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Research Article

Quantity and Quality in Saudi Research: Single- versus Multi-Authored Journal Articles

Awatif Alruwaili[1], Ali H. Al-Hoorie[2], Mohammed Mohsen[3,*]

[1]Department of Languages and Translation, College of Humanities and Social Sciences, Northern Border University, Arar, SAUDI ARABIA.
[2]Jubail English Language and Preparatory Year Institute, Royal Commission for Jubail and Yanbu, Jubail, SAUDI ARABIA.
[3]Department of Educational Science, College of Education, Qatar University, Doha, QATAR.

ABSTRACT
Collaboration constitutes a cornerstone of modern academia, fostering the dynamic exchange of ideas and expertise among researchers. The present study investigated the quantity and quality of single- versus multi-authored publications by scholars affiliated with Saudi higher education institutions. The analysis focused on the number of publications, journal impact factors, and citation rates for the period 2010-2021, based on data from the Web of Science Core Collection. The results revealed two distinct cultures: collaboration was more dominant in the social sciences-including management, economics, psychology, and law-whereas single authorship was more prevalent in the arts and humanities, including education, linguistics, and literature. The findings also showed that multi-authored publications were more than twice as numerous as single-authored ones, appeared in journals with higher impact factors, and received higher citation rates. These findings carry important implications for strengthening Saudi Arabia's research culture and modernizing formal promotion requirements.

Keywords: Authorship, Citation, Collaboration, Impact factor, Productivity.

Correspondence:
Mohammed Mohsen
Department of Educational Science, College of Education, Qatar University, Doha, QATAR.
Email: m.mohsen@qu.edu.qa

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INTRODUCTION

Publication is an essential element of academic life, shaping career prospects such as promotion and tenure. Growth in research output is also desirable because it contributes to the advancement of scientific knowledge and facilitates its dissemination (Bornmann *et al*., 2021). At the same time, academics operate within a "publish or perish" culture that has intensified competition and led to a significant increase in research output across disciplines (Fanelli and Larivière, 2016). Over recent decades, collaboration has also expanded, particularly in the natural and applied sciences, where the complexity and cost of large-scale projects often require interdisciplinary teamwork (Thelwall and Maflahi, 2020). Collaborative research tends to increase the likelihood of publication in high-impact journals and to achieve greater visibility through higher citation rates (Al-Herz *et al*., 2014; Kalwij and Smit, 2013). However, some scholars argue that collaborative work is not always equally valued in academic evaluation systems, as single-authored research is often perceived to involve greater individual effort (see Barlow *et al*., 2018; Sahu and Panda, 2014). Despite these debates, evidence suggests that co-authored papers tend to achieve higher citation rates than single-authored ones (Thelwall and Maflahi, 2020), although the pattern may vary across disciplines and countries (Shehatta and Mahmood, 2016).

Against this background, the present study compared single- and multi-authored publications produced by scholars affiliated with Saudi higher education institutions in terms of both quantity and quality. In this study, we use "quantity" to refer to publication frequency, whereas "quality" refers to the impact and visibility of the publication, as reflected in citation rates and journal indices. The analysis focuses on several quality indicators in the social sciences and the arts and humanities to identify emerging patterns of collaboration in these disciplines (see more below). The analysis focused on several quality indicators in the social sciences and the arts and humanities to identify emerging patterns of collaboration in these disciplines. Understanding these patterns can offer insights into the evolving research culture in Saudi Arabia and inform institutional policies that seek to enhance research productivity and quality across different academic fields.

Evaluation of Academic Research

In 1962, Polanyi argued that scientific merit should be evaluated based on three dimensions: plausibility, value, and originality. Plausibility refers to consistency with current scientific knowledge and to the claims, arguments, or findings presented being logically sound. Value refers to the reliability and validity of the conclusions

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as well as their degree of contribution to the overall human knowledge base and their specific field of inquiry. Originality is related to the unexpectedness of the findings according to the scientific community. While these criteria make sense in theory, judging scientific merit in practice is rarely a straightforward process. The purpose of peer review, again in theory, is to act as a safeguard against research that does not meet scientific standards, ensuring that research accepted for publication is vetted and its conclusions are valid and accurate. In reality, however, the peer review process is subjective, slow, unsystematic, and ad hoc (Nosek and Bar-Anan, 2012). Rejected papers usually manage to eventually appear somewhere given the author's persistence and willingness to pursue alternative avenues.

