

RUNNING HEAD: MAKING SENSE OF ALTMETRICS

Making sense of altmetrics: The perceived threats and opportunities for academic
identity

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Abstract

How research impact is defined and evaluated is much-debated at research policy level. Offering one avenue for capturing societal research impact, altmetrics are proposed as quantitative indicators providing a measure of the reach and attention that a research output, such as a peer-reviewed paper, is receiving online. Eighty publicly-funded food researchers participated in an online mixed-methods engagement study. The analytical framework of *sensemaking* was used to explore participants' views of altmetrics as a threat or opportunity for their perceived professional identities. The identities important to our participants included ensuring rigour and quality in knowledge production; communicating and engaging with non-academic audiences; and bringing about tangible and meaningful changes in society. Whilst an appetite for changes to research evaluation was apparent in our study, altmetrics was perceived to introduce a number of different threats as well as opportunities to the academic identity, which will influence its potential uptake and use.

Keywords: altmetrics, academic identity, research policy, research evaluation, research impact, social media

1. Introduction

Science is in a period of transition. Problem-oriented research and research-based innovation have come to dominate public research funding in recent decades (Henkel 2005; Stilgoe et al. 2013). Aligned to this trend, there has been a gradual shift in the principles which drive and govern science. *Responsible Research and Innovation* (RRI) has been an increasingly dominant feature in European science policies (Diemer et al. 2017; Owen et al. 2012; Von Schomberg 2013). RRI links with earlier movements such as *Public Understanding of Science* and *Public Engagement* in highlighting the limitations of the ‘deficit model’ approach taken in science which fails to engage meaningfully with society (Felt et al. 2013). RRI reinforces principles of engagement and inclusivity and attempts to reconcile our current global need for techno-scientific progress with the moral, social and ethical values, expectations and requirements of society as a whole (PROSO 2016; Von Schomberg 2013). Similar principles are of interest at an international level as evidenced by programmes related to *Ethical, Legal and Social Implications, responsible development* and *anticipatory governance* (Owen et al. 2012; Von Schomberg 2013). At their core, these movements aim to ensure that research and innovation are acceptable to and valued by society.

These macro-level changes in science policy and governance have an impact at the micro-level; specifically, bringing expectations of new roles and responsibilities to the research profession (Henkel 2005; Ylijoki and Ursin 2015). Researchers are likely to interpret and react to these organisational changes based on what it means for their identity as a researcher (Mills et al. 2010). As these policies and principals become embedded in institutionalised mechanisms (e.g. EU, regional and institutional research policies, funding stipulations and reporting requirements), researchers will need to consider, negotiate and potentially redefine what it means to be a researcher (Stilgoe et al. 2013). For example, a greater onus is being placed on scientists to consider and meet social and ethical demands

related to their research (Pelle and Reber 2015). For the researcher, this means embracing processes of upstream engagement with a diverse range of audiences at all stages of the research process (Khan et al. 2014). This involves not only communicating their science in a more accessible way to individuals outside of their immediate academic community, it means actively engaging, interacting with and listening to, these audiences at multiple points in the research process. However, from the researcher's perspective, the activities which embed these principles into day-to-day research life are often perceived to not be formally rewarded or recognised.

1.1. Evaluating research

It has long been argued that the predominant structures of research evaluation within academia do not recognise, reward or value the activities which underpin the transition of science to a more open, participatory and inclusive system with frequent and meaningful interactions with different publics (Wilsdon et al. 2017). The overriding focus on rewarding bibliometrics (i.e. journal publication counts, citation counts, Journal Impact Factor and author h-index) for career progression (employment, promotion and tenure) has been criticised for contributing to a 'papers culture' which places value mainly on academic impact and undervalues the influence that research can have beyond academic circles (Hoffmann et al. 2014; Neff 2017). This method of evaluating research also holds influence at the policy level, not only in determining what areas of research to prioritise and fund, but also as policy-makers seek to draw on information to develop policies more broadly for example, relating to economic, environmental or social issues; the 'best' available evidence is often judged to be that which is published in high impact journals and/or highly cited (Ferretti et al. 2018; Morton 2015; Neff 2017). The concern with placing too much emphasis on a narrow and defined set of quantitative indicators as the basis for evaluating research, and

researchers, is that it fails to acknowledge the diversity of scientific fields (e.g. natural sciences compared to social sciences or humanities) and the different types of impact that research can have (e.g. academic impact compared to societal impact). The narrow focus on academic excellence within science has long been acknowledged as a flaw, with the well-known figure of speech '*the ivory tower*' attributed to science and universities from the mid 1900's, initiating a decades-long debate on the role of science within society (Shapin 2012). The movement to renegotiate how we define and evaluate 'research excellence' has gained much momentum in recent years (Ferretti et al. 2018). High profile efforts, including The San Francisco Declaration on Research Assessment, The Leiden Manifesto (Hicks et al. 2015) and The Metric Tide (Wilsdon et al. 2015), have acknowledged flaws in the research evaluation system and have called for more critical approaches to evaluating the impact of academic research (Wilsdon et al. 2017). In an effort to reflect the fact that scientific impact is a multi-dimensional construct, there have been calls for a multi-metric approach in which it is acknowledged that multiple, rather than single metrics, are necessary (Wouters et al. 2015).

