Studies on the use of academic social networking sites by academics and researchers: a review

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The present review is an endeavour to understand the use of Academic Social Networking (ASN) sites by academics and researchers during the 2001-2020. The literature indicates existence of disciplinary differences in choice of ASN platforms as well as frequency of use of a particular platform by users belonging to a particular discipline. The strong disciplinary influence could be attributed to variations in social and cultural practices of a particular discipline. The review finds professional visibility as one of the outstanding motivating factors for academics and researchers to join ASN sites. Seeking scholarly answer, accruing citations, seeking expert, sharing research literature by availing self-archiving facilities of ASN sites, exploring collaborative research avenues and job seeking are some other important motivators. The review noticed that alternative metrics have become a strong contender for measuring research impact. The review also found age and gender discrimination, snooping, academic cyber bullying, flooding of ASN sites with substandard literature as some concerns which need concerted attention and suggests more research in these fronts and accordingly modification of ASN interfaces to make them more responsive to user's needs.

Keywords: Social Networking sites, Academic social networking, Network structure analysis.

Introduction

Social network as a concept was first coined by J.A. Barnes in 1954[1]. Research work on the dynamics of social networks though started gathering momentum since 1967[2], yet during the pre-Facebook era it was challenging. The most crucial part was to quantify the subjective perception of closeness and intimacy in a one-to-one relationship within a social network[3]. Particularly tracking down the passage of information through a social network was cumbersome as the whole process of data gathering was mainly manual work and heavily depended on replies from people being surveyed with accuracy issues. Duncan Watts, a sociologist, believed "a much better approach is to record what it is that people actually do, who they interact with and how they interact."[4]. Transition from Web 1.0 to Web 2.0, i.e., from static web to dynamic web gave birth to the idea of online social network[5] which in turn paved the way for implementing Watts's idea of recording what people do, who they interact with and how they interact.

Web 2.0 applications in social networking gave rise to several web-based platforms powered by online feedback mechanisms like computer-mediated communication technologies[6] and provide several common functionalities such as visible profile creation, sharing social connections, and messaging[7], generating and sharing contents, accessing contents created by others, posting comments[8,9], etc. SixDegrees.com was the first major social networking site to be launched in the year 1997[10] and was followed by many other social networking sites. But the most significant milestone in the history of computer-mediated social networking was the birth of Facebook as the most popular social networking site[11] in terms of registered user base[12]. By 2018, Facebook crossed the magic figure of 2.25 billion registered users[13]. At the same time few of the Facebook contemporaries such as Hi5, MySpace, Friendster, could not keep pace and eventually left the stage. Apart from Facebook, there are a few social networking platforms such as Youtube and Whatsapp with more than one billion users.

In recent years, social networking sites have become household entities with myriad applications in social life[14]. Even the scholarly community has shown keen interest in SNS and has been using this interactive platform for teaching as well as for other scholarly communication[15,16]. Although participation in these general SNSs instils a sense of virtual community among users[17], yet being general in nature

with a heterogeneous user base, these popular SNSs have their own downside in the form of a ceaseless stream of information from a multitude of sources leading to information overload[18] together with extreme difficulty in separating personal and professional life[19,20] resulting into a sense of insecurity, breach of privacy, and sometimes cyber-bullying[21] among academics and research community.

Academic Social Networking Sites (ASNSs) are steadily gaining popularity among academics and researchers as these are specifically oriented towards scholarly communities associated with different academic institutions and facilitate sharing of papers and datasets, exchange of information, provision of publication analytics, etc.[22]. Harnessing the benefits of the application of Web 2.0 technologies in the academic and research sphere, individuals in the academic and research community now have the unprecedented opportunities to connect and communicate with peers, researchers, and experts across the globe which would not have been possible without the interactive web.

There are several ASNSs at present catering to academic and research activities online. Few among them (such as Academia.edu, ResearchGate, Penprofile, LinkedIn) started off as pure ASNS. Few others (such as Mendeley, Zotero) were initially identified as social bookmarking and reference management tools but of late networking features are being added to these tools. The present review is an endeavour to understand how the first two decades of the twenty-first century have witnessed research on the use of ASNSs by academics and researchers.

