A case for Altmetrics: can measures of social media activity be used to support the academic research process?

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Abstract

Purpose
To assess whether measures of social media activity can be used to support the academic research process.

Aims
• To measure researchers’ behaviours – ie: to what extent researchers use social media for activities relating to impact
• To measure researchers’ attitudes towards altmetrics – ie: whether researchers consider altmetrics data to be a useful tool for supporting the research process

Objectives
• To identify whether and to what extent social media is used by researchers in activities relating to research impact
• To gain an understanding of whether the social media data used as the basis of altmetrics can be used as a measure of research impact
• To identify any potential need for training in altmetrics
• To identify a possible role for altmetrics in supporting researchers at the University

Methods
The study uses an online questionnaire to collect quantitative data from science researchers at the University of Sheffield. Data was analysed using SPSS.

Results
The study found that the majority of respondents (85%) made some use of social media for the discovery, dissemination and promotion of research. Social networks were found to be the most popular tools for these activities, followed by reference managers and Twitter. Respondents made most use of social media for research discovery.

Attitudes towards social media were generally positive, although negative attitudes were recorded regarding the quality of research found via social media.

Attitudes towards altmetrics as a tool for research discovery and promotion were generally positive, but negative attitudes were found concerning altmetrics as a measure of research quality. Awareness of altmetrics was found to be widespread, but levels of knowledge and use were low.

Conclusions
The findings suggest that researchers are using social media for activities relating to impact, and that there is a role for altmetrics as a tool to support the discovery, dissemination and promotion of research, as a supplement rather than a replacement for traditional citation metrics.
DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed

Date 2/9/2014

STATEMENT 1

This work is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s).

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed

Date 2/9/2014

STATEMENT 2

I hereby give consent for my work, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

Signed

Date 2/9/2014
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List of Abbreviations

APS: Animal & Plant Sciences

BMS: Biomedical Sciences

FoS: Faculty of Science

OA: Open access

RIS: Research and Innovation Services department at the University of Sheffield

SoMaS: School of Mathematics & Statistics

SPSS: Statistical Package for the Social Sciences

UoS: University of Sheffield
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Chapter 1: Introduction

1.1: Background to the study
The academic community is under increasing pressure to demonstrate the impact of its research outputs. The Research Excellence Framework defines impact as one of the criteria upon which research is assessed. Impact is also increasingly used by Higher Education Institutions and research funders to inform strategy and decision making. Established methods of assessing research impact use citation data, based on data from databases such as Web of Science and Scopus, as a measure of the impact of published research. However these methods, known as bibliometrics, have their drawbacks. For example, citation data takes years to accrue, data cannot be compared across research disciplines, citation data only measures one aspect of impact.

Altmetrics is a developing field looking at alternatives to established bibliometric methods. Altmetrics analyse social media activity (blog posts, tweets, Mendeley shares) rather than citation data, and use this as a measure of the online discussion or interest surrounding a piece of research.

Advocates of altmetrics claim that it offers many benefits over bibliometrics. Altmetrics data is available instantly, offers a broader and more complete measure of impact both within and beyond the academic community, and has a greater level of openness and transparency. However, there is little consensus as to whether social media activity can be used as an effective or accurate measure of research impact.

1.2: Research purpose
This study will attempt to assess whether altmetrics can be used to support the scientific research process by surveying the use of social media by researchers.

The research aims are twofold. Firstly, to assess the extent to which social media is used in the research process for activities relating to impact. Secondly, to assess researchers’ attitudes towards social media and altmetrics as a measure of impact.

1.2.1: Research question
Can measures of social media activity be used to support the academic research process?
1.2.2: Aims

- To measure researchers’ behaviours – ie: to what extent researchers use social media for activities relating to impact
- To measure researchers’ attitudes towards altmetrics – ie: whether researchers consider altmetrics data to be useful tool for supporting the research process

1.2.3: Objectives

- To identify whether and to what extent social media is used by researchers in activities relating to research impact
- To gain an understanding of whether the social media data used as the basis of altmetrics can be used as a measure of research impact
- To identify any potential training needs relating to altmetrics
- To identify a possible role for altmetrics in supporting researchers at the University

1.3: Scope

The study aims to explore a gap identified in the literature concerning researchers’ use of social media for activities relating to impact. The study uses an online questionnaire to collect quantitative data from post-doctoral researchers within the Faculty of Science at the University of Sheffield.

1.4: Structure

The dissertation consists of six sections:

- Chapter 1: Introduction
  - Outlines the aims and objectives of the study and the research question.
- Chapter 2: Literature Review
  - Maps the topic area and context of the study, identifies key themes in the literature, and situates the study in relation to existing research.
- Chapter 3: Methodology
  - Describes the research methods selected for the study, justifies them in terms of the research objectives and discusses limitations of the methods used.
- Chapter 4: Results
o Presents the findings of the research.

- Chapter 5: Discussion
  o Relates the findings to the existing research evidence and to the aims and objectives of the study.

- Chapter 6: Conclusion
  o Summarises the study and reviews whether the research question has been answered.

1.5: Referencing
The Harvard American Psychological Association (APA) 6th edition referencing and citation style is used throughout this study.
Chapter 2: Literature review

2.1: Introduction
This chapter comprises a review of the existing literature. The aims of the literature review, adapted from Hart (1998), are as follows:

- To map the topic area and establish the context of the study
- To identify research that has already been done in this area
- To identify the main methodologies used in this field
- To assess the feasibility and need for this study through the identification of gaps in the literature

The chapter outlines the methodology used in the literature review, gives a summary of the background and context of the study, followed by a synthesis of the main findings of the review organized by theme, and a conclusion outlining where this study fits within the wider literature.

2.2: Methodology
Hart’s “Flow chart of the literature search” and guidance on identifying relevant items through bibliographical analysis (Hart, 1998, pp. 34-35) were used as the basis of the literature review process. Initial, broad searches were run to identify key concepts and terms, which were then used to refine the search. Reference-chaining was also used to identify key references from the bibliographies of useful papers.

2.1.1: Terms
Preliminary searches for Altmetric*, Bibliometric* and “social media” were run to map the topic area and identify background and contextual information.

As the literature review progressed, alternative and more specific terms were identified and used to narrow the search. Many terms were discarded as they returned results that were outside the scope of this study (eg: webmetrics, webometrics).

Truncation, phrase searching and boolean operators were used to combine terms as in the examples in Table 1.
### Table 1: Search terms

<table>
<thead>
<tr>
<th>Almetric*</th>
<th>Research*</th>
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<tr>
<td>OR</td>
<td>OR</td>
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<tr>
<td>Bibliometric*</td>
<td>“Research process*”</td>
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<td>OR</td>
<td>OR</td>
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<tr>
<td>“Social media”</td>
<td>Academ*</td>
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<td>OR</td>
<td>AND</td>
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<td>“social network*”</td>
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<td>OR</td>
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<tr>
<td>Individual social media tools, eg:</td>
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<td>• Twitter</td>
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<td>• Facebook</td>
<td></td>
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<tr>
<td>• Blog*</td>
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#### 2.2.2: Scope and sources

As altmetrics and social media are relatively new fields, the search was limited to research published in the last 10 years, to exclude older material that was not directly related to the topic.

Due to the novel nature of the research area, and the timescales involved in academic publishing, no books were found relating to the use of altmetrics. The search was instead directed towards academic journal articles. Preliminary searches were undertaken using the University of Sheffield Library catalogue StarPlus (Primo), and Google Scholar. More advanced searches were undertaken using the Scopus and Web of Science databases.

Much of the key discussion of these areas takes place in non-traditional forums – key figures in the development and research of altmetrics tend to embrace social media as a form of scholarly communication and dissemination. Blogs, online news articles (for background
and contextual information) and conference reports were therefore included in the search. These were found through Google, Twitter (using the hashtag #altmetrics), and in the case of conference papers, through Web of Science, Scopus and Google Scholar.

2.2.3: Limitations
Much of the literature concerned the use of social media for non-academic purposes (eg: marketing) or within communities outside academia (eg: research into the use of social media by school children). These were discarded.

Many of the results used definitions of social media that were too broad for the purposes of this study – for example the use of collaborative scheduling software such as Doodle.com or Google Calendar (see section 2.4.5 for further discussion).

2.3: Background and context
In order to discuss the findings of the literature review in detail, it is first necessary to map the subject area and define the key terms and concepts used in the study.

2.3.1: Impact
Citation metrics and their alternatives are concerned with measuring the impact of research. The Research Excellence Framework (REF) is one of the main drivers for the measurement of impact. The REF is an initiative from the Higher Education Funding Council for England (HEFCE) which aims to assess the quality of research from UK Higher Education institutions. Impact is one of the criteria upon which research outputs are assessed in the REF, which defines impact as:

"an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life " (REF, 2011)

This definition of impact reflects a pressure placed on academia to demonstrate or quantify the practical benefits of publicly-funded research. Measurements of impact can be used to provide accountability (to funders, public and governments), assess performance (at an institutional, national or individual level) and inform funding decisions (Penfield, Baker, Scoble, & Wykes, 2014).
This focus on impact has caused a degree of controversy, with many academics arguing that a focus on demonstrable economic benefits may compromise academic freedom (Fernandez-Armesto, 2009; Oswald, 2009; Shepherd, 2009). Other commentators question how impact, defined as broadly as this, can be measured effectively or consistently, given the sheer breadth and range of research outputs and the complex ways in which they can be translated into real-world benefits (Penfield et al., 2014, p. 28).

Impact is a rather abstract concept and hard to measure directly. Therefore most attempts to find suitable impact metrics have been concerned with finding quantifiable data that can be used as a proxy for the influence or reach of a piece of research. This has led to a focus on quantitative approaches (which are regarded as relatively robust and objective), rather than qualitative measures (which are often regarded as subjective and unscientific) (Donaldson & Cooke, 2014). The most widely accepted measures of research impact have been produced by the field of bibliometrics.

2.3.2: Bibliometrics

Bibliometrics - a term coined by Alan Pritchard (1969) - is a field which attempts to quantify the impact of published research by tracking and analyzing citations. Citation databases (such as Web of Science, Scopus and Google Scholar) index journal articles, conference papers (and to a lesser extent, monographs) and track the references between them. Bibliometrics is founded on the idea that if research has been cited many times, it can be said to have been influential in its field - citation data is used to infer the reach and impact of an article. Bornmann and Marx (2012) summarise the basic assumption underpinning bibliometrics – namely that the number of citations a paper receives over time can be used as a ‘direct measure of its usefulness to other scientists’ and therefore ‘used as a proxy for...quality and...prestige' (p226). Bibliometric analysis can be used to assess the impact of individual research papers and academic journals, or it can be applied to the entire research output of authors, institutions or whole countries. It was first developed in the sciences, but can be applied to any discipline where journal articles are the primary research output (NDLR, 2011).

Many studies highlight concerns and drawbacks of bibliometrics. These include: the length of time taken for citation data to accumulate (Kwok, 2013; Thelwall, Haustein, Larivière, &
Sugimoto, 2013); a lack of openness, as metrics are based in subscription databases which are hidden behind a paywall (Czerniewicz, 2013; Priem, Piwowar, & Hemminger, 2012); a lack of transparency as the calculations underlying many metrics are proprietary (Czerniewicz, 2013); a lack of consistency (citation data will vary depending on which database is used as a source) and the inability to compare different academic disciplines due to variations in citation behavior (Bornmann & Marx, 2012).

Some argue that the focus on citation data gives a very narrow picture of impact, as it only measures the influence of research within the academic community (Liu & Adie, 2013; Yeong & Abdullah, 2012). As only a relatively small percentage of academics who read an article then go on to cite it, citation data is unable to capture the full extent of impact even within academia (Kwok, 2013; Liu & Adie, 2013), as citation is only one aspect of how research is 'consumed, used, and re-used' both within academia and beyond (Taylor, 2013, p. 28).

