

Dynamics of Scientometrics Indicators in three distinct Physics Journals with long publication history

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Core journals in any subject go through evolution processes before being accepted worldwide. The study of the journal's evolution with its long publication history gives insight into distinct characteristics acquired over time. This study explores the dynamics in scientometrics indicators of three distinct Physics journals with the same scope but published from different regions and impact factors. The result shows each journal has its discrete contributors, but the host or home country contributes more than 50%. In short or medium duration (decadal), the increase in authorship per article differs from journal to journal. Still, the change is approximately the same over a longer duration (1990-2019) (46.38% to 48.5%). A journal with linear authorship growth only correlates significantly with its impact factor ($r = 0.877$). These journals also show an increase in international co-authored publications, but the increase mostly depends on the host country's collaborations. More than 80% of associations are between two countries. The findings establish that irrespective of Physics's global use and implications, the researchers tend to publish in familiar journals from their region regardless of impact factors. The journals with higher impact factors publish more transnational articles.

Keywords: Journal selection, Journal choice, Authorship, Multiple authorship, Co-authorship, Impact factor, Core journals, Journal citation report, Publish or perish.

Introduction

Scientific knowledge that comes from research can have profound implications for the future progress of science and society. So it is essential to share the

knowledge generated from research with the public. Researchers communicate their research results through different channels, such as journals, conferences, popular media, etc. (Udovicich et. al., 2017). But a critical appraisal of research results by peers before dissemination establishes their credibility. Sharing credible research results with peers or colleagues brings credit to researchers, leads to new collaborations, and forms a part of the scientific knowledge base for future research build-up. Journals play an essential role in the dissemination of such credible research information.

In recent times, journals are not just the means of communication channels for academicians or researchers but beyond this. Researchers and their activities are judged based on journal articles and where these papers have been published (Rallison, 2015). A journal with a higher impact factor receives inflated importance and is considered better quality. This quantitative measure impact factor is increasingly used to assess scientists during recruitment, promotion, awards, research grants, etc. (Rieder et. al., 2010; Simons, 2008). Irrespective of controversies associated with the impact factor, it is still the most widely used measure of journal quality. Perhaps, it is less prone to biases than other available measures (Saha et. al., 2003).

Journal Impact factor is one of the top influencing factors while selecting a journal to publish. But journal reputation, scope and readership are still the leading deciding factors (Beshyah, 2019; Rowlands & Nicholas, 2005; Rowley et. al., 2020; SANDESH & WAHREKAR, 2017; Tenopir et. al., 2016). On the other hand, impactful journals usually have a quality editorial board. And the editors of these journals demand and facilitate quality reviews (Bourne, 2005). The researchers put more energy and resources into publishing in such journals to improve the manuscript before communication. Sometimes the desire and compulsion of primary researchers to publish in impact journals lead to collaboration or authorship increase (Baethge, 2008; Papatheodorou et. al., 2008; Reynolds & Wierzbicki, 2004; Strange, 2008).

The objectives of the research collaboration vary from researcher to researcher. The main goals of the partnership are to be involved in big research projects, secure funds, and improve personal competencies, enhancing the number and quality of publications for researchers (Abramo et. al., 2019). The level of collaboration (institutional, national and international) varies based on contextual factors and research discipline (Abramo et. al., 2014). The institutional and national collaborations usually show the social character of science in a country. At the same time, an International collaboration explains the reach or scientific network of the researcher. Some disciplines have regional differences in transnational scientific collaborations (Huang et. al., 2011). Irrespective of the degree of associations, the vague collaborations raise editors' concerns (Greenland & Fontanarosa, 2012; Yank & Rennie, 1999).

In any discipline, the core journals earn their status after a period of publication. The journals secure their position through the efforts of the editorial team, reviewers and the articles published. The citation practices in journals are similar in a discipline (Moed et. al., 1985), but the dynamics of internationalization, authorship patterns, collaboration, impact factor trend, etc., are not much studied for different quality journals in the same

discipline. This study analyses the above facets in detail to understand the characteristics of three distinct physics journals with long publication history. This study would help the researchers in Physics and information sciences understand the scientific process where disseminating quality knowledge is essential.