The tacit acknowledgement of the problematic nature of the peer review process led to the search for alternative approaches to evaluate the quality of research post-publication. Bibliometric indicators were therefore introduced as an attempt to assess and quantify the quality of individual publications, authors, and journals. Nevertheless, there is widespread agreement about the limitations of such bibliometric indicators (Aksnes *et al.*, 2019; Belter, 2015; Bornmann *et al.*, 2021) due to variation related to disciplines, document types, and individual authors. For example, research published in English language and research reporting reviews rather than primary studies typically enjoy higher visibility and circulation among the scientific community, even though quality per se may not be proportionally higher (Thelwall and Maflahi, 2020). Research by well-known figures in a field similarly also tend to receive more attention than that by more junior scholars.

Two of the most commonly used bibliometric indicators are citation counts for individual papers and impact factors for journals. Citation count refers to the times the publication has been referred to in subsequent research while an impact factor is the average number of citations to the journal relative to the number of its citable documents (Al-Hoorie & Vitta, 2019). Both of these indicators have had their share of criticism. Both are susceptible to factors other than quality, such as excessive self-citation, questionable editorial practices like coercive citations, the "hotness" of the topic, the author's influence and social network, let alone the citation conventions and expectations within different fields (Chen *et al.*, 2021; Guan *et al.*, 2017; Szomszor *et al.*, 2020). Such indicators are therefore vulnerable to manipulation through strategic behavior aiming to artificially inflate them (Vîiu, 2016). Indeed, according to Campbell's law, once a quantitative indicator is implemented as a basis for decision-making, it becomes prone to hacking, gaming, and distortion, which can ultimately undermine its validity as an indicator (Al-Hoorie & Hiver, 2025).

Nevertheless, these bibliometric indicators are now a routine part of decision-making at higher education institutions. These decisions include hiring, promotions, tenure, and policy-related decisions in general. This attitude is reinforced by international university rankings that rely heavily on the quantity of publications by faculty as well as their quality as assessed by such bibliometric indictors (see for example Shanghai methodology for ranking https://www.shanghairanking.com/methodology/arwu/2025). The convenience afforded by these bibliometric indicators additionally mean that deans no longer have to read scientific output closely in order to judge its scientific merit when they have numbers to tally for annual reports and for potential donors.

Despite these limitations and despite the concept of research quality being inherently complex and multidimensional, this study adopts an operational definition consistent with established bibliometric practice. Quality is understood here as the *impact* and *visibility* of a publication within the scholarly community. Following previous bibliometric studies (e.g., Thelwall and Maflahi, 2020; Shen *et al.*, 2021), we measure quality through two complementary indicators: citation counts and the indexing tier of the journal in which the work appears, as reflected in its impact factor within the Web of Science Core Collection. Citation counts capture the extent to which a publication has influenced subsequent research, whereas journal indices and impact factors provide a proxy for the perceived prestige and selectivity of the publication venue. While these indicators do not capture every aspect of research quality-such as methodological rigor or originality-they remain among the most widely recognized and empirically verifiable metrics for assessing scholarly influence at scale.

Single- versus Multi-Authored Publications

Research has examined the increase in collaboration, the reasons for this increase, and the impact it has had on publication quality. Researchers collaborate for various reasons, including the desire to increase the impact of their research and improve the scientific rigor and generalizability of its results. Collaboration may also result from the multidisciplinary nature of the research project and the internationalization of research (Barlow *et al.*, 2018). Large-scale research that involves data collection from multiple sites helps enhance statistical power, increase the generalizability of the results, and facilitate conducting meta-analysis (Vitta *et al.*, 2022). Collaboration also reduces the cost of performing research and saves time by dividing labor and funds among collaborators (Franceschet and Costantini, 2010). Team members are able to share multiple publications, which can increase each individual's list of publications as well as citation rates. Since each team member is still expending the same amount of effort they would have spent on solo research, this strategy becomes "a virtually cost-free strategy against pressures to publish" (Fanelli and Larivière, 2016, p. 9). Preregistered multiple-laboratory replications also tend to be superior to standard retrospective meta-analyses (Kvarven *et al.*, 2020). Due to the benefits of collaborative research, there was an expectation that single

authorship would become extinct (Price, 1963) and in some fields this extinction "appears imminent" (Barlow *et al.*, 2018, p. 1).

