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Towards Complexity-Sensitive Book Metrics for Scholarly Monographs in National Databases for Research Output

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Abstract

Purpose. We investigate an approach to book metrics for research evaluation that takes into account the complexity of scholarly monographs. This approach is based on work sets—unique scholarly works and their within-work related bibliographic entities—for scholarly monographs in national databases for research output.

Design. This study examines bibliographic records on scholarly monographs acquired from four European databases (VABB in Flanders, Belgium, CROSBI in Croatia, CRISTIN in Norway, COBISS in Slovenia). Following a data enrichment process using metadata from OCLC WorldCat and Amazon Goodreads, we identify work sets and the corresponding ISBNs. Next, on the basis of the number of ISBNs per work set and the presence in WorldCat, we design a typology of scholarly monographs: Globally visible single-expression works, Globally visible multi-expression works, Miscellaneous, and Globally invisible works.

Findings. Our findings show that the concept 'work set' and the proposed typology can aid the identification of influential scholarly monographs in the social sciences and humanities (i.e. the Globally visible multi-expression works).

Practical implications. In light of our findings, we outline requirements for the bibliographic control of scholarly monographs in national databases for research output that facilitate the use of the approach proposed here.

Originality. We use insights from library and information science (LIS) to construct complexity-sensitive book metrics. In doing so, we, on the one hand, propose a solution to a problem in research evaluation and, on the other hand, bring to attention the need for a dialogue between LIS and neighbouring communities that work with bibliographic data.

Keywords: scholarly monographs, books, research output, work sets, FRBR, bibliometrics, research evaluation, national databases, Europe

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1. Introduction

Scholarly monographs have been the central carriers of knowledge for multiple centuries. At the same time, scholarly monographs are complex bibliographic entities. The same scholarly work often is available in multiple formats (paperback, hardcover, e-book), published in different languages, by different publishers or have different revised editions. This complexity of scholarly monographs and books in general has been an area of debate and development within library and information science (LIS) as made evident by, for example, the development of conceptual models like Functional Requirements for Bibliographic Records (FRBR, IFLA Study Group on the Functional Requirements for Bibliographic Records, 2009). However, this complexity of scholarly monographs is rarely considered in two neighbouring communities—in research evaluation and research information. While in research evaluation, bibliographic data on monographs are used in the construction of book metrics, in the community of research information, bibliographic data on scholarly monographs is just one of the numerous data types stored in information systems and databases meant to depict various aspect of research. In this paper, we propose a novel approach to book metrics—complexity-sensitive book metrics. In doing so, we, on the one hand, address the absence of considerations of the complexity of scholarly monographs that typically characterises the current research evaluation and research information practices. On the other hand, drawing upon the insights from LIS, we demonstrate the importance of expertise within LIS for other communities that make use of bibliographic data.

For us, a scholarly monograph is "a work of scholarship on a particular topic or theme which is written by a scholar (or scholars) and intended for use by primarily other scholars" (Thompson, 2008, pp. 84–85). We see it as a genre in scholarly communication rather than a mode of issuance that reflects whether a resource is issued in one (e.g., monograph) or multiple units (e.g., serial) (RDA Steering Committee, 2019). Besides this, we see scholarly monographs as *long-form* publications written by the same author(-s). With this additional requirement, we draw a line between scholarly monographs and edited volumes where each chapter is typically written by (a) different author(s). Both scholarly monographs and edited volumes would be seen in a cataloguing context as *monographs* defined as "[a] complete bibliographic unity or resource" (Joudrey *et al.*, 2015, p. 986). In research evaluation and research information contexts, however, it is crucial to identify scholarly monographs as they represent a substantially different scholarship (i.e. long-form).

Even though the prominent position of monographs in many academic disciplines is replaced by journal articles (van Leeuwen *et al.*, 2016; Sivertsen and Larsen, 2012), there are areas of research where scholarly monographs retain their dominant position (Crossick, 2015; Fyfe, 2013; Hammarfelt and de Rijcke, 2015; Thompson, 2002). For example, in Norway for years 2005-2009, scholarly monographs accounted for 7% of all the scholarly publications in the humanities, while the share of monographs was only 0.4% in the natural sciences (Sivertsen and Larsen, 2012; see also Kulczycki *et al.*, 2018). These relatively small numbers, however, do not fully reveal the values a scholarly monograph embodies. Knowledge production in several areas of research is described with the phrase 'thinking through the book'. In other words, "[m]onographs should not be seen simply as the way in which research findings are communicated, because the act of constructing and writing a book is often a core way to shape the ideas, structure the argument, and work out the relationship between these and the evidence that has emerged from the research process" (Crossick, 2015, p. 15). This genre is a key space for developing ideas that

tie together findings from numerous studies and in doing so flesh out solid knowledge contributions that cannot be presented in a standard length journal article or a chapter in an edited volume. For these reasons, one might argue for a distinction between scholarly monographs (with scholarly community as the main audience) and textbooks and popular-scientific monographs. Consequently, it is not surprising that scholars from the humanities (at the University of Uppsala, Sweden) regard monographs as the central medium in scholarly communication (Hammarfelt and de Rijcke, 2015). Furthermore, the importance of monographs is demonstrated empirically by bibliometric studies exploring the share of monographs in reference lists. In a number of social sciences and humanities disciplines, scholarly monographs tend to be cited more than journal articles (Chi, 2014; Glänzel *et al.*, 2016; Hammarfelt, 2011; Thompson, 2002). Besides, monographs are often seen also as important academic achievement that can determine one's career path (Crossick, 2015). Thus, even though the share of monographs among all publications is relatively low, their value is irreplaceable. Scholarly monographs are essential for scholarship in the social sciences and humanities (see also Engels *et al.* 2018) and therefore it is important for research evaluation and research information to be able to identify scholarly monographs among other types of publications and research output.

The importance of scholarly monographs is mirrored also in LIS where books in general have been the primary concern within the realm of cataloguing since the early practices of descriptive cataloguing (Hopkins, 1992). Over the years, there has been an increasing awareness of the ambiguity in bibliographic records for monographs (among the other resources dealt with). When the recorded title of a resource states 'The sublime object of ideology', does this record refer to the famous work by the philosopher Žižek Slavoj first published in English in 1989, the revision published in 2009 or perhaps a group of bibliographic records consisting of all translations and editions related to this work?

