Integrative Literature Review

Component Content Management and Quality of Information Products for Global Audiences: An Integrative Literature Review

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***Abstract*—Research problem**: *For many organizations, high-quality technical information products for global audiences are becoming an increasingly important part of doing business. Component content management attempts to facilitate the creation of such information products. A growing number of technical communication groups are adopting the strategies, standards, and technologies of component content management. This integrative literature review examines the impacts of component content management on the quality of multilingual information products.* **Research questions**: *How are the impacts of component content management on multilingual quality conceptualized? How do best practices address the impacts of component content management on multilingual quality?* **Literature review**: *Two divides characterize component content management and multilingual quality. The divide between the academy and industry is marked by different levels of interest in quality, particularly its practical aspects. The divide between technical communication and technical translation and localization is defined by the lack of communication between the representatives of each field that leads to a narrower understanding of multilingual quality. Therefore, a comprehensive picture of the impacts of component content management on multilingual quality requires combining the perspectives of scholarly and industry authors in technical communication and technical translation and localization. Activity Theory provides an approach for bridging the divides and creating such a comprehensive picture.* **Methodology**: *To provide such a comprehensive picture, I systematically reviewed literature sources on component content management and multilingual quality in scholarly and trade sources in technical communication and technical translation and localization, then classified all selected publications by their relationships to the research questions, themes within them, and characteristics of the source.* **Results and conclusions**: *Contradictory conceptual understandings exist on the impacts of component content management on multilingual quality. While some sources praise benefits of component content management, particularly increased consistency and the promise to provide additional adaption possibilities, other sources focus on the challenges of using it, especially a lack of context, text segmentation, and human resources. Although best practices offer some suggestions for overcoming these challenges, the suggestions do not resolve them sufficiently and do not reconcile the contradiction between consistency and adaptation of information products based on the different expectations of audiences around the globe. This study is limited by the fact that it primarily focused on English language publications. Future research needs to be conducted collaboratively by stakeholders in academia and industry and from technical communication and technical translation and localization.*

Index Terms*—Component content management, content strategy, global communication, information quality, localization, multilingual, translation.*

INTRODUCTION

For decades, quality technical information products have been recognized as an asset for the organizations that publish them. High-quality technical information products help consumers make purchasing decisions and encourage them to recommend products and even brands to others [1]. At the same time, an increasing number of organizations are looking to find consumers all over the globe[1], making high-quality *multilingual* technical information products particularly important: Not only do many importing countries (such as the countries of the European Union and Russia) require user documentation to be in their official languages, the majority of consumers prefer to buy products in their native language [2].

With the increased demand for high-quality multilingual information products, component-content-management strategies, standards, and technologies, which allow manipulating content at a granular level, promise to facilitate and simplify practices. One of the major advertising pitches for component-content-management systems is the promise of improving the multilingual quality, all the while reducing time and cost of technical translation/localization. According to Dayton and Hopper [3], Society for Technical Communication

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[1]According to St. Louis Federal Reserve data service (FRED), there was a 91% growth in US exports between 2000 and 2011.

(STC) members named translation as one of the "top drivers" influencing their company to implement component content management.

While the adoption of component content management has reached a critical mass [4], no comprehensive sources describe its impacts on multilingual quality. What's more, available information is often contradictory. For example, the same survey [3] revealed the lack of ability to customize as one of the main tradeoffs of component content management[2]; this tradeoff conflicts with the need to customize information products on various levels to meet the needs of global users (cf., [5]–[17]).

With multilingual quality being a mission-critical aspect of conducting business internationally and a key prerequisite to meeting the "ethical standards of utility, rights, justice, and care" [18], this literature review aims at providing a comprehensive source that examines the contradictory information on the impacts—both conceptual and practical—of component content management on multilingual quality. To do so, it combines academic and industry discourses in technical communication and technical translation/localization. The goal of such an interdisciplinary approach is to provide practitioners who are stakeholders of multilingual quality (technical communicators, information designers, UX specialists, content strategists, subject-matter experts (SMEs), technical translation/localization specialists, etc.) with a common language for discussing multilingual quality issues and collaborating on improving multilingual quality, while making best use of component-content-management strategies and technologies. For academics, this literature review provides grounds for future research on global user-experience (UX) design.

Hayhoe [8] wrote in an editorial for *Technical Communication* that

> as we recognize that our profession is becoming global not only in terms of the audiences it serves but also in terms of those who practice it, we should likewise acknowledge that our discipline's research base is no longer adequate. [8, p. 141]

To enrich research and practice of global technical communication, to combine the technical communication and technical translation and localization discourses, and to limit any disciplinary bias—to make this literature review truly comprehensive—I use the method of the integrative literature review. This integrative literature review focuses on the following two research questions:

- How are the impacts of component content management on multilingual quality conceptualized?
- How do best practices address the impacts of component content management on multilingual quality?

