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Towards a consolidation of worldwide journal rankings – A classification using random forests and aggregate rating via data envelopment analysis[☆]



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ARTICLE INFO

Article history:

Received 11 July 2013

Accepted 5 August 2014

Processed by Podinovski

Available online 27 August 2014

Keywords:

Citation indices

Journal rankings

Journal lists

Research assessment

Data envelopment analysis

ABSTRACT

The question of how to assess research outputs published in journals is now a global concern for academics. Numerous journal ratings and rankings exist, some featuring perceptual and peer-review-based journal ranks, some focusing on objective information related to citations, some using a combination of the two. This research consolidates existing journal rankings into an up-to-date and comprehensive list. Existing approaches to determining journal rankings are significantly advanced with the application of a new classification approach, 'random forests', and data envelopment analysis. As a result, a fresh look at a publication's place in the global research community is offered. While our approach is applicable to all management and business journals, we specifically exemplify the relative position of 'operations research, management science, production and operations management' journals within the broader management field, as well as within their own subject domain.

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1. Introduction and objectives

The ranking of academic journals is a highly contentious element of research assessment, and thus a widely debated foundation stone for the ranking of individual research outputs and university rankings [1,2]. As it affects people's careers and aspirations, the issue is one of perennial topicality and debate. Findings are repeatedly challenged as lists arguably bear non-intended consequences, skew scholarship and foster academic monoculturalism [3], and the methodologies underpinning the various approaches are contested as they are open to non-intended use [4,5]. Within business and management, in recent years we have witnessed an increasing proliferation of rankings, listings and productivity indicators, drawing the attention

of a wide range of academic disciplines, including accounting, economics, finance, international business and marketing [6], of associations such as the Association of Business Schools (ABS and the Association to Advance Collegiate Schools of Business (AACSB), among others, but also that of dominant industry players such as Thomson Reuters' Web of Science, Elsevier's Scopus, and Google Scholar. These various parties are distinguished by unique interests. The commercial providers have started to monetize a rapidly expanding and lucrative global intelligence information business by building on the academic 'gift economy' [7] – collecting institutional profile information and then selling it back to the institutions for strategic-planning purposes [8]. However, the aim of this paper is not to go into aspects of 'use and abuse' or epistemological positions regarding journal rankings [2,4]. Instead, given their broad adoption in today's academic practice, we address some distinct methodological shortcomings of the previous attempts to rank journals and contribute to the development of a more suitable methodology, which in turn, can be used to gauge the relative standing of individual journals more realistically.

There are three conventional ways of assessing journal quality: (i) subjective (perceptual), (ii) objective (citation-based) and (iii) a combination thereof (hybrid). All three conventional ways feature well-known methodological limitations [9–11]. Recently, a fourth

[☆]This manuscript was processed by Associate Editor Podinovski.

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approach has gained momentum – the ‘meta’-ranking approach – which, like the hybrid approach, is intended to provide a balanced view by delivering a composite journal ranking (cf. [12,13]). In contrast to the hybrid studies, which usually combine a few rankings or ratings and often involve the hand-collection of perceptual data, meta-analyses typically rely on a comprehensive selection of existing, in many cases reputable, rankings or ratings, and aim to deliver a reproducible outcome (cf. Table 1). As outlined, the existence of journal rankings is often – justifiably – contested on philosophical grounds, and there is the fundamental question whether possible distortions in terms of scholarship and unintended consequences of ranking exercises (see e.g. [2]) may offset the advantages of increased manageability of scholarly outputs. Indeed, the emergence of meta-rankings can be seen as a result of the sheer volume and range of diverse lists that are – counter to the original motivation for developing them, which was to improve academic resource ‘management’ – proving to be unmanageable outside their respective academic institutions and often include different selections of journals. Within the academic community there seems to be agreement that if rankings are being used, the agenda should be the pursuit of a rigorous and objective perspective, based on state-of-the-art methodologies, free of individual stakeholder interests in this contentious area.

However, despite the advances made by meta-studies, a number of shortcomings remain. These include (i) arbitrary inclusion or datedness of journal lists; (ii) over-reliance on citation data; (iii) limited coverage in terms of disciplinary focus, number of journals and number of lists included; (iv) inadequate treatment of missing data and unsophisticated imputation methods; (v) treatment of ordinal rank data as metric; (vi) choice of ranking categories.