Objectives of the study
- To try to understand the motivations for establishing and sustaining connections and usage of ASNSs at individual and group levels through the lens of network structure analysis;
- To understand the nature of academic social interactions;
- To examine the scope of data generated out of academic social networking activities as an alternative to traditional scientific and academic impact assessment; and
- To encourage future research by pointing towards issues of academic social networking upon which not much research has been done or areas that need further research to understand their implications in the larger canvas of academic social networking (e.g., design and modification of interfaces of academic social networking sites)

Methodology
The present study was undertaken to critically review and examine the available selected literature on the use of academic social networking sites by academics and researchers for a deeper understanding of changing landscape of scholarly interactions among academics and researchers in response to the unprecedented invasion of social networking technology into academic and research domains.

A two-stage literature search was carried out. In the first stage Library, Information Science and Technology Abstract (LISTA), an abstracting and indexing database hosted by EBSCO, was searched for literature on 'academic social network', 'academic social networking', and 'academic social networking sites' keeping comprehensiveness of search output in mind.

From the titles and abstracts, 40 articles were found relevant. In the second stage, close attention was paid to the content of the 40 articles, and sub-facets such as network structure analysis, academic social interaction, peer and expert seeking behaviour, quality of exchanged information, and so on were picked up and used as search entities in Google Scholar search to find further research works on different dimensions of the sub-facets in order to enrich the review by incorporating findings of works on those dimensions. Literature on the use of academic social networking sites by undergraduate and post-graduate students and pedagogical aspects were not considered to narrow the scope of the review. Also, articles written in languages other than English were kept out of this study.

Network structure analysis
Network structure analysis is a potent method that can be leveraged to understand not only motivations for establishing and sustaining connections and trends of usage of ASNS by individuals but also community structure. Networks on academic social networking sites tend to be smaller and more highly clustered than general social networking sites such as Facebook, Twitter, etc.[23]. Jordan (2014)[24] used network structure analysis to find that discipline acts as an influencing factor for defining the community structure of ASNS use[25]. Megwalu (2015)[26] studied the disciplinary influence on the use of Academia.edu by scholars from physics, linguistics, and sociology. He found that physicists are somewhat passive in using Academia in comparison to linguists and sociologists. Also, what motivates linguists to be active users of

Academia differs from what motivates sociologists to be active users of the same.

To observe these disciplinary differences across different ASN platforms, Ortega (2015)[27] broadened the scope of his study by incorporating scientists from humanities, social sciences, and biological science and examined the usage behaviour on two different platforms namely Academia and ResearchGate. Academia was found to be thickly populated by humanists and social scientists while Researchgate was preferred by biologists. Not only do there exist disciplinary differences in the choice of academic social networking platforms but also in the frequency of use of a particular platform by users belonging to a particular discipline. Ortega found that scientists from humanities, social sciences, and natural resources have shown significant activity in contacting other members while biologists exhibited passivity in using social tools. These findings were strongly supported by another study by Goldstein (2020)[28] on reciprocity wherein it was revealed that arts and humanities disciplines were significantly more reciprocal than their other counterparts.

Variations in social and cultural practices of a particular discipline largely shape user motivations and user activities across the discipline[29]. This assumption holds true even in an engineering discipline. In one study on engineering researchers at the University of Teheran, Marahmani (2018)[30] found that engineering researchers held the highest number of members on LinkedIn following ResearchGate. Arguably LinkedIn has been the most successful platform for promoting portfolios of prospective employers and employees. Given the social and cultural practices of the engineering discipline which revolve around the career concept of industry absorption and promotion, it is quite natural for engineering researchers to be more active users of LinkedIn.

The discipline-centric structure may get blurred when a large volume of interdisciplinary information is generated on account of the participation of researchers and academicians from multiple disciplines. By studying this network structure, friend discipline distribution on academic social networking sites could be mapped which might help in identifying interdisciplinary collaborators and peer reviewers[31]. But as an exception, very few interdisciplinary interactions were observed in academic social networks of corporation users[32].

This network structure, when viewed from the level of academic institutions, reveals that users from higher research activity level universities and institutions tend to show better performance in ResearchGate metrics (on publications, profile views, citations, number of followers, etc.) than their lower research activity level counterparts[33]. The concept of the follower-followed relationship which, is the primary building block for the development and proliferation of an academic social network, could be employed in understanding network trends at institutional and corporation levels through follower-followed ratio analysis of three types of users, viz. Information source users, friend users, and information seeker users.