To answer these questions, I start by clarifying the theoretical framework that shaped these questions and guided this review, examining the key aspects of component content management and multilingual quality, and explaining the interdisciplinary complexity of this study. I then describe the methodology for conducting this integrative literature review. I follow with the results and conclude by stating conclusions and limitations and suggestions for future research.

Literature Review

In this section, I discuss the theoretical foundations of this integrative literature review and situate the review in the discourses of two relevant bodies of knowledge: component content management and multilingual quality. The section starts with an overview of the theoretical orientation and continues on to examine the definition of component content management and related practices, standards, and technologies, followed by an interdisciplinary review of definitions of and approaches to multilingual quality.

Theoretical Orientation This integrative literature review is guided by Activity Theory [19]–[24]. As Hart-Davidson et al. [25] suggested, we should see component content management as "a way of constructing new types of relationships between and among actors and resources within organizations and stakeholders outside them" [25, p. 14]. Activity Theory provided analytical tools for examining the impact of these new relations on the conceptual understandings of and practical approaches to multilingual quality. Since Activity Theory is a multidisciplinary construction, relying on it helped avoid the disciplinary bias.

If we look at multilingual quality as a goal of global technical communication, shared by academics and practitioners in technical communication and technical translation and localization, Activity Theory allowed

[2]Respondents needed "to use existing templates, which don't always fit [their] needs."

- separating multilingual technical communication practices into nodes (subjects, objects, mediating artifacts, rules, community, division of labor, outcomes) and looking at multilingual quality as the shared object of the separate activity systems of global technical communication;
- incorporating component-content-management strategies and technologies as mediating artifacts to see how their emergence influences the approaches to (the rules and the division of labor) and understandings of (the object) multilingual quality;
- tracing how contradictions in the co-mediational actions of the multilingual quality stakeholders and the new meditating artifact—component-content-management strategies and technologies—are connected to contradictions in the very goal of these actions, achieving multilingual quality;
- bridging the divide between technical communication and technical translation, as well as academy and industry, since Activity Theory provided tools for looking at multiple perspectives on multilingual quality, yet positioned multilingual quality as the shared object of global technical communication activity systems;
- questioning successful continuation of current multilingual quality practices and identifying directions for future research.

Component Content Management From the Activity Theory perspective, component content management fulfills the role of the mediating artifact of the activity systems of global technical communication. As such, it challenges and alters the understandings of multilingual quality (object) and best practices for approaching it (rules and division of labor), but, in return, can be modified by other nodes (such as multilingual quality stakeholders as the subjects, conceptual understandings of quality as the object). So, what is component content management?

Component content-management strategies rely on the principles of reuse and allow writers to author, review, and then assemble granular content in various outputs for various audiences and purposes. Component content-management strategies are often supported by component-content-management systems—technologies that rely on markup languages (most often XML) to "store content, as whole documents and/or as textual and graphical components"; these systems "mediate the workflow to collect, manage, and publish content with such functions as maintaining links among content sources and providing for revision control" [3]. In such a way, component content management introduces an immense paradigm shift into technical communication and requires changes in writing and managing strategies and supporting activities, standards, and technologies.

Component content management introduced a paradigm shift into the practices of technical translation and localization as well. This industry has already transitioned to computer-assisted translation technologies that allowed companies to reuse previously translated text segments over a decade ago; however, even when new segments matched previously translated segments, translators still reviewed them to make sure old translations fit within new contexts. Component content management provided a new level of reuse, allowing technical communicators to track all changed and new text segments and only send these out for translation. New texts were then assembled from these new segments after they were translated and combined with previously translated segments from a database. For technical translation and localization, this approach resulted in the proliferation of microtranslation projects, which can include anything from a single word, phrase, and sentence to complete paragraphs and topics.

Multilingual Quality across the Divides The impact of component content management on multilingual quality is situated along two divides: between academia and industry and between technical communication and technical translation/localization. The academia-practitioner divide in technical communication has been a topic of discussion in technical communication for many years (such as [26] and [27]), but has very recently been named a possible major hindrance to the development of our field [28]. While publications on quality of workplace documentation are quite abundant in industry-oriented sources, academic publications do not show such activity [26], proving that quality is an issues that "seems to matter quite a bit to industry, but to a much lesser extent to academia" [29].[3]

The divide between technical communication and technical translation and localization is

[3]The same is true for component content management—while academic interest in component content management is coming in waves, practitioner-oriented publications and presentations are booming, judging, for example, by the number of industry conferences that center around component content management and content strategy (such as CIDM conferences, Intelligent Content, Congility, DITA Europe, Information Development World).

even more pronounced. It is true that technical translation and localization are becoming closer to technical communication than to their original home, translation studies [30], and they are now included into the umbrella definition of technical communication [31]. However, technical translation and localization and technical communication are far from being integrated. Not only do technical communicators and technical translators usually publish in different venues; they often see their relations as clients (technical communicators) and contractors (technical translators). This separation is evident during technical communication conferences, where technical translation and localization are often a special topics area (such as vendor displays and panels).