LIS scholars and practitioners have addressed this complexity in conceptual models such as the Functional Requirements for Bibliographic Records (FRBR) and the more recent Library Reference Model (LRM) as well as the cataloguing instructions Resource Description and Access (RDA). These new developments help to conceptualise resources (including scholarly monographs) as complex objects, offer terminology to describe this complexity, and also provide guidelines that help to depict this complexity in bibliographic records.

In contrast, the complexity of scholarly monographs is rarely recognized, let alone addressed, in research information systems and databases that are used to construct book and other publication metrics utilised in research evaluation procedures (Gorraiz *et al.*, 2013; Zuccala *et al.*, 2018; Zuccala and Robinson-García, 2019). Little attention is paid to clarification of principles for creating bibliographic records on scholarly monographs and questions pertaining to the complexity of monographs are rarely discussed and are typically solved in an *ad hoc* manner. Hence our goal, as noted above, is to address a problem in research evaluation, namely to construct book metrics that take into account the complex nature of scholarly monographs. To achieve this goal, we apply insights developed within LIS to problems we identify in neighbouring communities—research evaluation and research information. In doing so, we attempt to bridge the different communities that each in their way has the potential to contribute to the development of novel approaches to book metrics.

This paper is structured as follows: we begin with our conceptual considerations in relation to complexity-sensitive book metrics (section 2). To conceptualise the complexity of scholarly monographs for use in research evaluation, we use two concepts—'work set' as it relates to

FRBR (IFLA Study Group on the Functional Requirements for Bibliographic Records, 2009) and LRM (Riva *et al.*, 2017) and 'evaluative inquiry' (Fochler and de Rijcke, 2017; de Rijcke *et al.*, 2019). First, we elaborate on the concept 'work set' after a brief introduction of FRBR and the more recently developed LRM (section 2.1). Second, we discuss the main approaches to book metrics (section 2.2). Finally, we outline and discuss the conceptual framing for complexity-sensitive metrics using the concept 'evaluative inquiry' (section 2.3). In section 3, we describe the methods and data we use in this study. The fourth section presents findings—an overview (4.1) followed by key characteristics of four groups of monographs that we identify (4.2-4.5). The fifth and final section presents a discussion of the findings with the focus on further steps to be taken towards complexity-sensitive book metrics and the enhancement of bibliographic control practices for monographs in databases for research output.

2. Conceptualising complexity-sensitive book metrics

2.1. *Work sets and the complexity of scholarly monographs*

The understanding of the term 'work set' requires an introduction of the key terms within the FRBR and LRM models. FRBR is a conceptual entity-relationship model for the bibliographic universe (IFLA Study Group on the Functional Requirements for Bibliographic Records, 2009; Tillett, 2004). It was created in late 1990s by a specialist group from the International Federation of Library Associations and Institutions (IFLA). FRBR was succeeded by the LRM in 2017 (Riva *et al.*, 2017). Even though the key entities remain unchanged, we follow the LRM due to the slight changes in entity definitions.

The purpose of LRM is to facilitate the tasks performed by users of bibliographic and authority data, i.e. to find, identify, select, obtain, and explore (Riva *et al.*, 2017). To complete these tasks, it is necessary to distinguish fine-grained features of bibliographic records (e.g. "Is this a translation? Which edition is this?"). This can be achieved using the LRM, since this model clarifies key terms such as 'work' and 'manifestation' and how they relate to each other.

The LRM model consists of eleven entities. Four of the entities—Work (LRM-E2), Expression (LRM-E3), Manifestation (LRM-E4), and Item (LRM-E5)—are also known as the *WEMI* entities and are defined as follows:

- a *work* that stands for "[t]he intellectual or artistic content of a distinct creation",
- an *expression* that refers to "[a] distinct combination of signs conveying intellectual or artistic content",
- a *manifestation* which means "[a] set of all carriers that are assumed to share the same characteristics as to intellectual or artistic content and aspects of physical form. That set is defined by both the overall content and the production plan for its carrier or carriers", and,
- an *item* that represents "[a]n object or objects carrying signs intended to convey intellectual or artistic content " (Riva *et al.*, 2017, pp. 21–27).

In other words, the first two entities, 'work' and 'expression', refer to the intellectual or artistic content, while 'manifestation' and 'item' refer to physical and digital objects. In this study, we use the entities 'work', 'expression', and 'manifestation'. When applied, these terms help, first, to clarify what is meant when we say 'scholarly monograph' (e.g. a specific work, expression or manifestation?). Second, these terms enable the identification and description of all expressions and manifestations related to a specific work, in other words—*work sets.*

Since the introduction of FRBR/LRM, several studies have explored the prevalence of the WEMI entities and bibliographic relationships between them. For example, Bennett *et al.* (2003) described a typology of works depending on their complexity: works with a single expression and a single manifestation are called *elemental works,* works with a single expression but multiple manifestations are *simple works,* and works with multiple expressions and editions are *complex works*. In their study, based on a sample of WorldCat records (*n*=8698), they found that elemental works constituted 78% and simple works accounted for 16% of all records. Complex works could be identified only for 6% of the records. A study that used an algorithm to identify works among all the WorldCat records, identified that 96% of all works (*n*=37 772 687) are elemental works (Hickey and O'Neill, 2005). Zuccala *et al.* (2018) explored records on scholarly monographs from the Clarivate Analytics Book Citation Index and BFI, the Danish national database for research output. This study found that 52% of the identified works were elemental works (published with a single ISBN).

Complex works have attracted additional attention—i.e. what kind of bibliographic relationships prevail in complex works? Smiraglia and Leazer's (1999) work with a WorldCat sample showed that 69.8% of works in WorldCat have no derivations and for works with derivations, half of derivations are editions, while translations account for only 6.8%. Bennet *et al.* (2003) found that while more than half of the complex works identified in their analysis are revised works, a quarter of works contains translations.

