Evaluation of Scientific Disciplines for Turkey: A Citation Analysis Study

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Abstract. This study focuses on Turkish scholars information use. For this aim 197,687 Turkey-addressed publications in Web of Science (1928-2009) for four main scientific disciplines (pure sciences, engineering, social sciences and art & humanities) were analyzed using citation analysis. Differences between these disciplines and between their sub-disciplines in terms of average author number, multiple authorship, half-life, publication types, journals characteristics were determined. Findings of this study can be helpful for national-level policy making on scientific productivity that will help to reach international level.

Keywords: Information behavior, Turkish scholars, scientific disciplines, pure sciences, social sciences, engineering, arts and humanities.

1 Introduction

Each individual from any working area or academic discipline retrieve, commentate and synthesize information in different ways. Consequently, it is important to understand information behaviors of individuals, groups or disciplines. Information behaviors can not only be identified by using surveys or questionnaires, but also it is possible to evaluate publications and citations for the aim of revealing behaviors.

Information behaviors for disciplines are the subject of many studies in the literature. These studies concentrated on pure scientists and engineers at the beginning. After Second World War ended, controlling produced materials by scientists and engineers became vital for countries [1]. Concordantly, the first information behavior studies have written in these years for scientists and engineers. Even Wilson claimed that "the study of information-seeking behavior can be said to be the study of scientists' information-seeking behavior" in that period [2]. Studies on social scientists began with INFROSS project in 1967 at Bath University [3]. Lastly, the studies focused on the people working in arts and humanities fields. Therefore, it is possible to say that understanding people's information needs and behaviors have become important to customize information services according to people's needs.

The main aim of this study is to evaluate scientific disciplines which are pure sciences, engineering, social sciences and art & humanities in Turkey by using citation analysis. It is also aimed to reveal differences in scientific disciplines and

sub-disciplines. To achieve these aims, Turkey-addressed publications placed in Web of Science analyzed deeply.

2 Research Questions and Methodology

This paper seeks answers for following research questions;

- Do the publication types differ for each discipline?
- Are there any differences between disciplines and sub-disciplines in terms of average author number for each publication?
- Are there any differences between disciplines and sub-disciplines from the point of single/multiple authorship?
- What is the citation half-life of publications in terms of their disciplines? Are there any differences among disciplines and sub-disciplines?
- Which journals do the authors choose to publish their publications? Are the authors discriminating to choose high-impact journals?
- What are the mostly cited journals and their impacts for each discipline? Is it possible to draw a parallel between selected journals for publication and mostly cited journals?

To answer these questions, 197,687 Turkey-addressed publications placed in Web of Science between 1928 and 2009 were gathered. Data about authors, journals, affiliations and countries were unified for the aim of accessing accurate data. Then, data is divided into disciplines and sub-disciplines. 4 different disciplines are determined for general comparisons; pure sciences, social sciences, engineering and art & humanities. Furthermore, determined sub-disciplines are; physics, chemistry, biology and mathematics for pure sciences; history, economy, library and information science and education for social sciences; chemical engineering, computer engineering, electrical and electronic engineering for engineering; art, philosophy and humanities for arts and humanities. 54,242 pure sciences, 2,846 social sciences, 11,042 engineering and 316 arts and humanities publications were evaluated deeply to find out differences between these disciplines.

Unfortunately, it is inevitable to avoid inequality for the data on *Web of Science* by the reason of distribution of journals to the disciplines. For example, 54,242 Turkey addressed pure sciences publications indexed in *Web of Science* while arts and humanities have only 316. In addition, it is expected to find mostly produced publication type as articles by the reason of Web of Science's content. It is founded that 77.2% of the documents produced by Turkey between 1928 and 2009 are articles [4]. The main limitation for this study is quantitative differences between disciplines and the content of Web of Science. To avoid the limitations, each discipline was evaluated in itself and percentages were emphasized. And also, different types of publications instead of articles are also considered to compare publication types for disciplines.

3 Findings and Discussion

3.1 Publications and their Distribution by Year

Figure 1 shows the graph of annual percent of distribution of publications for Turkey for each discipline.

