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Factors influencing the adoption and use of Open Access scholarly communication among researchers in India

Abstract

Purpose: The present study aims to examine the use of Open Access (OA) scholarly communication in India and investigate the factors affecting the adoption and use of OA scholarly communication among researchers.

Design/Methodology/Approach – The study adopted a quantitative research approach using a survey method. Science Citation Index Expanded (SCI-EXPANDED) of Web of Science (WoS) database was selected as a source for identifying potential researchers and their contact details. A web-based questionnaire was designed using Google Forms, and a link to the questionnaire was sent by email to 4237 researchers belonging to Science and Technology. Unified Theory of Acceptance and Use of Technology (UTAUT) is the primary basis for formulating the present study's conceptual model. Hierarchical Multiple Regression was applied for identifying the factors that influence the adoption and use of OA scholarly communication.

Finding-The study found that researchers have limited knowledge of different OA concepts, initiatives, and resources, resulting in a deficient level of participation in OA publishing. The HMR analysis authenticates that attitude, facilitating conditions, Internet usage self-efficacy, APC, and researchers' working experience significantly influence the adoption and use of OA scholarly communication. Based on the findings, the study proposed a validated model to investigate the adoption and use of OA scholarly communication.

Practical Implications – The findings have several practical and policy implications for improving OA publishing in India and formulating and could provide further research directions.

Originality/Value – This is the first study focusing on adopting and using OA scholarly communication in India. Findings may be helpful in planning and implementing OA initiatives. The influencing factors and the relative importance identified in the present study offered empirical evidence to demonstrate the researchers' attitudes and perceptions for adopting and using OA scholarly communication.

Keywords: Scholarly Communication; Open Access; Open Access Journals; Gold Road-Open Access; Adoption and Use-Open Access; Factor-Open Access

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Introduction

Scholarly communication is defined by the Association of College and Research Libraries (2003) as "a system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use. Substantial increases in journal subscription prices, and the emergence of supporting Information and Communication Technologies (ICTs), such as the Internet and the World Wide Web, have led to the evolution of the Open Access (OA) scholarly communication model (Mering, 2020; Lwoga & Questier, 2014). OA scholarly communication has been promoted as an alternative to the subscription-based model that requires readers to pay for the content they read. The OA concept refers to the free online distribution of scholarly literature to readers via the Internet, which often has minimum copyright and licensing restrictions for both the readers and the authors than traditionally published publications (Cornell University Library, 2021). Research literature can be made OA through publishing research articles in OA journals (Gold OA) or self-archiving in OA repositories (Green OA) (Dulle & Minishi-Majanja, 2011).

OA publishing has several advantages over traditional subscription-based publishing. It promotes scientific progress by providing researchers with broader access to scientific knowledge (Björk, 2017). It also lowers the price and permission constraints, increases national research potential, and advances research visibility (Nobes and Harris, 2019), resulting in a greater citation rate (Piwowar *et al*., 2018). Despite the potential benefits of OA and the deployment of OA mandates by research organizations, universities, and funders (Tautkeviien & Ceseviit, 2019), the adoption of OA publishing among researchers is low across the world (Pourret, 2020). According to some recent studies, only one-third of the world's scholarly literature is available for OA (Bosman & Kramer, 2018; Piwowar *et al*., 2018). OA adoption rate also varies by countries and disciplines (Ashby, 2020; de Filippo & Mañana-Rodríguez, 2020; Laakso & Lindman, 2016; Laakso & Polonioli, 2018; Peekhaus & Proferes, 2016; Pourret *et al*., 2020; Zhang & Watson, 2017). However, the success of OA scholarly communication depends on researchers' willingness to publish their research in an OA journal or self-archive accepted paper in the OA repository (Lwoga & Questier, 2014).

With around 900 universities and 0.34 million researchers, India has been moving toward OA publishing through national and institutional efforts (Naika and Pathak, 2020). India’s contribution to OA is significant globally as Indian journals are increasingly available on OA repositories such as Pubmed Central and Directory of Open Access Journals (DOAJ) (Misra & Agarwal, 2019). Despite all these efforts, OA adoption among Indian researchers is relatively low as only 24 per cent of India’s total research output is OA, compared to a global average of about 30 per cent (Piryani *et al*., 2019). A significant proportion of Indian research literature is published in paywall journals; however, a small proportion is self-archived in institutional and subject-based repositories (Mukherjee, 2014; Ahmadi & Nazim, 2017). Low-quality OA journals, lack of funds to afford gold OA publishing fees, lack of execution of OA mandates, and lack of incentive to self-archive their research work in OA repositories are barriers to OA adoption among Indian researchers (Misra & Agarwal, 2019).

Several studies have focused on OA availability to research literature in India (Nazim, 2018; Piryani *et al*., 2019), OA adoption among researchers in specific Indian institutions and universities (Nazim, 2021; Nazim & Zia, 2019), and attitudes of faculty and researchers towards OA publishing in one particular university (Gul et al., 2018; Ganesan & Mangai, 2021; Rangaswamy & Babu, 2021; Singson *et al*., 2015) or a few universities of a particular state

(Govindarajan & Dhanavandan, 2019). Some studies have also examined the perceptions and attitudes of researchers belonging to specific disciplines like health science researchers (Singh, 2015) or library professionals (Bhaskaran & Koovakkai, 2019). However, no study has examined the factors influencing the adoption and use of OA scholarly communication among Indian researchers. This study developed a model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) of Venkatesh *et al.* (2003) to examine the adoption and use of OA scholarly communications among Indian researchers and the factors which affect OA adoption.

Literature review

OA initiatives and types OA publishing

The movement for OA was started with the Budapest Open Access Initiative (2002) in 2001, followed by the Bethesda Statement on OA Publishing (2003) and the Berlin Declaration (2003), which resulted in the first community-agreed definition of OA. Since then, OA publishing has gained momentum in disseminating and extending free access to scientific research. Over the last two decades, several OA publishing models have been emerged (Piwowar *et al*., 2018), and the most prevalent among them are gold, green, and hybrid. Gold OA refers to publishing an article in an OA journal and immediately making it freely available on its website (van der Heyden & van Veen, 2017). Green OA refers to the practice of self-archiving (Harnad *et al*., 2008), where journal publishers allow authors to make their accepted manuscripts freely available by depositing them in the subject or Institutional Repositories (IRs) (Björk, 2017). In the hybrid OA model, articles published in subscription journals are instantly free to read under an open license in return for an Article Processing Charge (APC) paid by authors (Laakso & Björk, 2013). An OA resource is defined by Hilbert (2020) as "any type of educational materials that are free and accessible for use and modification such as videos, lessons, quizzes, and articles" (Hilbert, 2020, p. 54). Various OA resources include journals, journal articles, subject repositories, preprint servers, data repositories, books, theses, software, Open Educational Resources (OER), directories, search engines, and blogs (The University of Strathclyde, 2021).