If we look at multilingual quality through the lens of Activity Theory, we can position it as the shared object of multiple activity systems of global technical communication (academic global technical communication, industry global technical communication, academic technical translation, and industry translation and localization). This shared object, however, is the node that harbors multiple contradictions.

Contradiction 1: Contradictions in Defining Monolingual Quality in Technical Communication: Quality in technical communication is still a very fuzzy concept; for example, Spilka [25] noted that the "one constancy about the quality issue is that no two authors seem to agree on what is meant by the quality of workplace writing" [25, p. 209] and that "a circle of ambiguity" surrounds quality and its definition (also cf. [32]). Several authors attempted to design maps of design-based, product-based, customer-based, value-based, and strategic quality definitions that would help to avoid relying exclusively on one definition (e.g., [33] and [34]). Some suggested that quality is a contextualized concept, and technical communicators should customize definitions for particular worksites by taking into account what each context values most (e.g., [29], [33], [35]). Recently, however, quality approaches that focus on the customers and users have gained the most prominence (e.g., Carey et al. [36], who characterize quality technical information as easy to use, easy to understand, and easy to find).

Contradiction 2: Contradictions in Defining Multilingual Quality in Technical Communication: The distinction between monolingual and multilingual quality is often not clearly defined, resulting in comparatively little attention to multilingual quality specifically. The understanding of multilingual quality is often connected with the evolution of understanding of technical translators' approaches to creating good translations. For instance, Hallman noted that "a technical translator's only recourse (...) is to provide a faithful rendering of the text" [37, p. 245]; even if the translation is bad but it stays true to the source text, a translator's work is accomplished. Eubanks stressed that while translators do make composing decisions, they are "primarily concerned with fidelity to a source text" [38, p. 52]. Some professional and technical communication authors try to depart from this understanding of multilingual quality through the lens of a source text. Maylath [39] adds the usability variable to describe translation quality; however, Maylath still uses the term "accurate" in this context (while "accurate" means free from error, it also has the connotation of "conforming"). Weiss [40], however, cites Sándor and Higgins [41] to note that technical translation is pragmatic, practical, and purposive, and, thus, target-oriented. He further references Delisle [42] to emphasize that a target text and a source text should not necessarily be equivalent in any linguistic sense. In fact, evidence from a court case from Switzerland suggests that good technical translation and localization should first and foremost fulfill the purpose and function prescribed to it, regardless of the original source text [43].

Some authors take practical approaches to multilingual quality. For example, Carey et al. [36] focus on the users and describe clarity, conciseness, and style as the three primary issues of quality for international communication, while acknowledging the need to comply with other monolingual quality characteristics. Hoft [44] describes as minimum requirements technical accuracy, language, cultural bias, mechanics, formatting, and conformance to legal requirements. The author also distinguishes between the quality as translation centered and localization centered and puts special emphasis on the importance of usability.

The questions of linguistic nonequivalence and the focus on the users provide the grounds for differentiating translation from localization as approaches to creating high-quality multilingual technical information products. Translation is the interlingual transfer of content without significantly reworking the rhetorical approach of that content for the cultural specifics of the target audiences [45]. Localization describes the

> cross-cultural communication process of preparing locale-specific versions of a product or service, consisting of translation of textual material into the language and textual conventions of the target locale, and adaptation of nontextual materials as well as input, output, and delivery mechanisms to meet the cultural, technical, and regulatory requirements of that locale. [46]

Although localization ultimately better reflects the focus on users as a characteristic of multilingual quality, there are two problems that surround it. First, localization is often viewed as relating to software only (e.g., [36], [47], [48])—the fact that creates a need for another term to describe adaptation and cultural customization of information products in other industries. Second, when localization is defined broadly, it's time and resource consuming, so it's often deemed unpractical. Arguably, with the prominence of the user-focused approaches to monolingual quality in technical communication and in UX design, it is questionable to not apply the same approach to multilingual quality.