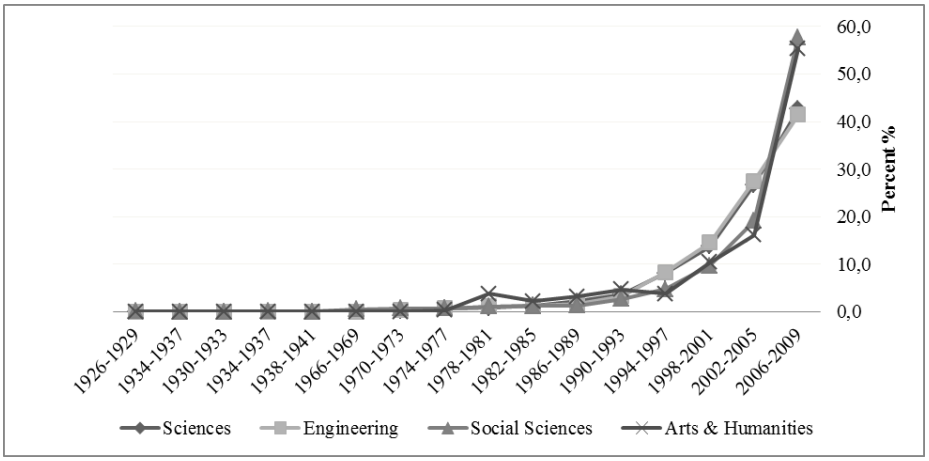

Fig. 1. Publication count for each discipline for Turkey

Publication counts have been increased since 1980s. Publication counts on each discipline approximately doubled for every next 4-year-period after 2000s. This situation can be based on two condition; foundation of The Council of Higher Education in 1981 [5] and the regional development policy of citation indexes [6]. The number of Turkish Journals in Web of Science has been raised enormously with the policy of regional development.

3.2 Document Types

Document types provide tips to understand information usage of disciplines. However, researches conducted by using citation databases generally reveal that the most produced documents are articles. The reason of this kind of findings is the content of the citation databases which is generally included journals. Unsurprisingly, the mostly produced document type for Turkish scientific disciplines is articles with the percent of 83.7% for science; 89.7% for engineering; 78.1% for social sciences and 79.4% for arts and humanities. Other document types and its distribution are shown on Figure 2.

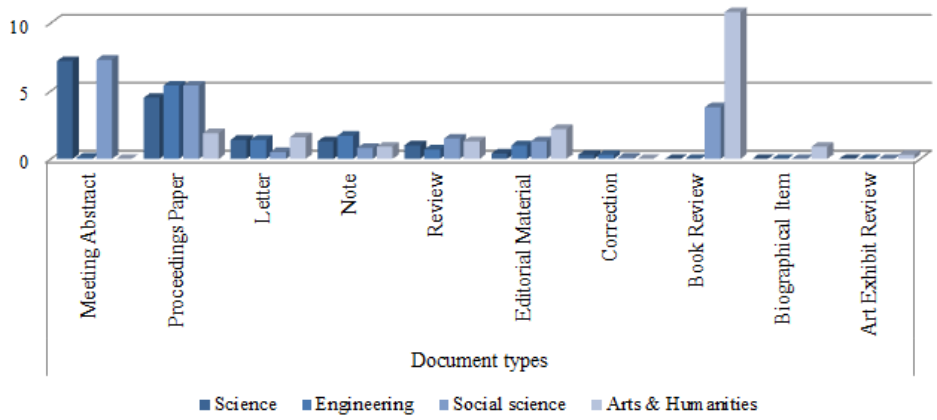

Fig. 2. Mostly produced document types for Turkish scientific disciplines

As it is seen on the Figure 2, letters, notes and reviews are produced for all the disciplines. Meeting abstracts are mostly written for the field of science and engineering. Book reviews, biographical items and art exhibit reviews are for arts and humanities field. The findings are important to show variety of document types and its distribution.

3.3 Number of Authors

Co-authorship can be accepted as the indicator of team work and scientific communication. According to our study, scholars who work for arts and humanities discipline prefer working alone. Maximum author count for arts and humanities literature is 10. Social sciences and engineering resemble each other from the point of co-authorship. Maximum author count for engineering is 101 (electrical-electronic engineering), for social sciences 105 (psychology). The median of author number for each publication is 2 for both disciplines. Sciences discipline is different from other areas. Biology authors give preference to working together (median is 4). Maximum author count is 105 for biology, 2010 for physics, 40 for chemistry and 10 for mathematics. Mathematics discipline is converging social sciences in the view of author numbers. Information about co-authorship is shown on Figure 3.

