

## Aberystwyth University

### *The impact of information and communication technologies on informal scientific communication*

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**The impact of information and communication technologies  
on informal scientific communication: a naturalistic inquiry  
approach**

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# The impact of information and communication technologies on informal scientific communication: a naturalistic inquiry approach

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## Abstract

**Purpose** - This study aims to accomplish three objectives. First, to investigate the role and impact of information and communication technologies on the practice of science in the UK. Second, to examine and characterise changes in scholarly communication activities such as information seeking, publishing, and collaboration. And, third, to investigate the validity of the current scholarly communication models and to determine if there is a need for a new model.

**Design/ methodology/approach** - The study deployed a naturalistic inquiry approach using semi-structured interviews as a qualitative research tool. A theoretical sample of 40 researchers in four universities were interviewed to gather data regarding informal scholarly communication practices, factors that affect the researchers' decisions, and changes in the scholarly communication system.

**Findings** - The results of the interviews suggest that there are three types of scholars who engage in scholarly communication activities. First, the 'Orthodox Scholar' who only uses formal and traditional scholarly communication approaches. Second, the 'Moderate Scholar' who prioritises formal communication approaches but at the same time is trying to get benefits from informal channels. Lastly, the 'Heterodox Scholar' who uses all channels available in scholarly communication. The study also proposes a model of scholarly communication that reflects the current changes in scholarly research.

**Research limitations/implications** - The paper describes the changes in informal scholarly communication practices in four universities in the UK. However, because the study used a naturalistic inquiry approach, the results cannot be generalised to a different population.

**Originality/ value** - There is limited literature investigating the changes in informal scholarly communication practices. The value of the current study lies in being the first study in this area that uses a naturalistic inquiry approach to investigate the changes in informal scholarly communication practices, and to develop a new model of scholarly communication.

**Keywords**- Informal communication, scholarly research, scholarly communication system, communication practices, scholarly publishing, scholarly collaboration, information seeking.

**Paper type**- Research paper (Postgraduate)

## Introduction

Scientific research is a social, academic activity rather than a solitary one. Researchers need to communicate their research with others and distribute their results so they can be rewarded, or promoted, for their efforts. Scholarly scientific communication is defined as “the processes by which scholars communicate with one another as they create new knowledge, and by which they measure its worth with colleagues prior to making a formal article available to the broader community” (Thorin, 2006).

In the last twenty years or so, new forms of scholarly communication channels have emerged to stand side by side with traditional channels. Digital repositories and open access publishing were thought of as new forms of formal scholarly publishing, while blogs, wikis, social academic networks, and preprint repositories were considered to be informal publishing media (Allen et al., 2013; Barjak, 2006; Collins and Hide, 2010; Davidson, 2005). Interestingly, this change in scholarly publishing has spread to other communication activities, such as dissemination, collaboration, information seeking, and referencing.

Despite awareness of the significance of informal communication in academic careers, and an expressed interest in diversification of scholarly communication practice, researchers, scholars, and practitioners have limited knowledge about how researchers in academia obtain and utilise information through informal channels. Equally little is known about how organisational and individual differences affect scholars' strategies for finding and utilising information. This study explores one particular aspect of scholarly research: informal communication in academia. Specifically, the study explores how researchers select informal communication channels, and how academic traditions, such as the established scholarly system, affect their communication strategies (or the behaviours which researchers employ to obtain scholarly information from informal resources), what communication and collaboration strategies emerge in informal channels, and what the patterns of access and use of information revealed. An exploration of scholars' networking strategies and patterns of access of information takes us a step towards a greater understanding of the ways in which informal communication affects the lives and careers of scholars.

## Review of related literature

Scholarly communication literature reveals that many studies have discussed the process of scholarly communication as an important part of creating and disseminating knowledge (Borgman, 2000; Thorin, 2006; Garvey, 1979). Notably, in all definitions, the process of scholarly communication was categorised into two activities: formal and informal communication (Barjak, 2006; Garvey and Griffith, 1971). The importance of the process of scholarly communication is seen in the way that it benefits the research community in conducting and sharing their research. Ideally, scholarly communication would serve to inform other researchers about a research project, promote current research results among the scholarly community, and inform a non-academic audience about the important results that were produced from scientific research (Kulczycki, 2012).

Many studies have investigated the scholarly communication process in academia. These tended to focus on measuring, evaluating, and identifying the changes in this process (Barjak, 2006; Davidson, 2005; Eisend, 2002; Rowlands et al., 2004). Notably, these studies did not consider the changes in scholarly communication as a whole, but instead investigated changes to individual elements within the process (Chen et al., 2009; Kaminer and Braunstein, 1998; Mulligan and Mabe, 2011).