Considering the practicalities of the identification and representation of the WEMI entities in bibliographic records (also known as the FRBRisation), several methods have been proposed (for an overview see Aalberg *et al.* 2019). The well-known OCLC work set algorithm that underpins work identifiers in WorldCat utilises keys generated from titles and author names to identify groups of records (Hickey and Toves, 2005, 2009). This approach relies on authority records that help to identify versions and translations of titles and author names. It has been argued that the identification and extraction of work sets is relatively easy, since the structure of a standard bibliographic record (e.g. MARC record based on AACR2) contains all the necessary information. This assumption, however, disregards the fact that not all systems with bibliographic records follow these standards. For example, Cho (2006) presented a semi-automated approach whereby work sets are identified on the basis of ISBNs. She argued that this is a better alternative in situations where no authority records are available and the bibliographic records do not contain uniform titles or other metadata elements that could facilitate the FRBRisation process. A similar approach was used by Zuccala et al. (2018), who also make use of bibliographic records with a limited level of detail. It is important, however, to note that both approaches indirectly benefit from the OCLC work set algorithm. Consequently, this approach is limited to records that can be identified in WorldCat. The key point that these examples, demonstrate is that, even though there are multiple approaches to choose from for the identification of work sets, not all approaches are always applicable. The choice of an approach greatly depends on the metadata structure, the prevalence of missing metadata elements in records, and the availability of an external data source that can be used for metadata enrichment.

In summary, results from earlier studies indicate that large work sets are relatively rare and can be interpreted as works with higher scholarly and artistic merits. Therefore the concept 'work set' has the potential to identify more influential scholarly works, an insight of use for research evaluation.

2.2. *Book metrics for research evaluation*

The now commonplace assumption in research evaluation is that bibliometric indicators should support, not replace, qualitative, expert assessment, the traditional yet often time-consuming and costly approach to research evaluation (Hicks *et al.*, 2015). Expert assessment is still part of, for example, the Research Excellence Framework (REF) in the United Kingdom wherein expert panels evaluate research on the basis of a selection of outputs submitted by institutions. A similar approach was used in the evaluation of humanities departments in Norway (West *et al.*, 2017). Expert assessment in research evaluation is challenging when evaluating research domains where the importance of scholarly monographs is high. For example, Kousha and colleagues (2011) point out that in the REF 2008 in some disciplines there were up to 100 monographs per reviewers (for example, 1665 monographs for 17 reviewers for history departments), which is hardly feasible. The value of a monograph is undoubtedly assessed most accurately by reading it. At the same time, the challenges in the current research evaluation practices indicate the need for supplementary quantitative measures that would help to gauge the merits of scholarly monographs.

Another impetus for the development of book metrics can be sought in the changes in the use of metrics in evaluation in general. Since the beginnings of the use of quantitative approaches in research evaluation, the primary focus has been on metrics for journal articles. This is related to the research policy focus on natural sciences where the journal article is the main medium of scholarly communication. In the recent decades, calls have been made to give more consideration to different publishing traditions (DORA, 2012; Hicks *et al.*, 2015). For research domains with books as the dominant carrier of knowledge this means that books should receive substantial attention in research evaluation. This has led to the development of book metrics (Hammarfelt, 2016; Zuccala and Robinson-García, 2019), data sources and evaluation procedures in general that take into account books (Giménez-Toledo *et al.*, 2016, 2019).

We distinguish between two main approaches in book metrics: book-based metrics (section 2.2.1) and publisher-based metrics (section 2.2.2). Book-based metrics are designed to capture some aspect of the quality of research communicated in a specific book. Publisher-based metrics, on the contrary, focus on the quality and the prestige of a book's publisher. Finally, we highlight key challenges related to data used for book metrics (2.2.3).

2.2.1. Book-based metrics

Citations are the most popular type of metrics and have also been explored in relation to scholarly monographs. For example, Bar-Ilan (2010) explored the citation impact of the book 'Introduction to Informetrics' by Leo Egghe and Ronald Rousseau, using citation data from the Web of Science (Clarivate Analytics), Scopus (Elsevier), and Google Scholar. Kousha and colleagues (2011) explored the citation impact for a sample of 1000 monographs submitted to the UK REF 2008. For citation counts, they used Google Scholar, Google Books, and Scopus. They found that the number of citations in Google Books and Google Scholar corresponds to 143 and 318% of citations respectively in Scopus; used in conjunction, citations in the different sources, for example, could be a source of interesting insights relevant in research evaluation settings.

Parallel to these developments is the continuously expanding range of various altmetrics, defined as social web metrics for academic publications (Sud and Thelwall, 2014). For example, Torres-Salinas and colleagues (2017) explored the impact of monographs using 18 indicators, including downloads, data views, PDF views, and social media mentions (on Twitter and Facebook). While Zuccala, Verleysen and colleagues (2015) investigated book ratings in the Amazon social

cataloguing website Goodreads, Mohammadi and Thelwall (2014) made use of readership data in the Mendeley reference manager. Howard White and colleagues (2009) suggested the use of libcitations—the number of library holdings for a particular book. All these examples illustrate the various directions taken in the development of book-based metrics.

2.2.2. Publisher-based metrics

Publisher-based metrics most often are part of performance-based research funding allocation systems (Hicks, 2012). In these systems bibliometric (and other) indicators are used to determine how much funding each university will receive. Publisher quality determines whether a book publication is taken into account in the funding system and/or at what level of publisher prestige. This differentiation translates into publication weights in bibliometric indicators. For example, in Norway, depending on the prestige of the publisher, a monograph is equated to 5 (for the lower level) or 8 (for the higher level) points (Giménez-Toledo *et al.*, 2016). To this end, publisher lists and rankings are maintained in Belgium (Flanders), Denmark, Finland, Norway, Poland, Slovakia, Slovenia, and Spain (Dagiene, 2020; Giménez-Toledo *et al.*, 2019). Another type of publisher-based metrics can be seen in rankings of publishers. See, for example, Zuccala, Guns, *et al.* (2015) on exploration of citation-based ranking of publishers in the field of history.

2.2.3. Data source specifics

The two types of metrics outlined above share a common feature: both rely on bibliographic data and delineation of the notion 'scholarly monograph'. The sources of bibliographic data that are used to construct book metrics typically are somewhat different from library catalogues. This difference is most visible in metadata schemes and in the specific way to understand scholarly monographs.