Some commentators define bibliometrics as a flawed but convenient measure of impact that has gained acceptance within the academic community due to a perceived lack of viable alternatives:

‘a highly limited, highly unrepresentative, yet alluringly available [measure of impact] that the ISI has fetishized and turned into a highly desirable and marketable commodity' (Hicks & Potter, 1991, p. 493)

Other authors point to the fact that bibliometrics is based in old-fashioned or outmoded models of research dissemination via academic publishers (Yeong & Abdullah, 2012), and is not suited to a research landscape in which researchers use new technologies to reach beyond traditional ‘boundaries of discipline, media, audience and format’ (Borchadt & Chin Roemer, 2012, p. 596). Indeed, several authors suggest that new technologies such as social media have created novel forms of scholarship and communication that require entirely new measures of impact (Anderson, 2009; Buschman & Michalek, 2013; Mounce, 2013; Piwowar, 2013a, 2013c; Priem & Hemminger, 2010; Shema, Bar-ilan, & Thelwall, 2014; Smith, 2014; Taraborelli, 2008; Weller, Dröge, & Puschmann, 2011).
2.3.3: Social Media

Social media can be defined as ‘web sites and applications which enable users to create and share content or to participate in social networking’ (Oxford English Dictionary Online, 2009). Social media are related to the broader concept of Web 2.0, which refers to a participatory or collaborative approach to the Web, in which users are active creators of content rather than passive consumers.

It may be argued that this has now become the dominant form of web use, with most major websites incorporating social or interactive features. Social media use is increasingly widespread, with the microblogging site Twitter reporting 255 million active users (Twitter, 2014).

2.3.4: Altmetrics

The Altmetrics movement is founded on the idea that new social media technologies, typified by collaboration and participation, are enabling novel forms of scholarship, and that these can yield new ways of measuring impact. Researchers can use social media tools, such as blogs, microblogging tools and social networking sites, to communicate with colleagues, discover and disseminate research, and work together in ways that transcend the traditional academic publication model (Anderson, 2009; Buschman & Michalek, 2013; Mounce, 2013; Piwowar, 2013a, 2013c; Priem & Hemminger, 2010; Shema et al., 2014; Smith, 2014; Taraborelli, 2008; Weller et al., 2011).

Altmetrics gathers data from social media, in order to capture online activity as people discover, share, and discuss research via their social networks (Eysenbach, 2011). This data is then used to calculate an altmetrics score, which reflects the amount of online discussion surrounding a piece of research. Tools such as the altmetrics badge (“Altmetric.com," 2014), allow researchers to monitor the number of blog posts, tweets, Facebook shares, news articles and Mendeley readers that their research receives (see figure 2).
According to altmetrics proponents, measuring social media activity can provide ‘a composite trace of impact far richer than any available before’ (Priem, Taraborelli, Groth, & Neylon, 2010). Many commentators highlight the potential of altmetrics to capture scholarly activity at all stages of the research process rather than just the end result (publication), and highlight important research behaviours that are invisible to bibliometrics - eg: scholarly communication, dissemination and discussion of research (Buschman & Michalek, 2013; Cronin, Snyder, Rosenbaum, Martinson, & Callahan, 1998; Piwowar, 2013b).

Social media is identified by several authors as a means to facilitate interdisciplinarity and collaboration across academic disciplines, and institutional/national boundaries. Altmetrics can help drive this process, as it provides a means of identifying possible collaborators (Borchadt & Chin Roemer, 2012; Czerniewicz, 2013; Priem & Costello, 2010; Procter et al., 2010; Taylor, 2013).

Several studies identify Open Access publishing as a driver for new measures of impact. The Finch report (Working Group on Expanding Access to Published Research Findings, 2012) requires that the findings of publicly-funded UK research be made available to the general public. As research becomes increasingly available to non-academic audiences, alternatives to traditional metrics (which only capture impact within academia) are required. Altmetrics are identified by several authors as a possible means of capturing public engagement with open access research, as it measures discussion on social media from academic and non-academic users alike (Brody, Harnad, & Carr, 2006; Czerniewicz, 2013; Priem & Costello, 2010; Procter et al., 2010; Shuai, Pepe, & Bollen, 2012; Taylor, 2013; Yeong & Abdullah, 2012).
Other benefits of altmetrics include: immediacy (social media data can be collected much more quickly than citation data, giving a ‘live’ picture of online discussion); openness (the data is freely available and not hidden behind a paywall); and transparency (altmetrics scores are presented with their underlying data to provide context and accountability) (Priem & Hemminger, 2010).

Disadvantages of altmetrics include: vulnerability to ‘gaming’ (some companies offer users ability to buy tweets or Facebook shares, bringing into question the reliability of altmetrics data); altmetrics can’t differentiate between positive and negative attention (a high number of tweets could indicate a controversial or unethical research paper) (Smith, 2014). There is also a lack of consensus amongst the academic community as to whether social media activity can be used as a suitable proxy for research impact. There is general agreement in the literature that altmetrics has the potential to provide useful new measures of impact, either as a supplement or as an alternative to traditional citation metrics. However, the majority of studies identify a need for more research into the conclusions that can be inferred from social media data. As Liu and Adie state, ‘most altmetric measures have not been rigorously validated against traditional metrics in systematic studies’ (2013, p. 156). For example, is a tweet comparable to a citation? What are researchers’ motivations when blogging about a research paper, and are these the same motivations that lead them to cite a paper in their own published research? Many authors call for more research to identify the precise nature of the activity measured by altmetrics, and into the ways in which this activity translates to impact (Allen, Stanton, Di Pietro, & Moseley, 2013; Czerniewicz, 2013; Eysenbach, 2011; Kwok, 2013; Liu & Adie, 2013; Priem & Costello, 2010; Priem & Hemminger, 2010; Priem et al., 2012; Shuai et al., 2012; Smith, 2014; Taylor, 2013; Thelwall et al., 2013; Weller et al., 2011)

2.4: Findings

This study aims to assess the possible role for Altmetrics as a tool to support researchers, by looking at researchers’ current use of, and attitudes towards, social media. In order to assess the feasibility of the study, it was first necessary to review the literature for existing research into the use of social media in the research process.
2.4.1: Use of social media

The literature review found strong evidence that social media is being used in all phases of the research process. Twitter, blogs, Facebook and the social reference management application Mendeley were found to be the most popular social media tools amongst researchers (Gibson, 2013; Gruzd, Staves, & Wilk, 2012; Priem & Hemminger, 2010; Priem et al., 2012; Procter et al., 2010; Rowlands, Nicholas, Russell, Canty, & Watkinson, 2011). Four large-scale studies of social media use by academic researchers were identified, whilst the rest of the literature focused on specific social media tools.

Rowlands et al (2011) surveyed researchers in 215 countries via an online questionnaire to assess which social media tools were used and for what purposes. The study identifies 7 stages in research lifecycle where social media finds useful application: identifying research opportunities, finding collaborators, securing support, reviewing the literature, collecting research data, analysing research data, disseminating findings, managing the research process. The study found that researchers are using a wide variety of social media tools, especially those for collaborative authoring (Google Docs, Wikis), conferencing (Skype) and scheduling (Google Calendar, Doodle). Social media use was most common amongst science researchers. Age, gender and nationality were not found to be significant factors affecting social media use. Researchers were found to be adopting non-academic tools (Twitter, Facebook etc) and repurposing them for academic activities. The definition of social media used in this study is very broad, and therefore the activities surveyed do not necessarily relate to impact – this is discussed further in section 2.4.5.

Gruzd et al (2012) took a small-scale qualitative approach, conducting semi-structured interviews with US information scientists to identify motivations for the use of social media. The study identified four key motivations for social media use within the research process: making/strengthening professional connections; keeping up to date with research in their field; promoting work online; and maintaining professional image. The five most popular types of social media amongst researchers were identified as wikis, social networking tools, listserv groups, blogs, and teleconferencing tools (such as skype). Again, the focus of the Gruzd study is broader than this one and many of the activities identified do not relate to research impact.
Procter et al (2010) performed a large scale quantitative survey into the adoption of web 2.0 services by UK researchers. The study found high use of generic web 2.0 tools such as Google Scholar and Wikipedia, but less evidence for researchers using social media for novel forms of scholarly communication. This may however be due to the date of the study, as later research does find significant use of social media for scholarly communication. The use of the term web 2.0 reflects a very broad approach to the technologies surveyed, and the findings do not relate specifically to social media. The study found that researchers are willing to use web 2.0 technologies if they see benefits in terms of saving time or making research easier, but that they still place value on traditional systems of publication and peer review. Web 2.0 is seen as adding value to traditional systems, rather than replacing them.

Priem and Hemminger (2010) undertook a large-scale review of social media to assess what data is available, and how it could be used to measure impact. They analysed a sample of 24331 PLOS papers over 7 year sample, and gathered related social-media ‘events’ (including Mendeley saves, tweets, Facebook likes, blog posts). They found that data associated with reading, saving and sharing articles was the most numerous. They found a large amount of social media data associated with the articles in the sample. 80% of the articles sampled were in at least one Mendeley library, 25% of the articles were mentioned in five or more different social media tools. This suggests that social media use is a significant and widespread part of the research process, and the authors conclude that social media can yield useful new measures of impact.

2.4.2: Drivers for use of social media
The literature identified several motivating factors for the use of social media by researchers (Gruzd et al., 2012; Priem & Hemminger, 2010; Procter et al., 2010; Rowlands et al., 2011):

- Communication with colleagues in other institutions or countries or research disciplines.
- Ability to disseminate research to a wider audience, promote research prior to publication, and increase the visibility of ones’ own research (Gruzd et al., 2012; Priem & Hemminger, 2010; Procter et al., 2010; Rowlands et al., 2011).
- Ease and speed of discovering new research, with networks of peers used as a ‘social filter’ when reviewing and keeping up to date with new literature.
• Ease of use, lack of subscription costs, and lack of technical support required.
• Ubiquity of social media tools makes them easy to adopt for academic purposes (as everyone is using the same systems).

2.4.3: Barriers to use of social media
The literature identified several barriers to the use of social media in research (Gruzd et al., 2012; Priem & Hemminger, 2010; Procter et al., 2010; Rowlands et al., 2011):

• Concerns over issues of privacy and intellectual property.
• Information overload - lack of time to monitor and maintain social media profiles, and keep up-to-date with new and emerging social media tools.
• Lack of awareness of existing tools and their benefits.
• Lack of institutional or departmental support for social media use.

2.4.4: Social media metrics as a measure of impact
Many studies aimed to identify a correlation between social media activity and citation counts. This approach uses traditional citation metrics as the standard against which altmetrics must be judged, with studies attempting validate altmetrics as an early indicator of eventual citation rates. Allen et al (2013) assess the correlation between social media mentions of PLOS articles (blog posts, tweets, LinkedIn and Facebook), HTML views/PDF downloads and eventual citations in Scopus. HTML views and PDF downloads were found to increase in the days following social media release, but no significant correlation was found between social media release and eventual citation rates. The authors suggest that the relationship between social media and citation is more complex than their study allows for, and they call for more research to elucidate this. Priem et al (2012) analyse researchers’ use of a wide range of social media tools and find that although there is a correlation between shares in Mendeley (a social reference management application) and citation, most altmetrics data is ‘orthogonal’ to citation metrics. The authors suggest that altmetric data measures different behaviours to citation metrics, tracking different forms of research activity and reflecting different aspects of impact.

Thelwall et al (2013) did find a positive correlation between social media activity (Twitter, Facebook, and blogs) and later citation rates in Web of Science. Articles receiving attention on social media went on to be highly cited, but the nature of the correlation was not clear.
The authors identify a need for further study into researchers’ motivations for posting on social media. Shuai et al (2012) found a positive correlation between Twitter activity and subsequent numbers of downloads and citations. However, the authors warn against inferring a direct correlation without further research into who tweets and why. Eysenbach (2011) concludes that tweets can be used to predict citations, and that highly tweeted articles are 11 times more likely to be highly cited, but again the nature of the correlation is unknown. Tweets may raise the visibility of an article and increase the chance of citation, or high numbers of tweets may simply reflect an underlying quality of articles that would be highly cited anyway. Eysenbach suggests Twitter metrics measure new behaviour that supplements rather than replaces citation data. Shema et al (2014) found that research articles mentioned in blog posts went on to receive more citations, but again, the nature of the correlation is not clear (they suggest that bloggers may simply select high-quality articles to write about, which would naturally receive higher citations regardless of blog mentions). Gibson (2013) compared a variety of social media metrics (Mendeley and CiteULike readers, Facebook and Google+ posts, Tweets and blog posts) with Web of Science citation data. Highly cited papers also had high numbers of readers in the reference management applications Mendeley and CiteULike – a correlation which was deemed statistically significant. However, no significant correlation was found with other social media, suggesting that researchers use different social media for different reasons – Gibson calls for more research into the motivations for social media use.

