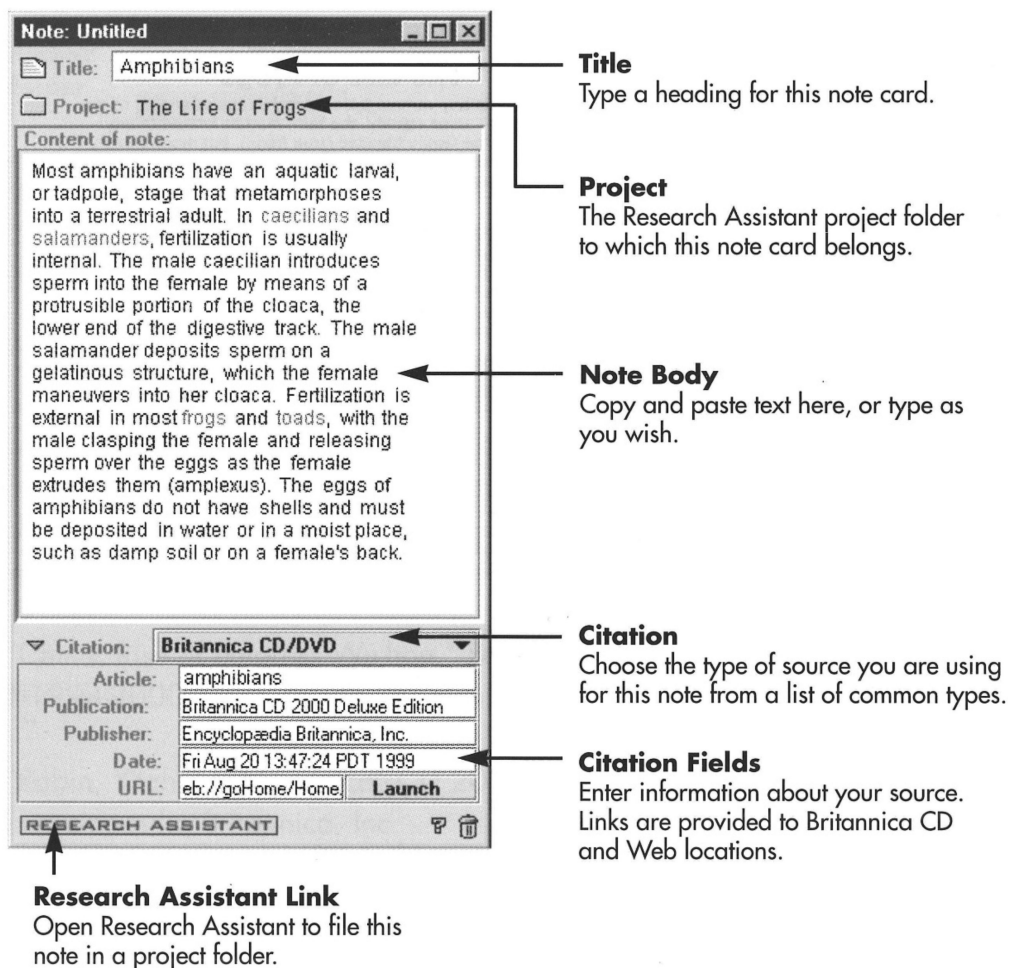


Fig. 10. Description of the “Note” feature [78, p. 27].

topic-based division of content. Table VII presents sample answers for the “quality of use” answer cluster.

As stated above for the “availability (medium)” category, practically all respondents prefer special language reference tools in electronic form. Therefore, it is logical that some respondents suggested topics for the “usability” subcategory in the “quality of use” answer cluster. For our purposes, the concept of usability, as specified in

the relevant international standard, can be described as the extent to which a special language reference tool enables technical communicators “to achieve [their] goals with effectiveness, efficiency and satisfaction” when researching information [80, p. 2]. As known from the specialist literature, “Usable systems can provide a number of benefits including improved productivity [and] enhanced user well-being” [81, p. 2]. For the “presentation of information” subcategory, respondents mainly raised topics that, according to the relevant