Contradiction 3: Contradictions in Defining Multilingual Quality in Academic Translation Studies: Technical translation and localization is a rather new field of study that stems from translation studies. While translation studies and technical translation and localization clearly share their subject—transferring meaning from one language to another—the major concerns of technical translation and localization are often ignored in the larger field, translation studies. One such concern is quality: there is no agreement among translation scholars on how to measure the quality of a translation and if we can even call a translation good, adequate, or appropriate (e.g., [49]–[52]).

When quality in technical translation and localization is viewed from the point of view of translation studies, then Byrne [53] argues that quality evaluation is usually devoid of reference to professional practice. For example, theories from translation studies do not account for such "practical" but frequent errors as omissions, incorrect comprehension, errors related to register, syntax, grammar, style, professional and technical communication. Pym [54] notes that translation errors "may be attributed to numerous causes (lack of comprehension, inappropriateness to readership, misuse of time) and located on numerous levels (language, pragmatics, culture)" and that "the terms often employed to describe such errors (over-translation, under-translation, discursive or semantic inadequacy) lack commonly agreed distinctions or fixed points of reference" (pp. 281–282).

Contradiction 4: Contradictions in Defining Multilingual Quality in Technical Translation and Localization: Several authors argue that quality in technical translation and localization should be defined through a translator's liability for it. Since a translated technical text can "directly affect their [readers'] wellbeing or their [readers'] ability to use a particular product" [55, p.12] errors in technical translation and localizations can have serious legal implications [53]. Quality is then best evaluated not by the correct outcomes of a project, but is rather based on whether translators were using their best efforts while translating [56] or whether a translation was done according to procedures that other translation community members would recognize as "proper, necessary, or appropriate for that type of work"—in a "good and workmanlike manner" [57, p. 13].

To address the fuzzy concept of quality on a practical basis, the technical translation and localization industry developed standards that prescribe workflow processes and offer a variation of approaches to quality. These standards include ASTM, ISO, EN, CEN, DIN guidelines. Three characteristics unite the standard-based approaches to quality in technical translation and localization:

(1) Quality is a process rather than product. A quality translation service must include a minimum of translation, during which a qualified translator translates the document and then checks the work once the initial translation is completed, and review, during which a person other than the translator examines a translation for its "suitability for the agreed purpose, and respect for the conventions of the domain to which it belongs" and recommends "corrective measures" [58].
(2) Quality is located in multiple possible variants. It can vary from "communicating an identical, uniform message to many locales at the same time" and "retaining the original flavor of the source text" to making products created for one audience "suitable to various foreign language audiences" by remaining sensitive to "cultural aspects of the geographic region and language of specific markets" [46].

(3) Quality is the result of agreement. ASTM F2575 [46] views quality as a "degree to which the characteristics of a translation fulfill the requirements of the agreed upon specifications." EN 15038 [58] states that the choice of the workflow elements for achieving quality depends on what the clients are trying to accomplish based on their budget, timeline, and goals.

Relying on the review of key concepts and themes that describe the impacts of component content management on multilingual quality conceptualizations and best practices, in the next section, I explain the process and methods for providing a synthesis of this emerging topic in global technical communication.

METHODOLOGY

The purpose of this section is to explain the approach to the study of multilingual quality and component content management and the details of literature selection and analysis. This section starts with an explanation of why I chose integrative literature review as a research methodology to answer the two research questions: How are the impacts of component content management on multilingual quality conceptualized? How do best practices address the impacts of component content management on multilingual quality? and then discusses how I collected, analyzed, and validated the data.

Choice of Research Methodology To create unbiased answers to the research questions, an approach that could synthesize research in a transparent and reproducible way was necessary. Since the research questions are situated along two interdisciplinary divides, a method that could bridge contradictory evidence and combine research that emerges in different fields was essential. In addition, component content management is a phenomenon that changes very rapidly, so a method that would allow examining change and reporting such change was crucial. These three prerequisites determined the choice of integrative literature review as the most appropriate genre for this study [59], [60].

The integrative literature review is a distinctive form of research that helps to generate new knowledge about the topic reviewed. When it is conducted with new and emerging topics, it provides the benefit of holistic conceptualization and synthesis of existing literature up to date [60]. The genre of integrative literature review requires specific approaches to conceptualizing the study and collecting and analyzing data; this literature review follows conceptualization and organization approaches as described by Ramey & Rao and Torraco [59], [60].

How Data Were Collected Because the subject of this literature review is situated along the two divides (academy and industry; technical communication and technical translation and localization), it is important to consider what literature means in the context of the interdisciplinary divides. To participate in the discourse of multilingual quality and component content management successfully, the understanding of quality needs to be comprehensive and multidisciplinary, and this could only be done, I argue, by combining scholarly and practitioner discourses in technical communication and technical translation and localization. Not only does such an approach help avoid bias, but it is also a step toward creating a dialogue between disciplines and between scholars and practitioners within each discipline.