Methodology

Generally, researchers use Web of Science (WOS) and Scopus databases for any quantitative studies related to publications or science or scientific behaviours. This study uses the Web of Science (WOS) database to collect data and further analyse to draw inferences. Twelve well-established physics (multidisciplinary) journals were first identified and arranged according to their decreasing impact factor in Journal Citation Report (JCR). These journals were divided into three categories as per their impact factor, i.e., high, medium, and low. The journals were carefully analyzed to know the publications' history, such as the starting year, the number of articles published in each issue, etc. Accordingly, a suitable journal was selected in each category in the base year 1990. Bibliographic records were downloaded from WOS for these journals from 1990 to 2019. The bibliographic records were downloaded in MS-excel file format. Then each file was standardized for easy analysis after removing documents type such as corrections, editorial, bibliographical-items, retractions, etc., in Microsoft Excel (Table-1). The number of authors was counted using an Excel formula to include Authors count as a new field. The first author's affiliation and country were extracted into separate columns. Using Perl regular expressions, the countries of the rest authors were also pulled out into a new column of Excel to study the research collaboration. WOS has started specifying addresses to authors from around one and half decades earlier. So to explore the collaboration behaviour of the first author, a detailed analysis of affiliations was done for the year 2010-19.

Table 1
Selected journals for this study

Sl. No.	Name of the Journals (Published monthly)	Publisher	Impact Factor		No of Records Downloaded (1990-2019)	Records considered for the study
			1990	2019		
1.	Journal of the Physical Society of Japan	The Physical Society of Japan (Japan)	1.932	1.579	18333	18032
2.	American Journal of Physics	American Association of Physics Teachers (USA)	0.548	1.194	6561	5829
3.	Indian Journal of Pure and Applied Physics	NISCAIR, New Delhi(India)	0.114	0.822	4339	4287

All the above core journals in physics (multidisciplinary) are of different impacts which publish from different regions. Country-wise distribution, authorship trends, and the authorship correlation with impact factors were studied to understand the evolution of these journals and their dynamics.

Results

Natural choice vs Recourse

Decade-wise affiliation analysis of the first author shows (Table-2) that the number of contributing countries has not changed significantly during different periods except for the Indian Journal of Pure & Applied Physics (IJPAP). For IJPAP, there has been an increase of 45% in contributing countries in the last decade. Further analysis of author contributions (Fig.1) from different countries exhibits that authors from the host or home country contribute more than half ($\frac{1}{2}$) to three-fourths ($\frac{3}{4}$) of total publications in these journals. The following top 10 contributors are of different clusters. Top contributors in the Journal of the Physical Society of Japan (JPSJ) and the American Journal of Physics (AJP) are from developed and regional countries, whereas developing and regional countries are top contributors to IJPAP. USA and India are common among these top. One or more countries of the region significantly contribute after the host country.

Table 2
Journal-wise distribution of first authors affiliated with the number of countries

Title of the Journals	1990-1999	2000-2009	2010-2019
Journal of the Physical Society of Japan	54	60	55
American Journal of Physics	61	63	64
Indian Journal of Pure & Applied Physics	37	31	45

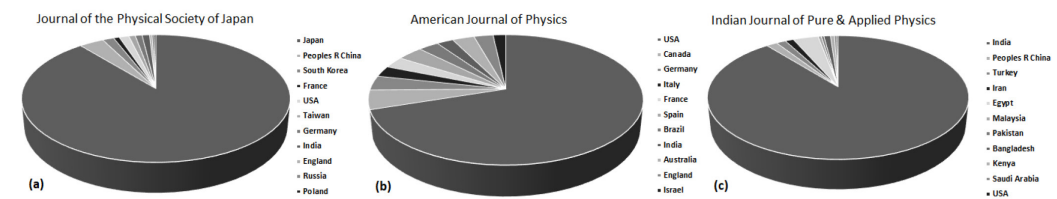


Figure 1
Contribution of authors from different countries

Authorship trends in established journals

There has been a significant increase in the number of authors per article over the years for all three physics journals (Fig.2). Irrespective of the quality of these journals,

Table 3
Percentage increase in the number of authors per article over different periods

Period	Journal of the Physical Society of Japan	American Journal of Physics	Indian Journal of Pure and Applied Physics
1990-2019	46.38	46.66	48.50
1990-1999	11.23	23.60	4.97
2000-2009	32.71	36.70	13.05
2010-2019	-2.25	3.95	11.71