In 2011, the Book Citation Index (now owned by Clarivate Analytics) was launched promising to make the analysis of book citations more accessible. Studies exploring this source, however, quickly flagged numerous problems with this data source (Glänzel *et al.*, 2016; Gorraiz *et al.*, 2013; Zuccala *et al.*, 2018). For example, the category 'book' contains both monographs and edited volumes, and chapters from *both* monographs *and* edited volumes are indexed separately (Gorraiz *et al.*, 2013; Leydesdorff and Felt, 2012). Even though this approach is reasonable for edited volumes where each chapter is written by different author(-s), it is unclear why this approach should be followed also for monographs. Gorraiz and colleagues (2013) highlight that if this is not corrected in data analysis, then publication and citations counts at higher levels of aggregations (e.g. organisation, country) are overestimated. Similar problems have been reported also in relation to citation counts in Google Books (Kousha *et al.* 2011).

Another problem with sources like Book Citation Index that are selective in their indexation strategies is that they cover only a very small percentage of scholarly monographs. The low coverage is especially problematic for research evaluation where the focus is on a specific institution or country. To address this challenge, a number of countries and institutions have implemented their in-house current research information systems or databases for research output (Sīle *et al.* 2018). Consequently, for example, Zuccala *et al.* (2018 could identify that for Denmark, less than 0.5% of ISBNs identified in the national database for research output (n=16392) could be found in the Book Citation Index.

These national databases come with another set of challenges. The metadata schemes in databases for research output, not just the national ones, typically do not have the level of sophistication that one encounters in library catalogues. For example, it is rare to record more

than one title even if alternative titles exist. A characteristic of national databases is that in many cases, there is no authority control for authors or it is applied only to authors affiliated to institutions in the country where the database is maintained. This, on the one hand, is understandable given that most databases for research output are created and/or used specifically for the construction of bibliometric indicators (Sīle *et al.* 2017, 2018). On the other hand, these specifics of databases for research output pose a challenge for FRBRisation since most of the methods that are used in library catalogues are not applicable.

In addition, in the context of book metrics scholarly monographs are typically understood as a specific genre (the long-form scholarship) as discussed above. Hence it is of central importance to record in databases a distinction between scholarly monographs and, for example, edited volumes. This is somewhat different from general cataloguing principles wherein the form (i.e. book, monograph) takes precedence over genre. All these features set additional constraints for the construction of complexity-sensitive book metrics (e.g., the limited metadata schemes, absence of authority control).

2.3. *Towards complexity-sensitive book metrics*

All book metrics require the use of a clearly defined and consistent approach to delineate scholarly monographs from other books; ideally, in a way that considers their complexity. To frame their use in research evaluation, a useful concept is 'evaluative inquiry', which stands for numerical, verbal, and/or visual representations of scholarship that are meant to "represent the complexity of actual practice and its engagements, rather than to reduce for the sake of standardization" (Fochler and de Rijcke, 2017, p. 34). This concept helps to frame an approach to book metrics that considers different manifestations of a book and how a book finds its way to readers, including its varied history or its general complexity.

Publication counts are a basic indicator of research activity. Counts of books could be one of the measures to consider when producing this indicator. The different challenges encountered in the work on book metrics discussed above highlight the need to address this ambiguity. In addition, in deduplication procedures employed in databases for research output, different expressions and manifestations are sometimes merged into a single record. In such cases, a unique book record refers to either a unique work which is published only once and can be identified with a single ISBN or a work set consisting of multiple related entities, typically, however, with no additional metadata describing their relations. Sometimes different expressions and manifestations are recorded as separate entries without any identification of relationships between them. Consequently, it is not clear to what entity a unique database record refers. This ambiguity could be addressed through the implementation of FRBR/LRM WEMI entities that help to specify the level (work, expression, or manifestation) at which book metrics are constructed. Making explicit which entity (i.e. a work, expression, or manifestation) is counted facilitates the accuracy of publication counts and consequently the accuracy of both book-based and publisher-based metrics that all rely on the delineation of scholarly monographs. Here we assume that specific works rather than manifestations or expressions are of central interest.

Along the same lines, research by Zuccala *et al*. (2018) exemplifies how to confront the complexity of scholarly monographs through the incorporation of FRBR concepts. Exploring data on scholarly monographs in the Book Citation Index and the Danish national database BFI, they concluded that book metrics ideally should be based on records that make use of both expression and work identifiers. This could help to overcome the challenge when multiple editions are recorded as distinct unrelated entries. Related ideas have been entertained by

scholars within sociology of translation. A case study showing such ideas with respect to the whole collection of a single author (here, Pierre Bourdieu) was carried out by Sapiro and Bustamante (2009) who conceptualise translation as a measure of international reception. Following the evolution in the number of translations as well as their speed, they show how gradually Bourdieu has become globally renowned. Such trajectories can be captured if bibliographic data on scholarly monographs are modelled following FRBR/LRM.

These examples point to the value 'work sets' and FRBR/LRM concepts could bring to research evaluation. Hence we propose that for research fields like the social sciences and humanities where scholarly monographs play a central role, it is worthwhile to identify distinct works and their work sets as a first step to sensitise book metrics to those aspects of scholarly merits of scholarly monographs (i.e. translations and editions), which have, up to this point, been invisible.

3. Method

3.1. *Bibliographic data*

We use bibliographic data from four national bibliographic databases for research output: Co-operative Online Bibliographic System and Services (COBISS[I], https://cobiss.si/en/, Slovenia), Croatian Scientific Bibliography (CROSBI, https://www.bib.irb.hr/, Croatia), Current Research Information System in Norway (CRISTIN, https://www.cristin.no/, Norway), and Flemish Academic Bibliographic Database for the Social Sciences and Humanities (VABB, https://www.ecoom.be/en/data-collections/vabb-shw, Flanders, the Dutch-speaking part of Belgium). In addition, OCLC WorldCat (https://www.worldcat.org/) and Amazon Goodreads (https://www.goodreads.com/) are used as sources for additional metadata. Both WorldCat and Goodreads rely on FRBR/LRM in their data structure.