In this context then, literature encompasses peer-reviewed journal articles, book chapters, books, conference proceedings, white papers, blogs and discipline-specific forums, and non-peer reviewed trade publications (magazines, newsletters, etc.). To review the literature, I focused on the following sources during the data collection:

- peer-reviewed journals in professional and technical communication (*Technical Communication*, IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION, *Technical Communication Quarterly*, *Journal of Business and Technical Communication*, *Communication Design Quarterly*, and *Journal of Technical Writing and Communication*) and technical translation and localization (the *Journal of Specialised Translation*). I searched for titles, abstracts, and full text documents.
- library databases of Arizona State University and University of Wisconsin-Milwaukee and Google Books for book titles and book chapter titles.
- publications by well-known voices in component content management and the organizations they represent (Rockley—The Rockley Group; Hackos—CIDM/Comtech Services; Gollner—Gnostyx Research; Bailie—Intentional Design; O'Keefe—Scriptorium Publishing; Abel—The Content Wrangler; Urbina—Urbina Consulting; and Swisher—Content Rules).

- high-traffic and widely cited trade publications, including articles, reports, and white papers (*Intercom*, *TCWorld*, ATA Chronicles, *MultiLingual* magazine and blog, http://www.proz.com/forum, http://www.translatorscafe.com/cafe/MegaBBS, http://www.gala-global.org/blog/; http://dita.xml.org, http://www.cmswire.com).

The search did not include conference presentations, discussion threads on forums and listservs that require group membership, or webinars since these sources are not readily available and retrievable, thus making a replicable study design difficult.

I included literature that appeared between 2000 and 2013 in the search and finalized the first draft of this article in January 2014. The starting date was determined by two factors: the fast development of component content management and relative absence of publications on quality by academics in the 1990s [26], [29].

To collect an exhaustive list of publications, I focused on determining keywords that describe global communication, quality, and component content management in technical communication and technical translation and localization and cover differences in understanding of these three topics. As I determined the initial keyword categories, I conducted several trial runs, refining and modifying the keywords. I used the Boolean special characters * to optimize the keywords and "" to search for exact phrasings, as well as the Boolean terms AND, OR, and NOT to look for overlapping concepts and reduce the number of false positives. As a result, I used the following list of keywords:

- Category 1: Global*, multilingual*, multicultur*, intercultur*, international*, translat*, local*, foreign, abroad, overseas.
- Category 2: "component content management," DITA, content AND topic* OR object* OR component* OR structured OR granular* OR chunk OR modular*, "content strategy," single-sourc*, microtranslat*.
- Category 3: quality.

Each source and database underwent the extensive search where each search string consisted of a combination of each keyword from category 1 with each keyword from category 2 and the word "quality". While using just the word "quality" for category 3 had certain disadvantages (not including publications that discuss, for instance, consistency but do not mention quality), it allowed examining what approaches to quality are prioritized in connection with component content management and, in a way, reconciling the differences in the understandings of quality (in addition to limiting the astronomical number of possible search strings). As a result, I used 60 search strings.

How Data Were Analyzed I manually evaluated full texts of all publications with the following inclusion criteria in mind: all publications needed to distinguish between multilingual quality and quality in just one language and they needed to distinguish multilingual quality in component-content-management contexts and multilingual quality in traditional contexts. I then compiled results into a spreadsheet and identified each publication by its source characteristic and relation to the research questions. To do so, I used two main categories for all articles: conceptual impacts and best practices.

I used descriptive codes to start the analysis of data. Descriptive codes summarize in a short phrase or a noun "the basic topic of a passage of qualitative data" [61, p. 70]; these topics do not abbreviate the content but rather describe it [62]. Descriptive codes are especially useful for this literature review due to the incremental nature of information on the impacts of component content management on multilingual quality within most publications (although all selected literature devoted some space to discussing the issues of multilingual quality and component content management, few sources focused solely and specifically on this issue).

During the second-cycle coding, I implemented pattern coding methods. Pattern codes are "explanatory or inferential codes, ones that identify an emergent theme, configuration, or explanation [63]. During this second cycle, themes that I present in the Results section emerged.

Assuring Credibility and Trustworthiness To ensure trustworthiness and credibility of the data, I took several steps. First, I reviewed publications referenced in the literature found in the original search to ensure that no relevant publications were missed. Since I was including non-peer-reviewed literature, I was particularly careful to eliminate all publications with solely promotional and advertorial messages. I then followed the same procedures for coding and analyzing all publications. Each descriptive code had to be mentioned by at least two publications to become part of the second cycle of coding.