The increasingly digital research environment has led to new opportunities for broader society to engage with science and also for evaluating this engagement. With increased capacity for real-time analysis of large, linked datasets (i.e. 'big data'), there is a growing interest within research and policy circles about the potential role that 'next generation metrics' can play within research evaluation. Alternative metrics (altmetrics) are proposed as an attractive option for capturing – to some degree at least – the societal impact of research (Bornmann 2014; Editorial 2012; Robinson-Garcia et al. 2017). Altmetrics aim to capture the current shift towards scholarly communication taking place in the online environments of social media (Robinson-Garcia et al. 2017). Although lacking a common definition, altmetrics have been broadly defined as the "study and use of scholarly impact measures based on activity in online tools and environments" (Priem 2014, P. 266) Providing

a measure of the online footprint of a research output (e.g. a peer-reviewed publication), altmetrics aggregate online metrics including for example, the number of views, clicks, saves, comments, or downloads it gets, along with its shares or mentions in various social media platforms such as blogs, Twitter or other online forums (Bornmann 2014; Woolston 2014). One advantage of altmetrics is that they can demonstrate the value of scholarly output which is not always in the form of journal papers, and thus generally are not considered in formal research assessments, for example; datasets, code, software, slide-sets, blog posts, and so on (Zahedi et al. 2014). It is argued that altmetrics can offer a measure of the interest, reach, uptake and diffusion of research to a wider audience beyond academia (Dinsmore et al. 2014). With social media an increasingly popular platform for societal discussions around science, having a mechanism to record potential online traction of research appears attractive. We were keen to explore how these metrics are received by those arguably most impacted by their introduction: researchers themselves.

1.2. Making sense of altmetrics: the role of identity

A survey of the bibliometric community revealed altmetrics are relatively well received amongst this particular audience (Haustein et al. 2014). However, little is known about the perceptions and attitudes of the broader scientific community, with existing research suggesting that uncertainty exists amongst scientists as to the value of altmetrics or what they even represent (Kratz and Strasser 2015). Given that their ultimate value depends on their acceptance and uptake within the scientific community, it is vital to understand what researchers think about these metrics. Altmetrics present a change to the academic culture of research evaluation, and researchers are likely to make sense of this change by considering what it means for their identity as a researcher and for their profession (Mills et al. 2010). The concept of *sensemaking* offers an analytical framework to explore how researchers

respond to the introduction of altmetrics into academia (Thurlow and Mills 2009; Weick et al. 2005). Sensemaking is enacted on a daily basis as individuals cope with the ambiguous, uncertain or novel stimuli they encounter in the world; it involves identifying cues (e.g. events, ideas, issues) relevant to existing frames (e.g. mental models, cultural scripts) to create a plausible narrative for ‘what is going on’ (Degn 2018). Sense-making is defined as being retrospective, social, based on plausibility rather than accuracy, and grounded in identity construction; it is also continuously being redefined and particularly sensitive to its environment (Thurlow and Mills 2009) . Whilst all these facets are important, in the current study, we focus specifically on the concept of *identity* as a central facet of sensemaking (Weick et al. 2005) and one which has been found to be particularly important within the academic setting (Degn 2018; Henkel 2000; Ylijoki and Ursin 2015).

Identities are defined by personal traits, beliefs and values and are continuously redefined within the context of social experiences, institutions and relationships {Thurlow, 2009 #365;Henkel, 2005 #364;Jawitz, 2009 #378;Costa, 2015 #373}. Identity is also a multi-dimensional concept; it encompasses one’s experiences, disposition, values, and cognitive beliefs – it is the essence of the ‘whole person’, providing a ‘sense of oneself’ (Osbeck and Nersessian 2017). Thus, whilst they are influenced by their social surroundings, individuals form and decide upon identities for themselves. Previous research has found that academic identity is strongly shaped by personal values such as commitment to rigour and quality, freedom, autonomy, communality and prestige (Degn 2018; Henkel 2000; Ylijoki and Ursin 2015). Such values determine the identities that academics are willing to commit to. This is an important consideration given it is well acknowledged that academics are expected to wear ‘many hats’ within their job (Dankel et al. 2016): researcher (with a disciplinary or an interdisciplinary focus); public communicator; teacher; mentor; administrator; manager; and with an increasing macro-level focus on generating ‘societal impact’ – entrepreneur

(commercialising research output) or lobbyist (trying to influence policy change). Willingness to wear these hats ultimately depends on answering the question, what does it mean to be a researcher?