Still, there are also certain factors that have helped sustain the practice of single-authored publications. A primary reason for the continuation of this practice is credit allocation (Sarsons *et al.*, 2021). Especially as the size of the research team increases, verification of meaningful contribution becomes harder which in turn results in institutional bias against multi-authored papers and consequently disincentivizing this practice (Borer *et al.*, 2023). Female researchers in particular face an additional challenge when they collaborate with male co-authors (Kwiek and Roszka, 2022) as credit tends to be attributed to the male authors. Although single-authored publications are decreasing in number, these factors may therefore have an influence on stabilizing this trend (Barlow *et al.*, 2018).

Ethical issues also arise in the context of multi-authorship. The publish-or-perish pressure that many early-career academics face leads to collaboration. Abramo *et al.*, (2014) argue that a Matthew effect may exist in this process since the involvement of a well-known author can increase perceived credibility and citations. Further, the relatively high citation rates of co-authored publications may also represent excessive self-citation (Franceschet and Costantini, 2010). Indeed, the co-authorship trend has ethical and problematic aspects, such as "abuses, disputes and diminished accountability" (Sahu and Panda, 2014, p. 2162), that have not had their fair share of discussion and investigation.

Empirical analysis generally tends to support the expectation that co-authored publications have higher impact. Wuchty *et al.*, (2007) analyzed 19.9 million articles in the Web of Science (WoS) database and found that co-authored publications have higher citation rates than single-authored articles. Larivière *et al.*, (2016) ran an analysis over a more extended period (1900-2011) and reported similar results. A meta-analysis by Shen *et al.*, (2021) found a significant positive though weak correlation between scientific collaboration and citation count. This relationship varied by discipline and by country in that the correlation was stronger for the life sciences and biomedicine and for researchers from developing countries. Regardless, both single and multi-authored contributions provide value to the academic community.

Academic Research in Saudi Arabia

Saudi Arabia is aiming to improve its global knowledge-based economy and to reduce its oil-dependent economy. This has led to an increase in the number of universities from 8 in 2002 to 60 in 2021, with 42 public universities and 18 private universities. Thirteen of these universities were listed among the top 1000 universities worldwide in the Shanghai ranking of 2025, with two of them achieving positions within the top 200th. Additionally, 10 of these universities were ranked within the top 500th in the world according to the Times Higher Education rankings, with one of them securing a position within the top 100 universities worldwide (Times Higher Education, 2023).

In the context of Saudi Arabia, excellence in academic research is emphasized and encouraged through a generous budget. Saudi Arabia has supported research by launching three phases of a scholarship program: the first started in 2005 (to encourage Saudi students to continue degrees that meet the needs of the labor market), the second in 2011 (the same as the first phase, but with an increased number of opportunities), and the third in 2015. The third phase, which ended in 2019, was known as 'Your Job, Your Mission' in which there was a coordination between the Ministry of Education and the labor market whereby every candidate would have a job after they obtained their degree. By the end of this program, a new path of scholarship was launched (Ministry of Education, 2023), in which scholarships were offered by different organizations and institutions.

Higher education institutions in Saudi Arabia adopt a point-based system for promotion. The applicant must achieve the minimum amount of research work required for promotion, which is four points for an associate professor and six for a full professor. A point is equal to one single-authored publication. If the publication is by two authors, it is worth half a point, and if the research was carried out by more than two individuals, it counts as one-quarter for each author and one-half for the principal author. Some universities stipulate additional conditions such as publishing a certain number of articles in indexed journals. Thus, single-authored publications are valued more than co-authored publications, considering that the former grants a full point.

The co-authorship trend in Saudi Arabia seems similar to that in other countries. Shehatta and Mahmood (2016) found that in Saudi Arabia, the number of co-authored publications is higher than the number of single-authored publications in the areas of clinical, pre-clinical and health sciences, engineering and technology, life sciences, physical sciences and social science. For the arts and humanities, the trend is towards solo authorship. Nevertheless, the citation rates of co-authored publications are also higher than those of single-authored publications.