Yan et al. (2018)[34] observed that although the proportion of information seeker users remained stable, yet with the increase in the scholarly reputation of a university, there was an increase in the proportion of friend users. Corporations users on academic social networking sites although build their social networks based on follower–followed relationships, they tend to connect with institutional users in regions with high research impact, and they interact most significantly with universities among types of institutions[35]. Academic social networking sites, in this sense, are better suited to act as catalytic agents in industry-university–research cooperation.

At a broader level, irrespective of particular ASNSs or institutions, the following prevailing common trends exist in a network: a large number of academics have few connections to others in the network, while a small number have relatively many connections[36]; faculty with more profile are likely to be more visible in search engine results and faculty with authority records are ranked higher in search results[37]; network centrality of nodes is linked with academic seniority within the network and as a result, junior academics, although more active users of the sites are more peripherally placed[38].

Academic social interactions

Perceived potential benefits to the academic community such as connection with fellow scholars, expert advice, self-expression, research updates, creating and joining events and discussions, exploring collaborative projects, finding jobs, sharing published and unpublished scholarly works such as articles, conference presentations, and other media files have been found to be main motivating factors for individual scholars to join ASNSs[39].

Salahshour Rad et al (2019)[40] in their study applied the Unified Theory of Acceptance and Use of Technology, a comprehensive model with constructs of perceived security, perceived privacy, trust, and attitude towards technology and communication benefits to validate academic researchers' intentions in the adoption of ASNSs. They found a positive correlation among factors but concluded that age, gender, and experience as moderator variables have very little or no effect on scholars adopting ASNSs. One outstanding motivating factor for individual scholars to join a group in ASNSs is the quest for increasing their professional visibility[41].

Whether an individual scholar joins an ASNS or a group in an ASNS, profile presentation is arguably the very first step that holds promises as well as perils in the future course of scholarly endeavour. As users of ASNSs represent a plurality of scientific backgrounds and academic levels, it is quite natural for them to have different kinds of self-presentation behaviour and nature of communication. Hence, it is worthwhile to study and understand the dynamics of how academics and researchers present themselves to their colleagues and how they are perceived in relation to professionalism and attractiveness.

In one such study, Tsou et al (2016)[42] identified gender and age disparity in the perception of ASN colleagues as older male scholars in their profile pictures were considered more professional than females and young individuals. Moreover, ASNSs reflect pre-existing professional relationships and do not foreground social interaction[43]. Ostermaier-Grabow and Linek (2019)[44] presented a different picture on the ResearchGate platform where mostly young male academics without previous connections to each other were found to engage in scholarly exchange. Arguably, this exchange is likely to be confined to young academics. Older and more experienced academics and researchers may restrict or limit scholarly exchanges of sensitive data with new entrants due to security reasons[45] which may be due to scarce know-how about new entrants and doubt about their ulterior motive. That means experienced academicians and scholars seem to be comfortable with acclaimed and seasoned scholars and researchers.

The overall communication behavior is characterized by an objective, professional, unemotional choice of words and at the same time conspicuous absence of polite salutation or words of farewell[46]. Except for long-term association among some scholars, the use of colloquial and emotional language seems not to be in vogue in ASN communication as opposed to general social networking.

The wide network facility of ASNSs provides a global audience for any kind of scholarly communication and phenomenal publicity of research work. This opportunity seems to be a motivating factor for scholars to upload their publications on ASNSs. Wider circulation draws more reads and thereby opens the possibility of more citations[47]. This could explain the willingness of users to publish their publications than publish projects[48]. Probably, because of this fact, a study by Shrivastava and Mahajan (2017)[49] found the highest correlation of ResearchGate score with publications added by physics researchers to their profiles.

On the other hand, limited or no accessibility of very expensive journal articles, hosted and controlled by profit-making publishers, compels users to look for alternative access through academic social network search[50] and interactions with other scholars. This is very much true for third-world countries where access to costly journal articles through institutional subscription remains limited due to severe budgetary constraints.