The on-going macro-level changes at science policy and governance level can be argued to have led to an identity crisis for academics as they engage in soul-searching around the roles, responsibilities and obligations that are expected of them (Degn 2018). When the academic organisation is confronted with change (such as that involved in reforming the research evaluation system), members of that academic community, researchers, will make sense of that change by considering what this change means for their professional identity – for example, does it pose a threat or an opportunity to their perceived identity as a researcher? (Degn 2018; Osbeck and Nersessian 2017; Thurlow and Mills 2009). By exploring how researchers make sense of altmetrics, we are able to identify those issues most pertinent to their minds within the broader changing research landscape, and their ability and willingness to commit to new patterns of behaviour related to this changing landscape (Weick et al. 2005). In the current study we analysed our qualitative data through a sensemaking and identity lens to explore how the introduction of altmetrics is perceived by researchers to undermine or reinforce their perceived identities as researchers.

2. Methodology

2.1. Participants

We explored the views of individuals working in the food research domain as we felt this sample would have particularly insightful views and opinions around recording and demonstrating research impact. Food is a research topic which historically has been in need of greater public engagement; generates much societal discussion; and is a research area with high expectations for demonstrating social, cultural, environmental, and economic impact. This is evident for example in the positioning of food at the heart of the Sustainable

Development Goals, with more than half of these seventeen goals emphasising the need for a safe, nutritious, and sustainable food supply (United Nations 2015). Researchers who work in publicly-funded, food-related research projects are thus well-aware of the growing pressure to show that their research contributes towards societal impact.

We recruited a sample of 80 individuals based in the Republic of Ireland and the United Kingdom (UK) working in publicly-funded food-related research. To account for potentially low response rates, an initial contact list of 350 possible participants was generated. Researchers for inclusion in this contact list were identified by (1) checking lists of partners in national and EU-funded food-related research projects from the preceding 5 years and (2) searching publicly-available researcher biographies on the websites of relevant schools and departments in third level and research institutes in Ireland and the UK. We ensured that our initial contact list included a range of researchers across key demographics (see Table 1) including social media use, which was initially determined by searching for the presence or absence of personal social media accounts (Twitter, YouTube or a personal blog). A personalised e-mail invitation was issued to all those on the contact list outlining the nature of the study and requesting their support. This was followed by a second e-mail and phone-call where necessary. Recruitment and data collection took place over a 5-week period during July/August 2016. We used purposive sampling; during data collection, we monitored the demographics of those participating based on their replies to questions included in the survey on gender, age, career stage, academic discipline and social media use. We wanted to ensure a reasonable spread of individuals across these key demographic characteristics (See Tables 1 and 2). Where certain demographic categories were lacking in numbers, we followed up with a targeted recruitment drive. Upon reaching 80 participants, we felt that we had reached a data saturation point and closed the study.

2.2. Design

An online engagement platform (www.vizzata.com) was employed to introduce scientists to the concept of altmetrics and capture their thoughts and deliberations. This platform facilitates the collection of quantitative data through traditional online survey functions, but it is particularly focused on the collection of qualitative data. A key and unique feature of this platform is the presentation of short sections of information (called ‘content testers’) in the form of text, video, images, or audio to participants who are then invited to submit their immediate questions and comments in response to this information. This platform has been shown to facilitate a rich data collection process which reflects the process of how individuals weigh up different viewpoints and information in deliberating about a new or potentially divisive concept (Marcu et al. 2014). The specific act of asking participants to construct comments and questions requires deliberative engagement with the material presented and prompts participants to engage more deeply with the topic under study (Regan et al. 2015). The questions asked by participants offer a direct insight into how they are making sense of a novel concept – in the current study, altmetrics – and the specific concerns and uncertainties which they may hold (Rutsaert et al. 2015).

2.3. Study materials and procedure

When participants enter the online platform, they are presented with a series of consecutive web pages which they click through, as with a traditional online survey. In our study, participants were invited to take part in the study, which took approximately 30 minutes, at a time convenient to them. Upon entering the online platform, participants were met with an introductory page explaining the nature of the study and asking for their consent before proceeding into the study itself. On the next page, they were asked to provide demographic information. On the third page of the platform, we then briefly introduced the term

‘altmetrics’ to the participants using the following sentence: “*With regard to evaluating research impact, the terms ‘altmetrics’, ‘article-level metrics’ and ‘alternative metrics’ are used inter-changeably to describe the same concept.*” This was kept deliberately vague as we wanted participants to initially indicate their familiarity with these terms, answering ‘yes’ or ‘no’ to the question ‘*have you heard of any of these terms before*’. They were then given free text space and asked to describe their understanding of altmetrics (‘*please describe what you think the ‘altmetrics’ concept might be*’)