Research investigating the productivity of publications in the Saudi scientific community is limited. Shin *et al.*, (2012) investigated international collaboration among Saudi academics in the university, industry, and government sectors using a triple-helix model. They found a rapid increase in academic publications as well as an increase in international collaborations since the late 2000s. Al-Ohali and Burdon (2013) discussed the issues in relation to the balance between internalization and preserving local culture and social identity, noting that internalization "carries risks as well as rewards" (p. 166). Shehatta and Mahmood (2016) examined the relationship between research productivity and collaboration in Saudi Arabia over the period 1980-2014 and found that there was an increase in co-authored publications as

well as growth in international collaboration, which enhanced the publication quality in terms of increased citations and higher impact factors. Haq *et al.*, (2020) analyzed the growth of publications in the health sciences, also showing a significant increase in publications along with international collaboration.

The above few studies dealt with productivity and international collaboration. Only two of these studies adopted a bibliometric approach (Haq *et al.*, 2020; Shehatta and Mahmood, 2016). The former aimed to evaluate the collaboration patterns, citation rates and number of publications as criteria of the quality of research output using WoS database, and the latter examined the growth of health research using the Scopus database. Both studies indicated that publications in Saudi Arabia were rapidly increasing in number, even though the samples and conditions of both studies were different. In addition, the international collaboration and multi-authored publications also increased, and Egypt and the USA were the most collaborative countries in both studies. Most research recorded by Haq *et al.*, (2020) was published in local journals that did not have impact factors while Shehatta and Mahmood's (2016) study utilized the data extracted from the WoS.

This study investigated the quantity and quality of single-authored versus multi-authored documents by authors affiliated with Saudi institutions in the areas of social science and the arts and humanities. Also, it aimed to find out if multi-authored documents publications were associated with higher research productivity as well as higher quality in terms of citation rates, venue of publications, impact factors. The present study therefore aimed to answer the following questions:

- How do single-authored documents compare to multi-authored documents in terms of quantity?
- How do single-authored documents compare to multi-authored documents in terms of quality?

METHODOLOGY

Data for the analyses were sourced from the WoS database, specifically focusing on Saudi scientific contributions from 2010 to 2021 that are indexed in the Web of Science Core Collection across selected subcategories. The collection process utilized multiple indices within WoS, including the Science Citation Index Expanded (SCI-EXPANDED), the Social Sciences Citation Index (SSCI), the Emerging Sources Citation Index (ESCI), and the Arts and Humanities Citation Index (A&HCI). SCI-EXPANDED and SSCI are considered the most prestigious indices within Web of Science Core Collection, adhering to stringent impact criteria (Mohsen *et al.*, 2023). In contrast, ESCI is considered the least rigorous among these indices. For this study, the dataset was refined to include only articles and review articles from Saudi Arabia. A targeted selection of sub-categories was made, including economics, education, law, management, psychology, language, linguistics, and literature. These were chosen for their relevance to social sciences and humanities. All data were imported into an Excel spreadsheet for authorship analysis. To enhance clarity, the categories of Linguistics and Language and Linguistics were consolidated into a single category termed Linguistics. Data were extracted in December 2022, and the final dataset comprised 5,090 documents, further categorized into Single-Authored Documents (SADs) and Multi-Authored Documents (MADs) and numbering 1,359 and 3,731, respectively.

RESULTS

In order to answer the research questions, a comprehensive bibliometric analysis was conducted, focusing on both the quantity and quality of publications. The quantitative metric assessed the total number of published documents, while the qualitative metrics evaluated the impact of these publications through citation counts and journal rankings. The analysis compared SADs and MADs.

Quantity

A total of 5090 documents were identified in the bibliometric search. Of these, 1359 documents (26.70%) were SADs while 3731 documents (73.30%) were MADs with at least one author affiliated with a Saudi institution. Table 1 provides a summary of the distribution of SADs and MADs across various research categories.

Table 1 shows that there are more MADs in management, economics, psychology, and law disciplines. In contrast, there are more SADs in education, linguistics, and literature. This suggests two different cultures of research practices. The next section compares the quality of research produced by these two cultures.