Whilst evidence exists to demonstrate a correlation between social media activity and citation, the majority of the literature suggests that the social media activity measured by altmetrics reflects a different aspect of impact than that measured by citation data. The literature identifies the need for more research into the nature of social media use by researchers in order to better understand how altmetrics data translates to impact.

2.4.5: Categorising social media

In order to assess researchers’ use of social media, it was first necessary to identify the social media tools that would form the focus of the study.

A number of the studies identified in the literature review took a very broad view of social media, typified by Gruzd et al as ‘any website or web-based service that...contains some
aspect of user generated content’ (2012). According to this definition, a large number of very different tools can be identified as social media, including wikis, listserv groups, teleconferencing tools (such as Skype), online document management tools (such as Google Docs) and scheduling tools such as Google Calendar (Gruzd et al., 2012; Priem & Hemminger, 2010; Procter et al., 2010; Rowlands et al., 2011). This definition was deemed too broad for the purposes of this study, as many of these activities (scheduling, conferencing) do not directly relate to the impact, influence or reach of published research. For the purposes of this study it was necessary to identify social media tools and activities that relate to research impact.

Several researchers identify a need for altmetrics to distinguish between different types of social media activity before it can yield meaningful data. They argue that many of the metrics grouped together under altmetrics represent very different activities. For example a Facebook ‘like’ is not necessarily equivalent to a blog post. They attempt to define a standardised vocabulary or ontology for altmetrics, where various social media metrics are grouped together according to ‘the purpose and nature of measurement’ and the 'underlying activity captured by the data source’ (Lin & Fenner, 2013, p. 23).

The literature review identified three core social media activities that relate to impact (Allen et al., 2013; Buschman & Michalek, 2013; Lin & Fenner, 2013; Penfield et al., 2014; Priem et al., 2012):

- Discovery (eg: literature review, finding and keeping up to date with new research)
- Dissemination (sharing other people’s research)
- Promotion (sharing one’s own research)

By tracking references to published research in social media, it may be possible to track the movement, reach and consumption of research. A ‘reference’ to published research can be defined as:

- links to published research (eg: journal articles, books or conference papers)
- information relating to published research (author, title)
- full text files (eg: PDF) of published research

Having identified these underlying activities relating to impact, it was necessary to identify the social media tools and applications that can be used to facilitate them. The leading altmetric providers ("Altmetric.com," 2014; "Impactstory," 2014; "Plum Analytics," 2014)
track mentions and links to research publications in a wide variety of social media sources. These are constantly updated and reviewed in order to provide an up-to-date reflection of the social media landscape. Social media technology evolves so quickly that attempts to produce comprehensive lists of individual tools are often out of date by the time they are published. The popularity of specific tools also changes over time (as in the case of MySpace, Facebook and Twitter). Several altmetrics researchers have addressed these issues by grouping social media tools into categories based on the type of activity they facilitate (Allen et al., 2013; Buschman & Michalek, 2013; Lin & Fenner, 2013; Penfield et al., 2014; Priem et al., 2012). These categories were identified as:

- Blogs (eg: Blogger, Wordpress)
- Microblogs (eg: Twitter)
- Social Networks (eg: Facebook, LinkedIn, Google+)
- Reference Management/Document Sharing (eg: Mendeley, CiteULike, FigShare)
- Social Bookmarking (eg: Delicious, Connotea, Evernote)

These categories encompass the major social media tools currently available for the discovery, dissemination and promotion of research. The tools are split into categories depending on differences in functionality and the type of activity they allow. Blogs allow their users to write in-depth articles responding to research (they also allow followers to comment and respond). Microblogs such as Twitter allow their users to write very short posts which can be shared and re-shared with networks of other users. Social networking tools encourage the formation of connections between their users and offer a variety of communication options. Online reference management applications allow users to save and share bibliographic references and full-text PDFs of research articles with each other. Social bookmarking tools allow users to create and share lists of links to useful online resources. Whilst there is some overlap between the functionality of some of these tools, they are considered distinct enough to constitute separate categories.

**2.4.6: Methodology**

Studies comparing altmetrics data with citation data used statistical analysis to compare data sets and identify correlations between the two (Allen et al., 2013; Brody et al., 2006; Eysenbach, 2011; Gibson, 2013; Priem et al., 2012; Shema et al., 2014; Shuai et al., 2012; Thelwall et al., 2013; Weller et al., 2011). This method was unable to identify the causes of
any correlation found, and did not provide contextual information regarding motivations and behaviours influencing social media activity.

Studies that investigated the use of social media by researchers, and the underlying research behaviours behind altmetrics data, used one of two methods: large-scale quantitative surveys that asked researchers to report on their use of and attitudes towards social media (Procter et al., 2010; Rowlands et al., 2011); small-scale qualitative research using semi-structured interviews (Gruzd et al., 2012; Priem & Costello, 2010; Zhao & Rosson, 2009).

The choice of methodology used in this study is discussed further in the next chapter.

2.5: Conclusion
The literature review outlined the background to the study. A need was identified within the academic research community to quantify, measure and demonstrate the impact of research.

The most widely accepted means of doing so was identified as bibliometrics, a field which uses citation data as a proxy for the reach and influence of published research articles, books and conference papers. Various issues were identified with bibliometrics, including time taken to accrue and the inability of citation data to capture the full breadth of impact.

Altmetrics, a field which tracks discussion and activity surrounding research in social media, was identified as an alternative to bibliometrics. The literature suggests that altmetrics has the potential to provide a richer picture of impact by capturing aspects of scholarly communication that are not measured by citation data.

However, a lack of evidence was identified concerning the validity of social media activity as a measure of research impact. Researchers point to a ‘dearth of empirical data’ exploring relationships between social media activity, research behaviour, impact and traditional metrics (Eysenbach, 2011). Whilst several studies found correlations between citation counts and social media metrics, the nature of this correlation was not clear. A need was identified for more research into researchers’ use of, and attitudes towards, social media in order to elucidate the meaning of altmetrics data.
A small number of studies were identified that investigated researchers’ use of social media (Gruzd et al., 2012; Priem et al., 2012; Procter et al., 2010; Rowlands et al., 2011). Whilst these studies indicate that researchers are making significant and widespread use of social media, they take a very broad approach, analysing social media use throughout the entire research process rather than for those activities relating specifically to impact. No studies were identified that allowed detailed conclusions to be drawn about the use of social media data to measure the discovery, dissemination or promotion of research publications.

A gap in the literature was therefore identified for a study of researchers’ use of social media to share and discover published research, in order to assess whether data relating to these activities can be used as a proxy for impact.
Chapter 3: Methodology

3.1: Introduction
The aim of the study is to assess the potential role for altmetrics as a tool for supporting academic researchers. This study aims to answer the research question through a survey of post-doctoral science researchers at the University of Sheffield.

The survey is designed to measure:

- the extent to which social media is used by researchers for activities relating to impact;
- attitudes amongst researchers towards social media as a tool for finding, sharing and promoting research;
- attitudes amongst researchers towards altmetrics as a tool to assess research.

This chapter will first outline the reasoning underlying the choices of research methodology, followed by a detailed description of the methods used (including literature review, sample selection and survey design), a description of data analysis methods used, and a discussion of the limitations of the methods chosen.

3.2: Justification of Research Methods
The study seeks to obtain an overview of the use of social media for activities relating to impact (as defined in the literature review) within the academic research process, and attitudes towards altmetrics.

It was felt that a relatively large-scale quantitative study of researchers would provide the breadth and scope of data necessary in order to answer the research question, and identify any trends or patterns in social media use. Whilst a qualitative or mixed-methods approach would allow greater insight into motivations and attitudes towards social media use and altmetrics, this was not deemed feasible on a large scale, given the time and resource limitations. Qualitative research is better suited to the in-depth study of small groups, the findings of which could not be deemed representative of the entire population. Semi-structured interviews or focus groups would be useful methods for further research, but the administrative burden involved in such methods made these impractical.
The population of postdoctoral science researchers assessed was 232. Given the size of the sample, it was decided that an online survey was the most effective means of gathering data. Survey research is an established method within the social sciences, and regarded by many as the best method for ‘determining, with a known level of accuracy, detailed and personal information about large populations’ (Rea & Parker, 2005). The advantages of a self-completion online survey include: relatively low administrative burden in terms of time and cost; automated data entry reducing human error; anonymity and confidentiality; absence of interviewer effects; relatively low demands of time and effort for respondents (Bryman, 2012; Dawson, 2009; Sudman & Bradburn, 2004).

A descriptive, rather than experimental approach was chosen. The purpose of the study is to measure behaviours and attitudes towards altmetrics across the entire population. Therefore comparison with a control group (eg: of non-users of social media) was not felt to be appropriate in this case. Whilst this study may assist with the identification of such a group for future study – (eg: the comparison of factors affecting use or non-use), such a comparison is outside the scope of this study.

3.3: Methods

3.3.1: Literature Review
A literature review was undertaken to map the topic area, identify key concepts and suitable methodologies, and identify gaps in the research literature. The literature review methodology and results are outlined in Chapter 2.

3.3.2: Preliminary Research
Staff in the Research and Innovation Services (RIS) department at the University of Sheffield were contacted in order to assess the feasibility of the study. Informal feedback was gathered at induction events for new research staff in order to gauge interest in the research question, the use of social media and awareness of altmetrics, and to promote engagement with the survey. Feedback was positive and informed the choice of questions and wording of the survey.
3.3.3: Subjects
Post-doctoral researchers in the Faculty of Science at the University of Sheffield were selected as the target population of the survey. This group was selected as they are actively engaged in research, and relatively homogenous in terms of age, status, career-stage and academic discipline. The literature review identified early-career researchers as a group likely to benefit from altmetrics, as they are not well-served by traditional citation metrics due to the length of time citation data takes to accumulate (Brody et al., 2006; Kwok, 2013; Priem & Hemminger, 2010). Assessing researchers from the same institution minimized variables in terms of institutional culture and infrastructure. As all participants are actively engaged in research at the University, it was assumed that IT levels amongst the population are sufficiently advanced that this would not be a significant factor affecting response rates.

The literature review identified academic discipline as one of the key factors affecting engagement with social media (Procter et al., 2010; Rowlands et al., 2011), so it was decided to limit to a single faculty with broadly similar research practices. Science researchers were chosen for the following reasons:

- they have a strong interest in the measurement and demonstration of research impact and are familiar with traditional citation metrics
- they are increasingly concerned with public engagement and dissemination of research beyond academia (one of the strengths of social media and altmetrics)
- their primary research output is the same across disciplines (academic journal articles)

It was decided to gather data from the entire population (rather than a sample) of postdoctoral researchers from the Faculty of Science at the university. It was hoped that this would allow for an overview of research practices, and reduce the possibility of skewed results due to low numbers of respondents. The faculty is split into seven departments, and responses were broken down and analysed by department, to identify any differences and trends in behaviours. Population size is detailed in Table 2.
### Table 2: Population breakdown

<table>
<thead>
<tr>
<th>Department</th>
<th>Number of researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal &amp; Plant Sciences</td>
<td>46</td>
</tr>
<tr>
<td>Biomedical Science</td>
<td>44</td>
</tr>
<tr>
<td>Chemistry</td>
<td>34</td>
</tr>
<tr>
<td>Molecular Biology &amp; Biotechnology</td>
<td>29</td>
</tr>
<tr>
<td>Physics &amp; Astronomy</td>
<td>46</td>
</tr>
<tr>
<td>Psychology</td>
<td>18</td>
</tr>
<tr>
<td>School of Mathematics &amp; Statistics</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>232</strong></td>
</tr>
</tbody>
</table>

#### 3.3.4: Ethical Considerations

In order to ensure anonymity, no personal details were collected other than academic department. Surveys were sent out by staff in RIS, so that the researcher had no access to respondents’ personal data. Research data was stored in a secure, password protected drive, only accessible to the researcher, and was deleted after the study. The group surveyed was not defined as vulnerable according to the Aberystwyth University Department of Information Studies (DIS) Ethics Policy for Research.

A covering email was sent with the online survey, outlining the aims and objectives of the research, defining key concepts (social media, altmetrics and impact), and stating that the findings of the research may be used to inform planning decisions relating to research support provision by the University Library. A copy of the covering email and informed consent form may be found in Appendix A.