Awareness and adoption of OA publishing

Awareness of OA among researchers has increased over the years (Rodriguez, 2014; Turgut *et al*., 2021). Researchers have generally gained knowledge of OA through the Internet and their friends (Serrano-Vicente et al., 2016). Despite growing awareness of the advantages of OA publishing, individual researchers appear to be hesitant to make use of OA publishing (Köster *et al*., 2021; Peekhaus & Proferes, 2016). According to the finding of a study, the high level of OA awareness among researchers did not translate into actual dissemination of their research work through OA outlets (Lwoga & Questier, 2015). The findings of recent studies suggest that 25- 28 per cent of the total scholarly literature worldwide is OA, and this proportion is growing, driven mainly by growth in gold and hybrid OA (Bosman & Kramer, 2018; Piwowar et al., 2018). However, the proportion of OA is varied across countries and disciplines, as the OA proportion is much higher in sciences and engineering disciplines than arts, humanities, and social sciences (Bosman & Kramer, 2018). Although researchers' engagement with OA has increased substantially in the previous five to ten years, their perceptions of OA have remained consistent because they perceive OA publication to be of lower quality, less prestigious, and less credible (O'Hanlon *et al*., 2020; Rodriguez, 2014; Turgut *et al*., 2021; Yang & Li, 2015). Researchers who are more informed about OA or published their work in an OA outlet are more confident in the quality of OA publications and are less hesitant about OA publishing (Peekhaus, 2019).

Attitudes versus actual OA publishing practice

Most previous studies have reported a significant relationship between researchers' attitudes towards OA and the adoption of OA publishing (Joung *et al*., 2017; Mammo & Ngulube, 2013; Narayan *et al*., 2018; Peekhaus, 2019; Ruiz-Pérez & Delgado-López-Cózar, 2017; Sheikh, 2017). According to a study, OA engagement among researchers in Latin America has increased significantly between 2013 and 2018; however, traditional considerations such as prestige and impact factor continued to influence publication choices (Peekhaus, 2019). In Australia, researchers in the humanities, arts, and social sciences are heavily influenced by conventional quality measures, such as the journal impact factor. They are less concerned with making their work more accessible and promoting it through social media (Narayan et al., 2018). Most researchers in Spain have published at least one OA article in the previous five years, and half of them have paid APCs for OA publication, despite their differing opinions on the quality of OA journals (Ruiz-Pérez & Delgado-López-Cózar, 2017). Scholars in Pakistan read OA scholarly content more frequently than their engagement in OA publishing (Sheikh, 2017). Academics in Korea were more optimistic about the benefits of OA publishing; however, OA adoption is differed by their gender and experience (Joung *et al*., 2017).

Factors influencing researchers' participation in OA publishing

The researchers' impression of OA as low-quality publishing has not altered from previous studies and remained a significant influence since the researchers seemed to agree with the principles of OA in theory but were reluctant to engage in OA (Tmava & Miksa, 2017). Despite agreeing with the OA principles, the majority of researchers at the Arctic University of Norway did not engage in OA for a variety of reasons, including the time-consuming procedure, academics' uncertainty about specific legal, copyright, peer review, and prestige issues, and ambiguity over which version to deposit or self-archive (Mbachi, 2019). While most biomedical and health informatics researchers favor making scientific knowledge freely accessible to everybody, some are hesitant to put this principle into reality by publishing their work in OA journals (Greussing *et al*., 2020). The primary motivations for researchers to adopt OA publishing are the large readership, impact factor, free access to readers, ability to pay publishing charges, subjective norm, and personal innovativeness (Heaton *et al*., 2019; Massoro & Adewale, 2019). In contrast, a lack of awareness about OA venues and OA journal processing fees are substantial impediments to OA adoption (Sheikh, 2017). Researchers' engagement in OA is influenced by several factors, including copyright concerns, a lack of time, a fear of plagiarism, OA culture, attitudes, peer pressure, and a reward system (Lwoga & Questier, 2015; Kim, 2010; Tmava & Miksa, 2017).

The reviewed literature indicated the growing participation of researchers in OA publishing. There has been a more determined effort in recent initiatives, such as the growth of OA journals, hybrid journals, and IRs, to mandate and engage researchers in OA. While substantial research is conducted on this area, no study has been undertaken in India to look into the factors that motivate or impede researchers' involvement in OA publishing. This study will undoubtedly bridge that gap.

Conceptual framework

Several conceptual models have been proposed and used by information system researchers to examine the factors that influence OA publishing behavior (Tmava & Miksa, 2017; Massoro & Othman, 2018; Moksness & Olsen, 2017). The UTAUT is one such model, widely used for investigating the factors that influence the adoption and use of OA publishing (Bashorun et al., 2016; Lwoga & Questier, 2015). The UTAUT model consists of four primary constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) that play a significant role as direct determinants of user acceptance and usage behavior. The effect of independent variables on dependent variables is moderated by four moderating variables: gender, age, experience, and voluntariness of use (Venkatesh et al., 2003).

The UTAUT model has been used to establish how awareness, attitudes, performance expectancy, Internet self-efficacy, and facilitating conditions significantly influenced the adoption and use of OA publishing by Bashorun *et al.* (2016) and Lwoga & Questier (2015). Despite various approaches used in analyzing the adoption and use of OA publishing, none of the studies in India has used the UTAUT model to establish such a relationship. Therefore, the UTAUT model is the primary basis for formulating the present study's conceptual model. The original UTAUT model was modified by adding three more constructs (attitudes, Internet self-efficacy, and APC) and two moderators (academic positions and research discipline). The effects of these additional constructs on the adoption of OA have already been established in previous studies (Bashorun *et.al.,* 2016; Dulle and Minisha-Manjanja, 2011; Khalili and Singh, 2012; Lwoga and Questier, 2014). As a result, a conceptual model was formulated for the present study, consisted of seven independent variables, two dependent variables, and five control variables (Appendix 1).

