Computer Standards & Interfaces 41 (2015) 67–71

Contents lists available at ScienceDirect

Computer Standards & Interfaces

journal homepage: www.elsevier.com/locate/csi

Citation analysis of Computer Standards & Interfaces: Technical or also non-technical focus?

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ARTICLE INFO

Article history:
Received 22 April 2014
Accepted 8 February 2015
Available online 23 February 2015

Keywords:
Computer Standards & Interfaces
Citation analysis
Standardization research
Journal scope

ABSTRACT

This paper analyzes to which extent research published in Computer Standards & Interfaces (CSI) has a technical focus. We find that CSI has been following its scope very closely in the last three years and that the majority of its publications have a technical focus. Articles published in CSI constantly cite research from various technical disciplines, but there are also a limited number of references to non-technical literature. Mostly technical journals cite CSI papers, with a few exceptions of non-technical journals. We conclude that CSI stays within its scope of computer standards and interfaces interpreted in a technical sense.

1. Introduction

Computer Standards & Interfaces (CSI) is an international bimonthly journal that provides a platform for publishing research work in the areas of Standards, Information Management, Formal Methods, Software Quality, Software Process, Distributed Systems, Open Systems, E-Topics, Data Acquisition and Digital Instruments Standardization. This scope suggests that the journal has a technical focus, but also covers more general topics such as technical, social, and political aspects of computer standards, market impacts, cost benefit analysis, and relationships between national and international standard bodies. This paper investigates to what extent CSI is a technical journal by analyzing citations in the journal and references to the journal from between 2011 and 2013.

On its homepage, CSI states that the journal: "*provides information about activities and progress on the definition of computer standards, software quality, interfaces and methods, at national, European and international levels*; *publishes critical comments on standards and standards activities*; *disseminates user's experiences and case studies in the application and exploitation of established or emerging standards, interfaces and methods*; *offers a forum for discussion on actual projects, standards, interfaces and methods by recognised experts*; *stimulates relevant research by providing a specialised refereed medium*" [1].

Thus, CSI aims to publish papers that are primarily related to computer and software standards and interfaces, and focuses on publishing research within its specialized scope definition. Therefore, we would not expect articles to cite research from beyond the field of software, computer standards, and interfaces. Similarly, we would not expect articles which are outside the scope of software and computer standards to cite papers from CSI. However, the journal website adds: *CSI also covers general topics concerning the standardisation process, such as technical, political and commercial aspects of standards, their impact on the marketplace, cost/benefit analyses, legislative issues, and relationships among national and international standards bodies* [1]. Most of these topics are non-technical although they may relate to the technical contents of standards. Accordingly, we would expect non-technical papers to be included in the journal.

In this paper, we investigate the balance between technical and non-technical papers in the journal by performing a citation analysis of CSI from 2011 to 2013. We determine the number and types of journals that articles in CSI refer to and vice versa. This includes the journal's primary field (the first field in the case more than one field is mentioned), the articles' date of publication, and the name of the journal. We start with a brief introduction of the research field of computer standards and interfaces. Next, we describe our methodology, and then present our results. We conclude with a discussion of the results and the limitations of the analysis.

2. Computer standards and interfaces and its position in the field of research

Research on computer standards and interfaces is a subset of the broader domain of research on standards and standardization. De

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http://dx.doi.org/10.1016/j.csi.2015.02.008
0920-5489/

Vries [2] has mapped this field of research and the disciplines that study it — both mono-disciplines such as mathematics, physics, psychology and economics, and applied sciences such as engineering, business and medical science. Applied sciences may be related to the topic of standardization (in the case of CSI: software and computer standards or interfaces) or to standards-related activities such as standards development, standards acceptance, and standards implementation. These activities are non-technical and may be studied by other disciplines than those related to the technical contents of standards and interface specifications.

CSI addresses both software and hardware [1]. The term 'interfaces' is not defined explicitly but it is stated that hardware and software need well-defined interfaces. Once such interface definitions are intended and expected to be used repeatedly by the intended users, we can call them standards [5]. Standards for interfaces can be classified as compatibility standards [3,4]. CSI also addresses other software and computer-related standards such as quality standards. De Vries [5] shows that standards have in common that they provide criteria for entities because of their relations with other entities. In the case of CSI's research field, at least one of these entities is computer hardware or software. Within this field, all categories of standards listed by De Vries [4] and Blind [3] apply.