The use of social network sites (SNS) has also been investigated in the scholarly communication literature. SNS are defined as “web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system” (Ellison, 2007, p. 2). Questions such as why scholars use SNS and what benefits they will gain from using these networks have been raised (Barjak, 2006; Bonetta, 2009; Letierce et al., 2010; Nicholas and Rowlands, 2011). These studies found that the main reasons that most scholars use SNS are: a) the ability to gain and expand new ideas from direct interaction with each other, and b) that these networks provide another way for scholars to publish in traditional channels, such as scholarly journals (Kirkup, 2010; Collins, 2010; Sauer et al., 2005)

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3 Recently, the use of academic social networking sites (ASNS) in scholarly  
4 communication has begun to be studied. Academic social networking sites are defined  
5 as “online services (e.g., online platforms and/or software) that focus on supporting  
6 online research oriented activities, as well as building social networks for scholars”  
7 (Oh and Jeng, 2011). As a result of interest in these networks, it was found that ASNS  
8 such as ResearchGate need improvement in order to attract more researchers to use  
9 them for scholarly communication (Chakraborty, 2012). However, despite this, these  
10 networks have proved that they may enhance multidisciplinary collaboration by  
11 providing a platform that helps researchers to find one another, and to cooperate on  
12 issues of common interest (Oh and Jeng, 2011) .

### 20 *Scholarly publishing and dissemination*

21  
22 In the past few decades, there has been increasing interest regarding the change in  
23 formal scholarly publishing in the light of new emerging technologies. Within the  
24 context of evolved communication, a number of authors (Borgman, 2000; Hesse et al.,  
25 1993; Cohen, 1996; Walsh et al., 2000; Kaminer and Braunstein, 1998; Bohlin, 2004;  
26 Waltham, 2010; Oppenheim et al., 2000) have found that these technologies have  
27 changed the trajectory of scholarly publishing, enabling authors to self-archive their  
28 publications, making the dissemination of their research faster and increasing the  
29 number of publications. These studies found that communication technologies are  
30 reshaping scholarly publishing practices. For example, it was found that:

- 31 • The open access movement, which led to institutional repositories being used as a  
32 medium to publish articles, created optimism for the future of scholarly publishing  
33 (Lynch, 2003). However, concerns arose regarding willingness among researchers  
34 to publish in open access journals, as many did not see open access as a proper  
35 publishing approach (Chen et al., 2009; Frandsen, 2009).
- 36 • Informal channels such as SNS were found to play an important role in  
37 distributing grey literature (Pardelli et al., 2012). However, while scholars see  
38 grey literature as an important source of information, some do not consider it to be  
39 scholarly because it is produced by researchers and specialists in the field, but not  
40 reviewed by the academic community (Seymour, 2010; Banks, 2006).
- 41 • Preprint repositories such arXiv.org are changing academic publishing practices as  
42 they serve various academic disciplines such as mathematics, nonlinear sciences,  
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3 computational linguistics, and neuroscience, allowing researchers, both academic  
4 and non-academic, to submit and download scholarly papers (Correia and de  
5 Castro Neto, 2002).  
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8  
9 In addition to scholarly publishing, the use of social network sites and Web 2.0  
10 services to disseminate scholarly research has been discussed in the literature. For  
11 instance, concerns regarding intellectual property, and the possibility of losing it  
12 because of informal dissemination, were discussed by several studies (Collins and  
13 Hide, 2010). Additionally, organisational factors such as institutional support,  
14 training, and the traditional scholarly communication system, as well as the  
15 individual's experience, skills, and awareness, were found to dissuade academics and  
16 research staff from using new social media (Acord and Harley, 2013). On the  
17 contrary, it was found that there were other factors which would motivate scholars to  
18 use social media to share information: the extent to which scholars are socially  
19 integrated with one another, appropriate technical infrastructure, dedicated staff, and  
20 financial incentives for information sharing (Hall and Widén-Wulff, 2008).  
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### 29 *Information seeking behaviour*

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32 As a result of believing that ICT changed researchers' information seeking behaviour,  
33 a number of studies tried to understand what those changes were (Niu et al., 2010;  
34 Heath, 2007; Olander, 2008; Rowlands et al., 2008). For instance, Hide (2010)  
35 investigated how researchers produce, use, share, and access information or  
36 knowledge, and how new technology and policy developments influence  
37 researcher seeking behaviour. Another study by Morris et al. (2010) identified SNS as  
38 a source used for information seeking and satisfying information needs. The study  
39 found that using social media to seek information enabled researchers to find  
40 information and receive personalised answers, increasing their confidence in the  
41 validity of the information. Other studies found that use of the Internet resulted in  
42 changes to the behaviour of researchers, though had relatively little effect on their  
43 motivations for publication. These changes were more commonly seen among senior  
44 faculty members and researchers as they were the most frequent and early adopters of  
45 the Internet and SNS (Mulligan and Mabe, 2011; Gruzd and Staves, 2011; Barjak,  
46 2006).  
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### 57 *Scholarly collaboration*

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3 Interest in researching scholarly collaboration has been rekindled in the last few years  
4 as Information and communication technologies (ICTs), and particularly the Internet,  
5 have changed traditional communication practices. Several studies have identified a  
6 shift in collaboration practices as a result of the use of the Internet, enabling more  
7 dynamic and flexible scholarly interactions (Carley, 1996; Genoni et al., 2005;  
8 Barjak, 2006). For instance:

- 14 • ICTs have made it easier for scientists to engage in long-distance collaborations.  
15 Technologies such as e-mail, video conferencing, shared whiteboards, and  
16 centralised databases made it possible to work from different laboratories on the  
17 same research project, and deliver the results instantly, while social networks  
18 supported collaboration and communication among peers as they provided many  
19 tools which allowed researchers to communicate and share work instantly (Olson  
20 et al., 2008; Gruzd et al., 2012).
- 25 • It was found that SNS encourage knowledge sharing, knowledge production,  
26 researchers' interaction, and collaborative writing among academics who are  
27 using these sites. These sites would also facilitate informal learning within the  
28 community and additionally would open academic institutes to the wider  
29 community. However, despite all these benefits, it has been suggested that the  
30 adoption of SNS has reached only modest levels so far (Forkosh-Baruch and  
31 Hershkovitz, 2012; Gu and Widén-Wulff, 2011; Nentwich and König, 2014;  
32 Procter et al., 2010).
- 37 • The use of technology can encourage and help scholars to interact at the technical  
38 rather than the conceptual level, and to exchange documents rather than produce  
39 new knowledge, which would not make any difference in the scholarly  
40 communication process (Resnyansky, 2010). Also, there are many challenges that  
41 would face collaborators who are using such technologies in their research such as  
42 establishing common ground and maintaining trust within the research team.  
43 These challenges, even with the help of the new technologies, could lead to the  
44 failure of the research project (Olson et al., 2008).

## 54 **Research method**



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3 This study deployed a naturalistic inquiry research approach. This approach was  
4 considered to be most appropriate for this research because it allows for the discovery  
5 of theoretical concepts related to the process of scholarly communication via  
6 interpreting the data extracted from interviews with the participants, and for building  
7 theory via the analysis process using grounded theory analysis techniques.  
8 Naturalistic inquiry analysis should be inductive and should use the constant  
9 comparison method, as described in Glaser and Strauss (1967) and suggested by  
10 Lincoln and Guba as a suitable analysis technique for analysing qualitative data  
11 (1985). As a result, this study used a grounded theory approach in the analysis  
12 process.  
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20 A sample of 40 academic researchers in four universities were interviewed between  
21 August 2013 and February 2014. The universities – Aberystwyth University, Cardiff  
22 University, University of Birmingham, and University of Manchester – were selected  
23 on the basis of geographical location. Theoretical sampling was used to select  
24 research-active academics and postgraduate students who engage in scholarly  
25 communication activities.  
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31 Saturation of the data was reached after interviewing 32 participants, as the researcher  
32 felt that no new themes or data would emerge; however, a further eight interviews  
33 were conducted, as they were already scheduled and it was thought that they would  
34 help to confirm the credibility of the data retrieved from the first sample.  
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39 The gender distribution of the participants was 37.5% female and 62.5% male:  
40 however, the analysis revealed no significance difference between genders in the use  
41 of modern information technologies in scholarly communication.  
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45 **Insert Table 1 Sample distribution**  
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49 Initially, this study attempted to answer questions regarding the impact of information  
50 and communication technologies on the informal scholarly communication process.  
51 The main research question is: “What is the impact of the information and  
52 communication technologies available on the Internet on informal scholarly  
53 communication practice?”. The thesis research on which this article is based  
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discusses several additional questions; however, this article focuses on the above, primary research question.

The process of analysis went through several steps. Qualitative data was collected using semi-structured interviews, after which all the information received was transcribed. The next stage was to select codes from the text, using open coding, while analysing the interviews. Axial coding was the next stage of the process: at this point, relationships were identified between the open codes in order to see the connections via inductive thinking. At the third stage, core codes were identified via selective coding. As a result, all codes were grouped under three main core codes, or types of scholar: Orthodox, Moderate, and Heterodox Scholars. The Orthodox Scholars represented 30% of the sample, Moderate Scholars 37.5%, and Heterodox Scholars 32.5%. Each group included scholars from different academic disciplines and academic positions.

Insert Table 2 Researchers' groups distribution

## Results and discussion of findings

This paper provides an overview of the themes which emerged as part of ongoing doctoral research. The findings from this study show that developments in communication and information technologies are changing the way in which scholars interact and share research with each other. The data suggest that scholars can be divided into three groups; Orthodox, Moderate, and Heterodox Scholars.

### *Orthodox Scholars*

For most of the interviewees identified as Orthodox Scholars, the foremost means of communication are the traditional methods, such as conferences, monographs, and journal articles. Even if an Orthodox Scholar uses traditional informal communication methods, there is an attempt to keep the reliance on informal communication minimal. In this type of scholar's opinion, formal scholarly communication is more valuable and is what the scholar has trained to do. There is a perception that the scholarly community will not look at what they have done in the informal sphere, but only in

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2  
3 formal scholarly communication activities. Informal communication for Orthodox  
4 Scholars does not carry the same prestige as formal communication. However, this  
5 would not prevent them from looking at these channels and correcting information if  
6 there is something wrong. Table 3 identifies the main characteristics and factors that  
7 distinguish the Orthodox Scholar:  
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13 **Insert Table 3 Orthodox Scholars**  
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16 The use of informal communication and informal channels is limited to exploring  
17 formal publications. Only at the beginning of the research would the researcher  
18 consider using informal communication as a mining tool to explore a particular area.  
19 This use will end as soon as the researcher gains confidence in his or her ability to  
20 identify and retrieve formal publications in the field.  
21  
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23

24  
25 *That is really to identify key journal papers in a particular topic it is not a substitute*  
26 *for journal publication. It is really like a search engine that led me to research papers*  
27 *that I am interested in.*  
28