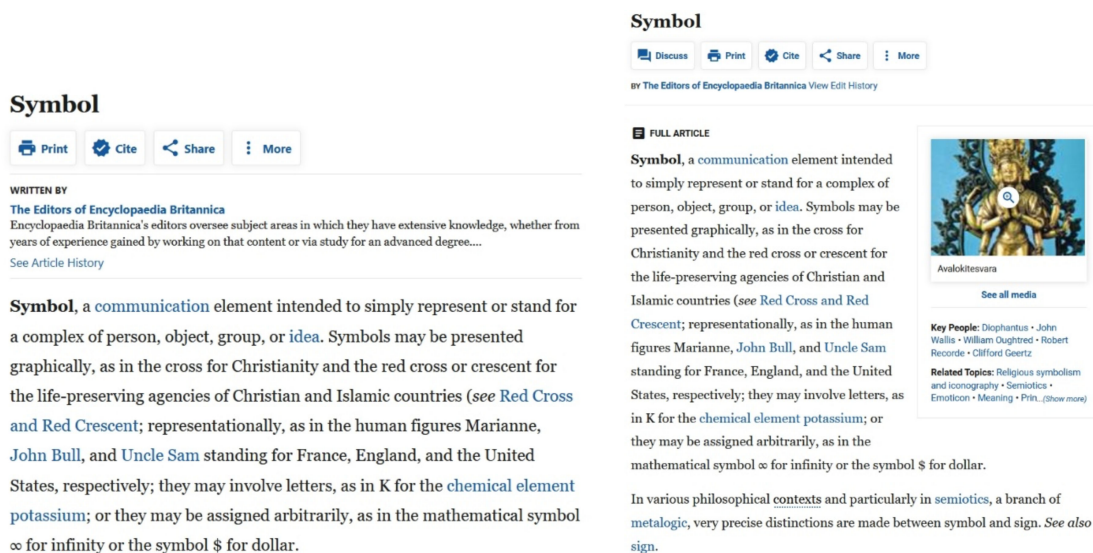


Fig. 11. Screenshots from an entry in [79]: June 2021 version on the left, July 2021 version on the right. *Note:* The entry “Symbol” has been intentionally selected.

TABLE VII  
SAMPLE ANSWERS FOR THE “QUALITY” CATEGORY, “QUALITY OF USE” ANSWER CLUSTER

“Usability” Subcategory	“Presentation of Information” Subcategory
<ul style="list-style-type: none"> <li>simple handling <i>einfache Handhabung</i></li> <li>UX, UI <i>UX, UI</i></li> <li>well-structured <i>gut überschaubar</i></li> </ul>	<ul style="list-style-type: none"> <li>easy language <i>verständlicher Sprachgebrauch</i></li> <li>can be sorted, e.g. according to manufacturing process <i>sortierbar nach z. B. Fertigungsverfahren</i></li> <li>selection according to mechanical engineering, electronics, ... <i>Selektion nach Maschinenbau, Elektronik, ...</i></li> </ul>

international standard, relate to the principles of discriminability and interpretability [82, pp. 11–17]. In our case, this means that content should be structured according to technical communicators’ needs and be as comprehensible as possible [83, p. 75].

### Expected Properties of Special Language

**Reference Tools: Summary** Based on the survey data, we can sum up by using two types of representation. In Fig. 12, a word cloud visualizes the categories, answer clusters, and subcategories described in Table II. Overall, the main properties of special language reference tools for technical communicators are contained in the following list. The properties are ordered in descending order of mention based on the absolute numbers of respondents who mentioned the relevant (sub)categories and answer clusters.

1. They are available in electronic form.

2. They can be searched in various ways.
3. They enable users to add content, to cooperate with others, and to mark important content with bookmarks or notes based on personal needs.
4. The content is fully up to date and tailored to the relevant domain.
5. The content can be easily used and is well presented.

### CONCLUSION, LIMITATIONS, AND OUTLOOK

#### Conclusions for RQ1 (What Types of Nonhuman Information Sources Do Technical Communicators Use When Researching Special Language Information?)

Technical communicators use a wide range of nonhuman information sources for researching special language information. Out of the 14 major types of information sources, seven can be categorized as reference tools: “special language dictionaries,” “general language dictionaries,” “specialized

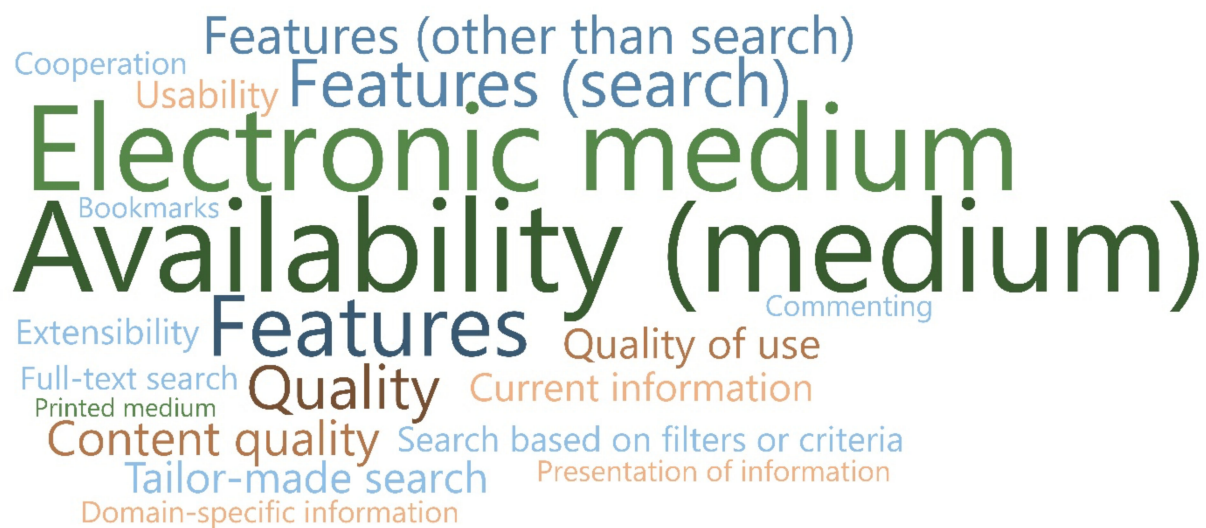


Fig. 12. Expected properties of special language reference tools. *Note:* Similar colors indicate which categories, answer clusters, and subcategories belong together.

encyclopedias,” “general encyclopedias,” “company-owned terminology databases,” “noncompany-owned terminology databases,” and “search engines.” The other seven information source types are more document-like: “existing documents,” “standards,” “documentation by competitors,” “expert literature,” “documentation by contractors,” “legislation,” and “company-owned guidelines.”