#### 3.3.5: Survey Design

A copy of the questionnaire may be found in Appendix B.

The survey uses closed questions based on the findings of the literature review. The survey attempts to measure:

- **Behaviours:** ordinal Likert (1932) scales were used to measure frequency of use of social media tools, as these have been found to be effective for measuring use of technologies (Kano, Horton, & Read, 2010)
- **Attitudes:** a five-point Likert (1932) scale was selected as these are widely used to measure attitudes (Bowling, 2014; Bryman, 2012). Fink (1995) advises that a neutral mid-point ('don’t know/unsure') option only be used if this response is valid. This was judged to be the case when measuring attitudes towards social media and altmetrics, as a lack of knowledge or certainty could indicate a need for training/support.
The literature review found evidence that age, gender or nationality were not significant contributing factors to the use of social media (Gruzd et al., 2012; Rowlands et al., 2011) therefore these were not measured by the survey. Academic discipline was found to be an important factor affecting behaviours and attitudes, and this was measured by the survey.

The literature review identified a wide range of research practices for which social media is used, including collaborative authoring, conferencing and scheduling (Gruzd et al., 2012; Rowlands et al., 2011). However, as the focus of this study is the use of social media metrics to assess impact, the survey focused only on those activities identified as relating to research impact. These were:

- Discovery (eg: literature review, finding and keeping up to date with new research)
- Dissemination (sharing other people’s research)
- Promotion (researchers sharing their own research)

The literature review identified a wide range of social media tools used within research, including applications for video conferencing (eg: Skype) and media sharing (eg: Youtube). However, this study was only concerned with those tools relating specifically to the measurement of research impact. As altmetrics is the focus of the study, only those tools measured by the current altmetrics providers were used ("Altmetric.com," 2014; "Impactstory," 2014; "Plum Analytics," 2014). As the focus of the study was print research outputs (articles, conference papers, reports, monographs) audio visual sources were discounted (YouTube etc). As social media technology is constantly evolving, with new tools emerging continuously, it was decided to group social media into categories according to use/purpose, rather than focus on the specific tools themselves. It was felt that an exhaustive list of tools would be difficult to compile, would become outdated quickly and make the survey overly long (thus reducing the response rate). The following categories were used, based on the findings of the literature review:

- Blogs (eg: Blogger, Wordpress)
- Microblogs (eg: Twitter) – as Twitter is the predominant microblogging tool, the term Twitter was used to avoid confusion between the term ‘blog’ and ‘microblog’
- Social Networking (eg: Facebook, LinkedIn, Google+)
- Reference Management/Document Sharing (eg: Mendeley, CiteULike, FigShare)
- Social Bookmarking (eg: Delicious, Connotea, Evernote)
Examples were given for each category in order to make the distinctions clear to respondents, and allow them to provide informed answers. These categories are not exhaustive, and certain tools could fall into more than one category, but it was felt that a balance had to be struck between a comprehensive list and a usable survey.

The survey is organised into three sections:

1. Assesses use of social media tools
2. Assesses attitudes towards social media
3. Assesses attitudes towards, use and awareness of altmetrics

Table 3 details how each question relates to the objectives of the study:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Concept</th>
<th>Measure/Indicator/Variable</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess the extent to which social media is used by researchers for activities relating to impact</td>
<td>Account for effects of academic discipline on social media use</td>
<td>Researcher’s department</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Assess researchers’ use of social media for finding research</td>
<td>Frequency of use of five categories of social media tools for research discovery</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Assess researchers’ use of social media for sharing research by other authors</td>
<td>Frequency of use of five categories of social media tools for dissemination of other people’s research</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Assess researchers’ use of social media for promoting their own research</td>
<td>Frequency of use of five categories of social media tools for dissemination of own research</td>
<td>4</td>
</tr>
<tr>
<td>Assess attitudes amongst researchers towards social media as a tool for research discovery, dissemination and promotion</td>
<td>Account for effects of academic discipline on attitudes</td>
<td>Researcher’s academic department</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Assess perception of quality of research found on social media</td>
<td>Attitude scale – ‘I can find high-quality research using social media’</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attitude scale – ‘The research I can find using social media is of the same quality as the research I can find using academic databases’</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Assess perception of social media as means of sharing research</td>
<td>Attitude scale – ‘Social media is an effective way to share research with my peers (ie: research by other people)’</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Assess perception of social media as means of promoting own research</td>
<td>Attitude scale – ‘Social media is an effective way to promote my own research’</td>
<td>8</td>
</tr>
</tbody>
</table>
Table 3: Objectives, indicators & questions

### Assess attitudes amongst researchers towards altmetrics as a tool to support research discovery, dissemination and promotion

<table>
<thead>
<tr>
<th>Objective</th>
<th>Indicator</th>
<th>Question</th>
<th>Scale/Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account for effects of academic discipline on attitudes</td>
<td>Researcher’s department</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness of altmetrics for finding research</td>
<td>Attitude scale – ‘A high altmetrics score would encourage me to read a piece of research’</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness of altmetrics for promotion of own research</td>
<td>Attitude scale – ‘I would be interested in using altmetrics tools to demonstrate the attention that my own research received on social media’</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Perceived validity of altmetrics as measure of quality</td>
<td>Attitude scale – ‘Social media activity is a good indication of research quality’</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attitude scale – ‘Altmetrics are a useful alternative to traditional measures of impact’</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Assess current awareness of altmetrics</td>
<td>Scale- ‘How much did you know about altmetrics before this survey’</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select from category – indicate use of common altmetrics tools</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.3.6: Procedures

SurveyMonkey was used to conduct the online survey. This software was selected for ease of use, clarity of design and because it is used widely within the University and thus familiar to respondents. Results were exported as an Excel spreadsheet and analysed using SPSS.

The survey was piloted on a convenience sample of postgraduate researchers and library staff to test questions for ambiguity, validity, and structure. Findings of this led to the amendment of the wording of some of the questions to reduce ambiguity, the clarification of technical terms, and the inclusion of an image illustrating an altmetrics tool in practice to illustrate the concept.

The following measures were taken in order to improve response rates:

- A covering letter to explain the purpose and importance of the research, address ethical concerns and clarify key concepts (Bryman, 2012)
- SurveyMonkey allowed clear, consistent and legible design (Dillman, 2000)
- Clear instructions were given for how to answer questions (Dawson, 2009)
• The survey was given a logical structure (starting with simple questions) (Dawson, 2009)

• A realistic estimate was given of the time necessary to complete the survey, and an in-survey indication of progress given to increase completion rates (Crawford, Couper, & Lamias, 2001)

The survey was administered by staff in RIS, using distribution email lists targeting post-doctoral researchers. Two weeks were allowed for data collection. A reminder email was sent to non-respondents after one week.

3.6: Analysis and Presentation of the Data

SPSS software was used to analyse the data. These results were then presented in charts created using Excel.

Univariate analysis was used for descriptive data (e.g., percentage use of the social media tools by category, mode average agreeing with attitude statements).

Nominal data was recorded in frequency distribution tables and presented in appropriate charts (pie charts, column charts). Following guidance from Robbins & Heiberger (2011), ordinal data from Likert scales was presented in the form of diverging stacked bar charts. These were created in Excel using data generated in SPSS. This method was chosen to make the comparison of categories clearer. Mode and median scores were calculated where appropriate – the mean was discounted due to the likelihood of misleading figures due to low response rates.

Bivariate analysis was performed to test for correlations between the following variables:

• The effect of academic department on social media use
• The effect of respondents’ level of social media use on attitudes towards social media/altmetrics

This analysis was performed using SPSS. The Cramers’ V test was used to test the magnitude of any correlations found. The Chi Square test was used to measure the strength or validity of the evidence.
3.7: Limitations
Qualitative data could have provided greater insight into motivations and barriers to the use of social media and altmetrics. Further research, based on semi-structured interviews and focus groups, would provide useful contextual data to build upon the findings of this study.

Response rates were low, introducing the risk of bias as respondents may not be representative of the entire population. This is one of the drawbacks of survey research – the variables affecting response/non response are not measured, and this must be taken into account when reviewing the findings. Greater promotion of the survey, and incentives for respondents may have helped to increase response rates.

The study focused on the use of social media and altmetrics by scientists to discover share and assess traditional academic research outputs: journal articles, conference papers, reports and research monographs. The study is not therefore effective in measuring behaviour amongst academic disciplines for which these are not the primary research outputs. Further study of other academic disciplines (eg: Arts & Humanities) and non-traditional research outputs (poetry, artworks, performance) would provide a useful insight into the role for altmetrics within such disciplines.

3.8: Summary
A quantitative approach was selected, using an online questionnaire as the data collection method. Data was collected on:

- the use of social media for the discovery, dissemination and promotion of research
- attitudes towards social media as a tool for the discovery, promotion and dissemination of research
- attitudes towards altmetrics to support the discovery, dissemination and promotion of research

Nominal and ordinal data was collected, using 5-point Likert scales where appropriate to record frequency and attitude.

Univariate analysis was used for descriptive data, and bivariate analysis was performed to identify possible correlations between academic department and social media use, and between social media use and attitudes.
Response rates were low, but the questionnaire yielded useful data, although a mixed-methods approach would have provided richer data and allowed a greater understanding of the results.
Chapter 4: Results

4.1 Introduction
The previous chapter outlined the data collection method of the study, an online questionnaire yielding quantitative data. This chapter reports the findings of the survey and presents the results of univariate and bivariate analysis performed on the data.

The results are separated into categories reflecting the structure of the survey:

- Use of social media tools:
  - For research discovery (finding research articles)
  - For research dissemination (of research by other people)
  - For research promotion (promotion of one’s own research)
  - Responses are broken down and compared by academic department, and analysed to test whether academic discipline affects social media use

- Attitudes towards social media
  - Data is analysed to test whether frequency of social media use affects attitudes towards social media as a means of research discovery, dissemination and promotion

- Assesses attitudes towards altmetrics
  - The data is analysed to test whether the frequency of social media use affects attitudes towards altmetrics as a measure of research impact

Data is presented with the corresponding question from the survey.

The implications of the findings are discussed in Chapter 5, which relates the findings to the research question, aims and objectives.

4.2 Response rate
The survey was sent to 232 researchers. Whilst responses were gathered from all the academic departments sampled, overall response rates were low. 19 responses were received after the initial email was sent, and a further 8 after the reminder email, yielding 27 in total, which represents 11.64% of the total population.
Q1: Please select the department you are based in

<table>
<thead>
<tr>
<th>Department</th>
<th>Responses</th>
<th>Total population</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal &amp; Plant Science</td>
<td>6</td>
<td>46</td>
<td>13.04%</td>
</tr>
<tr>
<td>Biomedical Science</td>
<td>5</td>
<td>44</td>
<td>11.36%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>2</td>
<td>34</td>
<td>5.88%</td>
</tr>
<tr>
<td>Molecular Biology and Biotechnology</td>
<td>3</td>
<td>29</td>
<td>10.34%</td>
</tr>
<tr>
<td>Physics &amp; Astronomy</td>
<td>7</td>
<td>46</td>
<td>15.22%</td>
</tr>
<tr>
<td>Psychology</td>
<td>3</td>
<td>18</td>
<td>16.67%</td>
</tr>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>1</td>
<td>15</td>
<td>6.67%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>232</strong></td>
<td><strong>11.64%</strong></td>
</tr>
</tbody>
</table>

Table 4: Responses

![Figure 2: Responses as a percentage of whole population](image1)

![Figure 3: Responses by department](image2)
4.3 Use of social media

This section reports on the use of social media by researchers for activities relating to impact. The data relates to questions 2-4 in the online questionnaire, which asked respondents to rate the frequency with which they use social media tools for the discovery, dissemination and promotion of published research.

Social media tools were split into 5 categories, as identified by the literature review:

- Blogs
- Twitter
- Social networks
- Reference managers
- Social Bookmarking

Social media use was split into 3 categories relating to impact, as identified by the literature review:

- Discovery of research (finding published research)
- Dissemination of research (sharing published research by other people)
- Promotion of research (sharing one’s own published research)

4.3.1: Use of Social media for research discovery

Respondents were asked to indicate (on a Likert scale) the frequency with which they use each category of social media for the discovery of published research.