On the next two pages, we presented two content testers to the participants which explained the altmetrics concept in detail. The first content tester was a YouTube video titled “A beginner’s guide to altmetrics”¹ produced by Altmetric, a UK Digital Science company specialising in the collection and analysis of altmetrics. The 3-minute video explains the basic concept of altmetrics and presents them as a complementary metric to traditional citations. Although relatively neutral and explanatory in tone, the video does not include any arguments against the use of altmetrics. Thus, in the interest of balance, we included a second content tester – a post from The Guardian’s Higher Education Network Blog². This 460-word blog post titled “Twitter, peer review and altmetrics: the future of research impact assessment” presents an impartial critique of altmetrics considering some of the challenges these metrics present as well as the opportunities. Both content testers are publically available online. As they viewed both the YouTube video and the blog post, participants had the opportunity to ask questions and make comments by clicking the ‘Ask a question’ or ‘Make a comment’ buttons located at the bottom of each content tester page.

After viewing and responding to each of the content testers, participants were then immediately presented with a page of closed and open-ended questions to assess in more

¹ <https://www.youtube.com/watch?v=M6XawJ7-880>

² <https://www.theguardian.com/higher-education-network/blog/2012/sep/19/peer-review-research-impact-altmetrics>

detail their specific attitudes towards altmetrics. They were asked to indicate whether they thought altmetrics are a good way of evaluating research impact, whether and how they would consider using altmetrics themselves and whether they thought altmetrics would be widely accepted in the scientific community.

The information presented in the content testers (the video and the blog post) provides a frame for responses; however, this is a parameter of the current study rather than a limitation. In order to explore researchers' sensemaking around altmetrics, it is necessary that we first explain the basic concept to them, using the content testers. The current study enabled us to do this in a balanced and engaging way and in a manner which enabled us to access the initial and unsolicited views of our participants (through the unprompted questions and comments they submitted) as well as more structured feedback (through the open and closed questions which immediately followed the content testers).

2.4. Analytic procedure

All data (the posted questions and comments and the responses to closed and open-ended questions) were downloaded in a Microsoft Excel-compatible CSV file for analysis. The quantitative data were transferred to SPSS for descriptive analysis (frequencies and chi-squared tests). The text-based data were transferred to QSR International's NVivo 10 qualitative software. For the qualitative analysis, an inductive thematic analysis was carried out following best practice guidelines (Boyatzis 1998; Braun and Clarke 2006). Thematic analysis is a method for identifying, analysing, and reporting patterns within a dataset (Braun & Clarke, 2006). It minimally organises and describes data in rich detail. A data-driven, inductive approach was employed which meant developing codes based on the reading the raw data and not forcing preconceived codes onto the analysis. Following Braun and Clarke's (2006) 6-step guide to thematic analysis, the data were read, coded, checked and re-coded.

Codes were then collated to start the process of building themes. Emerging themes were discussed amongst the authors, and the specifics of each were refined before finalising and developing clear names and descriptions for each theme.

3. Results

3.1. Descriptive Analysis

Table 3 provides a descriptive overview of participants' awareness and attitudes towards altmetrics. Prior to receiving an introduction to the altmetrics concept through the online engagement platform, participants were asked were they aware of the term and could they describe what they thought the term 'altmetrics' meant. Over half of the researchers (56%) in our sample were unfamiliar with the term 'altmetrics' prior to this study: of those who indicated that they were familiar with altmetrics (44%), only around half of these were able to provide a detailed and accurate description. Exploration of the qualitative responses showed that a misconception existed amongst some of the participants that altmetrics was simply another term for traditional bibliometrics such as citations. Overall, there was a relatively low awareness and familiarity of altmetrics amongst our sample. Chi-squared tests did not find any significant associations between demographics (gender, age, career-stage, country or discipline) and familiarity with altmetrics.

After receiving an introduction to the concept of altmetrics through the online platform, participants were on the surface relatively positive about altmetrics. A chi-squared test revealed a significant association between gender and beliefs about altmetrics as a way of evaluating research impact, $\chi^2 (1, n = 80) = 6.88, p = .009$: 81% of females agreed that altmetrics were a good way of evaluating the impact of scientific research, while males were more evenly split: 53% of males believed they were good for evaluation and 47% believed they were not. Age was also found to be significantly associated with perceptions towards

altmetrics for evaluation, $\chi^2 (2, n = 80) = 14.81, p < .001$. Only 20% of those in the age category 56 years + agreed that altmetrics were a good way of evaluating research impact compared to 86% in the 18-35 years category and 69% in the 36-55 years category. Career stage also revealed a similar significant trend, $\chi^2 (2, n = 80) = 9.53, p = .009$. Half of those at senior career level (50%) believed altmetrics were a good way of evaluating research impact compared to 92% of early-career researchers and 60% of mid-career researchers.