Attitude is defined as a set of emotions, beliefs, and behaviours toward a particular object, person, thing, or event (Cherry, 2021). The attitude plays a significant role in accepting and adopting OA scholarly communication. The belief that using a specific technology or method will benefit or improve an individual's performance to some extent is referred to as performance expectancy (Ogunsola & Olojo, 2021 Effort expectancy refers to the degree to which a system or a procedure may be used with ease. This is founded on the notion that there is a relationship between the amount of effort put in, the results obtained due to that effort, and the rewards received as a result of that effort (Ogunsola & Olojo, 2021). Internet self-efficacy refers to what individuals perceive they can achieve with technology competencies they already have (Venkatesh et al., 2003). Facilitating conditions refer to factors like training on ICTs and the Internet, technical support, and Internet facilities for the successful adoption and use of OA publishing (Njoku, 2016). Individuals' responses to the demands of a social context are referred to as social influence. People change their attitudes and behavior according to what they believe others are doing or thinking when under such influence (Ogunsola & Olojo, 2021). APC is the publication fee paid by authors to cover the costs of peer review, administration and management, professional production of articles in PDF and other formats, and dissemination of published papers in various venues (Morillo, 2020).

Previous studies have shown that attitude, performance expectancy, effort expectancy, facilitating conditions, social influence, Internet self-efficacy, and APC have significantly influenced the adoption and use of OA publishing (Bashorun *et al*., 2016; Dulle, & Minishi-Majanja, 2011; Krauskopf, 2021; Lwoga & Questier, 2015). Individual traits (age, gender, research experience, academic rank, and research area) can enhance faculty behavioural intention and, consequently, actual usage of OA publishing. Studies suggest differences in the

extent of OA practice between different universities, academic disciplines, age, and seniorities (Gul *et al*., 2018; Zhu, 2017).

Research Questions

The study sought answers to the following research questions to accomplish the objective of the study:

- To what extent are researchers aware of OA scholarly communication?
- To what extent have researchers adopted and used OA scholarly communication?
- What barriers hinder the adoption and use of OA scholarly communication among researchers in India?
- How can OA scholarly communication be promoted among researchers in India?
- What factors affect the adoption and use of OA scholarly communication among researchers in India?
- Is there any significant relationship between demographic variables (gender, age, designation, and experience) and adoption and use of OA scholarly communication among researchers and their intention to publish research work in OA outlets in the future?
- Is there any significant relationship between independent variables (attitudes, effort expectancy, facilitating conditions, Internet self-efficacy, performance expectancy, social influence, and APC) and adoption and use of OA scholarly communication among researchers and their intention to publish research work in OA outlets in the future?

Methodology

A web-based survey was conducted to collect data for the overarching goal of determining the factors influencing the adoption and use of OA scholarly communication among Indian researchers. The survey instrument was adapted from the surveys conducted in Nigerian universities by Bashorun et al. (2016), in Tanzanian public universities by Dulle (2011), and in Tanzanian health sciences universities by Lwoga & Questier (2015). The survey instrument is divided into the following three sections:

- Demographic details, including gender, age group, length of experience, academic position, and research discipline;
- Awareness and use of OA scholarly communication; and
- Factors that influence the adoption and use of OA scholarly communication (see Appendix-II).

The questionnaire was initially pre-tested with a small group of 40 faculty members from Aligarh Muslim University. Based on the pilot test results, the questionnaire was modified and refined.

The Science Citation Index Expanded (SCI-EXPANDED) of the Web of Science (WoS) database was selected as a source to choose a population that scientifically represents all potential researchers in the area of Science and Technology in India. The search was conducted on May 28, 2018, using an advanced search option of WoS. The following search strategy was used: Search term: CU=India, Timespan: 2014-2016, Publication type: journal

articles, Language: English, Database: SCI-EXPANDED. A total of 163243 articles authored by 211548 authors were retrieved, applying the above search strategy. Authors of other countries who collaborated with Indian authors were removed, and 42368 Indian authors with valid email IDs on the Gmail server were chosen as the study population. Email IDs other than the Gmail server were not considered because they were failed to deliver the online questionnaire's link. Still, the population was huge, and it was not easy to distribute and collect data from such a large population. Therefore, 4237 (10%) researchers were finally selected as a sample for the study following the rule of thumb. A simple random sampling method was used through Minitab software using Calc.>Random Data>Sample from Columns. Because this research is the part of a doctorate study conducted from 2016 to 2020, the findings are reported in this article only after the second author has awarded the degree.

The link to the web-based questionnaire was emailed to 4237 researchers on April 1, 2019. Each participant was asked to participate in this survey voluntarily and spent 15 to 20 minutes responding to the questionnaire. Reminder Emails were delivered twice in the two-week interval to increase participation. The survey was closed ten days after sending the last reminder email, i.e., June 30, 2019. A total of 318 responses were received, out of which five responses were incomplete and removed from the analysis. The response rate was 7.38 percent, which is considered sufficient in an online survey as recommended in previous studies (Radics, 2014; Saleh and Bista, 2017).

Reliability analysis was conducted using Cronbach's alpha for all the seven constructs used in this study. Cronbach's alpha is a measure to determine the reliability or internal consistency of a set of scale or test items. It is widely used in social sciences, business, nursing, and other disciplines (Bajpai & Bajpai, 2014). An alpha coefficient of 0.70–0.79 is considered fair, an alpha of 0.80–0.89 is good, and an alpha of 0.090 or higher is excellent (Sharma *et al*., 2021). The reliability analysis results revealed that Cronbach's alpha values of all constructs (attitude α=0.782, effort expectancy α=.0.866, facilitating conditions α=0.709, performance expectancy α=0.703, social influence α=0.823, Internet self-efficacy α=0.721, and article processing charges α =0.715) were either fair or good, and, therefore, eligible for retention during construct validity tests.

Results

Demographic details of respondents

Of the total respondents who participated in the study, 74.77 per cent (n=234) were male, and 25.23 per cent (n=79) were female. The average age was 39 years, with most respondents aged between 26 and 35 years (38.98%; n =122). Maximum number of respondents were assistant professors (n=98) and associate professors (n=68), and most of them (32.58%; n=102) have 11-20 years of experience. Respondents mainly belong to the medical science discipline (27.79%; n=87), followed by natural sciences (26.52%; n=83) and engineering and technology (25.23%; n=79). They had authored 11694 publications during the last ten years, of which 2602 (22.3%) publications were published in OA journals, while 9072 (77.77%) were published in subscription journals. When asked how likely they are willing to publish their research in OA outlets in the future, most respondents (62.61%; n=196) replied likely or very likely (19.16%; n=60). The demographic details of respondents are shown in Appendix III.