Q2: Do you use any of the following to find research? (eg: finding links to journal articles, conference papers, reports or books when performing a literature review, or searching for new research in your field)

<table>
<thead>
<tr>
<th>Social Media Used</th>
<th>Very Frequently</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Twitter</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Social Networks</td>
<td>1</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Reference Managers</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Social Bookmarking</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 5: Use of social media for research discovery - response count
The responses as a whole indicate that social networks are the most frequently used social media tools for research discovery, with 70% of respondents making some use of them to find research. Reference managers such as Mendeley were the second most popular category (56% of respondents reported using them), followed by Twitter (33% of respondents reported using it very frequently to rarely) and blogs (37% use frequently to rarely). Social bookmarking tools received the lowest scores, with only 8% of respondents reporting using them occasionally or rarely. Overall, the frequency of social media use for discovery was low, with small percentages of users reporting very frequent or frequent use.
4.3.2: Use of social media for research dissemination

Respondents were asked to indicate (on a Likert scale) the frequency with which they use each category of social media for the dissemination of research published by other authors.

Q3: Do you use any of the following to share research by other people? (eg: sharing new research articles in your field)

<table>
<thead>
<tr>
<th>Social media used</th>
<th>Very Frequently</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Twitter</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Social Networks</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Reference Managers</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Social Bookmarking</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 6: Use of social media for research dissemination - response count

Figure 6: Use of social media for research dissemination – divergent stacked bar chart
As with the findings of question 2, the responses indicate that social networks are the most frequently used social media tools for research discovery, with 59% of respondents making some use of them to find research. Twitter was the next most popular category (25% use), very closely followed by reference managers (21% use). As with the findings of the previous section, blog use was low (11%), and social bookmarks received the lowest use (only 4% reported using them ‘rarely’).

Overall, the frequency of social media use for research dissemination was lower than that for research discovery. For example, the figures indicate a difference of 11% in the use of social networks when compared to the figures for research discovery.
4.3.3: Use of social media for research promotion

Respondents were asked to indicate (on a Likert scale) the frequency with which they use each category of social media for the promotion of their own research.

Q4: Do you use any of the following to share your own research (eg: sharing your research findings, or sharing a link to a recently published article that you contributed to)

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Very Frequently</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Twitter</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Social Networks</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Reference Managers</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Social Bookmarking</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 7: Use of social media for research promotion – response count

Figure 8: Use of social media for research promotion – divergent stacked bar chart
Overall, the use of social media was lowest in this category, with two exceptions. The use of social bookmarks was higher for research promotion than in any other category. The use of blogs was also higher (by 7%) than for the dissemination of research by other people (but lower than that for dissemination). Social networks were once again the most popular category of tools (56% use), with Twitter second (23%) followed by reference managers (12% use very frequently – occasionally) and blogs (18% use occasionally-rarely). Social bookmarks were once again the least popular category.
4.4: Use of social media by department
The literature suggests that academic discipline is a key factor affecting research behaviours, and analysis was necessary to identify any trends in the data resulting from this variable. Bivariate analysis was performed to test whether respondents’ academic department had an effect on their use of social media. Analysis was performed using SPSS, with academic department as the (nominal) independent variable, and frequency of use as the (ordinal) dependent variable. Responses were analysed for each category of social media tool.

4.4.1: Departmental use of social media for research discovery

![Departmental use of blogs to find research](image)

The School of Mathematics & Statistics (SoMaS) and Molecular Biology & Biotechnology (MBB) show the lowest use of blogs, whilst Animal & Plant Sciences (APS) show the highest, followed by Biomedical Science (BMS) and Physics & Astronomy. Cramer’s V indicates a moderate correlation between department and blog use, but the Chi Square test indicates that the evidence is not strong enough to prove a correlation (as \( p > 0.05 \)). Therefore the null hypothesis must be accepted (ie: the two variables are not related).
As with blog use, SoMaS and MBB show the lowest use of Twitter, while APS shows the highest followed by BMS and Chemistry. Use by Chemistry and Psychology are higher than for blogs. Again, whilst Cramer’s V shows a moderate correlation between the variables, the $p$ value is too high to draw conclusions.

Psychology shows the highest use of social networks, closely followed by Chemistry, APS and BMS. Once again, SoMaS show the lowest use, although higher than for blogs and
Twitter (answering rarely rather than never). Again, whilst Cramer’s V indicates a moderate correlation between the variables, the $p$ value is too high to reject the null hypothesis.

<table>
<thead>
<tr>
<th>Departmental use of reference managers to find research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics &amp; Statistics</td>
</tr>
<tr>
<td>Psychology</td>
</tr>
<tr>
<td>Physics &amp; Astronomy</td>
</tr>
<tr>
<td>Molecular Biology &amp; Biotechnology</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>Biomedical Science</td>
</tr>
<tr>
<td>Animal &amp; Plant Science</td>
</tr>
</tbody>
</table>

$x^2 = 33.675, p > 0.9$

Cramers $V = .558$ (moderate) $p > 0.9$

**Figure 13: Departmental use of reference managers for research discovery**

SoMaS show a very high level of engagement with reference managers, higher than for any other category. Chemistry, Psychology and MBB are the next highest users, whilst BMS are the lowest. Cramer’s $V$ shows a moderate correlation between the variables, but the $p$ value is high.
All departments show low levels of use for social bookmarks. Again however, the $p$ value is too high to draw conclusions.

Modes could not be calculated due to the low numbers of responses in some departments. The median scores indicate a preference towards blogs and Twitter amongst APS.
researchers, and a trend towards Social networks and reference managers amongst the other departments.
4.4.2: Departmental use of social media for research dissemination

**Figure 16: Departmental use of blogs for research dissemination**

Blog use was low across all departments, but highest amongst APS. $p > 0.05$, indicating poor confidence in the correlation between department and frequency of use.

**Figure 17: Departmental use of Twitter for research dissemination**

As with blog use, Twitter use was low for all departments except APS. Again, $p > 0.05$. 

---

Table: Departmental use of blogs to share research by other people

<table>
<thead>
<tr>
<th>Department</th>
<th>Very Frequently</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td>33.3%</td>
<td>66.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics &amp; Astronomy</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molecular Biology &amp; Biotechnology</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomedical Science</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal &amp; Plant Science</td>
<td>16.7% 16.7%</td>
<td>66.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$x^2 = 15.750 \ p > 0.6$
Cramers $V = .441$ (moderate) $p > 0.6$

---

Table: Departmental use of Twitter to share research by other people

<table>
<thead>
<tr>
<th>Department</th>
<th>Very Frequently</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td>33.3%</td>
<td>66.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics &amp; Astronomy</td>
<td>14.3% 14.3%</td>
<td>71.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molecular Biology &amp; Biotechnology</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomedical Science</td>
<td>20.0% 80.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal &amp; Plant Science</td>
<td>33.3% 16.7%</td>
<td>50.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$x^2 = 18.624 \ p > 0.7$
Cramers $V = .415$ (moderate) $p > 0.7$
Use of social networks was moderate/low across all departments, and highest for Physics & Astronomy. Again, $p > 0.05$.

As with the findings for research discovery, SoMaS showed very high use of reference managers for research dissemination. BMS, MBB and Chemistry showed no use. $P > 0.05$. 

![Departmental use of reference managers to share research by other people](image-url)
Figure 20: Departmental use of social bookmarking for research dissemination

All departments reported low use of social bookmarking, with some use by MBB. \( P > 0.05 \)

<table>
<thead>
<tr>
<th>Department</th>
<th>Social Bookmarking to Share Research by Other People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>Very Frequently</td>
</tr>
<tr>
<td>Psychology</td>
<td>Very Frequently</td>
</tr>
<tr>
<td>Physics &amp; Astronomy</td>
<td>Very Frequently</td>
</tr>
<tr>
<td>Molecular Biology &amp; Biotechnology</td>
<td>Occasionally</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Rarely</td>
</tr>
<tr>
<td>Biomedical Science</td>
<td>Rarely</td>
</tr>
<tr>
<td>Animal &amp; Plant Science</td>
<td>Never</td>
</tr>
</tbody>
</table>

\( x^2 = 8.308 \ p > 0.2 \)
Cramers V = .555 (moderate) \( p > 0.2 \)

Figure 21: Departmental use of social media for research dissemination – radar chart

The median scores indicate, for most departments, low use of all categories except social networks, with the exception of SoMaS and Psychology who indicate high use of reference managers, and APS who display a preference towards Twitter.
4.4.3: Departmental use of social media for research promotion

**Figure 22: Departmental use of blogs for research promotion**

As with the previous two categories of social media use, blog use was highest amongst APS. However use was low across all departments. \( P > 0.05 \).

![Departmental use of blogs to share own research](image)

\( x^2 = 10.909 \ p > 0.5 \)

Cramers V = .449 (moderate) \( p > 0.5 \)

**Figure 23: Departmental use of Twitter for research promotion**

As with the previous two categories, APS showed relatively high Twitter use, but unlike the previous categories Psychology showed high use also. \( P > 0.05 \).

![Departmental use of Twitter to share own research](image)

\( x^2 = 20.241 \ p > 0.6 \)

Cramers V = .433 (moderate) \( p > 0.6 \)
All departments reported using social networks to some extent. Psychology reported higher use of social networks in this category than in any other. Again, $P$ was high.

Use of reference managers was lowest across all departments in this category. This is the only case where the Chi Square test indicated a $p$ value of less than 0.05.
This was the only category in which Physics & Astronomy and BMS registered use of social bookmarking. As with other the categories of social media use, the use of social bookmarks was low across all departments. Once again, the $p$ value was high.

**Figure 26: Departmental use of social bookmarks for research promotion**

**Figure 27: Departmental use of social media for research promotion – radar chart**
The median scores indicate low use of social media in this category, but with a preference for social networks. Maths also showed a preference for reference managers and APS showed higher use of blogs and Twitter than other departments.

### 4.5 Attitudes towards social media

In order to assess attitudes towards social media as a tool for research discovery, dissemination and promotion, respondents were asked to indicate (on a Likert scale) the degree to which they agreed or disagreed with four statements concerning social media.

*Please state how strongly you agree or disagree with the following statements:*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not Sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q5. I can find high-quality research by using social media</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Q6. The research I can find using social media is of the same quality as the research I can find using academic databases (eg: Web of Science, Scopus, StarPlus)</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Q7. Social media is an effective way to share interesting research with my peers (ie: research by other people)</td>
<td>3</td>
<td>11</td>
<td>9</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Q8. Social media is an effective way to promote my own research</td>
<td>2</td>
<td>9</td>
<td>11</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

*Table 8: Attitudes towards social media – response count*
Figure 28: Attitudes towards social media – divergent stacked bar chart

Figure 29: Attitudes towards social media – mode and median scores
### 4.5.1: Attitudes towards social media as a tool for research discovery

The results indicate a reasonably high level of uncertainty regarding the quality of research discovered through social media (Q5). Only 26% of respondents agreed that they could find high quality research through social media, whilst 30% disagreed. Just under half of respondents selected the ‘don’t know’ category.

Respondents were more certain when asked whether the research found through social media was as good as that found via traditional academic databases (Q6). 56% of respondents disagreed with this statement, whilst only 18% agreed. This question had the lowest number of ‘not sure’ responses in this section of the questionnaire.

### 4.5.2: Attitudes towards social media as a tool for research dissemination

Over half the respondents (52%) agreed that social media was an effective way to share research by other people, whilst only 15% of respondents disagreed with the statement. This was the highest level of agreement in this section of the questionnaire.

### 4.5.3: Attitudes towards social media as a tool for research promotion

40% of respondents agreed that social media is an effective means to share their own research. Whilst only 19% of respondents disagreed, a high proportion (41%) registered uncertainty.

### 4.5.4: Effects of social media use on attitudes

Due to the low response rates, it was not possible to draw statistically significant conclusions concerning the effect of academic department on attitudes towards social media. As with the data analysis performed in section 4.4, the results of chi square tests did not support the rejection of the null hypothesis between these variables.

It was instead decided to assess whether a correlation exists between respondents’ level of social media use and their attitudes towards social media as a measure of impact. Respondents were split into two groups, based on their answers to questions 2-4 concerning social media use:

- **High social media use** – respondents reporting the use of at least one category of social media tools ‘very frequently’ or ‘frequently’
- Low social media use – respondents selecting ‘occasionally’, ‘rarely’ or ‘never’ for all social media categories

Bivariate analysis was then performed using SPSS to compare the attitudes of the two groups. Chi Square and Cramers’ V tests were performed to test the validity of the data and the strength of any correlation found.