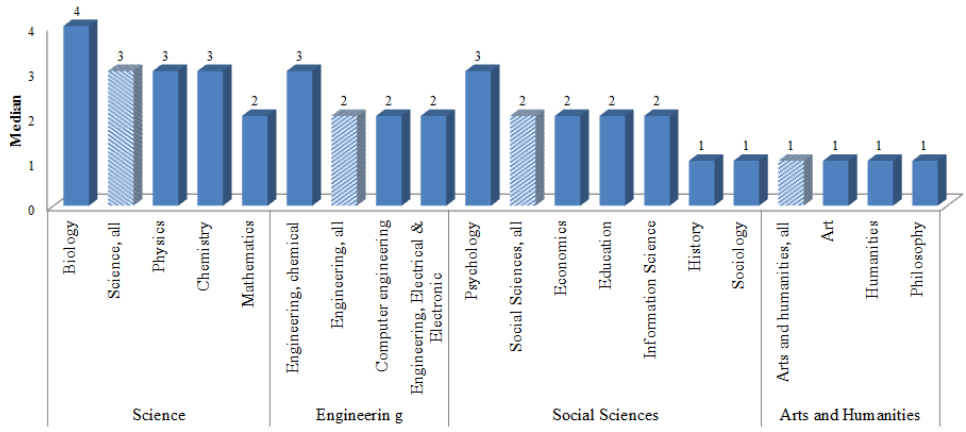

Fig. 3. Number of authors for Turkish disciplines

Findings of this study bear earlier studies out. According to a study that written in 2009 [7], single authorship is prevalent for social sciences (78%) and arts and humanities (93%). It is founded on this study that multiple authorship is preferred for engineering (62%) and sciences (64%) disciplines. Situation about single and multiple authorships of Turkish scholars according to disciplines is shown on Figure 4.

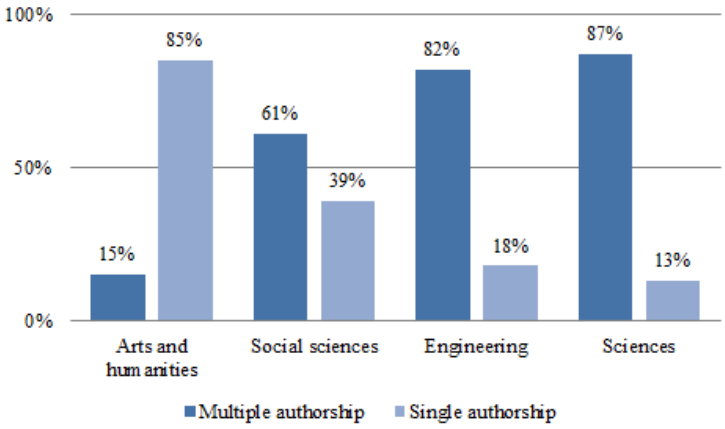

Fig. 4. Single and multiple authorships of Turkish scholars

3.4 Literature Obsolescence and Citing Half-Lives

Scientific publications are cited lower within the years. Therefore, it is needed to calculate half-lives to understand citation potentials of publications. Half-life is defined in the literature as “the median age of an article that were cited or citing” [8],

[9]. The meaning of citing half-life is identified by Thomson Reuters as "The citing half-life is the median age of articles cited by the journal in the JCR year" [10]. Half-lives of the citations according to disciplines calculated for this study. Figure 5 shows the half-lives.

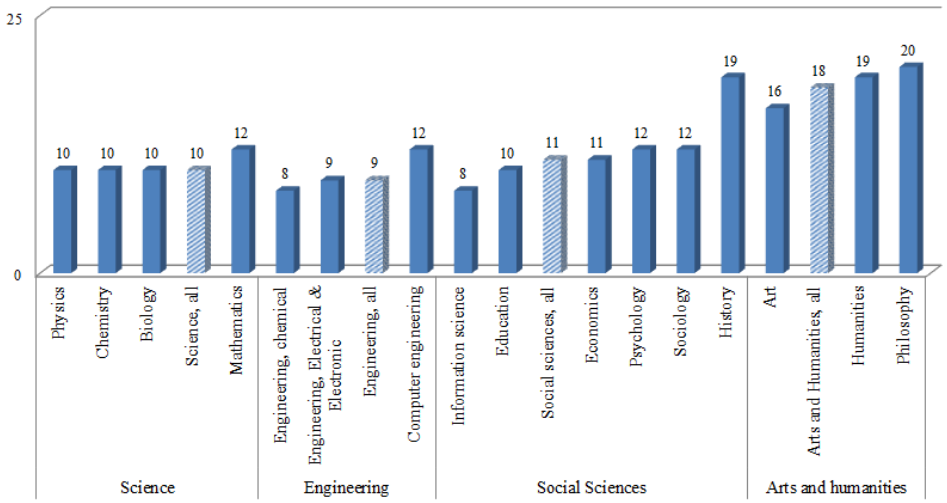

Fig. 5. Half-lives for Turkish disciplines

Our study identified that philosophy and history has the slowest half-life. Mathematics, history, art, information science and computer engineering areas show different characteristics in respect to their major areas.

3.5 Journal Choices of Authors

Information about journal choices of authors may be helpful to understand research trends of each discipline. Education, physics and computer engineering sub-disciplines, which reflect the characteristics of their disciplines' features, have been chosen for journal choices evaluation in the context of this study. Journal Citation Reports (JCR) 2012 edition was used as a data tool.