Awareness and use of OA scholarly communication

Respondents mainly were aware of some OA resources such as OA journals (64.53%; n=202) and the directory of open access journals (37.06%; n=116) but not very much familiar with other OA resources such as the directory of OA repositories and OA books; subject and institutional repositories; OA concepts (green and gold OA); and OA initiatives (Budapest Open Access Initiative). A high majority of respondents (87.22%; n= 273) replied in affirmation when asked whether they use OA scholarly content for teaching and research. When asked whether they published their articles in the OA outlet, 62.93 per cent (n=197) said they had published articles in OA outlets. When asked about the use of different OA routes, about half of the respondents (50.79%; n=156) indicated that they had published articles in pure OA journals, while 22.36 per cent (n=70) published articles in hybrid or tolls access journals on the payment of APC. The use of green OA (self-archiving) does not seem much common among researchers as only a few respondents indicated that they use different self-archiving venues such as personal or institutional web pages (6.7%; n=21), subject repositories (5.75%; n=18), and IRs (2.85%; n=9). Details of responses are shown in Appendix IV.

Barriers to OA publishing and strategies for promoting the use of OA scholarly communication

When asked about the reasons for not publishing articles in OA outlets, high APC (43.76%; n=137), low quality of OA journals (32.58%; n=102), and lack of adequate skills to publish in OA outlets (29.07%; n=91) were cited as the significant barriers to OA publishing by the respondents. When asked how OA publishing can be promoted among researchers, respondents suggested the following strategies: raising awareness about the benefits of OA (41.53; n=130), motivating researchers for using OA (32.58%; n=102), changing the mindset about the quality of OA publications (26.51; n=83), conducting a workshop on OA (24.6%; n=77), and financial support for paying APC (14.37%; n=45). The details of responses are shown in Appendix IV).

Factors affecting adoption and use of OA scholarly communication among researchers

A two-round Multiple Regression (HMR) analysis was applied to investigate any significant relationship between independent and dependent variables. Multiple Regression (MR) analysis was used to establish the relationships among the factors that influence the adoption and use of OA publishing. Although various regression methods exist for analyzing data, including simultaneous, step-wise, and hierarchical tests, this study employed the hierarchical method because of its theory-driven approach. It may be noted that some assumptions, such as sample size, multicollinearity, normality, underpin the use of regression. In this study, all assumptions to conduct regression were met. Moreover, in HMR, the independent variables are entered into the equation based on theoretical grounds in the researcher's order. A Pearson correlation (two-tailed) was first conducted to investigate the strength of the correlation between the independent and dependent variables of the study.

HMR analysis for determining significant relation between independent variables and adoption and use of OA scholarly communication

A nine-step HMR procedure (n=313) was conducted to assess the amount of additional variance in adoption and use of OA scholarly communication, as explained by adding independent variables to the equation. Table 1 displays the standard beta coefficient (β), R Square (R^2), and the squared semi-partial correlation (R^2 change).

The beta coefficients are regression coefficients transformed to a standardized value with a mean of 0 and a standard deviation of 1, which allows for the direct comparison of each independent variable's relative effect on the outcome. R^2 measures the degree of variation in the dependent variable induced by the independent variables. It represents the combined effect of all the variables in the prediction. R^2 change reflects a unique contribution and demonstrates how much of the overall variation of the outcome was accounted for by a specific independent variable after other variables have been taken into account (Pallant, 2007).

(i) Unique contribution: The significance of incremental partitioning of the variance between each independent variable and the intention to publish in the OA outlet was assessed at each step of the hierarchy through R^2 change. At the end of step one, with demographic variables as a block in the equation, the proportion of variance added to adoption and use of OA scholarly communication was 1 percent F (5,307) =.619 at p>.05, R=.100, R^2=.010 (Table 1). After step two, controlling for the demographic variables, *attitudes* added a significant proportion of variance to intention, accounting for 6.4 percent of unique contribution with F (1,306) =20.998 at p<.05, R=.271, R^2=.074. After step three, *performance expectancy* was added to the equation; it accounted for 3.1 percent of unique contribution with F (1,305) =10.622 at p<.05, R=.324, R^2=.105. After step five, *facilitating conditions* was added to the equation; it accounted for 2 percent of unique contribution with F (1,303) =7.004 at p<.05, R=.363, R^2=.132. After step seven, the *Internet usage self-efficacy* was added to the equation; it accounted for 2.4 percent of unique contribution with F (1,301) =8.645 at p<.05, R=.395, R^2=.156.

(ii) Collective contribution: Step nine of HMR (Table 1) illustrates a complete HMR analysis model whereby all variables were included in the analysis. Based on these results, the multiple R^2 was .185, which means that the total contribution by a combined set of independent variables accounted for approximately 18.5 per cent of the variance of adoption and use of OA scholarly communication, F(1, 299)=4.317 at p<.05, R=.430, R^2=.185.

(iii) Significant variables: Table 2 shows Unstandardized Coefficients (B), Standardized Coefficients (β), Std. Error, t values, and significant values for 13 predictor variables (independent variable) with the adoption and use of OA scholarly communication. The beta values indicate the individual contribution of each predictor to the model. Five independent variables (factors) made a significant contribution to the adoption and use of OA scholarly communication. Regarding the contribution level, the *length of experience* made the most significant contribution (β=.238, t=2.560, p < 0.05). *APC* followed this, with a value β=.151, t=2.536, p<0.05. Next is the *intention* to *publish in OA outlet in future* that made a significant contribution (β=.128, t=2.078, p<0.05). *Facilitating conditions* (β=.127, t=2.101, p<0.05) and *Internet usage self-efficacy* (β=.119, t=2.034, p<0.05) were also made a significant contribution to the adoption and use of OA scholarly communication. Thus, the higher the beta value, the greater the influence of the independent variables on the adoption and use of OA scholarly communication. Hence, it was identified that factors like *length of experience, APC, intention* to *publish in OA outlet in future*, *facilitating-conditions*, and *Internet usage self-efficacy* are significantly influence the adoption and use of OA scholarly communication.

HMR analysis for determining significant relation between independent variables and intention to publish in OA outlets in the future

An eight-step HMR procedure with seven independent variables and five demographic variables (n=313) was used to analyze the degree of additional variance in intention to publish in OA outlets in the future and explained by adding an independent variable to the equation. Table 3 shows the standard beta coefficient (β), R Square (R^2), and the R^2 change.