Figure 30: Comparison of attitudes to social media in high and low user groups – Q5

Frequent social media users agreed more strongly with the statement than infrequent users. The Cramers’ V test indicated a moderate correlation between social media use and attitudes towards social media as a research discovery tool, but $p > 0.05$, indicating that this evidence is not strong enough to reject the null hypothesis.
Q6: The research I can find using social media is of the same quality as the research I can find using academic databases

<table>
<thead>
<tr>
<th>Low soc media use</th>
<th>High soc media use</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.7%</td>
<td>20.0%</td>
</tr>
<tr>
<td>33.3%</td>
<td>20.0%</td>
</tr>
<tr>
<td>25.0%</td>
<td>53.3%</td>
</tr>
<tr>
<td>25.0%</td>
<td>6.7%</td>
</tr>
</tbody>
</table>

\[ x^2 = 8.183 \quad p > 0.08 \]
Cramers V = 0.551 (moderate) \( p > 0.08 \)

Figure 31: Comparison of attitudes to social media in high and low user groups – Q6

Q6: The response was roughly equivalent for the two groups, but a higher percentage of the high use group disagreed with the statement, despite their responses being more positive on average. \( P \) was relatively low, but still too high to draw firm conclusions.

Q7: Social media is an effective way to share interesting research with my peers (ie: research by other people)

<table>
<thead>
<tr>
<th>Low soc media use</th>
<th>High soc media use</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.3%</td>
<td>20.0%</td>
</tr>
<tr>
<td>50.0%</td>
<td>46.7%</td>
</tr>
<tr>
<td>8.3%</td>
<td>20.0%</td>
</tr>
<tr>
<td>8.3%</td>
<td>13.3%</td>
</tr>
</tbody>
</table>

\[ x^2 = 5.891 \quad p > 0.2 \]
Cramers V = 0.467 (moderate) \( p > 0.2 \)

Figure 32: Comparison of attitudes to social media in high and low user groups – Q7

Q7: Responses to this question were more positive from both groups than for any other in this section of the survey, with only a small percentage disagreeing. \( P > 0.05 \).
Q8: Again, responses were more positive from the high-use group, but they displayed a higher level of uncertainty than in response to the other questions in this section. $P > 0.05$. 

Figure 33: Comparison of attitudes to social media in high and low user groups – Q8
4.6: Attitudes towards altmetrics

In order to assess attitudes towards altmetrics as a tool to support research, respondents were asked to indicate (on a Likert scale) the degree to which they agreed or disagreed with four statements.

*Please state how strongly you agree or disagree with the following statements:*

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q9. A high altmetrics score would encourage me to read a piece of research</td>
<td>1</td>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Q10. Social media activity (amount of discussion/shares) is a good reflection of research quality</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Q11. I would be interested in using altmetrics tools to demonstrate the attention that my own research receives on social media</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Q12. Altmetrics are a useful alternative to traditional measures of impact (eg: citation counts, impact factor, peer review)</td>
<td>0</td>
<td>12</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 9: Attitudes towards altmetrics – response count

![Figure 34: Attitudes towards altmetrics – divergent stacked bar chart](image-url)
4.6.1: Altmetrics as a measure of research quality

The majority of respondents (60%) agreed that a high altmetrics score would encourage them to read a piece of research (Q9). This was the highest level of agreement in this section of the survey.

Responses were almost as positive in response to Q11 and 12. 49% of respondents would be interested in using altmetrics to demonstrate the impact of their own research and 44% agreed that altmetrics are a useful alternative to traditional metrics.

However, attitudes were much more negative when respondents were asked whether social media activity is a good reflection of research quality (Q10). 60% disagreed, and only 7% agreed with the statement.
4.6.1: Effect of social media use on attitudes towards altmetrics

Bivariate analysis was performed to assess the correlation between social media use and attitudes towards altmetrics. The procedure was the same as that used in section 4.5.4.

**Figure 36: Comparison of attitudes towards altmetrics in high and low user groups Q9**

Q9: Both groups displayed a positive response to this question, with the highest level of agreement of the 4 questions in this category. \( P > 0.05 \).

**Figure 37: Comparison of attitudes towards altmetrics in high and low user groups Q10**

Q10: Responses were largely negative for both categories, with the majority of both groups disagreeing with the statement. \( P > 0.05 \).
Q11: I would be interested in using altmetrics tools to demonstrate the attention that my own research receives on social media

<table>
<thead>
<tr>
<th></th>
<th>Low Social Media Use</th>
<th>High Social Media Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>8.3%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Agree</td>
<td>41.7%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Not Sure</td>
<td>8.3%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Disagree</td>
<td>33.3%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>8.3%</td>
<td></td>
</tr>
</tbody>
</table>

$x^2 = 3.375 \ p > 0.4$
Cramers V = .354 (moderate/low) $p > 0.4$

Figure 38: Comparison of attitudes towards altmetrics in high and low user groups Q11

Q11: Both groups displayed similar agreement with the statement, although the high-use group indicated a higher degree of uncertainty. $P > 0.05$.

Q12: Altmetrics are a useful alternative to traditional measures of impact

<table>
<thead>
<tr>
<th></th>
<th>Low Social Media Use</th>
<th>High Social Media Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>33.3%</td>
<td>53.3%</td>
</tr>
<tr>
<td>Agree</td>
<td>50.0%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Not Sure</td>
<td>16.7%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Disagree</td>
<td></td>
<td>13.3%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$x^2 = 5.265 \ p > 0.1$
Cramers V = .442 (moderate) $p > 0.1$

Figure 39: Comparison of attitudes towards altmetrics in high and low user groups Q12

Q12: Although their responses were largely positive, the high-use group displayed a higher level of disagreement with the statement, whilst the low use group displayed a high level of uncertainty. $P > 0.05$. 
4.6.2: Current awareness and use of altmetrics

<table>
<thead>
<tr>
<th>Q13. How much did you know about Altmetrics before this survey?</th>
<th>A great deal</th>
<th>A lot</th>
<th>A moderate amount</th>
<th>A little</th>
<th>Nothing at all</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 10: Current awareness of altmetrics – response count

Over half the respondents had some awareness of altmetrics, although the level of knowledge was low.
Q14: Do you use any altmetrics products?

<table>
<thead>
<tr>
<th>Product</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altmetric.com</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>ImpactStory</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>PLoS Impact Explorer</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 11: Current use of altmetrics – response count

Only three respondents reported using altmetrics products (approximately 11% of the total respondents). The ‘other’ product was stated as Total Impact, but this is an old brand name for ImpactStory.
4.7: Summary of findings

Response rate was low, at 11.64% of the total population. Response rates were highest from Physics & Astronomy, Animal & Plant Sciences and Biomedical Science.

Use of social media was widespread, with 85% of respondents using at least one category of social media, although the frequency of use was generally low. Use was highest for research discovery, followed by research dissemination. Use was lowest for research promotion.

Social networks were the most popular category of social media, followed by reference managers and Twitter. Social bookmarks were used least.

Differences in use were discovered between departments, but response rates were too low to prove a correlation between academic discipline and social media use.

Positive attitudes were recorded towards social media as a means of research dissemination and promotion, although respondents displayed a large degree of uncertainty. Negative attitudes were recorded concerning the quality of research found via social media.

Frequent social media users displayed more positive attitudes towards social media than infrequent users. It was not possible to prove a correlation between social media use and attitudes.

Positive attitudes were recorded towards altmetrics as an alternative tool to traditional metrics for research discovery and promotion, although negative attitudes were expressed towards altmetrics as a measure of research quality. Attitudes were more positive among frequent users of social media, although reasonably high levels of uncertainty were expressed by both high and low-use groups. It was not possible to prove a correlation between social media use and attitudes.

Over half the respondents had some awareness of altmetrics, although the level of knowledge was low. Use of altmetrics tools was low (11%).
Chapter 5: Discussion

5.1 Introduction
This discussion relates the findings presented in the previous chapter to the research question, aims and objectives, and to evidence identified in the literature review.

5.2 Response rate
The response rates were low, at 11.64% of the total population. This may indicate a low level of interest or engagement with the research topic, or a lack of awareness of what altmetrics is and why it is relevant to researchers. This would correspond with responses to question 14, which indicated a low level of awareness surrounding altmetrics. However other factors such as timing, or a generally low engagement with online surveys within the target population may have been responsible. Further qualitative research into attitudes towards social media and barriers to the adoption of altmetrics would be necessary to shed light on the reasons for the low response rate.

Greater promotional efforts such as attending more departmental events to explain the research prior to the survey, targeted marketing, or the offering of an incentive (eg: vouchers) may have increased response rates.

Due to the low response rates, it is not possible to generalize the findings to the broader population. When Chi Square and Cramer’s V tests were carried out on the results of bivariate analysis, the *p value* was greater than the recommended level of 0.05 in all but one case, which indicates that the findings cannot be considered representative of the wider population, and the null hypothesis must be accepted. Responder bias cannot be ruled out – the respondents may represent researchers with a particularly strong interest in social media – further research would be required to test this. Nevertheless, the findings do provide useful data. Responses were gathered from all departments within the Faculty of Science, which provides a cross-section of research behaviours, albeit one that cannot be considered representative of the population.
5.3 Use of social media

The survey found that social media was being used by researchers in all departments for the discovery, dissemination and promotion of published research. Social networks were the most popular category, followed by reference managers and Twitter.

5.3.1: Use of social media for research discovery

The relatively high use of social networks could reflect their popularity and longevity outside of academia, with researchers re-purposing a successful non-academic tool for academic purposes, as suggested by Rowlands et al (2011). The lower use of Twitter is perhaps surprising, given its popularity beyond academia. However, as it is a relatively new tool in relation to social networks such as Facebook, this may indicate a time-lag between the introduction of a non-academic tool and its adoption by the research community. Further research would be necessary to explore the drivers and barriers to the adoption and use of different social media tools by researchers, and the specific qualities or features that drive adoption.

5.3.2: Use of social media for research dissemination

There is a marked difference in the use of blogs for research dissemination when compared to the results for research discovery. This could be due to the level of effort required to write a blog post when compared to the effort required to read one. Blog posts are relatively labour-intensive to create when compared to other social media – the amount of words is generally much longer than for a social network post or tweet, so they require more time and effort to produce. The popularity of social networks, Twitter and reference managers could reflect the ease and speed with which users can share links to research (or in the case of reference managers, the research publication itself). Further, qualitative research would be necessary to explore the reasons for the differences in use between categories.

Overall, respondents make less use of social media for research dissemination than for research discovery. Again, this could be due to the relative cost in effort and time required to create social media content, when compared to that required to consume it.
5.3.3: Use of social media for research promotion

Overall, use was lowest in this category. This could reflect the relatively low rate at which researchers are able to publish research, due to the time-scales involved. As such it is perhaps unfair to compare this category with the previous two. To avoid this issue, a different scale may have been more suitable for this question, equating frequency of use with a different time scale (eg: ‘very frequent’ use might be classed as once a month rather than daily).

The slight increase in the use of blogs (relative to the data for research dissemination) – may be because researchers are more motivated to promote their own work than they are to promote the work of others. This could also explain the higher use of social bookmarks in this category (relative to their use for research discovery and dissemination). Again, qualitative research could be used to further explore researchers’ motivations for using social media.

5.3.4: Use of social media by department

The findings indicate that reference managers and social networks have been adopted to some extent by researchers in all academic departments. Twitter is used in all but two departments.

Although the results indicate differences in the use of social media and preferences for different social media tools between academic departments, it was not possible to draw viable conclusions due to the low response rates. A larger survey or a more in depth qualitative study could provide further detail on the effect of academic cultures and disciplines on the use of social media.

5.3.5: Conclusions on social media use

Despite the low response rates, the findings indicate that respondents do use social media for activities relating to impact – namely the discovery, dissemination and promotion of published research. The majority of respondents (85%) make some use of at least one social media tool. Social networks were shown to be the most popular social media tools in all categories, followed by Twitter and reference managers. This corresponds with evidence from the literature that researchers are adopting social media tools for academic purposes
(Gibson, 2013; Gruzd et al., 2012; Priem & Hemminger, 2010; Priem et al., 2012; Rowlands et al., 2011).