Looking at Table 3, the descriptive statistics paint a picture of participants who were relatively satisfied with personally using altmetrics; only 20% of the sample indicated that they would not consider using altmetrics. However, when it came to judgements over their acceptability within the wider institution of science, there was a marked change in attitude with 62.5% of the sample believing that altmetrics would not be accepted by the wider scientific community. Chi-squared tests found that this was largely unexplained by demographics, with the exception of academic discipline, $\chi^2 (1, n = 80) = 5.76, p = .016$. 70% of STEM researchers felt that altmetrics would be accepted by the wider scientific community, while only 40% of AHSS researchers felt that altmetrics would be accepted. The qualitative analysis which follows provides us with further insight into the concerns held by our participants about the potential threats posed by altmetrics to the institution of science. It is worth noting that for the small number of participants who indicated that they are already using altmetrics (12.5% of the sample), the qualitative analysis revealed that the sentiments they expressed did not differ to the broader sample; like the rest of the participants, they had both positive things to say about altmetrics as well as reservations.

3.2. Frame of Reference: The On-going Metrics Debate

Our participants situated altmetrics, a new or uncertain concept for most, within a broader frame of understanding to create a narrative with personal meaning. Participants made sense

of altmetrics largely through one particular frame of reference, the on-going metrics debate. Whilst altmetrics may have been a new concept for many of the participants, it was evident that participants had strong pre-existing beliefs and dispositions about the broader concepts of ‘research impact’ and ‘research evaluation’ and they used this lens to assist their sensemaking processes. This was evident from the outset; in their provided descriptions of what altmetrics are, many of the participants indicated that they felt this concept represented a ‘change’ from the traditional way of defining and measuring the impact of research. At this stage, they offered no judgements on the topic, but it was clear that these participants were attempting to make sense of the altmetrics concept within their current conceptualisations of how research impact is defined and the metrics which are used to demonstrate impact:

“A move away from traditional citations-based metrics...” – P22, Male, UK, SCR, 36-45 years, STEM

“I think the concept entails dealing with a range of metrics instead of focusing on the traditional ones like impact factor or h-index that are typical for journals/publications.” – P47, Female, Ireland, ECR, 26-35 years, STEM

This was a frame which continued to be used for sensemaking around altmetrics in the discourse and themes which follow. As they discussed the value of altmetrics in evaluating research impact, there was a very strong sentiment amongst most of our participants that impact is a complex and multi-faceted concept. Most participants did not make explicit statements around how they defined or conceptualised ‘research impact’. Indeed this discussion prompted some participants to highlight the ‘fuzzy’ and unclear nature of what research impact actually is and how it is defined, viewing it as somewhat of an ‘empty signifier’:

“Someone who is busy on twitter promoting their own research might be making more 'impact' despite the quality of their research - but is this real impact...? And what is impact anyway!” – P9, Female, UK, SCR, 46-55 years, STEM

What was consistent across most of our sample was that in addition to viewing research impact as a complex phenomenon many felt this should be mirrored in how research is evaluated and impact is demonstrated. There was a strong sentiment amongst these participants that change was needed to the current research evaluation system in order to capture the wider and varied impact that their research has. Affect was a strong accompaniment to this discourse; it was clear that quite a number of the participants felt very strongly about this topic with some participants indicating their frustration at the current system:

“I fully agree with the need for alternative, additional metrics to the traditional 'impact factor'. These tools are definitely required to bring additional dimensions which can be used to assess the 'impact of scholarship' in a broader way.” – P7, Male, Ireland, SCR, 46-55 years, STEM

“Scientists want to demonstrate / understand their impact as comprehensively as possible.” – P52, Female, Ireland, SCR, 36-45 years, AHSS

It is important to note that co-existing with this strong appetite for change was also a strong sentiment of caution. It was strongly felt amongst the sample that academia still needs to retain a system – one based on peer review – which will continue to ensure research quality:

“Science consists simply of the formulation and testing of hypotheses based on observational evidence. Science also becomes knowledge by publication of research results. And no one in the scientific community will know about, or place much confidence in, a piece of scientific research until it is published in a peer-reviewed journal...We also need new measurables. But as reliable as the process of peer review is now.” – P78, Male, Ireland, ECR, 36-45 years, STEM

Finally, the tension which surrounds this on-going debate was evident in the narratives of several participants who vented their frustration at what they perceived to be a resistance to

change within the academic setting. This sentiment seemed to be grounded in a frustration that academia is ‘traditional’ and slow to react to or accept change:

“I would hope that scientists are forward thinking enough to accept the new technology, however I feel the might of the 'dusty old academic' may rather underpin the new breed for a few more years - won't be long though, before people realise that scientists need to be able to converse with non-scientists to achieve change in the world.” P41, Female, UK, SCR, 46-55 years, STEM

The altmetrics concept took on a symbolic meaning for our researchers; this new metric represented a departure from the norm and its introduction acted as a platform for participants to reflect on their frustration and discontent with the current system. Whilst there was a strong sentiment in our sample about the need for change within the current research evaluation system, this is not to say that there was unequivocal and widespread acceptance of the altmetrics system as the solution. In the themes which follow, we discuss the facets of identity that participants in our study constructed and signified as important within the context of altmetrics, and how they perceived altmetrics as either a threat or an opportunity to undermine or reinforce those identities.