29  
30 (S 40 A)  
31

32 Most Orthodox Scholars are concerned with the credibility and reliability of  
33 information. The informal channels, in their opinion, are not controlled and lack  
34 reliability. On the contrary, formal communication approaches, tools, and methods are  
35 needed in order to promote and build an academic profile, and they have benefited  
36 from the developments in communication technologies.  
37  
38  
39

40  
41 *Because it is informal, not structured [...] because it is not refereed I am not*  
42 *interested in them. Journals are getting much quicker, and they make use of new*  
43 *technology they got an automated system.*  
44

45  
46 (S 38 A)  
47

48 Academic social networks are receiving the same treatment from Orthodox Scholars.  
49 However, a few of them attempted to use these channels in order to discover their  
50 benefits. Interestingly, those researchers did not feel that these channels changed their  
51 research practice.  
52  
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54  
55 *Recently, I somehow connected to ResearchGate, which draw my attention to new*  
56 *papers that published in my discipline area by other people, and draw attention to*  
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3 *my papers and also give statistics to situations and things like that. I suppose if you*  
4 *say to me, has it changed my life the answer is no.*  
5  
6

7 (S 40 A)

8 Some participants who identified as Orthodox Scholars do not mind communicating  
9 informally if the information shared in this way is not to be used for scholarly  
10 research. The context in which the information will be used effects the decision of  
11 whether an informal method is appropriate or not.  
12  
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14

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16  
17 *Possibly to expand the information sources outside the traditional ones, but again, I*  
18 *would only rely on formal resources.*  
19

20 (S 13 A)

21 Beliefs that the researcher carries regarding the different types of scholarly  
22 communication practice, academic discipline, and type of use were identified as  
23 factors that may affect researcher decisions regarding the use of informal  
24 communication.  
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30 *Like I said I consider these kind of resources not sufficient.*  
31

32 (S 29 P)

33  
34 *Some areas are changing more than others, particularly where people are much*  
35 *more I don't know like social science have much community engagement I suspect*  
36 *they are using these media rather more.*  
37

38 (S 13 A)

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40  
41 *Depends on what I am using it for, you do have to be very careful when using*  
42 *informal because no quality control on informal information.*  
43

44 (S 17 R)

45  
46 Interestingly, it was found that cognitive dissonance for Orthodox Scholars arises  
47 from their belief that some informal channels may contain useful and reliable  
48 information. Despite that, they do not use these channels as they also believe that  
49 these channels are not suitable for research. Orthodox Scholars are always concerned  
50 that their work will not be given serious consideration if they rely on these types of  
51 scholarly communication channels.  
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3 *Actually, some of the articles are quite good. Certainly I look at it, but in conjunction*  
4 *with other materials. I do not take citations from Wikipedia I will be worried that*  
5 *people will not my research seriously if I did that.*  
6

7  
8 (H 27 A)

9  
10 *Moderate Scholars*

11  
12 As with Orthodox Scholars, Moderate Scholars rely heavily on traditional, formal  
13 scholarly communication approaches. Formal channels are seen as irreplaceable, as  
14 researchers cannot abandon textbooks, journal papers, and conferences. Moderate  
15 Scholars are the same as other researchers who are working in academia in that they  
16 are trained to use formal scholarly communication approaches and always advised to  
17 avoid using informal channels. Despite this, Moderate Scholars do use informal  
18 channels, as long as their use will not adversely affect their research. The Moderate  
19 Scholar usually tries to balance the use of formal and informal approaches by not  
20 putting a huge reliance on informal approaches. For instance, a Moderate Scholar  
21 might use informal channels to get help from peers in order to resolve a problem.  
22 Table 4 identifies the main characteristics and factors that distinguish the Moderate  
23 Scholar.  
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**Insert Table 4 Moderate Scholars**

Moderate Scholars tend to use mixed approaches while they are engaged in scholarly communication. Formal traditional approaches are the best for them to initiate a contact and to introduce themselves to other peers, while informal approaches are preferred to maintain communication with the network that was built using formal approaches. Occasionally, the use of informal scholarly communication channels happens unconsciously. Many scholars engage in informal communication without realising that they are doing so.

*I have quite a lot of informal communication with people working in the health sector hospitals, sometimes central health authorities, they are people I talk to on telephone informally, but again, I do not think that is, informal formal both overlapping, talking about something formal but in an informal way through informal channels.*

(S 30 A)

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3 Notably, Moderate Scholars are more likely to be consumers in informal channels  
4 than participants. Moderate Scholars will read other peoples' blogs and websites, but  
5 will not create their own blog or website. They prioritise formal practices over  
6 informal practices, and although they would be happy to engage in informal  
7 communication, they would not spend their time in these channels because they  
8 believe that formal methods are more valuable.  
9

10  
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12  
13 *I don't have time personally to write a blog and I some time look at other peoples*  
14 *blogs. Occasionally I make a comment on one, but mostly I tempted to look rather*  
15 *than actually participate.*  
16

17  
18 (S 31 P)

19  
20 Academic social networks (ASNS) are used by Moderate Scholars in the scholarly  
21 communication process. ASNS are a way to contact other peers by checking users'  
22 profiles, and to find new papers. For Moderate Scholars, there are many ASNS that  
23 could be used; the choice of a particular ASNS depends on personal preference.  
24

25  
26 *I am on academia.edu. But I do not use other channels because I do not know about*  
27 *them.*  
28

29  
30 (SS 24 P)