RESULTS

The purpose of this section is to describe the collected data and to summarize the findings of the data analysis with the focus on research questions. This section begins with a description of the literature included in this review and then goes on to provide answers to each research question.

About the Literature Included in the Review

After excluding duplicates and publications that did not discuss multilingual quality and component content management together (even though they included the keywords from all three categories), I selected 60 articles. While most articles related to a single research question, there were several overlaps (eight publications); in such a way, there were 48 articles that discussed conceptual impacts of component content management and 20 best practices. Out of the 60, 10 publications came from peer-reviewed sources (4 from technical communication, 6 from translation and localization). Literature that included journal articles, magazine articles, newsletters, opinion pieces and forum discussions, white papers, blogs, book chapters, and books was published in the following sources: *Technical Communication, Chinese Translators Journal, IPCC Proceedings, STC Proceedings, Proceedings of the International Conference on Computer Documentation (ACM), Routledge, Baywood Publishing, John Wiley & Sons, Croydon: ISTC, New Riders, William Andrew Publishing, Intercom, ATA Chronicle, OASIS DITA Translation Subcommittee, Center for Information Development Management: Best Practices Newsletter & Information Management News*, *http://intentionaldesign.ca*, *http://www.multilingualblog.com*, *http://urbinaconsulting.com*, *http://www.scriptorium.com*, *http://www.jodybyrne.com/category/blog*, *http://www.contentrules.com/*, *http://focusonreaders.blogspot.com*, *www.proz.com*.

Research Question 1: How are the Impacts of Component Content Management on Multilingual Quality Conceptualized?

Publications identified in the literature review answer this question in differing and often contradictory ways.

Component Content Management Can Improve Multilingual Quality: The potential to improve multilingual quality, all the while saving on technical translation and localization, is mentioned as one of the top reasons for adopting component-content-management methods and technologies in book-length publications by leading consultants and in the non-peer-reviewed literature. In these publications, the potential of component content management for improving quality includes the following aspects:

- increasing consistency (such as [47], [64]–[67]);
- automating many translation and localization processes, thus making these processes a lot cheaper and less prone to human error (such as [68]–[73]);
- creating opportunities for cost savings through reuse, DTP elimination, and reduction of administrative involvement with better XCLIFF file compatibility (such as [48], [74]–[76], [77]–[79], [94]);
- providing additional technological tools for quality control ([66], [80], [67]).

These views of the benefits of component content management are also repeated in conference proceedings of STC, ACM, and IPCC (such as [73] and [81]–[83]).

Another area of possible benefits of component content management became apparent in both peer-reviewed and non-peer-reviewed sources. Component content management provides opportunities for adapting content for different audiences, including global users who speak various languages and come from different cultures (such as [84]–[86]). Authors who identify the adaptation opportunities of component content management suggest separate CSS for different languages [64], separate topics varied by language [72], marking generic and customizable content [68], and investing money saved from component-content-management approaches in localization [87].

Component Content Management Poses Challenges for Multilingual Quality: Challenges and problems that component content management creates for multilingual quality are also discussed in the literature. An article published in a peer-reviewed journal in 2010 describes the results of a 2008 survey of STC practitioner members that focused on component-content-management strategies and technologies [3]. The results of the survey showed that one of the driving factors for adopting component content management was the growing need for technical translation and localization. At the same time, 10%–50% of survey respondents (depending on the definition of "failure") reported that they had experienced a failed implementation and 25% of respondents were considering a change in methods and tools due to significant downsides of component content management, which included, among others, a lack of ability to

customize. Since the ability to customize is one of the major conceptual promises of component content management for global communication, this finding suggests conceptual challenges of component content management and multilingual quality.

In academic publications, several technical communication and technical translation and localization authors start to identify component content management's problematic implications for quality of global information products; they focus on information expectations of international users and technology affordances of component-content-management systems. For example, component-content-management systems can promote "reducing internationalization to literal, linear translations of content" and are often an "enormous incentive to not improve phrasings, change designs, or add user-requested content" [88]. They do not account for the "linguistic, psychological, and cultural principles underlying reading comprehension" [7]. Since users from different cultures have different navigational and imagery preferences, technical communication needs more research on global usability, such as intercultural interfaces [89]. Technical translation and localization authors also point out the problematic implications of textual granularity for the humanistic values of quality, such as "understanding, cooperation, and job satisfaction" [90]. While increasing productivity and consistency, component content management has such possible disadvantages as "the deepening of divisions within the labor market and the conceptual restriction of translation to narrow text-replacement activities" [91].