3.3. Researcher as ‘Knowledge Producer’

Ensuring high quality, rigorous science was viewed as a major priority for many of our participants. The majority of our sample viewed first and foremost that the job of the researcher is to ensure the production of sound knowledge through reliable and rigorous science. This commitment to retaining the reputation of science as a quality-driven profession was one of the most frequently expressed sentiments amongst our sample. This identity often co-existed with other identities, however, many participants talked about the importance of ensuring that ‘good science’ prevailed above of all else:

“I share CS Peirce's view that the purpose of science is to seek the truth, not to be involved in sham science which aims to add to the noise.” – P79, Male, UK, SCR, 65+ years, AHSS

Two threats to this identity were observed as participants made sense of altmetrics and considered what they would mean for their profession.

3.3.1. Threat: Altmetrics does not constitute scientific quality.

This was the most prevalent threat identified by our participants. Participants were wary that while altmetrics may offer an indicator of the reach of an article, it tells nothing about the academic quality of that article. There was a concern amongst many participants that poor quality research has a considerable chance of getting significant attention online, with the non-academic public selecting and focusing on research based on ‘news’ value and interest, rather than on academic merit. While capturing other forms of impact was perceived as important for many of these participants, ensuring the quality and rigour of science remained the priority. The concern for these participants was that poor quality science could end up getting a lot of attention online and that altmetrics would reward this attention:

“I think it is good to be able to measure the impact of an article in this way in terms of its interest for the public. The danger lies in how the value is interpreted. In my opinion, just because an article receives a lot of attention online, this does not mean it is of excellent research quality. Some topics will always be of interest to the population, regardless of the scientific rigour of the work itself.” – P6, Female, Ireland, ECR, 26-35 years, STEM

Some participants felt that altmetrics would unfairly benefit scientists who are good communicators but not necessarily ‘good researchers’ – implying that the judgement of a ‘good researcher’ is academic excellence first and foremost:

“Can altmetrics in some sense discriminate against certain researchers? If one is good at promoting oneself and one's work then there will be a high 'rating' but

that does not necessarily mean that a person is a good researcher or producing good work?” – P54, Female, UK, SCR, 56-65 years, STEM

“Altmetrics...indicate communication effectiveness more than quality of underpinning science, which is a danger in a world of information overload where people don't have time to critically evaluate information. If scientists join this trend, we risk losing sight of scientific rigour...” – P43, Male, UK, MCR, 36-45 years, STEM

Some participants felt that the non-academic public were not equipped to filter out or recognise poor quality science, with the mainstream media pinpointed as having a role to play in this regard also:

“Research that is spread in the media is commonly that that has the most shocking results. Altmetrics may cause such research to seem more important than smaller studies which may have as much true importance.” – P30, Male, Irish, ECR, 26-35 years, STEM

“An additional issue is the risk of style over substance. Catchy headlines may mask poor science which an uninformed audience may be unaware of.” – P35, Male, UK, ECR, 18-25 years, STEM

For these participants, it was evident that they used the concept of altmetrics to vent their concerns about science being disseminated and discussed in online platforms. These concerns related to the unfiltered and uncontrolled discussion of science online, perceived to trivialise, demean or damage the overall reputation of rigour and quality within science. Altmetrics was viewed as part of a broader movement where the discussion and debate of science is being taken out of the academic setting (papers and journals) and into a much more public setting (e.g. social media). This was something which did not sit comfortably for quite a few of our participants who wished to protect academic integrity, quality and rigour.

3.3.2. Threat: Altmetrics is not based on a robust or rigorous science.

The identity of the scientist as someone striving for integrity and rigour within science was again echoed in participants' doubts and concerns over the robustness of these metrics. There was uncertainty by some about the underlying processes and algorithms used to calculate these metrics, and a question mark over how rigorous they were. For some, concerns existed over the robustness of the metrics themselves to detect inconsistencies and inaccuracies in the data, while others were concerned about the deliberate gaming and manipulation of these metrics:

“Scientists will always be sceptical about how the figure is generated (e.g. an article being shared on Twitter, is the account real or fake, does it have followers, do those followers actually click on the link and read the article etc.) and what exactly it is measuring (real impact, the number of reads, or just the number of shared links), so this is important to bear in mind, and not to overstate it.” - P6, Female, Ireland, ECR, 26-35 years, STEM

“You can't pull the wool over a scientist's eyes, we know when the statistics produced are manipulation... when others use them we are likely to know that they have been manipulated for individual's means” – P11, Female, UK, MCR, 36-45 years, STEM

3.4. Researcher as ‘Communicator’

Quite a number of participants indicated that an important part of working within science is to communicate and engage with external, non-academic audiences. Inclusivity and transparency were viewed as important guiding principles for these researchers. Making science more accessible to diverse audiences was viewed as an important component of the researcher's role:

“I feel the tide is changing. A lot of leading academics are keen social media advocates and many others are now disseminating/working towards disseminating their work through such channels.” – P2, Female, Ireland, ECR, 36-45 years, AHSS

For some participants, raising awareness of research was an important form of impact in and of itself. Participants felt therefore that communication activities engaged in by researchers should be rewarded, and altmetrics was perceived as an opportunity in this regard. For others, communication and outreach were viewed as important stepping stones on the way to generating tangible societal impact, but did not constitute an end point in itself, and therefore they held some reservations about the interpretation of altmetrics.