31  
32 Preference was identified as one of the factors that affects the Moderate Scholar's  
33 choice regarding the use of informal channels. Many Moderate Scholars prefer to use  
34 some informal channels more than others:  
35

36  
37 *I use LinkedIn also. I use emails on papers to talk with authors directly. I do not use*  
38 *Twitter I think it's one-way communication and not all people using it as Facebook. I*  
39 *have my research group in Facebook and I communicate with researchers through it.*  
40 *I may use Twitter to tell people about my research, but I am not confident that*  
41 *others are using it.*  
42  
43

44  
45 (SS 7 P)

46  
47 The enormous number of informal channels available on the Internet make it  
48 impossible for the Moderate Researcher to use or to be aware of all of them. Moderate  
49 Scholars receive similar academic training to Orthodox and Heterodox Scholars. The  
50 Moderate Scholar is attracted to the use of informal channels; however, if the  
51 Moderate Scholar is not aware of an informal channel he or she can not use it.  
52  
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55  
56 *I do not use ResearchGate and Mendeley because I had not heard about them.*  
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(SS 18 A)

Despite their acceptance of informal scholarly communication approaches, Moderate Scholars have mixed feelings regarding the use of these channels. As a result, when a Moderate Scholar engages in informal communication there is always evidence of hesitation. While Moderate Scholars believe in the potential of informal communication, they do not want to breach the traditional system. This would be a cause of cognitive dissonance for the researcher, and to reduce this dissonance, the Moderate Scholar does not give informal communication the same importance as formal ones.

*I think social networks like Facebook you see formal colleagues and linkdIn you see people that quite intersting. Wikipedia is great as initial go to if you do not know about the subject very well, [...], but you have bear in mind that might not be complete or fully structured source.*

(S 36 A)

### *Heterodox Scholars*

In contrast, the Heterodox Scholar depends heavily on informal scholarly communication approaches to connect with peers. All Heterodox Scholars revealed that they have positive feelings towards informal scholarly communication. Heterodox Scholars use a variety of informal channels as part of their research, in order to communicate with and engage with their peers. However, even the Heterodox Scholar feels that there is a need to utilise these channels with some caution: information shared through informal channels is not controlled and there is no guarantee that the information obtained is true.

### **Insert Table 5 Heterodox Scholars**

While doing their research, Heterodox Scholars do not have a particular approach or process that they follow. Heterodox Scholars know that they should publish in peer review journals; however, they are also willing to publish via informal channels. In their opinion, the scholarly communication system is going to change. As a result, they tend to prioritise more modern practices such as informal communication, publishing

1  
2  
3 in open access journals, and putting an early version of their work on preprint  
4 repositories.  
5

6  
7 *I do not have a particular process that I follow you meet people you find information*  
8 *and something interesting come together. [...]. I think scholarly communication going*  
9 *to change dramatically in the next few years there are forces like Arxiv, which is*  
10 *important and it will be accepted by publishers. Also peer review, most of the studies*  
11 *about peer review suggest that it is not good as we think it is, and perhaps there are*  
12 *other models that may work better than the current model.*  
13  
14

15 (S 26 A)

16  
17 Unlike Orthodox and Moderate Scholars, Heterodox Scholars will use informal  
18 channels to collect data from other peers or to obtain a study sample. For them,  
19 informal channels are rich with data waiting to be collected and analysed by  
20 researchers, and engaging with people in these channels and obtaining information  
21 from them is the best way to collect data. Heterodox Scholars feel that people tend to  
22 be honest and revealing while they are using these channels, which make the data  
23 more credible and reliable.  
24  
25

26  
27 *I teach film cinema so a lot of my work I am interested in how the audience received*  
28 *the film how they responding to that film and what are they doing to the film and in*  
29 *particular I am interested towards gender, attitude, ethics, and sexuality. So I am*  
30 *doing a lot of research about racist responses to films. And a lot of my research*  
31 *looking at Internet discussion groups this might be a general Internet website or*  
32 *specialist website.*  
33  
34

35 (SS 15 A)

36  
37 Academic social network sites (ASNS) are also utilised by Heterodox Scholars. Some  
38 of them feel that these networks are very useful, and their use by their peers motivates  
39 those scholars to use them. However, they also believe that this type of channel is not  
40 useful as they thought.  
41  
42

43  
44 *I use Mendeley it looks very interesting and very exciting, but they are not really*  
45 *engage me as much as they should have.*  
46  
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48 (SS 37 A)

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50 Preference, academic discipline, openness, and training are factors that could affect  
51 Heterodox Scholars' use of informal channels. They would try using all channels  
52 available, then select only the channels that are suitable for their needs. Additionally,  
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3 there are academic disciplines that encourage scholars to engage more in informal  
4 scholarly communication, and many scholars in these disciplines are heavily  
5 dependent on informal approaches.  
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9 *I think in computer science because we do a lot of programming compared to other*  
10 *fields I think we depend more on informal communication channels like blogs, maybe*  
11 *as I mentioned before like stack overflow .*  
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13 (S 3 P)