While CROSBI, CRISTIN, and VABB have been established for reporting (CROSBI) and funding allocation purposes (CRISTIN and VABB), COBISS is the national library information system with a module that serves as a database for research output (Curk, 2019). Consequently, bibliographic data in COBISS are more alike with data stored in digital library catalogues rather than databases for research output.

Data were acquired from May to August 2019 based on data delineation criteria presented in Table I. In relation to timespan, we use records for monographs published from 2000 to 2017. Such a timespan, however, is not available in CRISTIN. Therefore we use records from 2005 onwards, the first year for which data on scholarly monographs are available. As shown in the table, we use two datasets from VABB: a peer-reviewed set and not peer-reviewed set. We include the two datasets as two distinct datasets due to the fact that for the other databases information on peer-review is either not available (COBISS[II] and CROSBI) or all data refer only to peer-reviewed publications (CRISTIN[III]). Since for VABB this information is available, we anticipate that potentially interesting insights can be drawn from the comparison of results with respect to the two VABB datasets. At the same time, we should note we limit the not peer-reviewed set from VABB to a shorter time span (2011-2017) since this dataset is not the focus of this study.

[Table I Delineation criteria for datasets from national bibliographic databases for research output]

The OCLC WorldCat data were provided in July 2019 by the OCLC staff, and the data that were retrieved from WorldCat are linked directly to the list of ISBNs of monographs identified in the national databases. Data from Goodreads were acquired in August 2019 using a list of all unique ISBNs.

3.2. *Metadata enrichment and identification of work sets*

A preliminary exploration of the metadata acquired from the four national databases indicated that what was initially available was not fine-grained enough in all cases to identify works and work sets based on the FRBR/LRM. Also, the available metadata were not suitable for the use of FRBRisation methods that make use of authority records for titles and authors. Hence, the metadata enrichment was a necessary step.

We proceeded as follows:

1. Delineate a dataset consisting of scholarly monographs in the social sciences and humanities;
2. Extract a list of unique ISBNs (ISBN-10 versions transformed to ISBN-13, validated and deduplicated);
3. Acquire from OCLC WorldCat additional ISBNs (all ISBNs from OCLC records grouped with a single work identifier and all ISBNs from OCLC records that contain the input ISBN);
4. Identify work sets in the input dataset on the basis of an overlap of ISBNs;
5. Manually validate the overlap of ISBNs using basic metadata (title, author);
6. Assign a unique identifier for each unique work;
7. Retrieve additional metadata (year, language, publisher, edition, format) for each unique ISBN from Goodreads.

Data processing, enrichment, and analysis was carried out in R. For manual data processing tasks we used MS Excel and Notepad++.

3.3. *Analysis*

The unit of analysis present here is work as understood within FRBR/LRM. This means that we describe the identified work sets as distinct works. For the operationalisation of the term 'work' we assume that in our dataset all editions and translations are expressions of the same work. Sources of metadata for individual works are the four national databases. We treat the earliest record in a national database as the first edition. Even though this approach might not always be accurate, it is sufficient for the identification of works that are of potentially higher scholarly value—the goal of the approach presented here.

The datasets have been analysed according to the metadata categories that could lead to insights relevant for research evaluation,—i.e., the number of ISBNs, publisher, and language, and presence in WorldCat.

Concerning the field 'publisher', in each national database, it is recorded as a free text field, resulting in 5319 unique values. Data from this field were standardised and recoded. All values for the field 'publisher' that appeared 5 times or less (n=3695) were assigned to the category 'Other'. All values for the field 'publisher' that contain ";" (n=848) were assigned to the

category 'Multiple publishers'. Remaining values were checked for variants of the same publisher and, where applicable, recoded using a single value (e.g. 'Allen Lane', 'Allen Lane, an imprint of Penguin Books', and 'Allen Lane, Penguin Books' were recoded as 'Allen Lane'). The final set consisted of 478 publishers and two additional categories—'Multiple publishers' and 'Other'. The field 'language' (406 unique values) was standardised according to ISO 639. All values referring to multiple languages were recoded to the category 'multiple languages'. The resulting set of values consisted of 46 language categories.

4. Findings

4.1. Metadata enrichment for identification of work sets

The metadata enrichment exercise led to the results summarised in Table II. The 16577 unique records on scholarly monographs in four national databases for research output led to the identification of 16294 unique ISBNs and 15091 unique works. Thus, on average there are 1.1 records per work and 1.1 ISBNs per work. In conjunction with the distribution of ISBNs per work per data source (Figure 1 on the left), this finding is in line with other studies that highlight that complex works are rather rare.

Table II also shows that the share of works identified in OCLC WorldCat is high for COBISS (98%), CRISTIN (97%), and VABB peer-reviewed (97%) thus indicating that WorldCat is a potential source for the enrichment of records in databases for research output. In contrast, for CROSBI and VABB not peer-reviewed the share of works in WorldCat is somewhat lower (72% and 68 respectively). This likely can be explained by the extent libraries that store the respective works, share their records in WorldCat. Further, we can see that the search for additional ISBNs resulted in, on average, 32% increase in the number of unique ISBNs. Also here, a variation can be observed in relation to the different databases: from 16% for CROSBI to 62% for VABB peer-reviewed.

Our original intention was to construct schematic representations of bibliographic relationships thus depicting the complexity and value of scholarly monographs. This requires information at the level of ISBNs: to which expression or manifestation does this ISBN refer? To acquire this information, we used Goodreads as this resource makes use of FRBR and provides. This study showed that less than a third of works could be identified in this platform. This finding made it clear that the suitability of Goodreads as a source for the enrichment of records in national databases for research output strongly depends on the popularity of this platform in a given context. For example, this source could be used for the enrichment of VABB peer-reviewed records where the coverage at work level is relatively high (87%). For comparison, due to the low coverage it clearly should not be used in relation to COBISS (16%) and CROSBI (10%).