The popularity of reference managers such as Mendeley may reflect the fact that they are designed with the academic community in mind, and facilitate the sharing and discussion of full text research papers in a way that circumvents institutional boundaries (such as institutional journal subscriptions). The popularity of social networks and Twitter may be due to their popularity beyond the academic community – researchers may already be using them and re-purposing them for academic purposes. The relatively low use of blogs could be due to the relatively high level of effort required to create and maintain content. The low use of social bookmarks may indicate that this technology has been superseded, and that functionality can be replicated in other social media tools (ie: Twitter, reference managers and social networks all allow users to share links, whilst also offering many other additional features). However, more study would be required to establish the drivers behind researchers’ adoption of specific social media. Qualitative research such as focus groups or semi-structured interviews would be useful to provide this information.

Nevertheless, the data indicates a widespread use of social media by researchers for the discovery, dissemination and promotion of published research. Therefore the study can be said to have met the first of the key research aims and objectives – to identify whether and to what extent social media is used by researchers in activities relating to research impact. This suggests that altmetrics could be a useful tool for researchers – a hypothesis which will be further explored in the following sections.

The data gathered in this section can also be used to meet the second objective of the research: to gain an understanding of whether the social media data used as the basis of altmetrics can be used as a measure of research impact. The results indicates that respondents are using social media for activities relating to impact and that data relating to these activities could therefore be used as a measure of research impact.
5.4: Attitudes towards social media

5.4.1: Attitudes towards social media as a tool for research discovery
The responses indicate a reasonably low level of confidence in the quality of research discovered through social media. The responses appear to show that whilst social media are considered useful tools for research discovery, they do not provide the level of quality control and rigor provided by peer reviewed and curated academic resources such as Web of Science. This concurs with evidence from the literature review, which indicates that researchers put more value on traditional academic discovery tools and are skeptical as to the quality of articles receiving large amounts of attention via social media (Liu & Adie, 2013; Procter et al., 2010; Rowlands et al., 2011). This may be due to the fact that most social media are open to non-academic users, with no restrictions on who can create and post content, and not therefore subject to the same quality-control procedures as academic databases. This would appear to support findings from the literature that social media is an effective supplement to traditional academic resources, rather than a replacement. The high level of respondents selecting the ‘not sure’ option indicates a high degree of uncertainty surrounding the use of social media for research discovery. This may indicate a need for training in order to help researchers identify useful research using social media, to increase their confidence in it as a discovery tool. However, further qualitative research would be necessary in order to test these hypotheses and explore the reasons for the lack of certainty and confidence.

5.4.2: Attitudes towards social media as a tool for research dissemination
The responses indicate that the majority of researchers consider social media an effective way to share research with others. This is interesting when compared to the low usage figures for social media for research dissemination. It may be possible to infer that whilst respondents have a relatively high degree of confidence in the efficacy of social media as a means of sharing research, they make relatively little use of it for this purpose. It would be useful to follow these findings up with further research into researchers’ motivations for sharing research with their peers, and the type of research they tend to share. The data indicates a reasonably high level of uncertainty (33%) regarding the effectiveness of social media for research dissemination, which may indicate a training need concerning social media as a means of sharing research with peer networks.
5.4.3: Attitudes towards social media as a tool for research promotion

40% of respondents agreed that social media is an effective way to promote their own research. This is reasonably high, although lower than for the previous category, and the responses indicate a higher level of uncertainty in this area. This may be reflected in the relatively low usage figures for this category of social media use. One may infer that researchers are less confident in using social media to promote their own research, than they are in using it to promote other people’s work. Further research would be necessary to investigate the attitudes underlying these figures. However this may highlight a training need in the use of social media to raise one’s profile and the visibility of ones’ research.

5.4.4: Effects of social media use on attitudes

Comparisons of low users of social media with frequent users yielded interesting data. However, whilst Cramers’ V tests indicated a moderate correlation between social media use and attitudes, Chi Square tests did not indicate that this evidence was strong enough to reject the null hypothesis.

Q5. I can find high-quality research by using social media

The high-use group, perhaps unsurprisingly, had more positive attitudes towards social media as a research discovery tool. It is not possible to ascertain from the data whether high use of social media leads to positive attitudes towards it, or whether positive attitudes lead to high use. Further qualitative study of the two groups and the drivers and barriers to use of social media would be necessary to answer this question. A high level of uncertainty amongst the low-use group may indicate a need for more information or training concerning the use and potential benefits of social media.

Q6: The research I can find using social media is of the same quality as the research I can find using academic databases (eg: Web of Science, Scopus, StarPlus)

The two groups provided roughly equivalent answers to this question. Interestingly, although the response was on the whole more positive from the high-use group, a higher proportion disagreed with the statement than the low-use group. This may be because the high-use group has more experience of social media, and therefore a higher proportion of negative experiences, or it may highlight a training need related to searching/filtering social media for research.
Q7: Social media is an effective way to share interesting research with my peers (i.e., research by other people)

Both groups gave a relatively positive response to this question, but agreement with the statement was much stronger amongst the high-use group. Again, it is difficult to tell the direction of influence between the two variables (i.e., do attitudes affect use or vice versa). A high level of uncertainty from the low-use group suggests a lack of awareness of the potential benefits of social media for research dissemination, but again further research would be needed to test this.

Q8: Social media is an effective way to promote my own research

Again, the high-use group responded more positively, although both groups displayed a high level of uncertainty. This may suggest a need for more information on the use of social media for research promotion.

5.4.5: Conclusions on attitudes towards social media

The findings indicate a lack of certainty and negative attitudes towards the quality of research found via social media. This may be used as evidence for a possible role for altmetrics as a tool for information discovery. By flagging highly-discussed or highly shared work, altmetrics may assist researchers struggling to find material using social media. If more information can be provided to researchers on the use of altmetrics to identify high-impact research, this may drive adoption of social media as a means of research discovery.

Likewise altmetrics could be used to demonstrate the impact and raise the visibility of research – this in turn could act as a driver for the use of social media for research dissemination and promotion. Therefore, whilst qualitative research would be necessary to fully understand the attitudes expressed in the responses, the data can be said to have met the following objectives of the study:

- To identify any potential training needs relating to altmetrics
- To identify a possible role for altmetrics in supporting researchers at the University
5.5: Attitudes towards altmetrics

5.5.1: Altmetrics as a measure of research quality

Responses to Q9 suggest that respondents are prepared to use altmetrics to alert them to new research. However, answers to Q10 suggest they are not confident that such metrics will necessarily denote the quality of research (this is also reflected in responses to Q6). One of the barriers to social media use, as identified in the literature review, was the concern that a high amount of social media attention surrounding an article could be due to factors other than research quality – e.g.: the controversial, humorous or headline-grabbing nature of its content (Gruzd et al., 2012; Liu & Adie, 2013; Rowlands et al., 2011). However, this is also an issue affecting traditional metrics (albeit to a lesser extent) and altmetrics proponents argue that as their data is transparent and open, it is easy to analyse the context and meaning behind altmetrics scores. Responses could indicate a need for training on the interpretation and application of altmetrics data.

Overall, despite concerns over altmetrics as a measure of quality, both groups showed significant interest in the use of altmetrics as an alternative to traditional metrics (Q12) as a tool to support research discovery (Q9) and research promotion (Q11).

5.4.4: Effects of social media use on attitudes

As with attitudes towards social media, frequent social media users responded more positively than the low-use group. However, the differences were less pronounced, and overall both groups were positive about the use of altmetrics to help discover, disseminate and promote research. They were less positive about altmetrics as a measure of research quality. The high-use group showed a higher proportion of disagreement than the low-use group concerning altmetrics as a suitable alternative to traditional measures of impact (Q12). This corresponds with their answers to Q6 concerning the quality of social media as a discovery tool when compared to traditional academic databases. This may reflect a preference for traditional academic resources and metrics, rather than a rejection of social media and altmetrics. Positive attitudes to alternative measures suggest a role for them as a supplement rather than a replacement to traditional metrics.

Although the data does suggest that active social media users are likely to be more positive towards altmetrics, p values were too low to reject the null hypothesis, due to the low
response rates. It is also not possible to establish the direction of a causal relationship between social media use and attitudes towards altmetrics without further research.

5.4.5: Current awareness and use of altmetrics
Overall, awareness of altmetrics was low, but over half the respondents had at least some knowledge of the area. This suggests a degree of interest in the subject although this could be due to responder bias – research on a larger scale would be necessary to test this. Only three respondents reported using altmetrics products. The large gap between the relatively high levels of awareness and interest (as displayed in respondents’ attitudes towards altmetrics), and low levels of current use suggests that whilst respondents are interested in altmetrics, they may be unsure how to use them in practical terms. This suggests a possible need for training on the tools available and how they can be used to support research. Additional research would be necessary to test this hypothesis and explore the reasons for low use of altmetrics. The inclusion of an open question asking respondents to state why they did not currently use altmetrics products could have provided useful qualitative data to help interpret these responses.

5.4.6: Conclusions on attitudes, awareness and use of altmetrics
Although response rates are too low to generalize to the entire population, the findings, in conjunction with those on respondents’ attitudes towards social media, do go some way towards meeting the second aim of the study:

- Measure researchers’ attitudes towards altmetrics – ie: whether researchers consider altmetrics data to be useful tool for supporting the research process

A very low level of awareness and use of altmetrics indicates a need for training, and the relatively positive attitudes towards altmetrics to support research discovery and promotion indicates a potential role for them in supporting the research process. Therefore the findings support the following objectives:

- To identify any potential training needs relating to altmetrics
- To identify a possible role for altmetrics in supporting researchers at the University
5.6: Conclusions

The findings indicate a significant use of social media by researchers as a tool for research discovery, dissemination and promotion. This supports the hypothesis that researchers do use social media for activities relating to impact, and that data relating to these activities can therefore be used as a measure of impact.

The data reflects positive attitudes towards social media and associated metrics. However, low levels of confidence in altmetrics as a measure of quality suggest that altmetrics would be better suited as a tool to support the activities of discovery, dissemination and promotion of research rather than as a replacement for traditional measures of research quality.

The findings indicate low levels of awareness and use of altmetrics, but relatively high levels of interest. This suggests a need for training and support for altmetrics and how it can be used in practical terms to support the research process. High levels of uncertainty in the attitudes section may indicate a need to demonstrate the benefits and uses of social media and altmetrics.

Further qualitative study would provide context for the findings and allow greater understanding of the drivers and barriers for the use of and attitudes towards social media and altmetrics. Whilst the response rate is too low to draw firm conclusions about the whole population, the quantitative data gathered does provide a useful insight into researchers’ use of social media for activities relating to impact, and the potential role for altmetrics as a tool to support the research process. Therefore the findings support the research question and the aims and objectives of the study can be said to have been met to a reasonable degree.
Chapter 6: Conclusion

6.1: Introduction

This chapter concludes the study by:

- reviewing the purpose, aims and objectives of the research
- reviewing the evidence identified in the literature review and the methodology chosen
- reviewing the findings, relating them to the purpose, aims and objectives of the research, and discussing whether these have been met
- reviewing the suitability of the research methods, the validity and transferability of the findings, and what could have been done differently
- considering what recommendations can be drawn from the research

6.2: Purpose, aims and objectives

The purpose of the study was to answer the following research question:

*Can measures of social media activity be used to support the academic research process?*

The aims and objectives of the study were:

Aims:

- To measure researchers’ behaviours – ie: to what extent researchers use social media for activities relating to impact
- To measure researchers’ attitudes towards altmetrics –ie: whether researchers consider altmetrics data to be useful tool for supporting the research process

Objectives:

- To identify whether and to what extent social media is used by researchers in activities relating to research impact
- To gain an understanding of whether the social media data used as the basis of altmetrics can be used as a measure of research impact
- To identify any potential training needs relating to altmetrics
- To identify a possible role for altmetrics in supporting researchers at the University
6.3: Literature Review

As altmetrics is an emerging field, it was challenging to find literature relating to the research topic. Whilst much has been written about altmetrics, few empirical studies have been performed into the use of altmetrics to support research. However, evidence was found to support the validity of altmetrics as a measure of research impact, and several benefits over traditional citation metrics were identified. Evidence was found confirming the availability of social media data and the feasibility of its use to assess the impact of research.