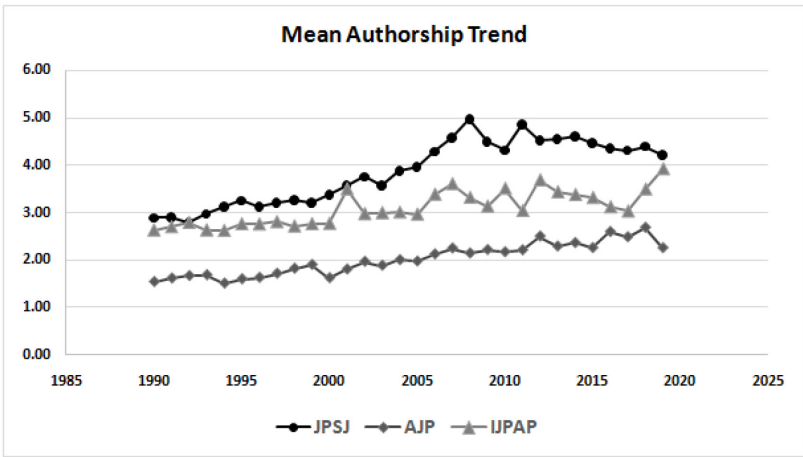


Figure 2
Mean authorship trend in the journals

roughly an equal percentage of authors increased per article (46.38% to 48.5%) from 1990 to 2019. But the decade-wise growths of authors are very different. There was a substantial rise in authors from 2000-09 (Table-3). The rising trend is reasonably slow down during 2010-19. The JPSJ shows negative growth in the number of authors per article from 2010 ($\bar{X} = 4.31$) to 2019 ($\bar{X} = 4.22$). Figure 2 shows that the downward trend of JPSP is visible from 2008 ($\bar{X} = 4.97$) onwards, except for an increase in authors during 2011 ($\bar{X} = 4.86$). Comparing the mean authors' trend of all three journals shows the American Journal of Physics (AJP) follows a very linear trend ($R^2 = 0.886$).

The distribution of articles to the multi-authorship in the studied journals shows different patterns (Fig.3). Over the years, there has been a visible reduction in single and two-authored publications. The American Journal of Physics (AJP) shows deviation from the other two journals. Still, more than 1/3 (36.16%) of AJP publications are single-authored. In contrast, single-authored publications in the Indian Journal of Pure and Applied Physics (IJPAP) have gone down to less than 10% since a decade or more. It was as low as 2.83% in 2014 (Fig.4).

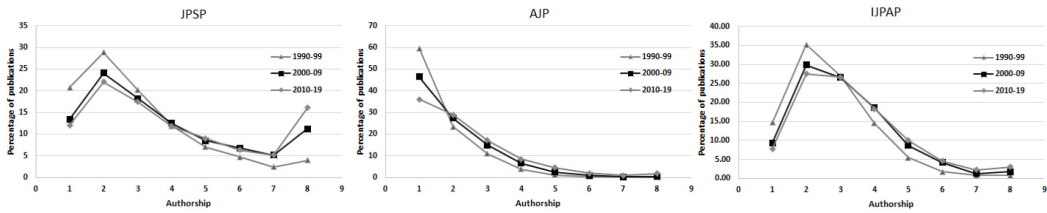


Figure 3
Authorship distribution pattern in the journals

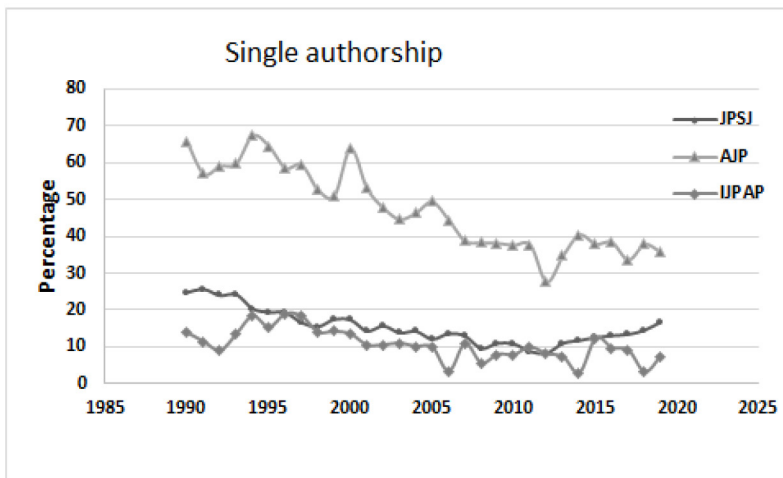


Figure 4
Distribution of single authored publications

Increasing an article's authorship tempts authors to publish in a better impact factor journal (Sahu & Panda, 2014). We studied the correlations between authorship and impact factors to evaluate this phenomenon. The correlation analysis shows (Figure 5) a strong relationship in AJP ($R=0.877$), significant relation in IJPAP ($R=0.701$) to no relationship for JPSP ($R=0.094$). Further looking at the impact factor (IF) trends of the journals