(i) Unique contribution: Demographic variables were entered as a block in the first step of the regression analysis (Table 3); the proportion of variance added to intention to publish in OA outlets in the future in this step was 1.2 percent $F(5, 307)=.754$ at $p>.05$, $R=.110$, $R^2=.012$. After step two, *attitudes* added a significant proportion of variance to the intention by controlling demographic variables, accounting for 22.8 percent of unique contribution with $F(1, 306)=92.070$ at $p<.05$, $R=.491$, $R^2=.241$. After step three, the *performance-expectancy* was added to the equation; it accounted for 1.7 percent of unique contribution with $F(1, 305)=7.155$ at $p<.05$, $R=.508$, $R^2=.258$. The magnitude of improvement for predictive power with the addition of the next five steps was minimal.

(ii) Collective contribution: Results of HMR analysis (Table 3) indicate that at the end of step eight, the collective contribution (R^2) of all independent variables was .287, which means that the total contribution by a combined set of independent variables accounted for approximately 28.7 percent of the variance in the intention to publish in OA outlets in the future, $F(1, 300)=.500$ at $p>.05$, $R=.535$, $R^2=.287$.

(iii) Significant variables: Table 4 shows Unstandardized Coefficients (B), Standardized Coefficients (β), Std. Error, t values, and significant values for 12 predictor variables to the intention to publish in OA outlets in the future. *Attitudes* ($\beta=.238$, $t=2.560$, $p<0.05$) and *facilitating conditions* ($\beta=.238$, $t=2.560$, $p<0.05$) made the significant contribution to the prediction. Both had a positive β value indicating significant relationships to publish in OA outlets in the future (Field, 2005). However, *performance expectancy, effort expectancy,* and *Internet usage self-efficacy* had made an insignificant contribution but positively related to intention to publish in OA outlets in the future. Moreover, all demographic variables had neither significant contribution nor positively related to the intention to publish in OA outlets in the future.

Discussion

The present study's findings indicate that researchers are aware of different concepts related to OA scholarly communication. Still, they are less familiar with OA resources and initiatives, indicating a lack of proper knowledge of OA. These findings are consistent with a study in Pakistan where most faculty members were aware of the scholarly OA, but their awareness about OA-related resources and initiatives was shallow (Sheikh, 2017). Awareness and knowledge of OA can be a source of motivation for researchers to adopt OA publishing. There is a close relationship between awareness and the benefits of OA and OA publishing practices. The findings of the previous studies revealed that knowledge about OA influences researchers' decision to publish in OA outlets (Narayan *et al*., 2018; Peekhaus, 2019). Thus, limited knowledge about OA influenced researchers' decision to publish in OA outlets.

Most of the respondents think that raising awareness about OA is essential for promoting OA adoption. Several studies have shown that awareness of OA among researchers has increased over the years (Rodriguez, 2014; Turgut et al., 2021), but it does not influence the use of OA publishing among researchers (Lwoga & Questier, 2015). Thus, despite growing awareness of the advantages of OA publishing, individual researchers appear to be hesitant to make use of OA publishing (Köster *et al*., 2021; Peekhaus & Proferes, 2016). The present study's findings indicate a deficient level of OA adoption among Indian researchers. Approximately 22 percent of publications were published through OA mode. Thus, the publication data of respondents showed that they prefer a subscription-based model for publishing their research work. However, most respondents (87.22%) use OA scholarly content for teaching and research. In this respect, the study findings revealed that researchers are

primarily oriented towards using the OA work of others instead of making their research work OA.

This study contributed to the theoretical advancement of the research in OA scholarly communication. This study developed a conceptual model (Appendix I) based on the UTAUT model of Venkatesh et al. (2003) to investigate factors that influence the adoption and use of OA among researchers and their intention to publish in an OA outlet in the future. The study findings showed that facilitating conditions, Internet usage self-efficacy, APC, intention to publish in OA outlet in the future, and individual traits (length of researchers' experience) were found to be positively associated with the adoption and use of OA scholarly communication. Contextual factors like attitudes and facilitating conditions were also positively associated with the intention to publish in OA outlets in the future. However, performance expectancy, effort expectancy, social influence, and personal traits (gender, age, research discipline, and academic position) had a negative relationship with the adoption and use of OA scholarly communication. Performance expectancy, effort expectancy, social influence, Internet usage self-efficacy, APC, personal traits (gender, age, research discipline, experience, and academic position) had a negative relationship with the intention to publish in OA outlet in the future.

Based on the findings of the study, the conceptual model was refined, and a validated model was proposed. The validated model (Figure 1) consists of seven dimensions: attitudes, facilitating conditions, internet usage self-efficacy, APC, individual traits (length of researchers' experience), adoption and use of OA scholarly communication, and intention to publish in OA outlet in the future. The study further contributes to theory by revealing factors that do not influence OA adoption and usage, including effort expectancy, facilitating conditions and social influence, and personal traits (gender, age, research discipline, and academic position). Although these factors significantly influenced OA usage behavior in previous studies (Bashorun *et al*., 2016; Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012), they have an insignificant role in the present study. However, the results established that all OA predictors (factors) jointly contribute 47.2% towards adopting and using OA scholarly communication and intention to publish in OA outlets in the future. The findings have important research implications and can be used for further research directions. The validated model for OA scholarly communication can be used to investigate the adoption and use of OA in different institutions, research disciplines, and developing countries with similar conditions.

Practical and policy implications

The influencing factors and the relative importance identified in the present study offered empirical evidence to demonstrate the importance of the researchers' attitudes toerads OA publishing. The study findings revealed that facilitating conditions, including APC, are amongthe significant factors that impact researchers' adoption of OA publishing. As a result, the governments, research institutions, and funding agencies are required to provide an additional research grant for the payment APC to facilitate researchers publishing their work in OA journals. Although all the major research funding bodies in India have OA policies requiring researchers to make their published work available OA, but its execution is lacking. The academic and research institutions should review their academic reward policies by recognizing new forms of scholarly communication for recruitment and promotion to motivate researchers to contribute their research work in OA journals. In India, academic and research institutions are also required to provide necessary technical support to enable researchers to self-archiving their research works in IRs.