Quality

We assessed the quality of journals by examining their indices on the Web of Science Core Collection. We identified the top ten most productive journals in terms of highest impact factor according to Journal Citation Report (JCR) 2021, which both SADs and MADs were published. Additionally, we highlighted the top ten most cited articles for both SADs and MADs. Table 2 provides a detailed overview of the highest indices of journals for both SADs and MADs.

Table 2 reveals that about 66% of SADs were published in journals indexed in ESCI. In contrast, journals indexed in the A&HCI had the fewest SADs. The data further indicate that 77.38% of MADs were published in journals indexed in the top tiers of the Web of Science (WoS), specifically in the SSCI, SCIE, or A&HCI. Only 32.62% of MADs appeared in journals indexed in ESCI, the least rigorous index within WoS. When compared to SADs, a smaller proportion of MADs were published in ESCI-indexed journals.

Regarding the journals where SADs and MADs appeared, it is noted that only two journals indexed in the SSCI were the highest venues where SADs were published while journals indexed in the ESCI were the most frequent venues for SADs. The most productive journal for SADs was the *Arab World English Journal*, with 231 articles, accounting for 17% of SADs, followed by the *International Journal of English Linguistics*, with 107 articles or 7.87% of SADs. The latter was indexed in ESCI in 2016 but was discontinued in 2019. Only two SSCI journals published 46 articles, making up 3.38% of SADs, while six ESCI journals published 441 articles, accounting for 32.45% of SADs. These ESCI journals are not covered by the Scopus database, suggesting lower scientific rigor. Table 3 presents the ten most highly published journals for SADs. On the other hand, all the highly cited MADs were indexed in the SSCI or the SCIE-EXPANDED. Furthermore, all MADs were in the top quartile with high impact factors, as shown in Table 4. This suggests a higher level of scientific rigor and impact among MADs compared to SADs.

In terms of MADs, the *Arab World English Journal*, indexed in ESCI, published the highest number of co-authored documents from Saudi Arabia, accounting for 3.30% of the total. Two other journals also emerged as significant venues for co-authored documents: *International Journal of English Linguistics*, formerly indexed in ESCI, published 1.37% of the documents; and *International Journal of Emerging Technologies in Learning*, indexed in both ESCI and Scopus, published 1.23%. The remaining seven journals were indexed in SSCI and/or SCIE.

The final metric for evaluating the quality of SADs and MADs was citation count. Table 5 presents the most highly cited SADs, providing insights into the impact of these articles based on the indices of the journals in WoS categories. Similarly, Table 6 provides this information for the highly cited co-authored documents, offering a measure of the quality of the journals in which these documents appeared, based on WoS indices.

DISCUSSION

This study compared the quantity and quality of SADs and MADs in a number of categories extracted from the WoS database, namely social science (management, economics, psychology, and law) and arts and humanities (education, linguistics, and literature). The comparison targeted research productivity in terms of number of publications, as well as citation rates, publication

Table 1: Total number and percentage of publications for SAD and MAD in social science studies.

Category	SADs	MADs
Management	167 (18.85%)	719 (81.15%)
Economics	146 (19.04%)	621 (80.96%)
Psychology	98 (12.30%)	699 (87.70%)
Law	7 (23.33%)	23 (76.67%)
Education	473 (99.37%)	3 (0.63%)
Linguistics	437 (84.04%)	83 (15.96%)
Literature	31 (96.88%)	1 (3.13%)
Total	1359 (26.70%)	3731 (73.30%)

Table 2: Total number of SADs and MADs in the WoS indices.

Indices	SADs		MADs	
	n	%	*n*	%
ESCI	898	66.08	1217	32.62
SSCI	282	20.17	1413	37.83
SCI-EXPANDED; SSCI	65	4.26	626	16.74
SCI-EXPANDED	52	3.83	426	11.42
SSCI; A&HCI	47	3.46	43	1.15
A&HCI	13	0.96	2	0.05
SCI-EXPANDED; SSCI; A&HCI	2	0.15	4	0.11
Total	1359	100%	3731	100%

Notes. ESCI=Emerging Source Citation Index, SSCI=Social Science Citation Index, SCI-EXPANDED=Science Citation Index Expanded, AHCI= Arts and Humanities Citation Index.

Table 3: The ten most highly published journals for SADs as per the JCR 2021.