However, there was little consensus concerning the meaning of altmetrics data. Whilst there is a wealth of data available relating to social media activity, there is little evidence as to what this data represents and to what extent it relates to research impact. Key questions raised by the literature were: how exactly do researchers use social media and does this use relate to impact? Whilst a small number of studies were identified that explore use of social media across the whole research process, a need was identified to explore use for activities relating specifically to impact, namely research discovery (literature search, current awareness), dissemination (sharing published research by other authors) and promotion (sharing ones’ own research publications). The study aimed to assess researchers’ use of social media for these activities, and their attitudes towards metrics based on these activities, in order to assess the suitability of altmetrics as a tool to support these aspects of the research process.

6.4: Methods

The study aimed to gain an overview of researcher’s behaviours and attitudes on a relatively large scale. A descriptive, quantitative study was devised, using an online questionnaire comprising of closed questions as the data collection instrument. The questionnaire was tested on a convenience sample prior to use. The survey was delivered to all postdoctoral researchers within the Faculty of Science at the University of Sheffield. This group was selected for their homogeneity in terms of research discipline, age and status. Whilst a mixed-methods or qualitative approach could have provided richer data and a greater insight into the motivations drivers and barriers to use, non-use and attitudes towards social media, it was felt that qualitative methods were better suited to in-depth, small-scale
studies that would not provide results that could be generalized to the population as a whole.

6.5: Results

The results collected by the first part of the questionnaire measure the use of social media by researchers. The data collected suggest that social media use is widespread, if not frequent, amongst respondents, and that this use does relate to the discovery, dissemination and promotion of research. Therefore, the study can be said to have found evidence to support the research question and meet three of the aims and objectives:

- Measure researchers’ behaviours – to what extent researchers use social media for activities relating to impact
  - Identify whether and to what extent social media is used by researchers in activities relating to research impact
  - To gain an understanding of whether the social media data used as the basis of altmetrics can be used as a measure of research impact

The results collected by the second and third parts of the questionnaire measure the attitudes of researchers towards social media as a means of research discovery, dissemination and promotion, and towards altmetrics as a tool to support these activities. The results reflect a concern amongst respondents regarding the quality of research found via social media, and the use of altmetrics as a measure of quality. However, the results also reflect positive attitudes towards the effectiveness of social media as a tool for research discovery, dissemination and promotion, and towards the use of altmetrics to support these activities. The data suggests that researchers are positive about the use of altmetrics to help identify potentially useful research, or demonstrate the attention their own research receives via social media. Negative responses to questions comparing social media with established academic databases, and altmetrics with established citation-based metrics, suggest that altmetrics may best be used as a supplement to, rather than replacement for, traditional measures of impact (this reflects the findings of Proctor et al (2010)). Therefore, the study can be said to have found evidence to support the following aims and objectives:
- Measure researchers’ attitudes towards altmetrics – ie: whether researchers consider altmetrics data to be useful tool for supporting the research process
  - To gain an understanding of whether the social media data used as the basis of altmetrics can be used as a measure of research impact
  - Identify a role for altmetrics in supporting researchers at the University

Relatively high levels of uncertainty were discovered concerning social media and altmetrics. Whilst awareness of altmetrics was fairly high, the level of knowledge amongst respondents was low, as was use of altmetrics tools. Coupled with the positive attitudes and relatively high level of interest in altmetrics recorded by the study, the findings therefore suggest a need for training amongst the population surveyed. This meets the final objective of the study:
  - Identify the need for training in altmetrics

6.6: Limitations of the study
Due to the low response rate (11.64%) the sample size is not large enough to support generalisations concerning the population as a whole. Whilst responses were gathered from all departments within the faculty surveyed, and respondents exhibited a wide range of behaviors and attitudes, there is no way to rule out responder bias. As suggested by Nulty (2008), various techniques could have been employed to improve response rates, including greater engagement with academics in the development and delivery of the questionnaire, and the offering of an incentive for completion.

Due to low response rates, chi square tests on the results of bivariate analysis did not support the rejection of the null hypothesis. However, as the survey was largely descriptive (rather than experimental) this was not as great an issue as it could have been. A larger sample or qualitative study would be required to explore the relationships between the variables further.

Whilst the quantitative data on behaviours and attitudes is informative, qualitative data would have been useful to provide context and background to aid in the interpretation of
the data. Interviews or focus groups with respondents would be an interesting topic for follow-up study.

6.8: Recommendations

The findings suggest that whilst social media and altmetrics are finding useful application within the research process, guidance and support could be useful in helping researchers get the most from these tools. A high level of uncertainty regarding the relatively new area of altmetrics suggests that researchers may value information regarding benefits and practical applications. The University Library could offer training and publicity, as part of its existing support for researchers, on the use of altmetrics to support research discovery, dissemination and promotion via social media. The findings of this research could be used to help develop such support. This study could also form the basis for further qualitative research, which could be used to identify examples of best practice in social media use, and identify altmetrics champions to assist in promoting the benefits of altmetrics and in developing training.

In summary, this study has identified evidence to suggest that researchers are making significant use of social media for activities relating to impact, and that there is a role for altmetrics in supplementing traditional metrics as a tool to support these activities. It is hoped that this research will be useful in the development of training materials to support researchers in the use of altmetrics within their research activities.

Word Count: 14844
References


Likert, R. (1932). A technique for the measurement of attitudes. *Archives of psychology*.


Bibliography


Appendix A: Covering email for questionnaire

Dear Researcher

I am a member of University of Sheffield Library staff currently undertaking a research project as part of a Masters qualification in Library and Information Studies.

The project concerns altmetrics – a field which attempts to find new ways to assess research impact, based on measures of social media activity.

This survey aims are as follows:

- to assess the use of social media within the research process
- to assess researchers’ attitudes towards social media as a means of finding, sharing and promoting research
- to assess researchers’ attitudes towards altmetrics as a means of assessing research

The research is being supervised by the Department of Information Science at Aberystwyth University (distance learning) and has received ethical approval.

I would be very grateful if you would take the time to complete my online questionnaire. It will take approximately 5 minutes to complete, and involves answering a series of multiple choice questions.

If you choose to take part in this research please read the statements below and follow the link to the survey.

Thank you in advance for your time and help

Oliver Allchin

I understand that my participation in this project will involve completing a questionnaire about my use of social media within the research process, my attitudes towards social media, and my attitudes towards altmetrics.

I understand that participation in this study is entirely voluntary and that I can withdraw from the study at any time without giving a reason.

I understand that the information provided by me will be totally anonymous and cannot be traced back to me, and that all data gathered will be deleted upon completion of the project.

I understand that I am free to ask any questions at any time and am free to discuss my concerns with Oliver Allchin at the University of Sheffield Library at any time.

I agree that by completing this questionnaire I am giving my consent for the data I have provided to be used for the process of research. I also understand that at the end of the study I will be provided with additional information relating to the study.

I understand that the findings of the study may be used to inform the development of support materials produced by the University Library.

[Link to survey]
Appendix B: Online questionnaire

The use of social media in the research process

1. Introduction to the survey

Thank you for taking part in this survey.

It should take 5-10 minutes to complete and consists of multiple choice questions.

The first part of the survey concerns researchers’ use of social media tools to discover, share and promote research.

The second part concerns researchers’ attitudes towards social media.

The third part concerns altmetrics - a field which uses social media activity as a measure of research impact.

The research aims to survey researchers’ use of social media and assess how altmetrics could be used as a tool to support research.

1. Please select the department you are based in:

- Animal & Plant Sciences
- Biomedical Science
- Chemistry
- Molecular Biology & Biotechnology
- Physics & Astronomy
- Psychology
- School of Mathematics & Statistics
- Other (please specify)

The use of social media in the research process

2. Use of Social Media

The term ‘social media’ refers to online tools that can be used to share, comment or collaborate with other users (such as Twitter, blogs, Mendeley or Facebook).

The term ‘research’ could include links to journal articles, conference papers, reports or books.

2. Do you use any of the following to find research? (eg: finding links to journal articles, conference papers, reports or books when performing a literature review, or searching for new research in your field)

<table>
<thead>
<tr>
<th></th>
<th>Very Frequently (eg: every day)</th>
<th>Frequently (eg: every week)</th>
<th>Occasionally (eg: once or twice a month)</th>
<th>Rarely (eg: less than once a month)</th>
<th>Never</th>
</tr>
</thead>
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<tr>
<td>Blogs (eg: Blogger, WordPress)</td>
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<tr>
<td>Twitter</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Social Networks (eg: Facebook, LinkedIn, ResearchGate)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference Managers (eg: Mendeley, CiteULike, FigShare)</td>
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</tr>
<tr>
<td>Social Bookmarking (eg: Delicious, Connotea, Evernote)</td>
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</table>

3. Do you use any of the following to share research by other people? (eg: sharing new research articles in your field)

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<thead>
<tr>
<th></th>
<th>Very Frequently (eg: every day)</th>
<th>Frequently (eg: every week)</th>
<th>Occasionally (eg: once or twice a month)</th>
<th>Rarely (eg: less than once a month)</th>
<th>Never</th>
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<td>Twitter</td>
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<td>Social Networks (eg: Facebook, LinkedIn, ResearchGate)</td>
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<tr>
<td>Reference Managers (eg: Mendeley, CiteULike, FigShare)</td>
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</tr>
<tr>
<td>Social Bookmarking (eg: Delicious, Connotea, Evernote)</td>
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</tbody>
</table>
The use of social media in the research process

4. Do you use any of the following to share your own research? (eg: sharing your research findings, or sharing a link to a recently published article that you contributed to)

<table>
<thead>
<tr>
<th></th>
<th>Very Frequently (eg: every day)</th>
<th>Frequently (eg: every week)</th>
<th>Occasionally (eg: once or twice a month)</th>
<th>Rarely (eg: less than once a month)</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs (eg: Blogger, WordPress)</td>
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<td>Twitter</td>
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<tr>
<td>Social Networks (eg: Facebook, LinkedIn, ResearchGate)</td>
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<tr>
<td>Reference Managers (eg: Mendeley, CiteULike, FigShare)</td>
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</tr>
</tbody>
</table>

The use of social media in the research process

3. Attitudes towards social media

Please state how strongly you agree or disagree with the following statements:

5. I can find high-quality research by using social media

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

6. The research I can find using social media is of the same quality as the research I can find using academic databases (eg: Web of Science, Scopus, StarPlus)

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

7. Social media is an effective way to share interesting research with my peers (ie: research by other people)

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

8. Social media is an effective way to promote my own research

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
The use of social media in the research process

4. Attitudes towards Altmetrics

Altmetrics is a way of assessing research, based on social media activity.

Traditional methods of assessing research (e.g., citation counts, h-index, impact factor) analyse the number of citations to published research.

Altmetrics analyse the social media activity surrounding a piece of published research (e.g., tweets mentioning the article, shares of the article in Mendeley, mentions in blogs) to calculate an altmetrics score.

A high altmetrics score for a journal article could indicate a high level of online discussion about it.

Here is an example of an altmetrics tool (Altmetric Explorer from altmetric.com) which indicates the amount of mentions and shares that a journal article has received via social media:

<table>
<thead>
<tr>
<th>Tweeted by 596</th>
<th>On 1 Facebook Page</th>
<th>Mentioned in 2 Google+ Posts</th>
<th>Picked up by 1 news outlet</th>
<th>Blogged by 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>62 readers on Mendeley</td>
<td>6 readers on Connotea</td>
<td>2 readers on Chris.Uknke</td>
<td>Brain imaging: the</td>
<td>Experimental measurements</td>
</tr>
</tbody>
</table>

Please state how strongly you agree or disagree with the following statements:

9. A high altmetrics score would encourage me to read a piece of research

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

10. Social media activity (amount of discussion/shares) is a good reflection of research quality

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

11. I would be interested in using altmetrics tools (like the example given at the top of this page) to demonstrate the attention that my own research receives on social media

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

12. Altmetrics are a useful alternative to traditional measures of impact (e.g., citation counts, impact factor, peer review)

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
The use of social media in the research process

13. How much did you know about Altmetrics before this survey?

<table>
<thead>
<tr>
<th></th>
<th>A great deal</th>
<th>A lot</th>
<th>A moderate amount</th>
<th>A little</th>
<th>Nothing at all</th>
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<td></td>
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</table>

14. Do you use any altmetrics products?

<table>
<thead>
<tr>
<th>Product</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altmetric.com</td>
<td></td>
<td></td>
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<tr>
<td>ImpactStory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLoS Impact Explorer</td>
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</tbody>
</table>

Other (please specify if you use any tools not listed)