At the same time, non-peer-reviewed sources largely focus on the problems text segmentation and granularity introduced by component content management can create for the quality of information products for global audiences:

- Levels of segmentation. One needs to be careful when working in inflected languages (such as most Slavic and Germanic languages) with conditional text [79], term propagation from terminology databases [72], and conrefs[4] in DITA [79], [92], [93], since there is a risk of ungrammatical translations.
- Context. Segmentation of granular content strips it of its larger context, making it extremely hard for technical translators to judge the additional contextual information and avoid context-related errors [94]–[99]. Additional problems arise when texts are assembled from these chunks translated out of context [93].
- Human resources. Because handling the challenges of segmentation during translation is on the shoulders of technical translators, it might not be desirable for highly experienced translators to keep working with granular content, and companies might run the risk of losing valuable human resources (discussion prompted by [94]). At the same time, some technical translators wonder if their clients, technical communicators, are willing to pay for researching possible end uses and context of granular content rather than a per-word rate (discussion prompted by [94], [100]). Translators are usually freelancers, which means that they do not get to participate in company training and expensive seminars that teach component content management. As a result

  > not only do your translators have to figure out how your content convergence strategy is intended to work for you, they have to figure out how to retain the accuracy and flavor of your intent across languages and cultures [101]

  —a challenge that should not be ignored. Some wonder if translating chunks of content out of context can be detrimental to quality, since such practice forces translators to switch between different projects and clients and constantly breaks their concentration [102].

The fact that component content management might create quality issues for global information products is sometimes contested. Some technical communicators discount such issues as false problems; they state that the knowledge of genres where translated topic or chunks can be used is only marginally useful to translators. Some suggest that by writing perfect DITA topics that are "short enough to be specific to a single subject or answer a single question, but long enough to make sense on its own and be authored as a unit" technical communicators can eliminate any potential quality issues for technical translators (based on discussion prompted by a blog posting [94]). Other technical communicators, however, question the assumptions that component-content-management strategies and technologies are always implemented

[4]Conrefs or content reference attributes provide a mechanism for reuse of content fragments—building blocks smaller than topics that store a reference to other elements and can be processed to replace the referencing elements with the referenced elements (DITA OASIS).

using good practices while alternatives use bad practices and advise consulting technical translation and localization providers [103].

Research Question 2: How Do Best Practices Address the Impacts of Component Content Management on Multilingual Quality? The literature search identified several directions for making better use of component content management in multilingual projects.

Communication and Integration: Authors and translators must align their efforts to avoid content that is "bloated, disorganized, and inefficient" (such as [104, p. 7]). Translation should be integrated as early as possible into the document creation process, and component content management should be used to track modifications in the source documents (such as [105] and [106]).

Use of Metadata: Authors can use semantic tagging to distinguish translatable and non-translatable text [81]. They can create notes for translators about how to translate specific content within an XML file, identify elements that need to be translated according to specific rules, and name attributes according to their purpose [48]. They can create separate CSS for different languages [64]. They need to learn how to index topics for translation to obtain the best possible results in reuse [92]. They can mark generic topics and the ones that need to be adapted and customized [68]. They can adjust DITA Open Tool Kit resources for better string replacement in different languages [107].

Focus on the Source Language: Authors need to use language-quality assurance software and controlled and simplified English to provide good-quality source text, since it has an impact on translation quality [108]–[111], [72], [112].

Segmentation: Authors need to keep "topic granularity low" and "document structure simple" [113]. Using sentence-level segmentation provides better matching (better consistency), while segmenting text at the paragraph level improves the quality of the translations. During translation memory migration to DITA, segmentation in this translation memory should be set to sentence level and then back to block after the migration is complete [114]. In DITA, conrefs in highly inflected and gender-sensitive languages should reference only grammatically complete sentences, phrases, or complete blocks of text. Sometimes this would require resolving conrefs prior to translation and translating versions of the same topic separately [113].

Context: Information developers need to make context of XML chunks clear to technical translators by providing at least terminology databases, translation memories, and style guides and integrating component-content-management systems and translation-management systems (such as [115]). In the DITA paradigm, it is recommended that translators be provided with a composed version of the source text to review and understand the context of the text in which a conref appears [113]. DITA metadata, however, "could allow the translator to recover useful context when presented with an isolated segment from a CMS" [97].

Conclusions, Limitations, and Suggestions for Future Research

This section describes the broader implications of the study by summarizing conclusions of the integrative literature review, acknowledging its limitations, and providing suggestions for future research. This section focuses consecutively on these three thematic categories.