	Source	*n*	%	Index	IF	Notes
1	Arab World English Journal	231	17.00	ESCI	N/A	
2	International Journal of English Linguistics	107	7.87	ESCI†	N/A	
3	International Journal of Emerging Technologies in Learning	29	2.13	ESCI	N/A	Scopus-indexed
4	International Journal of Educational Sciences	29	2.13	ESCI	N/A	
5	Journal Of Organizational Behavior Research	18	1.32	ESCI	N/A	
6	International Journal of Instruction	17	1.25	ESCI	N/A	Scopus-indexed
7	Computers in Human Behavior	15	1.10	SSCI	8.59	Q1 (top 10%)
8	Middle East Journal of Management	14	1.03	ESCI	N/A	
9	ASIATIC-IIUM Journal of English Language and Literature	14	1.03	ESCI	N/A	
10	Education and Information Technologies	13	0.96	SSCI	3.66	Q1

Notes. IF=Impact Factor, ESCI= Emerging Source Citation Index, SSCI=Social Science Citation Index.† This journal was discontinued from the ESCI in 2019.

Table 4: The ten most highly published journals for MADS as per the JCR 2021.

	Source	*n*	%	Index	IF	Notes
1	Arab World English Journal	123	3.30	ESCI	N/A	
2	Medical Teacher	99	2.65	SCIE	4.28	
3	Advances In Medical Education and Practice	81	2.17	ESCI	N/A	Scopus-indexed
4	BMC Medical Education	78	2.09	SSCI/ SCIE	3.26	Q2
5	Frontiers in Psychology	71	1.90	SSCI	4.23	Q1
6	Indian Journal of Pharmaceutical Education and Research	70	1.88	SCIE	0.68	Q4
7	Computers in Human Behavior	65	1.74	SSCI	8.59	Q1 (top 10%)
8	International Journal of English Linguistics	51	1.37	ESCI†	N/A	
9	International Journal of Emerging Technologies in Learning	46	1.23	ESCI	N/A	Scopus-indexed
10	Energy Policy	43	1.15	SSCI	7.57	Q1

† This journal was discontinued from the ESCI in 2019.

venues, and impact factors in order to better understand the performance of SADs and MADs in the academic arena. More specifically, the comparison was conducted using the following criteria: comparison of the total number of SADs and MADs in the WoS indices, examination of the top ten most productive journals in terms of WoS indices to identify their impact factors, and identification of the top ten most cited articles for both SADs and MADs and then comparing of the impact factors of their publication venues.

The results revealed that, for certain disciplines, collaboration is generally associated with both the quality and quantity of publications while also increasing the likelihood of publication in journals with higher impact factors. During the period covered by this study, the number of MADs was more than twice that of SADs. This finding is consistent with the global trend towards an increase in multi-authorship (Thelwall and Maflahi, 2020). The nearly twofold increase in multi-authored publications in social science categories is consistent with findings showing an increasing trend for collaboration (Fanelli and Larivière, 2016; Franceschet and Costantini, 2010).

When it comes to specific fields, MADs were more dominant in the social sciences, such as management, economics, psychology and law, while SADs were more dominant in the arts and humanities, such as education, linguistics and literature. This observation is in line with findings by Shehatta and Mahmood (2016), who observed a tendency toward individualism in the arts and humanities which might also reflect cultural conventions within certain Arabic language and Middle East literature circles.

Table 5: The most highly cited SADs.