Thus, we can conclude that half of the information source types reported can be exploited by means of text analysis methods and text corpus-management tools. Judging from workshops, industry contacts, and practical experience, such methods and tools are not yet as common as they should be. The evidence suggests that, generally, technical communicators are not aware of them or have not been trained in using them. Such lack of awareness or training can also be deduced from the free-text answers to survey questions Q13 and Q15 (264 responses, respectively). There, respondents were asked how they go about searching for terms or concepts. Not a single respondent referred to text corpora or to text analysis tools. As stated in [7, p. 54] and [8, p. 280], they should thus be promoted within the technical communication community, both in practice and academic teaching. In [32, pp. 156–164], a methodology has been proposed for how language professionals can go about exploiting text corpora in their daily work.

**Conclusions for RQ2 (What Properties Do Technical Communicators Expect From Special Language Reference Tools?)** The categories,

answer clusters, and subcategories discussed in this article provide a solid basis for developing special language reference tools that are tailor-made for technical communicators. Quantitatively speaking, the main takeaway from the survey responses is that special language reference tools for technical communicators must be available in electronic form. Furthermore, they should be customizable for searching, adding, and sharing content. The content offered should be current and easy to use, and derived from relevant domains. In general, technical communicators’ requirements seem to be very similar to those of translators, confirming earlier assumptions in this regard [9, p. 15].

**Limitations** The research results discussed in this article reflect those members of *tekomp Deutschland*, *tekomp Österreich* and *TECOM Schweiz* that participated in the survey. However, practical experience and earlier research (for example, [9] and [10]) suggest that the results can also be applied to other technical communicators. Furthermore, some of the information source types used for survey questions Q8, Q9, and Q10 could be made even more granular. This would mean to further differentiate between information source subtypes such as “instruction manuals” and “training documents,” finally narrowing down the focus to individual information product types. Also, bearing in mind that the survey data were collected in spring 2017, technical communicators may now use electronic and printed information sources somewhat differently. In general, the COVID-19 crisis has stimulated

the use of electronic tools in many environments and industries. It would thus be interesting to know how the ratio between the electronic and printed dimensions has changed in the meantime.

**Outlook** To deepen academic knowledge about our research topic, the research results presented in this article should be examined further. For example, it would be interesting to know which information source types technical communicators use and for what reason—i.e., to link survey questions Q8, Q9, and Q10 with survey question Q5. Furthermore, using the method of open observation in combination with think-aloud protocols [84, pp. 97–112] could provide more detailed insights into actual practice. A user experiment, as described for translators [10, pp. 153–175], [85, p. 820], would be another option. In that setting, “reference tools available to participants” [33, pp. 10–12] would be the independent variable that is examined for its effects on various dependent variables. Participants’ satisfaction or the time needed to find the correct information could be such dependent variables.

For a better understanding of how technical communicators obtain special language information, quite a few things must still be researched. That is true for fundamental issues, such as the combination of individual research with oral conversations [11, pp. 17–18] or cognitive information processing when carrying out individual research. Applied research issues are still open, too—for example, the details of designing special language reference tools for technical communicators from an information technology perspective. An empirical study involving translators and technical communicators could reveal more details about the commonalities and differences between these two types of language professionals. For example, a study might examine how individual translators and technical communicators go about researching specific types of special language information (e.g., searching for definitions based on a term hitherto unknown to them).

As a vision of the future, technical communicators’ requirements for special language reference tools could be implemented as follows. A technical communicator needs to write or revise an instruction manual. In this context, the technical communicator realizes that there is an information deficit, so he or she triggers a retrieval in the special language reference tool using specific inputs (e.g., product category, language) [32, pp. 156–164]. Then, this “dynamic ... terminology and full-text database” system [10, p. 316] collects all necessary up-to-date information including the following [17, p. 67], [9, pp. 18–19].

- Entries of one or more terminology databases (for the individual types of special language information, see [7, pp. 53–54] and [8, pp. 269–271])
- Monolingual full-text documents such as instruction manuals
- Extracts from bilingual translation memories
- Laws and standards pertaining to the relevant product category

After the retrieval has been completed, the system provides a summary about the content delivered. In the next step, the technical communicator can create search queries or filters, trigger further retrievals, add content to the existing content, save personal comments, discuss content with others, and so forth.

## ACKNOWLEDGMENT

An earlier German-language publication [53] covers RQ2 of this article. To present the research results to a wider international audience, parts of this article constitute a translated and revised version of that publication.

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