Conclusions The integrative literature review provided interesting answers to the research questions. The review revealed that conceptual understandings of the impact of component content management on multilingual quality are contradictory, with opinions being rather polar and technical translation and localization authors being more reserved about the positive impacts. However, the contradiction between the two possibly positive impacts, consistency, and localization opportunities, deserves particular attention. Consistency was a major positive impact of component content management on multilingual quality, particularly in technical communication publications. The potential of component content management for adapting texts for global readers was also a common topic. However, consistency between languages implies similarity of all texts of the same genres in different languages, while localization implies difference.

This contradiction may partially result from the problem with terminology. The term "consistency" doesn't differentiate between consistency between languages (such as the installation guide in English, French, and German) and consistency within languages (such as all information products in French). Localization can be narrowly and broadly

defined.[5] Still, this contradiction is not resolved by best practices. In fact, ways of using component content management for adapting information products depending on the differing information needs of audiences in different counties are only starting to appear in best practices publications.[6]

Other possible negative impacts of component content management on multilingual quality were resolved to various degrees. For the problems with segmentation, the advice was not to use low granularity in highly inflected languages—a valuable solution but one that discounts certain reuse practices. For the lack of context, the advice was to provide translators with whole information products and not just granular content—again, an approach that discounts a large number of reuse practices. While acknowledging that this might not be enough, other authors suggested providing as much context as possible through metadata, terminology databases, style guides, etc. For problems with talent retention and training translators to work with granular content, I found no solution in the best practices literature as of January 2014. Communicating with translators at all stages of the project and involving them early on can provide only some remediation to this problem.

Limitations A limitation of this study could be that it focuses on English-only sources within a topic that included multilingual communication. While some non-English sources are available, they would have provided little help to the mostly English-speaking audience of this journal due to the language barrier. In addition, they would have made the scope of this study infeasible, since the research or a group of researchers would need to speak at least 10+ languages. However, a study that investigates multilingual sources could be a future research project.

Another possible limitation is that the same value is given to all publications due to an expanded understanding of literature in this review. While I identified each publication by whether it was peer-reviewed or not, I counted them equally. This limitation, however, did not harm the findings. I was particularly careful to eliminate all publications with solely promotional and advertorial messages. What is more, the goal of bringing academy and industry discourses on multilingual quality and component content management and pinpointing unresolved contradictions inherent in this topic was only possible with this method. In such a way, the goal validated the method.

Because I conducted the searches repeatedly over a period of three years and due to the large variation of search strings and the rapid development of component content management, I did not collect the overall number of publications. Thanks to the rigorous data-collection procedures, as well as review of publications referenced in the literature found in the original search, this limitation did not invalidate the findings.

Suggestions for Future Research Although there were 20 best practices publications in this review, not one of them provided a comprehensive view of component content management and multilingual-quality understandings and practices. In addition, conceptual and best practices publications were largely written by nonacademic authors and were not peer-reviewed. There was no empirical research on how component content management impacts multilingual quality. In such a way, the results of this literature review showed that the interdisciplinary divides persist, resulting in conceptual contradictions and lack of their resolution.

Contradictions, however, are essential to the developmental change [24]. When we analyze the contradictions within and between the nodes of activity systems and project possible solutions for these contradictions, we can develop a zone of proximal development for these activity systems [20]. This zone of proximal development is the distance between the present actions and the new forms of activity that can be generated as a solution to problems in current actions [116]. To resolve the contradictions within the shared object node (conceptual understandings of multilingual quality) of the activity systems of global technical communication and project the zone of proximal development for these systems, future research needs to focus on the following areas:

- What is the most appropriate terminology for defining the process of adapting technical information products to the needs of global users and the requirement of keeping certain information similar across languages?
- How can we implement the principles of UX to multilingual contexts?
- How can we best make use of component content management to implement these principles?

[5]See *Contradictions in defining multilingual quality in TC.*

[6]See *Use of metadata.*

To resolve the contradictions within the rules and division of labor nodes (best practices), best practices research needs to focus on the following areas:

- defining minimum and maximum requirements for multilingual quality based on available resources and organizational goals
- determining measurements for the ROI of localization (broadly defined)
- determining ways to involve technical translation and localization specialists into component-content-management training.

What these research questions and areas ultimately suggest is that multilingual quality needs to be conceived as a goal that takes the participation of all stakeholders in an organization into consideration [87], [117]. In a context larger than an organization, this conception means bridging the gaps between academia and industry and between technical communication and technical translation and localization and promoting collaboration in conceptual and best practices research. Empirical studies of workplace contexts that involve content strategists, information developers, technical writers and editors, translation and localization project managers, and technical translators are needed and should be conducted by researchers from both technical communication and technical translation and localization. These empirical studies can draw on Activity Theory to explore understandings and approaches of multiple quality stakeholders, as well as the Genre Theory to investigate what quality might mean for content elements and information products in different languages.

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