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16 *Proposed model*

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18 This study revealed that researchers engage in scholarly communication practices  
19 using different techniques and, as a result, has categorised them into three different  
20 types.  
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24 Additionally, during the interviews, five scholarly communication activities were  
25 identified that had changed as a result of developments in information and  
26 communication technologies. These activities should be considered when developing  
27 a new model:  
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- 30  
31 1) Communication;  
32 2) Seeking information;  
33 3) Collaboration;  
34 4) Citing information; and  
35 5) Publishing and dissemination.  
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41 In the proposed model, the scholarly communication process is divided into two parts.  
42 The first part includes formal scholarly communication, which is inspired by the  
43 Garvey and Griffith (1972) model. However, the structure of the process has been  
44 changed to reflect the order followed by scholars who participated in this study's  
45 interviews. As a result, the scholarly communication process would begin with  
46 communicating, followed by seeking information, citing information, collaborating,  
47 and publishing and disseminating information. Hence, following this approach would  
48 lead to publishing in formal peer-reviewed journals and building an academic profile  
49 for the researcher.  
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3 The second part is informal scholarly communication, which includes the same formal  
4 activities, but conducted in an informal way: instigating informal communication,  
5 having informal discussions, preparing preprint copies of the research, informal  
6 publishing, informal dissemination, and citations. Hence, following the informal  
7 approach would help scholars to build their social profile.  
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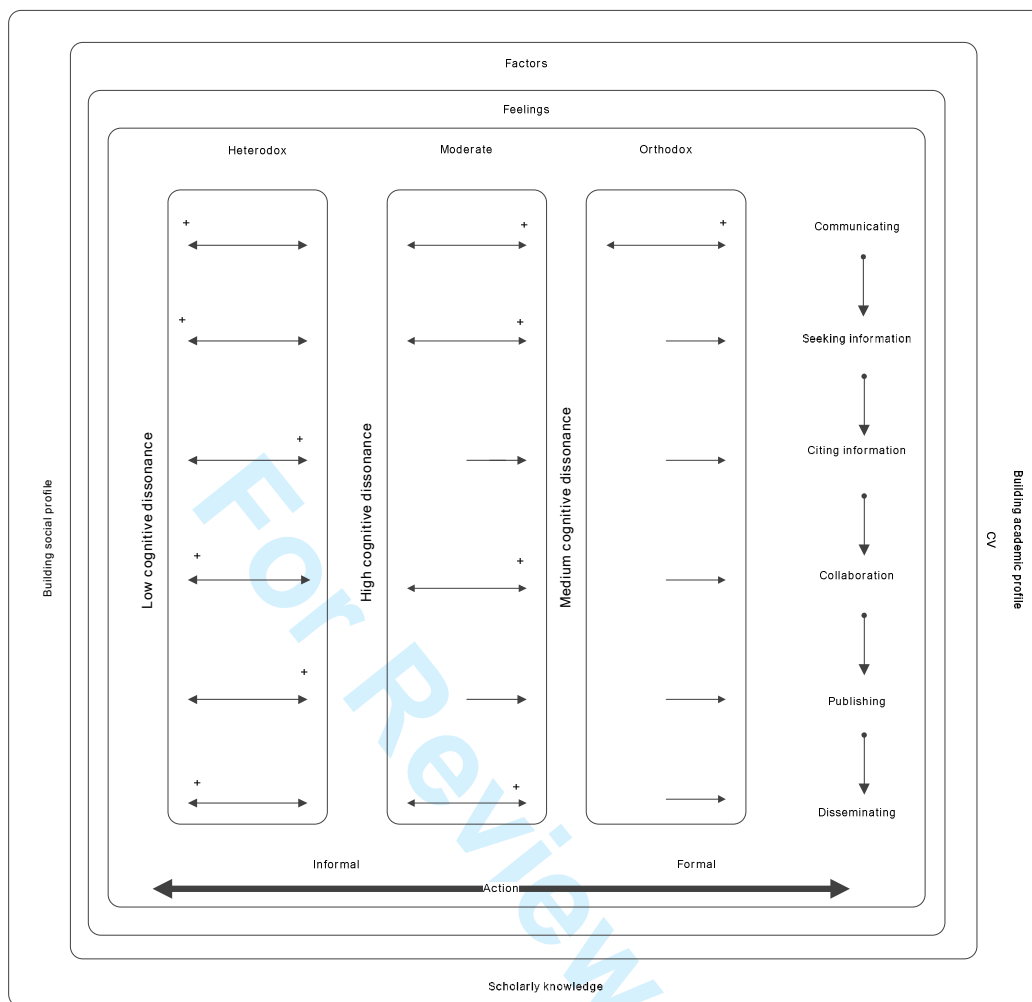


Figure 1 Proposed communication model

In the proposed model, there are factors that drive the scholarly communication process such as norms, culture and values; these factors are fixed in academia and cannot be ignored. However, researchers are driven by other factors in the choice of the techniques that they could use to conduct their research: these factors, such as beliefs, academic discipline and fame, are considered just as important in the researchers' choice.

As a result of taking a decision, cognitive dissonance may emerge. Subsequently, dissonance caused by making this decision (whether it is in favour of using informal technologies or not) would be reduced by viewing the chosen alternative as more attractive and seeing the rejected alternative as less attractive (Harmon-Jones et al., 2009).