In the present study, we elaborate an approach that addresses these shortcomings while combining the strong features of existing studies, extending these and adding novel features. Therefore, we substantiate the methodological underpinnings to the current debate on journal rankings. We (i) extend recent work and offer an aggregate journal ranking based on a comprehensive number of journals, (ii) cover a significant number of disciplines within business and management, and (iii) deploy a unique methodological approach and integrate subjective and objective rankings with a focus on systematism and the production of comprehensive journal rankings. Specifically, this is the first meta-ranking to feature both the random forests framework (a non-parametric state-of-the-art predictive learning method) for missing data imputation and data envelopment analysis (DEA) (an established non-parametric approach to performance evaluation of peer entities) for the aggregation of rankings. This paper is decidedly focused on the methodological advancement of existing journal rankings. Thus, our final aggregate journal ranking outcomes (see Table 5) can be seen as a frame of reference for a substantive discussion and objectification of journal rankings, which is otherwise rather politicized.

The paper is organized as follows. The next section provides a critical review of objective, subjective and hybrid approaches to journal ranking and rating. Following this, Section 3 provides an overview of the major meta-ranking studies. Subsequently, in Sections 4–6, we present our novel meta-approach to journal ranking and rating, discuss its specific methodological advancements and apply it to our data set of journal rankings and ratings. This involves dealing with issues of database compilation, data missingness and imputation methods, classification trees, random forests and the subjection of the data to DEA (for full modeling and computational details, please refer to our working paper [78]). Section 7 concludes with a discussion of main results of our study and their implications.

With particular emphasis on operations research, management science, production and operations management (OR/MS/POM), we apply the method to ascertain the relative positions of journals

within the broader business and management discipline, as well as the relative position within the OR/MS/POM field.

2. Review of objective, subjective and hybrid approaches to journal ranking and rating

With regard to *objective* ranking, issues arise around the analysis of citation data. The Impact Factor delivered by the Journal Citation Reports [14] – defined as the number of cites received in the given year by an average article published in the given journal within a pre-defined number of preceding years – is the most widely accepted citation-based measure for “significance and performance of scientific journals”. It is widely acknowledged for its comprehensibility, robustness and availability [15]. Yet, it has received a considerable amount of criticism in the literature, connected to the accuracy problem in collecting citation data, undifferentiated treatment of citations, biases due to different maturing of published work across different journals, inaccurate definition of citable work and differing citation habits across different sub-disciplines. Further criticism includes biasedness towards journals with lengthy articles [15], see also [16]; and a selective disciplinary and geographical coverage [17,18]. Some of these deficits have recently been addressed by introducing a newer, prestige-oriented metric called Eigenfactor Score [19] which augments the Journal Citation Reports, and the emergence of Scopus – a citation database by Elsevier which offers a broader journal coverage together with new citation indices Source-Normalized Impact per Paper (SNIP) and SCImago Journal Rank (SJR). These aim to account for discipline-related citation habits and the prestige of the citing journals, respectively [20,21]. Yet, and despite these advancements, extensive discussions of the underlying methodological issues raise concern of the sole reliance on citation-based analysis in journal ranking exercises. This is because important work may be considered as “common knowledge” and is sometimes left uncited – with acknowledgment given to other work or citation counts frequently representing simply fashion and herding within the academic community which implicates that citing does not necessarily imply influence [9,22,23]. There are also problems of selective citations and the opportunity for self- and mutual citations, a poor association between the quality of a journal and that of individual articles in it, as well as possible subjectivity which can be pertinent to the analysis based on the objective citation data [5,24,25]. Regardless of these shortcomings, the citation impact factor remains an important indicator in the academic community to assess journal quality.

Subjective, or perceptual, rankings are developed via opinion surveys among the experts within an institution, a society, or a research network and may be motivated by the needs to elaborate a basis for institutional decision making and evaluation purposes as well as to provide guidance within particular disciplines [1,26,27]. For these reasons, a variety of rankings exist which are tailored to the needs of a particular institution or a discipline [10,26–28]. Generally, perceptual rankings alleviate the problems pertinent to citation data, and explicitly capture the *perceived* quality of journals [5,29]. On the other hand, they are prone to biasedness in the experts’ judgments – due to the institutional focus or self-identification with particular journals [11,26]. Furthermore, the coverage of perceptual lists is often restricted to a particular discipline or by institutional preferences [26].

Due to the shortcomings of the above two approaches, the *hybrid* lists – which in some way combine subjective and/or objective data – have gained attention in the literature (e.g. [13,29,30]). Indeed, pooling data that originates from different sources helps to produce a more balanced view and is seen as a desired approach [13,27,31]. However, hybrid ranking lists typically have a particular disciplinary or geographical focus; they

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