3.4.1. Opportunity: Altmetrics recognises and incentivises outreach activities.

In the previous theme, we had some participants holding a negative view of altmetrics as benefiting researchers who engaged in ‘self-promotion’ of their research online; other participants had a different take on this. They felt that researchers who engaged in disseminating their research online were fulfilling a responsibility to communicate their science to the wider public. This was explicitly acknowledged by one participant:

“The argument that they can be easily tampered with doesn't hold too much water. Yes, you can tweet and blog about your own work to improve your score but that's the same as disseminating and actively increasing impact - which should be recognised and applauded.” – P13, Male, UK, ECR, 26-35 years, STEM

A sizeable number of participants were enthused by the concept of altmetrics as they viewed them as a good measure of the attention, interest and engagement of the broader public in research. Participants generally discussed these metrics as a useful addition (rather than a replacement) to current research evaluation systems. For these participants, inclusivity of the wider public in science was important, and altmetrics acted as a way to reward the outreach work of researchers. It was also noted that altmetrics would act to incentivise and encourage more researchers to engage and communicate online:

“Non-academics will more likely look for easily accessible information through group forums, slides etc. rather than explore an academic peer reviewed paper

with a lot of jargon. If research can be presented in a more creative way online - it will capture a greater audience and thanks to altmetrics, that impact can be measured.” – P34, Female, Ireland, ECR, 18-25, AHSS

“Altmetrics seems to be a fantastic new tool for researchers. The importance of science communication is slowly being realised and altmetrics is a brilliant way to incentivise communication of research to the general public and measure its impact.”- P30, Male, Ireland, ECR, 18-25 years, STEM

However, this opportunity was perceived to be contingent on other actors recognising and using these metrics formally. A number of participants indicated that it would be important for official bodies to recognise altmetrics through official channels – for example, REF in the UK, reports to research funders, when applying for promotion/tenure, and for directing policy:

“If altmetrics were required by funding bodies and grant reviewers, these techniques would be adapted by scientists.”- P35, Male, UK, ECR, 18-25 years, STEM

3.4.2. Threat: Altmetrics should not be confused with ‘real’ impact.

Although it wasn’t the strongest identity to emerge in our sample, it was evident that a small number of participants felt strongly that the role of researchers was ultimately to ensure that their research brought about tangible and meaningful changes in society. They acknowledged that communication and outreach were important pathways to impact in this regard. However, these participants felt that altmetrics, while potentially useful in telling us about the attention research is receiving, can tell us very little about the ‘real’ impact that science is having on society. They questioned the value of altmetrics as a meaningful tool for research evaluation and cautioned against attempting to simplify what is a very complex picture when it comes to demonstrating societal research impact:

“I cannot personally see how things like twitter activity can really translate into impact. Your work being re-tweeted may raise awareness but doesn't necessarily mean it achieves a societal impact or changes the state of play!” – P25, Female, UK, MCR, 46-55 years, AHSS

“It's good to see something that attempts to go beyond merely counting citations or using journal impact factors, but there is a major risk of things being skewed by short term media interest and sensationalism rather than true impact. There is also a huge problem of time scale, and reliance on an oversimplified, if not facile, model of single research papers exerting impact. Change only very, very rarely happens that way, and in most cases it is the aggregate impact of many small research contributions over many years that leads to genuine change. Online discussion is not the same as impact.” – P37, Male, England, SCR, 46-55 years, STEM

Interestingly, and mirroring our quantitative findings, there was a disciplinary angle to this discussion. It was acknowledged by a number of our participants that how impact is defined varies across different disciplines and therefore altmetrics is perceived as more or less useful as a result.

“Only in certain fields - for certain areas of research true impact may only be evidenced by more concrete parameters e.g. changes to regulatory policy, new products, etc.” – P58, Male, UK, SCR, 36-45 years, STEM

“As I work in nutrition research the use of altmetrics makes our research much more 'countable'...nutrition is often a discussion point, socially and scientifically.” – P41, Female, UK, SCR, 46-55 years, STEM

4. Discussion

Despite the attention which altmetrics are receiving at EU and national research policy level (Dinsmore et al. 2014; Wilsdon et al. 2017) and despite the preponderance of journal publishers now embedding altmetrics scores on their websites (Zahedi et al. 2014), the majority of our participants (all publicly-funded researchers) were not even vaguely aware of

their existence, whilst only a small proportion of the remainder were actively engaging with them. There have been calls for further research to determine the value of these metrics before integrating them into formalised research evaluation processes (Wouters et al. 2015). The current study used an online engagement platform to introduce a diverse sample of publicly-funded researchers to altmetrics and to capture their thoughts on the value of altmetrics.