As the study's findings indicated a limited understanding of OA concepts and resources among researchers, librarians in academic and research institutions should organize awareness programmes to help researchers understand its benefits and, as a result, improve their habits of OA publishing. Libraries may also introduce support services that focus on OA issues, including copyright and legal implications of OA. The study results may also benefit society as they can bridge the gap between researchers with access to research literature through their institutions and those who do not have such access.

Conclusion

Although the study's findings indicate that researchers are willing to make their research work OA, there is limited adoption of OA among researchers. The factors like personal characteristics (length of researchers' experience), facilitating conditions, attitudes, Internet usage self-efficacy, APC, and intention to publish in OA outlets in the future significantly influenced the adoption and use of OA scholarly communication among Indian researchers in various dimensions. Social influence, effort expectancy, and performance expectancy had limited significant effect on adoption and use of OA scholarly communication and intention to publish their research work in OA outlets in the future. The barriers that hinder OA publishing among researchers in India sinclude low quality of OA journals, lack of adequate skills to publish in OA outlets, and fear of openness. APC is a significant barrier to OA publishing, particularly in developing countries like India. Therefore, it is suggested that funding agencies or research institutes may provide extra funds for publishing research in OA journals. Executing OA policies at the national level by the government is essential for making published work available OA.

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Table 1: Baseline Regression: Standardized Beta Coefficients from HMR-Adoption and Use of OA Scholarly Communication

Predictors (Independent Variables)		Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
Demo	Age	-.085	-.098	-.127	-.105	-.130	-.130	-.085	-.106	-.114
	Gender	.019	.012	.019	.016	.023	.022	.023	.024	.032
	Experience	.161	.158	.201	.191	.216	.215	.203	.221	.238
	Discipline	-.012	.002	.004	.016	.005	.005	.022	.033	.032
	Academic Position	-.016	-.013	-.015	-.029	-.009	-.009	-.043	-.064	-.076
Attitudes			.253	.147	.137	.147	.148	.163	.176	.124
Performance Expectancy				.207	.147	.102	.103	.094	.076	.063
Effort Expectancy					.109	.059	.061	.042	.022	.019
Facilitating Conditions						.165	.167	.138	.147	.127
Social Influence							-.012	-.006	-.030	-.018
Internet Usage Self-Efficacy								.167	.125	.119
APC									.146	.151
Intention to use OA in future										.128
R^2		**.010**	**.074**	**.105**	**.112**	**.132**	**.132**	**.156**	**.173**	**.185**
R^2 Change		**.010**	**.064**	**.031**	**.007**	**.020**	**.000**	**.024**	**.016**	**.012**

Table 2: Summary of Hierarchical Regression: Adoption and Use of OA Scholarly Communication (*Note: n=313; R^2=18.5; *p <.05)*

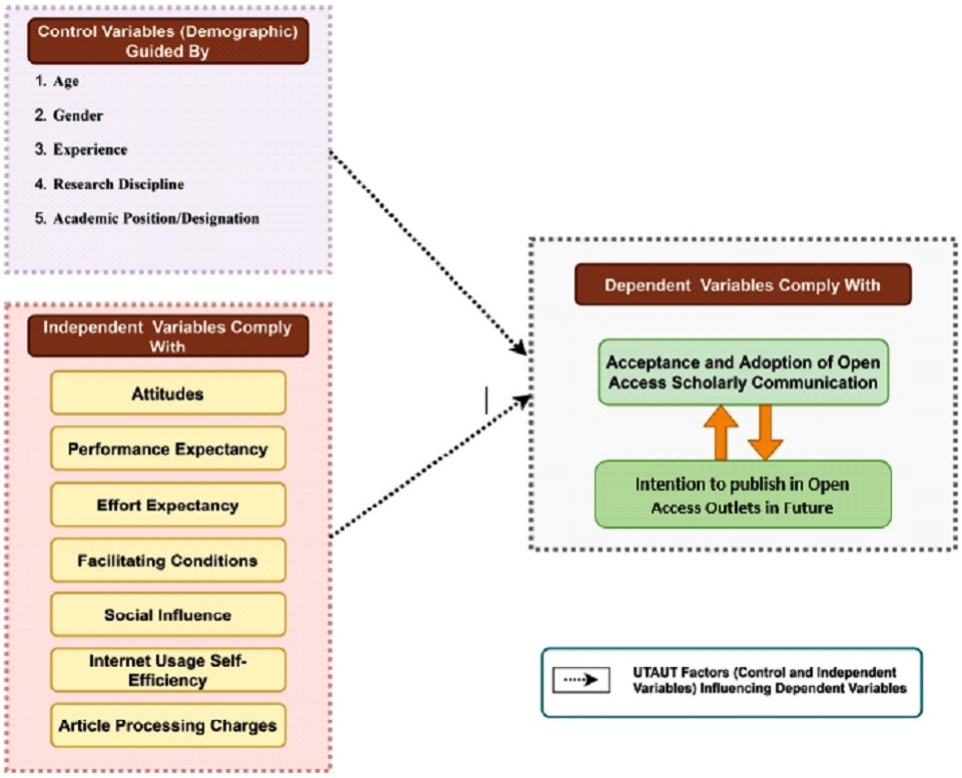
Model	B	Std. Error	β	t	Sig. (p)
Step 9 Constant	-.709	.611		-1.160	.247
Age	-.111	.092	-.114	-1.200	.231
Gender	.071	.118	.032	.597	.551
Experience	.202	.082	.238	2.560	.014*
Discipline	.027	.046	.032	.595	.553
Academic Position	-.029	.024	-.076	-1.228	.220
Attitudes	.248	.134	.124	1.844	.066
Performance Expectancy	.102	.119	.063	.855	.393
Effort Expectancy	.030	.114	.019	.266	.790
Facilitating Conditions	.213	.106	.127	2.101	.046*
Social Influence	-.031	.100	-.018	-.310	.757
Internet Usage Self Efficacy	.180	.089	.119	2.034	.043*
APC	.167	.066	.151	2.536	.012*
Intention to use OA in future	.151	.073	.128	2.078	.039*

Table 3: Baseline Regression: Standardized Beta Coefficients from HMR-Intention to publish in OA outlets in future