Seeking peers and experts

Robust networks of different ASNSs provide unique opportunities to search for, select, and connect with not only peers but also experts in a particular domain of knowledge. In fact, curious research was done by Wu et al (2021)[51] where they chronologically linked different navigation pathways of users of ResearchGate to understand expert seeking behaviour and found that profile pages, search pages, and publication pages were targeted by the seekers to evaluate the likelihood of a person to be selected as an expert in a particular domain of interest. In doing so, users paid utmost attention to research result pages within profile pages.

Quest for the quality of scholarly information

As ASNSs are gradually gaining popularity as "Facebook for nerds"[52] among academic and research fraternity, these sites are being seriously considered as venues for disseminating and accessing scholarly discipline-specific information[53]. With the plethora of questions being put up, discussed, and answered on different ASN platforms, it is particularly interesting

to gain an insight into the way the quality of an answer is being judged by information seekers and other experts.

Li et al (2018)[54] studied three disciplines with the apparent absence of nearness among them, namely library and information services, history of art, and astrophysics, and found a common thread that cuts across the disciplines: high-quality answers tend to be longer, containing objective information and fewer subjective opinions, and given by scholars with acclaimed academic reputation and having larger follower base. Additionally, users perceive high information quality based on the cues provided by peers as the peer relationships among researchers bears the testimony of their similar research objectives[55]. Sometimes collective feedback on a particular answer (Facebook 'like' concept) may influence the judgment of a recommending scholar. Scholar's demographic characteristics, the discipline s/he belongs to, and the credibility of the ASNS which hosts the question & answer might, in various combinations, influence perception about an answer[56]. Other quality criteria such as relevance, completeness, verifiability, comprehensiveness, the answer's scholarship, and value-added might be applicable to generic answers as well[57]. Objectivity although varies with discipline. Sometimes it is not the discipline, but the questioner's intention of either seeking information or seeking discussion that determines the nature of the answer[58].

But what makes a question or an answer popular among scholars on ASNSs? Probably, the statement embedded in a question and/or its answer goes a long way to determine whether that very question and/or answer would motivate a scholar to respond in terms of reading, following, or recommending that question and/or answer.

Deng et al.'s (2019)[59] study revealed two interesting facts: first-the threshold effect where they found that scholars would quickly lose interest in case the length of question description crosses circa 150 words, and thus not read the description; second-questions with positive action-oriented statements, would likely to sustain subsequent reads from other scholars. Similarly, answer with positive procedural statements or negative action-oriented statements would likely get recommended by scholars. A thoughtful design and incremental improvements of academic social networking interfaces could go a long way in stimulating scholarly interactions by minimizing confusion, improving the clarity of questions, and promoting scholarly content management[60].

Looking beyond an institutional repository

Traditional profit-making publishing models have done little to facilitate free dissemination of research output by limiting access facilities through imposing conditions on the global audience and thereby limiting the visibility of research output of individual researchers on a global scale. Ever since the concept of academic social networking came into being, it has opened the possibility of reaching the unreached through individual scholar/researcher's initiative to push for easy access of his/her publications to larger academic and research community by availing archiving facilities of different ASN platforms.

"Self-archiving" in this sense may be referred to as the action of uploading any kind of academic work, material, or research data to personal websites or institutional or subject repositories to make them freely available to and accessible by the public online[61-63]. This includes information regarding or full-text versions of refereed/ non-referred journal articles, conference articles, raw data, full-texts, bibliographic information, or any kinds of materials produced in the process of research[64]. Institutional repositories could have filled the void created by the policy of the for-profit publication industry. But research related to self-archiving practices in institutional repositories indicates that institutional repositories have not been the platforms of choice, rather ASNSs especially ResearchGate repeatedly outperformed institutional deposits[65].

But the question is what motivates scholars to go for self-archiving on ASNSs? Lee et al. (2019)[66] in their study demonstrated a motivational model based on pre-existing models of motivation for self-archiving in academia and motivations for information sharing in social media and incorporated several factors from personal, social, professional, and external contexts within the model to examine how the factors motivate scholars towards self-archiving on ASNSs. Accessibility happened to be the most highly rated factor fuelled by perceived benefits of the open access approach[67], followed by altruism, reciprocity, trust, self-efficacy, reputation, publicity[68], and others. Thus, the benefits offered by ASNSs exacerbated the ignorance among research scholars about the existence and operations of institutional repositories[69]. The motivating factors (as mentioned

above) are heavily dependent on the self-archiving culture of a particular discipline and naturally would show variations in ranking when multiple disciplines are compared[70].