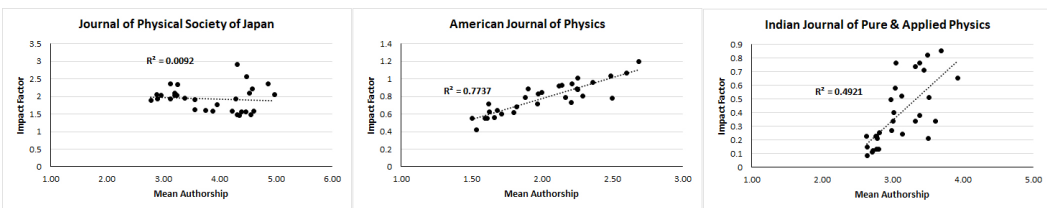


Figure 5
Correlations between authorship and impact factor

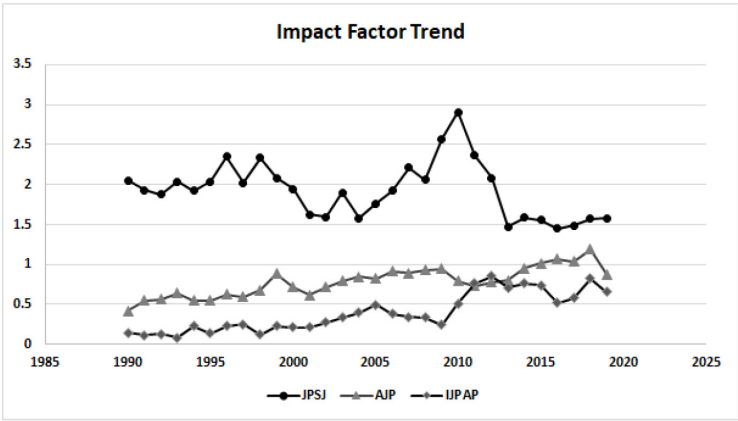


Figure 6

Impact factor trend of the journals

(Figure 6) shows that JPSP could not sustain its impact. The gradual increase in IF of the American Journal of Physics corresponds to its authorship increase of articles.

Dynamics of International Co-authored Publications

Authors' affiliations in the published articles usually show scientific collaborations in R&D activities. Table-4 shows the percentages of international co-authorship publications that have increased steadily in all the journals. A visible increase happened in the 2000s over the 1990s. Surprisingly, no transnational co-authored articles were published in IJPAP during the 1990s. India publishes the lowest international co-authorship articles, followed by the USA and Japan in their respective hosted journals. The percentage of international co-authorship papers in a journal strongly correlates to the host country's multinational co-authored publications rate (Fig.7). Figure-8 shows that the association of authors in such publications is primarily (>80%) between two countries, and the host country dominates by the share (Table-4).

Table 4

Percentage of international co-authorship in the journals and by the host countries. The share of such publications by host countries

	In journals			By host countries			Host countries share		
	JPSJ	AJP	IJPAP	Japan	USA	India	Japan	USA	India
1990-99	4.30	2.03	0.00	3.81	2.00	0.00	80.49	61.54	0.00
2000-09	12.26	7.73	3.72	10.89	7.16	3.72	77.83	54.42	77.78
2010-19	15.36	9.53	6.67	13.86	8.95	6.67	76.45	54.62	54.55

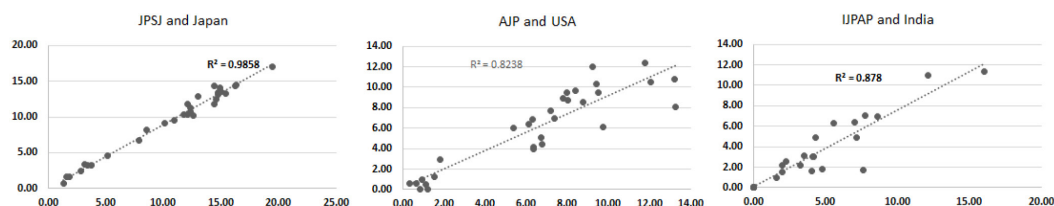


Figure 7

Correlation between International co-authored publications to host countries' co-authored publications