Predictor (Independent Variables)		Step 1	Step 2	Step 3	Step4	Step5	Step 6	Step7	Step8
Demo	Age	.101	.075	.054	.064	.041	.045	.054	.060
	Gender	-.054	-.065	-.061	-.062	-.056	-.063	-.062	-.063
	Experience	-.155	-.161	-.129	-.134	-.111	-.120	-.123	-.128
	Discipline	-.017	.011	.012	.018	.008	.010	.013	.011
	Academic Position	.082	.087	.086	.079	.097	.096	.088	.094
Attitudes			.480	.401	.396	.405	.411	.414	.411
Performance Expectancy				.155	.128	.088	.095	.093	.098
Effort Expectancy					.049	.005	.023	.019	.024
Facilitating Conditions						.145	.166	.160	.157
Social Influence							-.104	-.103	-.096
Internet Usage Self-Efficacy								.037	.048
APC									-.039
R^2		**.012**	**.241**	**.258**	**.259**	**.275**	**.284**	**.285**	**.287**
R^2 Change		**.012**	**.228**	**.017**	**.001**	**.016**	**.009**	**.001**	**.001**

Table 4: Summary of Hierarchical Regression: Intention to publish in OA outlets in future (*Note: n=313; R^2=.287; *p <.05)*

Model	B	Std. Error	β	t	Sig. (p)
Step 9 Constant	-.237	.484		-.490	.625
Age	.050	.073	.060	.678	.499
Gender	-.118	.094	-.063	-1.265	.207
Experience	-.092	.065	-.128	-1.418	.157
Discipline	.008	.036	.011	.210	.834
Academic Position	.030	.019	.094	1.625	.105
Attitudes	.699	.099	.411	7.090	.000*
Performance Expectancy	.134	.094	.098	1.418	.157
Effort Expectancy	.033	.090	.024	.364	.716
Facilitating Conditions	.224	.083	.157	2.686	.008*
Social Influence	-.141	.079	-.096	-1.779	.076
Internet Usage Self-Efficacy	.062	.070	.048	.882	.379
APC	-.037	.052	-.039	-.707	.480



Appendix I: Conceptual Model for OA Scholarly Communication

176x141mm (144 x 144 DPI)

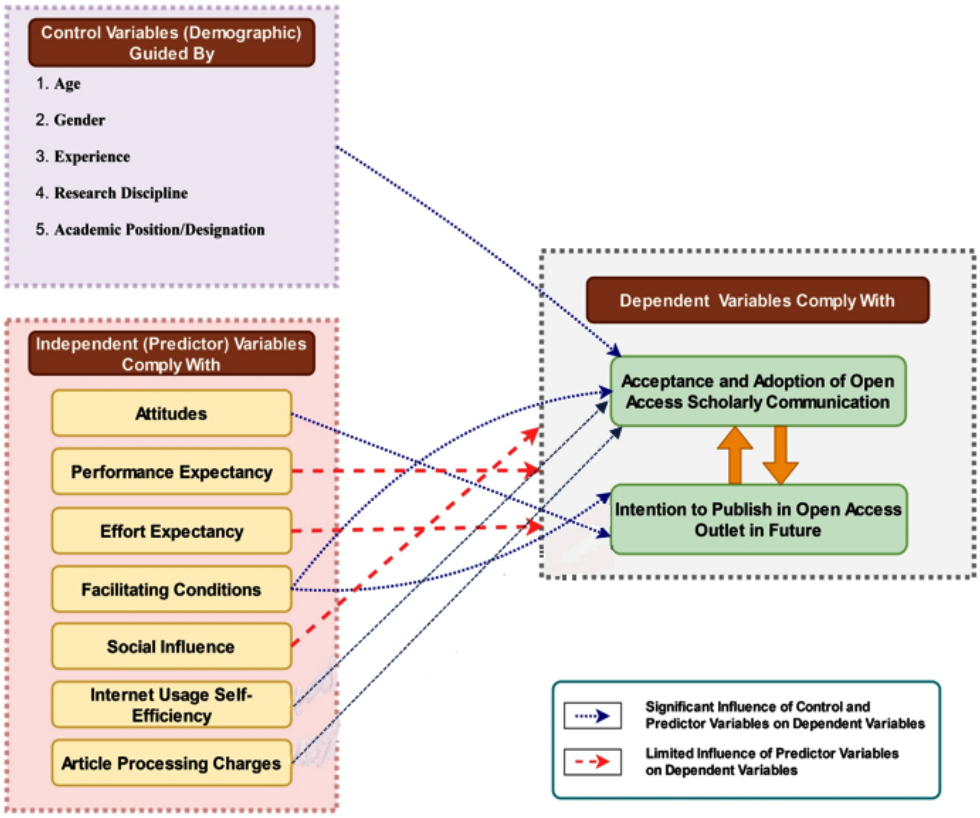


Figure 1: Validated model for OA scholarly communication

471x395mm (38 x 38 DPI)

Appendix II: Questionnaire

Section A: Demographic information

1. Gender:

a) Male
b) Female

2. Age:

a) Below 25 Years
b) 26-35 Years
c) 36-45 Years
d) 46-55 Years
e) Above 55 Years

3. Academic position:

a) Professor
b) Associate Professor
c) Reader
d) Research Associate
e) Assistant Professor
f) Lecturer
g) Research Assistant
h) Others (Please Specify): _____

4. Year of experience:

a) 0-5 Years
b) 6-10 Years
c) 11-20 Years
d) 21-30 Years
e) More than 30 Years

5. Area of specialization/ research discipline: _____

6. How many articles have you published during the last ten years?

a) In subscription journals_____
b) In Open Access journals_____

Section B: Awareness and use of OA scholarly communication

7. Are you aware of OA concepts, initiatives, and resources? (Tick all that apply)

a) OA journals
b) Directory of Open Access Journals (DOAJ)
c) Self-archiving
d) Open Access Theses and Dissertations (OATD)
e) Directory of Open Access Books (DOAB)
f) Open access institutional repositories
g) Open access subject repositories
h) Directory of Open Access Repositories (Open DOAR)
i) Green open access model
j) Gold open access model
k) Budapest Open Access Initiative
l) Registry of Open Access Repositories (ROAR)

8. Have you ever used OA scholarly content for teaching and research? *Yes* *No*

9. Have you ever made your research work OA? *Yes* *No*

10. How likely are you willing to publish your research in OA outlets in the future?

a) Very likely
b) Likely
c) Unlikely
d) Very unlikely

11. Which of the following OA outlets have you used for publishing your articles? (Tick all that apply)

a) Published an article in OA Journal
b) in hybrid or tolls access journals on the payment of APC
c) Posted an article on the personal or institutional web page
d) Deposited an article in a subject repository
e) Deposited an article in an institutional repository
f) Other *(Please specify):* _____