However, concerns about copyright, extra time and effort, technical ability, and age exert a negative influence on self-archiving effort[71]. As self-archiving is not best supported by copyright transfer to publishers[72], academics and scholars who are aware of copyright issues may ditch self-archiving practice selectively to avoid legal entanglement[73]. Investment of time for getting acquainted with ASNS features and for practically using the platform may deter busy academics and researchers to utilise the advantages of ASN platforms[74]. Apart from this, the digital divide especially the lack of know-how relating to using specific technologies may act as a de-motivating factor for the author's self-archiving[75]. Older academics at the fag end of their accomplished career may not be much motivated in keeping abreast of the latest technologies related to ASNSs.

Librarians at higher educational institutions, owing to their professional compulsion, are well aware of copyright issues in connection with exercising self-archiving on institutional repositories, personal websites/servers, and, ASNSs[76], and their understanding of the fact that increased visibility of self-archived papers may lead to accumulation of citations and chance of possible collaboration with international peers for research projects[77], might prompt them to reach out to academics and research scholars not only in their creation of effective online academic profiles[78] but also offering services to assist them with copyright management along with technical and logistical issues[79].

The real worry could be a trend of use of ASNSs for dumping publications under the guise of self-archiving which include preliminary research, works in progress, and conference presentations that have been abandoned and could not be published elsewhere due to quality issues[80]. This would overwhelmingly increase the proportion of junk in scholarly search results and thereby would create an unwanted abundance.

Exploring possibilities of alternative metrics

With ever-growing traffic on different ASNSs, a large amount of data is being generated out of usage activities of different academic social media platforms by academics and research scholars. Proponents of relational dynamics of scientific impact criticized traditional impact measures for being silent on the influence of scholarly interactions among academic and research scholars on scientific and research impact measurement[81]. The tunnel vision of assessing the research productivity of individual scientists only by counting the number of citations or aggregate/average values of the Journal Impact Factor (JIF) seems to be inadequate to represent the larger canvas of research and academic evaluation[82].

In fact, it is now being seriously debated and researched regularly whether alternative metrics (popularly designated as altmetrics), generated out of academic social interactions on different ASN platforms, are mature enough to be considered as an alternative as well as reliable to traditional scientific impact measures or could at the best be considered as supplementary to the existing one. Or could there be any correlation between an institution's national/international ranking and its respective alternate metrics score? Ali et al. (2017)[83], while working on ResearchGate, did not find any correlation between an institution's national/international ranking and its respective RG Score but noticed a tendency for lower-ranked institutions to have lower RG Score.

Apart from an institutional point of view, exploration of the connection between altmetrics and bibliometric indicators at other levels (such as author, article, and journal-level) could be of help to understand as to what extent altmetric indicators, collected from ASNSs, might be thought of as a proxy for research impact.

Ortega (2015)[84] studied altmetrics and bibliometric indicators at the author level to find a scant relationship between them at the author level. The site dependency of altmetric indicators made them unstable across platforms as one author may manage only one profile on one ASN platform or have different profiles for different platforms together with the difference in the management of usage and social indicators by different ASN platforms.

Whereas bibliometric indicators are time-tested and are more stable across websites but given that citations take time to accrue, it is not feasible to use citations for research evaluation or research impact of an article during the intervening time. Resorting to Journal Impact Factor as a proxy for the potential citation value of an article (article-level indicator) within a journal to compensate for the loss of initial years (when an article may have an insufficient

number of citations), may not yield an accurate citation value at individual article level due to skewness of citation distribution[85].

Also, citation analysis does not recognize new scholarly forms like datasets, software, and research blogs as citable research objects[86]. Moreover, beyond the 'citing-cited' relationship and the whole gamut of its offshoots, there exists a large audience of scholarly papers who may read but do not cite. Thus, traditional citation practices fail to consider the above issues, whereas altmetric indicators with unique approaches may provide new avenues to those issues.