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3 The proposed model of scholarly communication consists of four main elements:  
4 players, factors, feelings, and activities. The players are categorised as Orthodox,  
5 Moderate, and Heterodox Scholars; the factors are those issues that affect scholars'  
6 decisions, and were outlined in the findings; feelings are the opinions which the three  
7 types of scholar carry toward scholarly communication, varying from acceptance of  
8 informal communication to the rejection of these practices; and finally the activities  
9 that done to produce knowledge which are communicating, seeking, collaborating,  
10 citing, publishing and dissemination.  
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### 18 **Conclusion and recommendations**

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21 The findings of this study suggest that there are three types of scholar who engage in  
22 scholarly communication practice, using three different approaches. The first type is  
23 the Orthodox Scholar, who only follows traditional scholarly communication  
24 practices and rejects any other methods. The second type is the Moderate Scholar,  
25 who believes that informal communication is very useful in scholarly research;  
26 however, there is also a belief that following the traditional approaches is the only  
27 way for promotion in an academic career. The Moderate Scholar will use informal  
28 channels of scholarly communication, if he is sure that there is no contradiction with  
29 formal activities and if it will not cause any harm to their career. The third type is the  
30 Heterodox Scholar, who has faith in the importance of informal communication in  
31 research and, as a result, uses both formal and informal approaches in research.  
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40 Interestingly, the literature reveals that even if scholars are using modern channels,  
41 such as social media, in communication, the change in scholarly communication  
42 practice is very slow. Many researchers are wary of moving away from the traditional  
43 scholarly communication process, because the use of modern informal  
44 communication chaneels is not acceptable in academia (Weller, 2011). The speed of  
45 change with regard to using modern informal channels in communication practices  
46 would increase if these channels had an impact on the promotion process at academic  
47 institutions (Gruzd et al., 2011). Recent studies found that modern, informal channels  
48 such as social networks are used to gain new ideas, share research, communicate with  
49 other scholars, and publish research (Sauer et al., 2005; Kirkup, 2010; Mahmood et  
50 al., 2009). These findings, as in this study, suggest that these networks are facilitating  
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3 scholarly communication activities. However, many studies, including this one, find  
4 that the adoption of SNS has reached only modest levels so far (Forkosh-Baruch and  
5 Hershkovitz, 2012).  
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9 Factors that could affect scholars' decisions regarding the use of informal  
10 communication channels have been also addressed in various studies. It was found  
11 that academic discipline, speed of these channels and age could affect scholars'  
12 decisions to use informal channels. In addition, the personality of the scholar was  
13 considered to be a key element in the informal exchange of information (Centre for  
14 Research Communications, 2011; Procter et al., 2010; Barrett, 2005). In contrast, lack  
15 of encouragement and lack of skills and awareness were found to be factors that  
16 would prevent scholars from engaging in informal communication. Because informal  
17 communication practices are not encouraged or rewarded by academia, scholars feel  
18 that these practices are a waste of time and lose the motivation to use these channels  
19 in scholarly activities (Procter et al., 2010; Birnholtz et al., 2010). As a result,  
20 participants in the current study suggested that academia should play a role in  
21 encouraging informal communication activities. Many other studies have suggested  
22 that academia is not giving enough consideration to these activities and should  
23 increase its role in encouraging such practices (Collins and Hide, 2010).  
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35 Traditional scholarly communication models described the scholarly communication  
36 process from one perspective only: the Orthodox Scholar's perspective. However, the  
37 findings of this study suggest that there are other possibilities and that scholarly  
38 communication practices are changing. It further suggests that there are different  
39 types of scholars who engage in the scholarly communication process; as a result the  
40 current study sought to develop a new scholarly communication model to describe the  
41 current changes in scholarly communication. The proposed model suggests that  
42 scholars who engage in communication activities are affected by various factors and  
43 do suffer cognitive dissonance; this was not addressed in previous models.  
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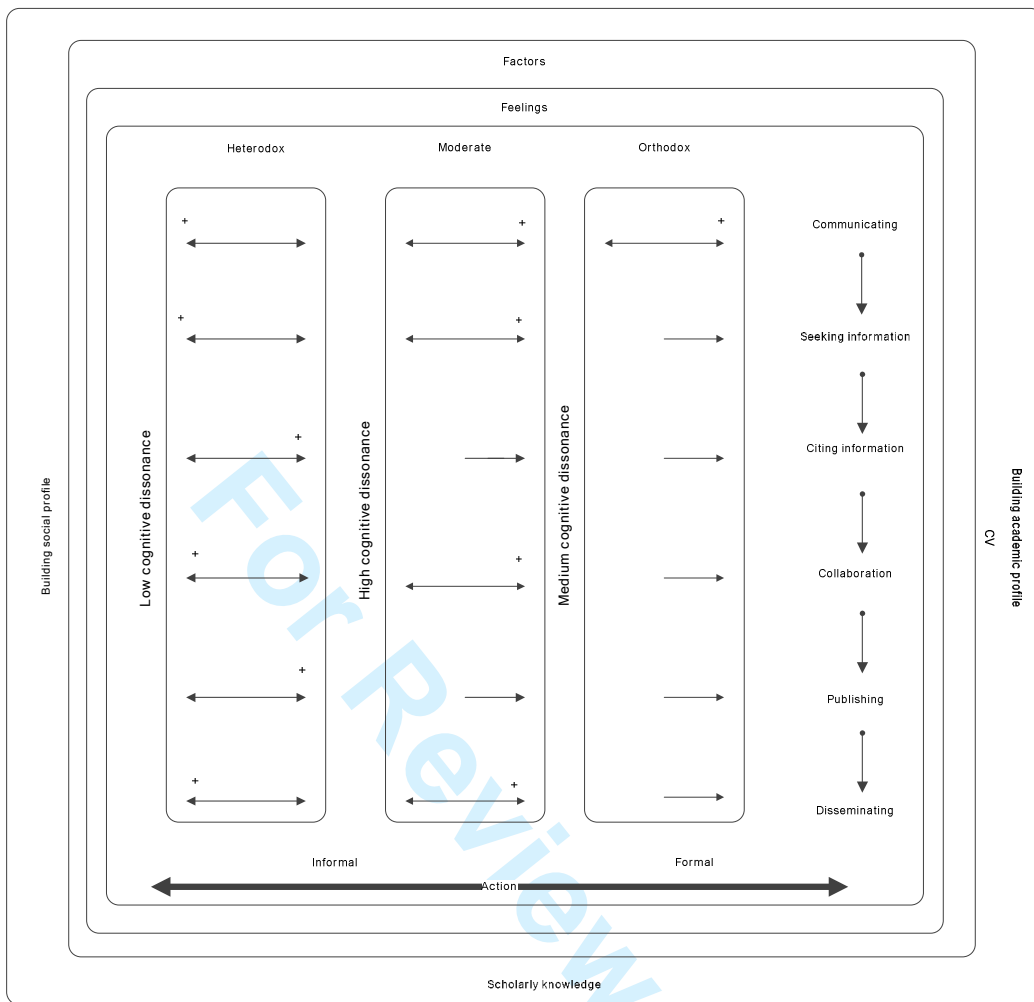
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Figuer 1 Proposed model