12. In your opinion, what are the reasons for not publishing research work OA outlets? (Tick all that apply)

a) Negative impressions of OA publishing Traditional Mindset
b) Lack of adequate skills publish in OA outlets
c) OA journals are of low quality
d) Article Processing Charges are high
e) Fear of openness
f) OA publications are like to be misused or plagiarised

13. How can OA scholarly communication be promoted among researchers?

a) Awareness Raising awareness about the benefits of OA
b) Motivating researchers for using OA
c) Workshop on OA
d) Changing the mindset about the quality of OA publications
e) Conducting workshop on OA
f) Financial support for paying APC
g) Other, please specify

Section C: Factors affecting adoption and use of OA scholarly communication

14. Attitudes

a) Publishing in OA outlets is a good idea.
b) Publishing in OA outlets would make my work more interesting.
c) OA journals are original and help in improving the quality of research.
d) Publishing in OA journals is easy for me.
e) OA journals are alternative to subscription journals and beneficial for the academic community.
f) OA journals are peer-reviewed, copyrighted, and have a significant impact factor.
g) Citation of OA journals/articles are widely accepted.
h) I see more scope for OA in the higher education system in the future.
i) OA journals/resources provide relevant information on my project/research.
j) OA articles are cited more frequently.

15. Performance expectancy

a) OA outlets enable researchers to publish research more quickly.
b) Publishing in OA outlets increases the research impact of research works.
c) OA outlets improve accessibility to scholarly literature because it is free and without access limitations.
d) Open Access enables researchers in developing countries to access literature more easily.
e) Publishing in OA outlets exposes scholarly work to a large potential readership.

16. Effort expectancy

a) I believe that the interaction with the OA publication system is clear and understandable for the publication of scholarly content (e.g., web interfaces).
b) It is easy for me to become skillful at publishing my work in OA outlets.
c) Learning to publish my work in OA outlets is easy for me.
d) I find it easy to access and use OA scholarly content from the Internet.
e) I clearly understand the implications of publishing in OA outlets.

17. Internet usage self-efficacy

a) I feel confident in searching scholarly information on the Internet.
b) I feel confident in publishing my research output on the Internet.
c) I feel confident in designing my website.
d) I feel confident in publishing on the Internet even when no one is around to show me how to do it.

18. Facilitating conditions

a) I have the necessary knowledge to publish my work in OA outlets.
b) I have the necessary resources to publish my work in OA outlets (e.g., IT infrastructure, Internet access, etc.).
c) Guidance is available for me to use the Internet effectively for information access and dissemination.
d) My institution recognizes OA publications for my carrier development (promotion criteria).
e) Guidance is available for me to use the Internet for publishing my research output through OA outlets.

19. Social Influence

a) An essential criterion for deciding whether to publish research work in OA outlets is the recommendation of an author's peers.
b) An essential criterion for deciding whether to publish research work in OA outlets is the recommendation of an author's superiors.
c) An essential criterion for deciding whether to publish research work in OA outlets is the recommendation of important people to an author.
d) A peer's article in a specific OA journal is an essential motivator for deciding whether to publish in an OA journal.
e) A superior's article in a specific OA journal is an essential motivator for deciding whether to publish in an OA journal.

20. Article Processing Charges

a) Cost in the form of Author Processing Charges (APCs) is an essential factor influencing my decision to publish in OA journals.
b) An essential criterion for deciding whether to publish in an OA journal is financial support to pay the publishing fees (APCs) if the payments are charged for the publishing.

Appendix III: Demographic details of respondents

		Frequencies	Percentages
Gender	Male	234	74.77
	Female	79	25.23
Age	Below 25 Years	3	0.98
	26-35 Years	122	38.97
	36-45 Years	116	37.06
	46-55 Years	49	15.65
	Above 55 Years	23	7.34
Academic position	Professors	54	17.25
	Associate Professors	68	21.72
	Research Associates	18	5.75
	Assistant Professors	98	31.30
	Lecturers	7	2.27
	Research Assistants	9	2.87
	Research Scholars	30	9.58
	Scientists	29	9.26
Level of experience	0-5 Years	48	15.33
	6-10 Years	100	31.94
	11-20 Years	102	32.58
	21-30 Years	34	10.86
	More than 30 Years	29	9.29
Research discipline	Natural Sciences	83	26.51
	Life Sciences	64	20.47
	Medical Sciences	87	27.79
	Engineering and Technology	79	25.23
Number of publications	In OA journals	2602	22.30
	In subscription jurnals	9072	77.70

Appendix IV: Awareness and use of OA scholarly communication

		Frequencies	Percentages
Are you aware of the concepts of OA, OA initiatives, and resources?	OA journals	202	64.53
	Directory of Open Access Journals (DOAJ)	116	37.06
	Self-archiving	62	19.80
	Open Access Theses and Dissertations (OATD)	51	16.29
	Directory of Open Access Books (DOAB)	51	16.29
	Open access institutional repositories	54	17.25
	Open access subject repositories	30	9.58
	Directory of Open Access Repositories (Open DOAR)	37	11.82
	Green open access model	29	9.26
	Gold open access model	40	12.77
	Budapest Open Access Initiative	14	4.47
	Registry of Open Access Repositories (ROAR)	20	6.38
Have you ever used OA scholarly content for teaching and research?	Yes	273	87.22
	No	40	12.78
Have you made your research work OA?	Yes	197	62.93
	No	116	37.07
How likely are you willing to publish your research in OA outlets in the future	Very likely	60	19.16
	likely	196	62.61
	Unlikely	31	9.90
	Very unlikely	26	8.33
Use of OA outlets	Article in pure OA journals	159	50.79
	Article in hybrid or tolls access journals on the payment of APC	70	22.36
	Articles posted at the personal or institutional web page	21	6.70
	Articles deposited in a subject repository	18	5.75
	Articles deposited in an IR	9	2.87
Reasons for not publishing research work OA outlets	Negative impressions of OA publishing	58	18.53
	Lack of adequate skills publish in OA outlets	91	29.07
	OA journals are of low quality	102	32.58
	Article Processing Charges are high	137	43.76
	Fear of openness	44	14.05
	OA publications are like to be misused or plagiarised	11	3.51
How can OA scholarly communication be promoted among researchers?	Conducting workshop on OA	77	24.60
	Raising awareness about the benefits of OA	130	41.53
	Changing the mindset about the quality of OA publications	83	26.51
	Motivating researchers for using OA	102	32.58
	Financial support for paying APC	45	14.37