Author	Document title	Publication Source	Type	Year	Citations	Index	Notes
1. Baumeister	Self-regulation, ego depletion, and inhibition	Neuropsychologia	Article	2014	165	SSCI/ SCI-Expanded	Q3, IF=3.08
2. Belloumi	The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model	Economic Systems	Article	2014	143	SSCI	Q2, IF=2.31
3. Al-Zahrani	From passive to active: The impact of the flipped classroom through social learning platforms on higher education students' creative thinking	British Journal of Educational Technology	Article	2015	139	SSCI	Q1, IF=5.26 (top 10%)
4. Al-Hoorie	The L2 motivational self-system: A meta-analysis	Studies in Second Language Learning and Teaching	Article	2018	82	SSCI	Q1, IF=2.35
5. Habbash	Corporate governance and corporate social responsibility disclosure: Evidence from Saudi Arabia	Social Responsibility Journal	Article	2016	80	ESCI	Q1 in Scopus
6. Almarashdeh	Sharing instructors experience of learning management system: A technology perspective of user satisfaction in distance learning course	Computers in Human Behavior	Article	2016	67	SSCI	Q1, IF=8.59 (top 10%)
7. AlHogail	Design and validation of information security culture framework	Computers in Human Behavior	Article	2015	65	SSCI	Q1, IF=8.59 (top 10%)
8. Azer	The top-cited articles in medical education: A bibliometric analysis	Academic Medicine	Review	2015	64	SSCI/ SCI-Expanded	Q1, IF=8.0 (top %10)
9. Jouini	Return and volatility interaction between oil prices and stock markets in Saudi Arabia	Journal of Policy Modeling	Article	2013	62	SSCI	Q2, IF=2.72
10. Ali	Personality traits, individual innovativeness and satisfaction with life	Journal of Innovation and Knowledge	Article	2019	60	SSCI	Q1, IF=11.2 (top %10)

MADs seemed to have more impact than SADs, as most of the latter (66%) appeared in the ESCI, which is perceived as less prestigious. This finding was predictable, as has been emphasized by many scholars (e.g., Sahu and Panda, 2014; Thelwall and Maflahi, 2020). Of MADs, 37% were indexed in the SSCI and 28% were indexed in the SCI-EXPANDED, both of which are considered highly rigor indices in the WoS Core Collection, while only 32% of appeared in the ESCI. For SADs, about one-fifth (20.75%) were indexed in the SSCI, indicating a more limited representation in higher-tier journals compared to MADs.

The quality of the source of a publication was assessed using its citation rate and the WoS indices. The data indicated that journals indexed in the ESCI were the most frequent venues for SADs, whereas journals indexed in the SSCI and SCIE-EXPANDED were the most frequent venues for MADs. The impact therefore seemed also higher for MADs than for SADs, consistent with previous findings in the literature (Al-Herz *et al.*, 2014; Kalwij and Smit, 2013; Thelwall and Maflahi, 2020).

Table 6: The most highly cited MADs.

Author	Document title	Publication Source	Type	Year	Citations	Index	Notes
1. Jindong, *et al.*,	An extended TODIM multi-criteria group decision making method for green supplier selection in interval type-2 fuzzy environment.	European Journal of Operational Research	Article	2017	398	SCI-EXPANDED	Q1, IF=6.36
2. Shulman, *et al.*,	The dual systems model: Review, reappraisal, and reaffirmation.	Developmental Cognitive Neuroscience	Review	2016	388	SCI-EXPANDED; SSCI	Q1, IF=5.8
3. Fnais, *et al.*,	Harassment and discrimination in medical training: A systematic review and meta-analysis.	Academic Medicine	Review	2014	335	SCIE; SSCI	Q1, IF=8.03 (top 10%)
4. Marsh, *et al.*,	Measurement invariance of big-five factors over the life span: ESEM tests of gender, age, plasticity, maturity, and la dolce vita effects.	Developmental Psychology	Article	2013	270	SSCI	Q1, IF=4.49
5. Marsh, *et al.*,	Why item parcels are (almost) never appropriate: Two wrongs do not make a right-camouflaging misspecification with item parcels in CFA models.	Psychological Methods	Article	2013	259	SSCI	Q1, IF=10.9 (top 10%)
6. Almaiah, *et al.*,	Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic.	Education and Information Technologies	Article	2020	228	SSCI	Q1, IF=3.66
7. Belsky and Pluess	Beyond risk, resilience, and dysregulation: Phenotypic plasticity and human development.	Development and Psychopathology	Article	2013	226	SSCI	Q1, IF=5.31
8. Morina, *et al.*,	Can virtual reality exposure therapy gains be generalized to real-life? A meta-analysis of studies applying behavioral assessments.	Behaviour Research and Therapy	Article	2015	221	SSCI	Q1, IF=5.32
9. Marsh, *et al.*,	Passion: Does one scale fit all? Construct validity of two-factor passion scale and psychometric invariance over different activities and languages.	Psychological Assessment	Article	2013	212	SSCI	Q1, IF=6.08
10. Agag and El-Masry	Understanding consumer intention to participate in online travel community and effects on consumer intention to purchase travel online and WOM: An integration of innovation diffusion theory and TAM with trust.	Computers in Human Behavior	Article	2016	211	SSCI	Q1, IF=8.59 (top 10%)