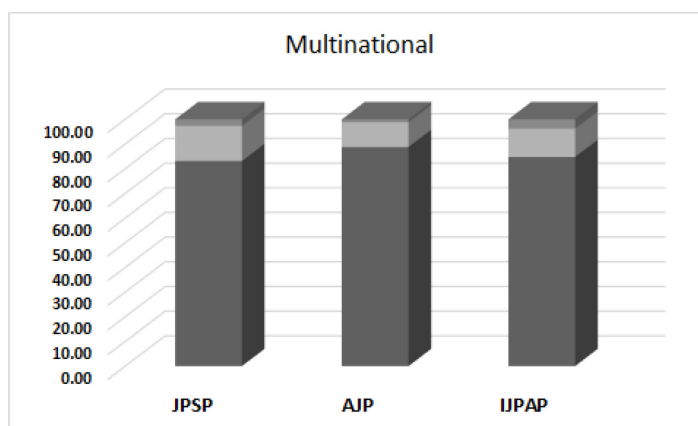


Figure 8

Co-authors from number of countries in the International co-authored publications

Discussion

Physics is a fundamental science, and its usage is universal (Young & Freedman, 2014). Its R&D outputs have global use and implications. The journals in the discussion have a very long publication history though published from distinct geographical locations. It was expected more global contributors. But many articles from host countries suggest a higher rate of submission and acceptance (Mahawar et. al., 2006). Different factors influence the submission and acceptance of manuscripts in a journal. Studies show that the journal's reputation, scope, impact factor, reliability of reviewing process and time taken to publish are the most influential attributes (Rowley et. al., 2020; Tenopir et. al., 2016). In these journals, details such as familiarity and confidence play a more significant role. The belief that the journal will publish or the writing ability as per journal language (Rowley et. al., 2020) would have influenced the authors during the submission process.

We know that the selection of core journals are not influenced by the increase in authors per article (Sahu & Panda, 2014). The increase in authors of the articles in these

core journals may be due to better interchange of research knowledge, complexity, scale, and cost of doing science (Porter & Rafols, 2009; Wuchty et. al., 2007). The readiness of the primary author to share ideas and credits with others in return for cooperation shows the growing openness in scientific activities. The increase in authors during 2000-09 is relatively high. The wider usage of ICT and online resources (journals, books, databases, etc.) might have inflated the values. But the negative growth in the authorship of JPSJ during 2010-19 indicates that the increase in authors per article was much higher during 2000-09 may be due to some outliers. The slow and steady growth in authors of AJP articles is likely attributed to its objectives and editorial policy (https://www.aapt.org/Publications/AJP/About/editorial_policy.cfm). It is clear from the results and figures that the publications with many authors are increasing with the decrease in a few authored (single or two) publications. Surprisingly, solo-authored publications in IJPAP were below 10% when the IF of this journal is lowest among the three. It might be indicating the behaviour of the researchers from this region. The researchers would prefer to work in teams or give undue credit to others in the field of Physics.

Authors always prefer the core journals over general or interdisciplinary to communicate their research findings irrespective of the number of authors in the manuscript. It gives the published article more reach and wider visibility. But when there is a choice of journals, the authors would compare based on established criteria of Impact Factor (IF). The significant correlation between IF and authorship in AJP & IJPAP would show the later phenomena of comparison. The Journal of the Physical Society of Japan (JPSJ), a high rated core journal, would be independent of comparison with zero correlation.

There is a significant number of international co-authored publications in the studied journals. The international co-authorship papers follow the global trend of science in their growth (Huang et. al., 2011; Persson et. al., 2004). The increase in international collaboration is due to the wider reach of the internet, email and online journals around the year 2000, which would have acted as the catalyst for international co-authorship. But the percentage of increases are not quite substantial. It also contradicts the finding of Huang et al. (2011), which shows in ascending order Japan, India, and the USA are the three out of the four lowest contributors towards international co-authorship papers in Physics. Probably, the contradiction attributes to the journals' impact factor (IF) and the influence of the host country authors in the selection of the journal during the publication process. The influence is visible more from two countries' associations and a high share of the host country in the international co-authored publications.

Conclusion

Core journals on a subject should attract worldwide researchers to publish in them. Three Physics journals in the study have succeeded in their acceptance over the years. These physics journals have been researchers' natural choice at their respective geographic locations due to the perception that it is 'easier to publish' in these journals. The perception has developed mainly from familiarity with the journal and own writing ability in alignment with the journal's language. The natural choice is more critical to

the impact factor of these core journals for authors, irrespective of the increase in the authorship of articles. These journals do not follow the international co-authorship pattern as happens in Physics but the impact factor of the journals. The journal with a high impact factor published more transnational articles.

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