Alhoori and Furuta (2014)[87] studied altmetrics on article and journal levels to understand whether the online attention received by research articles was related to scholarly impact or might be due to other factors. They found that online attention to scholarly articles is related to traditional journal rankings and favours journals with a long history of scholarly impact. They also noticed the journal-level altmetrics to have strong significant correlations among themselves in comparison to the weak correlations among article-level altmetrics. Out of all individual altmetrics studied by them, readership of academic social networks was found to have the highest correlations with citation-based metrics. This was echoed by Ergüta and Camkıran (2021)[88] after finding a statistically significant correlation between the number of citations and Mendeley readership counts in their research.

RGScore, an indicator developed by ResearchGate to analyze how a researcher is perceived by his/her peers, has been used by researchers to quantify and understand correlations among different altmetric indicators and to examine how RGScore goes with other traditional bibliometric indicators in research impact assessment at individual researcher level.

Shrivastava and Mahajan (2017)[89], while performing altmetric analysis of ResearchGate profiles of physics researchers, found a strong positive correlation between RGScore and reads, profile views, number of Full Texts, and number of followers of a researcher. Also, a very strong correlation between RGScore and citations from ResearchGate was noticed. ResearchGate showed a strong positive correlation with Scopus metrics except that RGScore did not go strong with citations (Scopus)[90]. Not only RGScore, but other altmetric scores exhibited low correlation with citation count at article level as well[91,92]. These findings indicate that altmetrics, while subject to platform-specific dynamics, may add richness

and differentiation to scientific impact assessment, yet time may not be ripe enough to replace traditional bibliometric indicators altogether with altmetric indicators.

Conclusion

In 2002, the Budapest Declaration[93] and subsequently Berlin[94] and Bethesda Declaration[95] in 2003 related to the Open Access Movement ensured online availability of scholarly research publications to research fraternity, common citizens, and taxpayers across the globe. The San Francisco Declaration on Research Assessment (DORA)[96] which was signed by the scientific and research communities across the world in 2012, advocated the promotion of altmetrics over traditional JIF-based assessment. These two apparently heterogeneous yet epoch-making incidents of the first two decades of the twenty-first century paved alternate ways for research publication, reading, and assessment where ASNSs have become centres of attraction for the collection of multidimensional metrics data on published literature.

Research funding agencies in developed countries regularly look beyond traditional metrics for impact evaluation of research publications or funded research projects by encompassing a paper's downloads, reads, expert opinion, citations, links, bookmarks, conversations, etc[97]. Thus, higher education and research institutions and research funding agencies that still consider traditional metrics as the gold standard for assessing research impact may give a second thought to including altmetric data for a comprehensive evaluation. Riding on the success of the open access movement, it would be extremely beneficial for the academics and researchers to get exposed to the concept of creative commons to exercise wider circulation of their research publication and self-archiving while minimizing copyright entanglement. A host of other benefits could be harvested by being active users of ASNSs.

Library and information science professionals of higher academic and research institutions, with their unique responsibility as information facilitators, may act as catalytic agents for sensitizing academics and researchers by arranging workshops and lecture series on features and use of different ASNSs highlighting ethical aspects so that phenomenal increase in individual and institutional level participation could be realized with all-encompassing benefits to larger academic and research community.

But the brouhaha over the benefits of using ASNSs must not drown the reality of the flip side of ASN such as gender discrimination, academic cyberbullying, plagiarism, snooping, ASNSs as an academic junkyard for unwanted papers, and so on. Also, as the majority of ASNSs are for-profit businesses looking for some ways to monetize the network, one must not forget that all the expectations from an ASNS might never become reality. Whenever and wherever, there is a chance of potential profit against a particular service, the same would likely be kept under the premium service option. Nonetheless, an improvement upon existing features of the ASN platforms, especially innovative interface design could help the ANS service providers to address prevailing discriminations along with facilitating improved user experience and robust security features.

With the tremendous growth of research on the application of artificial intelligence (AI), possibilities galore for ASNSs to incorporate some of the cutting-edge applications of AI algorithms to better understand information search behaviour and information need of individual scholars and eventually to make better-personalized recommendations.

Perhaps, a deeper insight into socio-cultural factors such as individualism-collectivism could give a clue to the nature of adoption of ASNS by scholars and academics and thereby would lead to more responsive ASN platforms[98].

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