Regarding citations, the most cited SADs were published in the SSCI/SCI-EXPANDED indices, except for one article, which was indexed in ESCI. By contrast, the most cited MADs were published in the SSCI and SCI-EXPANDED indices. The indices of the most cited articles were similar for SADs and MADs; however, the number of citations were clearly distinct. The number of citations was almost three-fold higher for the MADs than for the SADs. Thus, as reported in the earlier literature, MADs still have higher citation rates than SADs (Larivière *et al.*, 2016; Shen *et al.*, 2021; Wuchty *et al.*, 2007).

A number of studies have found that Saudi research has shown rapid growth in general as well as increased international collaborations since the late 2000s (Haq *et al.*, 2020; Shehatta and Mahmood, 2016; Shen *et al.*, 2021). However, only two of these studies adopted a bibliometric approach and both have different starting points. Shehatta and Mahmood (2016) aimed to investigate the pattern of collaboration in Saudi Arabia using a WoS data set, while Haq *et al.* (2020) aimed to investigate the growth in health research and its pattern of collaboration using a Scopus data set. In the present paper, our focus was on a certain set of sub-categories, namely management, economics, psychology, law, education, linguistics, and literature. Our findings indicate that collaboration patterns vary systematically across these disciplines, influencing both the impact factor of publication venues and the citation performance of published works.

Overall, our results indicate that collaboration is associated with higher quality according to standard adopted by many higher education institutions worldwide. These findings therefore have implications for promotion policies. If collaboration leads to improvement in research quality, it becomes imperative for policymakers to proactively encourage collaborations. One way to achieve this might be to, at least, consider SADs and MADs equally in terms of allocation of promotion points (especially when the promotion applicant is the principal investigator), rather than giving more weight to SADs across the board. For example, a publication where the applicant is a single author or a principal investigation could incur half a point only.

While it is true that single authorship entails more effort on the part of the promotion applicant, and perhaps might intuitively justify the allocation of more points, the long-term benefits in terms of quantity and quality for the researcher, the institution, and the field as a whole might trump the immediate considerations of individual effort. Collaborative efforts often lead to a broader exchange of ideas, diverse perspectives, and a pooling of resources, ultimately contributing to a richer and more impactful research landscape. The long-lasting impact of collaborative work and strategic investment of effort extends beyond individual accomplishments, fostering a culture of knowledge exchange and innovation. Furthermore, discipline-specific promotion guidelines that appreciate the uniqueness of each field of study might also be more appropriate than a unified promotion system.

The study has limitations that affect the generalizability of its findings. First, the data were limited to the WoS dataset and to specific sub-categories. Second, the study period was limited to 10 years, so this range may be extended in future research. As this area of research has the potential to improve research practices, future research may draw use other datasets, such as Scopus, and include more categories. Also, other researcher-related variables may be investigated, such as institution of graduation, nationality, and age in order to investigate cultural and generational trends in collaboration attitudes and practices, as well as shedding light on reasons for interest and disinterest in collaboration.

CONCLUSION

The present study compared single-authored publications and multi-authored publications across social science (management, economics, psychology, and law) and arts and humanities (education, linguistics, and literature) disciplines, utilizing the Web of Science database. The results indicated a trend towards an increase in multi-authorship, with multi-authored publications surpassing single-authored publications by more than twice in quantity. Social sciences exhibited a higher prevalence of collaboration, aligning with previous studies, while arts and humanities leaned towards single authorship, reflecting potential cultural conventions. Institutions should play a proactive role in promoting collaborative research considering the long-term benefit this type of research is expected to provide.

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ABBREVIATIONS

AHCI: Arts and Humanities Citation Index; **ESCI:** Emerging Sources Citation Index; **JCR:** Journal Citation Reports; **SCI:** Science Citation Index; **SCIE:** Science Citation Index Expanded; **SSCI:** Social Sciences Citation Index; **WoS:** Web of Science; **IF:** Impact Factor; **HEI:** Higher Education Institution; **USA:** United States of America.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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