[Table II Overview of the datasets and metadata enrichment exercise results]

In light of the results of the metadata enrichment exercise, we devised our strategy and developed a typology of scholarly monographs at the level of works. We propose four groups of works, which we have identified on the basis of criteria shown in Table III: Globally visible single-expression works (GV-SE), Globally visible multi-expression works (GV-ME), Miscellaneous (MISC), Globally invisible works (GI). GV-SE refers to works identified in WorldCat and with no more than 6 ISBNs; this is the largest group as it accounts for 82% of all works. Through manual exploration, we have identified that 6 ISBNs is a suitable threshold to distinguish between single-expression and multi-expression works. GV-ME is the category of

interest to research evaluation, along the lines of evaluative inquiry. This is a small group of works (n=389, 3%) with a relatively high number of ISBNs (Figure 1 right) that indicate the existence of multiple manifestations and, most importantly, expressions (revised editions, translations). The latter can be interpreted as an indication of a particular scholarly value. The remaining two groups—MISC (1%) and GI (15%)—cannot directly be used for construction of book metrics. Instead, we describe these groups in relation to specifics of our data sources and possible steps for their development in future. The group MISC refers to a sample of works that according to our criteria (Table III) should be part of GV-ME. However, following a manual exploration of these records, we highlight that it is open for discussion whether these works are scholarly monographs as seen in the context of book metrics and discussed above (i.e. long-form scholarship). We have identified them manually on the basis of the title, author, and, by looking up additional basic information about the content. Even though it is possible that works similar to those in group MISC are found also in GV-SE, we limit us to the main group of interest in research evaluation focus (GV-ME). The GI group are the works that could not be identified in WorldCat (n=2236; 15%); thus, identification of work sets was not possible due to (potentially) missing ISBNs.

[Figure 1 Number of ISBNs per work; by data source (left) and by group (right)]

[Table III Delineation criteria for groups of scholarly monographs]

[Table IV Number of works per data source by group]

Table IV reveals that there is a slight variation in the distribution of works across the four groups in relation to the four national databases. For example, the share of GV-ME works is 1% or lower for COBISS, CROSBI, and VABB not peer-reviewed. In contrast, for CRISTIN and VABB peer-reviewed the share is 6 and 10% respectively. This study cannot offer explanation for this variation, but this relatively higher share of complex works might be an indication of higher concentration of works that have attracted more attention (through translations and editions).

We included two datasets from VABB—peer-reviewed and not peer-reviewed—to determine whether this analysis reveals any patterns in relation to this characteristic. Table IV shows that the share of works that could not be identified in WorldCat is much higher for the not peer-reviewed dataset (n=980, 32% compared to n=41, 3% for the peer-reviewed dataset). A potential explanation could be sought in the perceived status of peer-reviewed publications in OCLC member libraries. We continue with a summary of main characteristics of each of the four groups.

4.2. *Globally-visible single-expression works (GV-SE)*

The works from this group, GV-SE, constitute 82% of all scholarly works in the dataset. Three-fourths of the works in this group also refer to single-ISBN publications. Those with several ISBNs, have different manifestations – i.e., paperback, hardcover copies, in addition to multiple e-book versions. On average, a work in this group has 1.5 ISBNs (*Md*=1*, SD*=0.9).

In terms of language use, we can see a noteworthy diversity: this group represents 44 different languages in total. Table V presents an overview of language use by group. The ten most often

used languages account for more than 95% of all works. For GV-SE, the share of works in English (20%) is nearly the same as the use of national languages from the four respective countries (regions). Slovene accounts for 25%, Croatian for 17%, Dutch for 13%, and Norwegian for 8% of all records within this group.

[Table V Overview of language use in scholarly monographs by group]

Works in this group are published by 473 different publishers. The largest group of records are attributed to the publishers' category from the dataset with less than 5 works in the dataset (category 'Other': n=3058). These can be small publishers as well as publishers that do not often publish the type of works represented here. Often (n=742), one can see multiple publishers listed for one work. Local publishers that occur frequently include the *Publishing house of the Research Centre of the Slovenian Academy of the Sciences and Arts* (*Založba ZRC SAZU*, n=330), the Norwegian *Universitetsforlaget* (n=240) and *Fagbokforlaget* (n=163), and the Flemish publishers *Intersentia* (n=189) and *Acco* (n=184). It is noteworthy that both *Acco* and *Fagbokforlaget* are specialised in the publishing of textbooks.

4.3. Globally visible multi-expression works (GV-ME)

This group accounts for a relatively small number of records (n=389; 3%). Nevertheless this is the group of records that is most relevant for research evaluation purposes. These are the works that typically have more than one expression (i.e., multiple editions and/or one or more translations); thus, can be regarded as having attracted more attention in national and/or international publishing realms.

Three fourths of records from this group have 6 to 9 ISBNs with an average of 8 ISBNs (*Md*=7, *SD*=2.8) and only 3% (n=14) have more than 14 ISBNs. These works are a relatively rare set of particularly influential works with a continued record of new editions and/or translations. The range of languages and publishers is much smaller in contrast to the works assigned to GV-SE. In total, the works from this group have been published in 15 languages with English as the dominant language (n=298; 77%; Table V). Amongst the 69 publishers in this group, we see *Routledge* (n=83), *Cambridge University Press* (n=43), *Ashgate* (n=33), *Oxford University Press* (n=9), *Sage* (n=7), and *Springer* (n=7). A substantial number of records is associated with the category '*Other*' (n=62).

For research evaluation, it might be of interest to examine works with the highest number of ISBNs. In Table VI we have extracted three works from each dataset with the highest number of ISBNs; among them we find two books by the renowned scholar Žižek Slavoj (from the COBISS dataset). It could be useful, therefore, in a real evaluation context to identify authors and titles with a high international value similarly to the study of Sapiro and Bustamante (2009).

It is, at the same time, interesting that several of the GV-ME works are textbooks. Table VII shows a sample list of 20 ISBNs identified in Goodreads for a work—a textbook—, which has the largest number of ISBNs in our sample—i.e., 'American Civilization; an Introduction' by David Mauk and John Oakland. Whilst the information on the year, publisher, language, and format was retrieved from Goodreads, the information on the edition was acquired manually either from the free text description in Goodreads or through a Web search based on the ISBN and other related metadata. This overview of ISBNs per work demonstrates a direction for research evaluation settings: such overviews, on the one hand, provide evidence of continued value of a particular work within the academic community. On the other hand, this overview can serve as a trigger for a discussion on contextual factors that have facilitated a work of this type.