Turkish journals which are indexed in Web of Science generally have been chosen for publication by Turkish education scholars. It is seemed that impact factor is not an important determiner for choices. Table 1 shows the mostly preferred and the top journals of education field.

Table 1. Top and mostly preferred journals of education field.

Top journals	**IF***	**JR****	**NTP*****
Review of Educational Research	4.229	1	0

Learning and Instruction	3.337	2	3
American Educational Research Journal	3.104	3	0
Journal of The Learning Sciences	3.036	4	2
Academy of Management Learning & Education	3.000	5	0
Preferred Journals	**IF***	**JR****	**NTP*****
Hacettepe Universitesi Egitim Fakultesi Dergisi	0.350	173	141
Kuram ve Uygulamada Egitim Bilimleri	0.316	179	124
Egitim Arastirmalari-Eurasian Journal of Educational Research	0.455	142	123
Egitim ve Bilim-Education and Science	0.429	150	113
Turkish Online Journal of Educational Technology	n/a	n/a	46

*IF: Impact factor
**JR: Journal rank in the category
***NTP: Number of Turkey-addressed publications

Mostly preferred five journals are published in Turkey. However, Turkish scholars on education field published only five articles in top journals of JCR. It shows that locality of journals is more important actor than impact factors in education and social sciences field.

The criterion for journal selection for physics seems to be different from education. Impact factors is not an identifier of journal selection for Turkish physicians, however, they haven't preferred Turkish journals. Table 2 shows the selections of the physics scholars.

Table 2. Top and mostly preferred journals of physics field.

Top Journals	**IF***	**JR****	**NTP*****
Reviews of Modern Physics	44.982	1	1
Nature Materials	35.749	1	4
Advances In Physics	34.294	2	1
Nature Photonics	27.254	2	0
Physics Reports-Review Section of Physics Letters	22.929	2	3
Preferred Journals	**IF***	**JR****	**NTP*****
Acta Crystallographica Section E-Structure Reports Online	n/a	n/a	923
Energy Conversion and Management	2.775	4	449
Physical Review B	3.767	15	381
Acta Crystallographica Sectıon C-Crystal Structure Communicatıons	0.492	21	352
Journal of Sound and Vibration	1.613	10	318

*IF: Impact factor
**JR: Journal rank in the category
***NTP: Number of Turkey-addressed publications in this journal

Computer engineering field was evaluated by its journal choices. Impact factors are also insignificant for computer engineers like physicians. Table 3 shows the situation for computer engineering field.

Table 2. Top and mostly preferred journals of computer engineering field.

Top journals	**IF***	**JR****	**NTP*****
Acm Transactions on Graphics	3.361	1	1
SIAM Journal of Imaging Sciences	2.966	2	0
IEEE Transactions on Software Engineering	2.588	3	5
Communications of the ACM	2.511	4	7
IEEE Transactions on Services Computing	2.460	5	0
Preferred Journals	**IF***	**JR****	**NTP*****
Mathematical and Computer Modelling	1.420	26	83
Advances in Engineering Software	1.220	35	65
Simulation Modelling Practice and Theory	1.159	40	26
Mathematics and Computers in Simulation	0.836	64	19
Journal of Systems and Software	1.135	41	16

*IF: Impact factor
**JR: Journal rank in the category
***NTP: Number of Turkey-addressed publications in this journal

Journal information about Arts and Humanities field couldn't be collected for this study by the reason of non-existence of a JCR collection for A&HCI. It is possible to say that the journal selection criteria of scholars should be evaluated deeply to understand this picture according to Table 1, 2 and 3. Although the main reason of journal choices can be defined as feature of some disciplines, it is important to reveal other reasons for all disciplines. It can be possible to update national incentive system in case considering selection criterions.

4 Results and Evaluation

This study aimed to reveal the information use of Turkish scholars based on Turkey addressed Web of Science publications for four main field: pure sciences, engineering, social sciences, arts and humanities. Findings show that article is most preferred document type for these four fields but because the structure of Web of Science it is not right to generalize this finding. Co-authorship is most common for engineering and science, especially among biologists for science. Mathematicians have lowest rate of co-authorship among scientists. Arts and humanities have highest rate of single authorship. Half-life that shows literature use behaviour in a field is highest for arts and humanities and similar for science, engineering and social

sciences generally. History from social sciences is closer to arts and humanities according to half-life, on the other hand information science is closer to engineering. Turkish scholars prefer Turkey addressed journals for publishing their papers; impact factor is not a determiner for their choices. Findings of this study reinforce the findings of similar studies in the literature and can be used for scientific and financial decisions of universities and research institutions.

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