• **Table 1 Sample distribution**

Academic discipline	Postgraduate	Academic staff	Research staff
<i>Social science</i>	6	10	2
<i>Humanities</i>	-	3	-
<i>Science</i>	4	10	5

• **Table 2 Researchers groups distribution**

Scholars type	Social science	Humanities	Science
<i>Orthodox</i>	2	3	7
<i>Moderate</i>	9	-	6
<i>Heterodox</i>	7	-	6

• **Table 3 Orthodox Scholars**

<i>Approach</i>	<ul style="list-style-type: none"> <li>➤ <i>Formal scholarly communication is the only approach.</i></li> <li>➤ <i>Avoidance of informal traditional and modern scholarly communication practices.</i></li> </ul>
<i>Factors</i>	<ul style="list-style-type: none"> <li>➤ <i>Beliefs.</i></li> <li>➤ <i>Academic discipline.</i></li> <li>➤ <i>Type of use.</i></li> </ul>
<i>Feeling</i>	<ul style="list-style-type: none"> <li>➤ <i>Rejection of informal scholarly communication approach is the prevalent feeling among Orthodox Scholars.</i></li> <li>➤ <i>Both traditional and modern informal channels lack credibility as information is hard to control.</i></li> </ul>
<i>Dissonance</i>	<ul style="list-style-type: none"> <li>➤ <i>Cognitive dissonance arises from Orthodox Scholars' beliefs that they have to follow the traditional scholarly communication system, ignoring other channels even if they are useful.</i></li> </ul>

• **Table 4 Moderate Scholars**

<i>Approach</i>	<ul style="list-style-type: none"> <li>➤ <i>Formal scholarly communication is the main approach. However, informal channels are also used.</i></li> <li>➤ <i>Moderate Scholars always use mixed approaches as they believe that will make communication more efficient.</i></li> </ul>
<i>Factors</i>	<ul style="list-style-type: none"> <li>➤ <i>Preference.</i></li> <li>➤ <i>Awareness.</i></li> <li>➤ <i>Project type.</i></li> <li>➤ <i>Benefits.</i></li> </ul>
<i>Feeling</i>	<ul style="list-style-type: none"> <li>➤ <i>Acceptance of informal scholarly communication activities.</i></li> <li>➤ <i>Modern informal channels change the way a Moderate Scholar communicates with other peers.</i></li> </ul>
<i>Dissonance</i>	<ul style="list-style-type: none"> <li>➤ <i>Cognitive dissonance arises from having mixed feelings as the Moderate Scholars use modern, informal channels, but at the same time they know that academia does not recognise informal practices.</i></li> </ul>

• **Table 5 Heterodox scholar**

<i>Approach</i>	<ul style="list-style-type: none"> <li>➤ <i>Both formal and informal communication approaches are used by the Heterodox Scholar.</i></li> <li>➤ <i>Modern informal channels are heavily used by Heterodox Scholars in scholarly activities such as following their peers, collecting data, and seeking help.</i></li> </ul>
<i>Factors</i>	<ul style="list-style-type: none"> <li>➤ <i>Preference.</i></li> <li>➤ <i>Academic discipline .</i></li> <li>➤ <i>Openness.</i></li> <li>➤ <i>Training.</i></li> </ul>
<i>Feeling</i>	<ul style="list-style-type: none"> <li>➤ <i>Heterodox Scholars feel that modern, informal channels have changed the way they engage in scholarly communication activities.</i></li> <li>➤ <i>Heterodox Scholars are biased towards modern, informal scholarly communication practices</i></li> </ul>

<i>Dissonance</i>	➤ <i>Because of their bias towards modern, informal channels, Heterodox Scholars rarely suffer cognitive dissonance.</i>
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