[Table VI GV-ME works with the largest number of ISBNs, three works per data source]

[Table VII Sample list of 20 related ISBNs and their metadata identified in Goodreads for American Civilization: an Introduction by David Mauk and John Oakland; the work with the largest number of ISBNs (n=26)]

4.4. Miscellaneous (MISC)

The following paragraphs highlight some examples of works within this group. Most often in this group we find publications in law, where there are different conventions for registering multiple editions of the same work. A typical example is the loose-leaf publication format. In the Slovenian database, COBISS, we found an entry titled 'Slovenia' [IV], a 296-page monograph on labour law and industrial relations in Slovenia, which is part of the International Encyclopaedia for Labour Law and Industrial Relations. This encyclopaedia encompasses several thematic monographs and monographs focused on specific country. Authors are invited to continuously monitor the relevance of these monographs and update them once a year if necessary. A comparison of ISBNs for different national monographs on the publisher website shows that each has been assigned an identical ISBN. Such loose-leaf publications receive yearly additions, all with the same ISBN. This poses a challenge for book metrics reliant on ISBNs. Therefore, even though these publications do meet our definition of scholarly monographs, we suggest the use of designated category in the classification of publication types for loose-leaf publications in databases that are used for the development of book metrics.

We also find in this group translations or compilations of a world classic like *'Die Bernauer Manuskripte über das Zeitbewusstsein (1917/1918)'*, which is a collection of works by Edmund Husserl [V] . We find also dictionaries [VI], collections [VII], as well as edited volumes [VIII]. All these may well be scholarly monographs (as genre and not mode of issuance); however, it is clear that the understanding of the content of these works requires domain expertise.

Lastly, it is noteworthy that VABB records (both peer-reviewed and not peer-reviewed) account for over a half of records in this group (Table IV). This partly can be explained by the relatively higher number of publications are in law, which is a well-established and active discipline in Flanders as shown by earlier studies of publication patterns in Flanders (Engels *et al.*, 2012). Another explanation could be related to specific publishing traditions in humanities disciplines (e.g. theology and linguistics) that cannot be captured with the five broad publication types in use in VABB (Verleysen *et al.*, 2014).

4.5. Globally invisible works (GI)

The 'Globally invisible' group are the works that could not be identified in WorldCat (n=2236; 15%); thus, identification of work sets was hindered. Similar to the works in GV-SE, these have been published in a considerable range of languages (30 languages in total); where the majority have been published in Croatian (41%), Dutch (31%), and also in English (14%). In terms of publishers, similarly, most works are published by less common publishers (category 'Other': n=896) as well as local or national publishers such as the Flemish publishers *Acco* (n=212), *HIVA-KU Leuven* (n=104), and the Dutch *Kluwer* (n=64).

There can be multiple reasons why records are not found in WorldCat. The content of WorldCat is based on the content of catalogues from libraries that share their metadata in WorldCat. Thus,

the absence of a record in WorldCat does not relate to the quality of these works. Instead it reflects, firstly, the extent to which libraries or other organisations with collections of bibliographic records contribute their metadata to WorldCat. Another explanation may be sought from the accuracy of the metadata and from the ISBN in particular. For example, in the CRISTIN dataset for GI there is a work '*Illustrated Shakespeare*' by Stuart Sillars with an ISBN: 9781107330696. A search by title reveals that it is recorded in WorldCat, and registered with four other ISBNs (9780521878371, 9781107336308, 9781107334649, 9781107332980).

Some of the works in this group may be complex works and therefore of interest for research evaluation. However, in the absence of alternative sources of suitable metadata, a full analysis of this group is not possible.

5. Discussion and conclusion

Our goal in this study was to find a way to better appreciate the merits of scholarly monographs in research evaluation procedures that increasingly make use of quantitative approaches. Specifically, we proposed an approach to complexity-sensitive book metrics, exemplified by the identification of influential monographs (the group 'Globally visible multi-expression works', GV-ME). This could be achieved in all four databases thus showing that our approach can be applied in research evaluation settings that make use of national databases for research output.

Our proposed typology and specifically the group GV-ME can serve as a source of information for an evaluative inquiry into the international standing of scholarly monographs written in a specific country, institution, or a department similarly to the study by Sapiro and Bustamante (2009). For example, the higher share of monographs in the group GV-ME could be an indication of scholarly influence in a particular domain. Furthermore, the group GV-ME can be used to sample scholarly monographs to be evaluated in detail. As noted above, often expert review organised in panels is one of the main methods used in research evaluation especially when it comes to research where scholarly monographs play a central role. In evaluation settings, a challenge is posed by the number of books each reviewer ought to read. Our approach could be used to select particularly influential books (GV-ME) for reading by reviewers. We would like to, however, emphasise that this approach cannot be used to generate purely numeric indicators based on, for example, the number of ISBNs or presence in WorldCat or Goodreads, which leads us to the second key outcome of this study.

The current state of metadata on scholarly monographs in national bibliographic databases for research output does not enable the identification of work sets unless the data are enriched with additional metadata. None of the databases at the moment employ FRBR/LRM in their bibliographic control practices [IX], and none of the databases contain all ISBNs attributed to each registered publication (i.e. expression). Furthermore, the use of external sources for metadata enrichment is limited since not all records from national databases are included in international sources. While in WorldCat we could identify 85%, only about a third of works could be identified in Goodreads. Thus, at the moment, complexity-sensitive metrics for books as introduced here can be applied to small samples of works the metadata of which can be enriched manually.

These findings lead to our next point: the lack of accurate and rich bibliographic metadata for book metrics that make use of FRBR/LRM. Surely, neither the national bibliographic databases for research output nor WorldCat and Goodreads are intended for exercises such as the one we

pursue here. At the same time, the vast amount of bibliographic metadata collections curated in diverse settings are invaluable resources that upon enhancement can benefit not only research evaluation but also researchers interested in, for example, book statistics (Kovač *et al.*, 2017) or trajectories of works (Sapiro and Bustamante, 2009).