CSI was founded 36 years ago and is by far the oldest standardization journal. Other scientific journals in the field of standardization include the International Journal of IT Standards and Standardization Research (JITSR), the International Journal of Services and Standards, the (Korean) Journal of Standards and Standardization (a new journal with only a few papers in English), and the Journal of ICT Standardization (a mixed scientific and professional journal, also new).

3. Methodology

We use Thomson Reuters Web of Science for our citation analysis. Web of Science consists of seven datasets containing information gathered from thousands of scholarly journals, books, book series, reports, conferences, and more. It has indexed journals from all over the world and from a broad variety of disciplines such as agricultural engineering, life sciences, economics, psychology, and computer science. Hence, the databases can be considered to be multidisciplinary. In our analysis, we use two databases: Science and Social Science. Both databases have indexed journals dating back to 1900 and have bibliographic information and citation data.

Not all the articles referenced in CSI are indexed in Web of Science. Moreover, books, conference and proceedings papers are excluded from this analysis. Table 1 lists the total number of references and citations, indexed or non-indexed in Web of Science.

Next, using Web of Science, we determined the discipline of each article and citation and added it to the database. If the journal of the article or citation belonged to more than one discipline, we included only the primary discipline. Thus, we had two databases, one comprising articles, based on their primary discipline, cited in CSI, and one comprising citations, based on their primary discipline, which refer to CSI, and which are indexed in Web of Science. Table 2 lists the datasets that were used to categorize the data.

We limited our analysis to the primary discipline, the source of the references, and the citations. The discipline and the source are sufficient to track the interdisciplinary character of the journal. Table 3 shows the number of cited articles, the number of journals cited, and the number of primary disciplines that were cited. On average, each CSI article had 7.4 references.

Next we collected and categorized the keywords mentioned in each of the articles. We first categorized each keyword in the Science or Social Science category of Web of Science. Secondly, we divided the keywords in the Science and Social Science categories into sub-disciplines, which we identified from the journal's mission statement [1]. Table 4 shows the list of sub-disciplines and the number of keywords in each sub-discipline. Keywords that could not be categorized into any of the sub-disciplines were categorized as 'others'.

Table 1
Number of references and citations in CSI articles: indexed and non-indexed in Web of Science.

CSI	2011	2012	2013	Overall
Number of references	1722	1415	2002	5139
Number of references indexed in Web of Science	459	446	387	1292
Number of citations	84	30	3	117
Total number of citations indexed in Web of Science	39	18	3	60

4. Results

4.1. Articles cited by CSI

4.1.1. Primary discipline

Once the database was created, we ordered the database based on the number of articles indexed in a discipline, from highest to lowest. Table 5 lists the ten most cited primary disciplines by CSI articles. Out of the 1292 references, 781 references (about 60%) are from the first four most cited primary disciplines shown in Table 4.

If we look at the top ten most cited primary disciplines, only one of them belongs to the Social Science category of Web of Science, namely Business. Forty-five references are from this discipline and five of the disciplines are sub-disciplines of the category Computer Science. The top four most cited disciplines are the most cited for all three years — 2011, 2012, and 2013.

In total, 94 references belong to the Social Science category, and are from 17 primary disciplines (Supplementary material A). Table 6 lists of most cited primary disciplines. Fifty-seven references are from Business and Management disciplines, which account for approximately 61%. Psychology has the highest number of sub-disciplines that were cited.

By analyzing references and their primary disciplines, we observe that CSI focuses on citing articles in its own discipline or closely linked disciplines, which is shown by the number of sub-disciplines of Computer Science in the top ten most cited disciplines. However, CSI also refers to other Social Science disciplines such as Business and Management, which shows that CSI is, to a certain extent, interdisciplinary and sometimes refers to other, non-technical, disciplines.

4.1.2. Source journal

In the next phase of our analysis, we categorized the references based on their source journal to assess the extent to which CSI is multidisciplinary. Table 7 lists the top ten most cited journals. Supporting the primary discipline results, the journals that were most frequently cited belong to the top four primary disciplines.

Table 2
Datasets created to analyze research papers cited by CSI articles and those that cite CSI articles.

Dataset	Description
References_CSI	Research papers cited in CSI articles
Citations_CSI	Research papers that cite CSI articles
References_discipline	Research papers cited in CSI articles, categorized based on discipline
References_journal	Research papers cited in CSI articles, categorized based on journal
Citations_discipline	Research papers that cite CSI articles, categorized based on discipline
Citations_journal	Research papers that cite CSI articles, categorized based on journal