A possible strategy for the enhancement of records in national databases for research output could be based on partnerships with libraries. This study as well as earlier ones, have shown that the share of complex works is rather small (Bennett *et al.*, 2003; Hickey and Toves, 2005), thus making the enrichment practically feasible. For example, bibliographic control practices for scholarly monographs in national databases for research output would need to be revised to include title variations. In addition, authority control for all authors, titles, and publishers would enable the use of more fine-grained FRBRisation approaches. This enrichment could be facilitated through a partnership with OCLC, since WorldCat remains a resource with a global scope. Such a partnership could also address the fact that not all scholarly monographs can be found in WorldCat. This would not only benefit the national databases for research output, but also enable global access to works that currently remain invisible. This latter point is supported by a WorldCat user analysis that shows that students and researchers often use WorldCat for exploratory purposes (Wakeling *et al.*, 2017). An alternative strategy of metadata enhancement could be based on collaborations with local (or national) libraries that have more detailed metadata available in their collections and are better suited for the implementation of FRBR/LRM.

5.1. *Limitations and further research*

A limitation of our study relates to the identification of work sets. Here we relied on ISBNs and we limited ourselves to the identification of four broad groups rather than detailed mapping of bibliographic relationships across all the identities present in our dataset. Due to this, we could not identify those manifestations that are not always assigned an ISBN (e.g. types of e-books, audiobooks). In addition, our approach strongly relied on the accuracy of ISBNs in bibliographic records and the OCLC work-set algorithm. A manual search by title of the work 'American Civilization' (discussed above) in the UNESCO Index Translationum retrieved a Polish translation from 2006 that is also available in WorldCat, but was not linked to the English editions and therefore was not in our dataset. This could be related to our use of ISBNs to identify work sets. Thus, a further step in the development of an approach to complexity-sensitive book metrics could be an exploration of other FRBRisation methods that have been developed for use in library catalogues (Aalberg *et al.*, 2019; Hickey and Toves, 2009).

Here we limited ourselves to the notion 'work set', namely, bibliographic entities that are related within the boundaries of a single work. This approach could be expanded to bibliographic families that include also work-to-work relationships (e.g. book reviews, text adaptions) thus adding an additional layer of information valuable for research evaluation.

On a more conceptual level, this study has hinted to the ambiguity of the term 'scholarly monograph', which is not only defined differently in different use contexts, but differs also in terms of its usage both by authors and database staff. This ambiguity points to the need of a better understanding of both publishing traditions in different academic disciplines and bibliographic control practices in different bibliographic databases. Better understanding of this could be used to refine publication type classifications and/or inclusion criteria in use in national databases for research output.

5.2. *Conclusion*

It is undeniable that reading is the best manner to judge the worth of a book. Yet circumstances under which research evaluation exercises take place rarely allow for an in-depth engagement with large amounts of lengthy texts, thus opening space for more quantitative approaches. One such an approach is complexity-sensitive book metrics that make use of the concept 'work set' to identify influential scholarly monographs, as exemplified here.

Our study highlights that it is possible to produce novel insights about scholarly monographs recorded in national databases for research output but it is also clear that an approach of this type requires not only accuracy and consistency, but also a high level of detail in metadata on scholarly monographs. Databases for research output, typically, operate with a rather limited amount of metadata categories (with exceptions like COBISS). This is understandable given that these databases primarily are used to produce a limited range of quantitative metrics. At the same time, many of the challenges that are only recently encountered in research on book metrics, have been long discussed within the LIS community. And not just that, conceptual models such as FRBR and LRM exemplify a solution that can be of use of also in research evaluation. Therefore, if research evaluation procedures and book metrics in particular were to take more innovative routes, there is a need for an active dialogue between LIS and the neighbouring communities all of which share interest in bibliographic data.

I COBISS is a library information system with multiple modules. Data that we use in this study are retrieved from one of the modules—the bibliographic database COBIB. For simplicity of the text we use the name COBISS when we refer both to the bibliographic database COBIB and the system as a whole (COBISS).

II The definition of scientific monographs includes a requirement for publications to be peer-reviewed. However, we have no information available on criteria that are used to determine the peer-review status. Therefore, we assume that information on peer-review is not available.

III The Norwegian database CRISTIN has a smaller, more restrictive subset called Norwegian Science Index (also known as NVI). Even though we use a dataset consisting of monographs only from NVI, we refer to the database as CRISTIN as that is the more common used title in scholarly literature. The broader database CRISTIN, similarly to VABB, also contain data on both peer-reviewed and not peer-reviewed monographs.

IV This work can be found in COBISS by identifier '513633656'. The URL of the encyclopaedia: http://www.kluwerlawonline.com/toc.php?pubcode=IELL. See information on updates of the encyclopaedia here: https://ielaws.com/authors. Examples of two monographs with the same ISBN: http://www.kluwerlawonline.com/abstract.php?area=Looseleafs&id=IELL20110058 and http://www.kluwerlawonline.com/abstract.php?area=Looseleafs&id=IELL1993025.

V Can be found in VABB with the identifier 'c:vabb:18377'.

VI For example: '*Istrorumenian etymologies. Vol. 4: insect-names; color-names*' in CROSBI: 407314; also *Woordenboek van de Vlaamse dialecten : deel III : algemene woordenschat : aflevering 7 : het menselijk lichaam*' in VABB peer-reviewed: c:vabb:316983.

VII '*Norwegian Collections, part I: Anglo-Saxon Coins to 1016*' in CRISTIN: 1104452; '*Clavis patrum graecorum. 3A:a Cyrillo Alexandrino ad Iohannem Damascenum: addenda volumini II*' in VABB: c:vabb:269796 '

VIII '*Démocratie, dans quel état?*' COBISS: 1938823; '*People and Societies*' VABB: c:vabb:375262).

IX We note that authority records for works, based on LRM, are in the process of implementation in COBISS. Also the COBISS OPAC enables the identification of related editions and translations for some records. This identification is based on automated matching of bibliographic metadata (e.g. titles) and therefore strongly depends

on the quality of underlying metadata. For a substantial number of records with editions and translations, links to other editions and translations are not available in OPAC.

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