We used the analytical framework of sensemaking, specifically focusing on identity construction, to understand the narratives of meaning used by researchers when debating the concept of altmetrics (Thurlow and Mills 2009; Weick et al. 2005). We discovered a number of facets important to the identity of the researcher which were used by our participants to make sense of altmetrics. These are the identities that our participants shaped for themselves, informed by prior dispositions, beliefs, experiences, social influences and psychological aspects which provided them with a ‘sense of oneself’ (Osbeck and Nersessian 2017). The identities that we found important amongst our participants related to their responsibilities around scientifically sound knowledge production, non-academic communication and engagement, and bringing about tangible and meaningful changes in society. Being committed to rigour and quality in science has previously been identified as an important component of the academic identity (Degn 2018). The latter identities, emphasising participants’ commitment to communication/outreach and ensuring societal impact, are in line with the new roles and responsibilities increasingly expected of researchers in the evolving science governance landscape (Henkel 2005; Ylijoki and Ursin 2015). It is worth highlighting that our sample of researchers work in the area of food, and so may be more primed than other scientists to adapt to these new roles, given the applied nature of their research topic and the general expectations for societal impact which are placed on this research area (United Nations 2015). The current study’s findings should be understood

within the context of the conversation around altmetrics – these are the features of the identity of the researcher which were deemed important to *this* particular conversation. Other features of identity are likely to be more important in other conversations. For example, previous research has found that freedom, autonomy, communality and prestige are also important facets of the academic identity (Degn 2018; Henkel 2000; Ylijoki and Ursin 2015). From the perspective of our participants, the identities which emerged were the most pertinent as they made sense of altmetrics and negotiated the threats and opportunities presented by these metrics to their professional roles. Research impact is a multi-faceted construct with multiple understandings and meanings (Robinson-Garcia et al. 2017). It reflects the contribution that research makes in advancing our scientific, methodological, and theoretical understanding of a topic; but it also reflects the meaningful contribution that research makes to society, for example; economic, cultural, policy and public service, health and well-being, environmental, and human capacity (Ravenscroft et al. 2017). Ferretti et al. (2018) argued that the related notion of ‘research excellence’, specifically how we define it and evaluate it, is what is known as an *essentially contested concept*. Research impact and research evaluation fit this description as they are phenomena which are inherently complex, multi-dimensional, value-laden, and describable in multiple ways; therefore, becoming the topic of endless disputes and debates by those involved in their use (Ferretti et al. 2018; Gallie 1955). This debate was evident in the narratives of participants in our study. Where sensemaking is concerned, new or ambiguous concepts are interpreted through a lens of prior experiences, dispositions and discourses (Thurlow and Mills 2009). Cues and frames provide structure for understanding and generating meaning (Weick et al. 2005). In the current study, one particular frame of reference dominated how participants made sense of altmetrics; that frame related to how researchers currently conceptualise research impact and associated thoughts around research evaluation. Introducing the altmetrics concept to participants in our

study acted as a vehicle for our cohort of researchers to raise their broader concerns and issues related to the definition and evaluation of research impact more generally. The process of sensemaking around altmetrics allowed participants to verbalise their concerns that there are fundamental flaws with the current research evaluation system. Whilst this concern did not translate to resolute support for altmetrics, there was a clear appetite amongst our sample for new approaches. As highlighted in our findings, the question of how we conceptualise research impact and associated indicators is central to research evaluation. Whilst there has been much discussion on the ill-defined nature of altmetrics (Haustein 2016), in our study it was in fact the nebulous nature of these new metrics that facilitated the participants to understand and voice the concerns they had with the old metrics. Concerns with traditional metrics have long been cited (Hicks et al. 2015; Wilsdon et al. 2015); the introduction of altmetrics into research evaluation, and the additional challenges that they will bring, may provide a renewed impetus to start searching for solutions to this long-running debate.

Quantitative indicators such as citations and altmetrics are appealing and often used, particularly by policymakers, as they offer a succinct and simplified narrative of complex phenomena (Ferretti et al. 2018). Although quantitative indicators offer a mechanically objective approach to understanding an issue, they can also over-simplify, mask important details and be liable to misuse and misinterpretation. In the current study, participants had some concerns regarding the misuse of altmetrics. For example, one of the concerns identified by our participants was the manipulation of altmetrics through generating false ‘likes’, ‘shares’ or ‘mentions’ or by researchers’ self-promoting their research online; a concern which has been previously noted (Bornmann 2014). An interesting observation is that the literature has pointed to similar problems for traditional bibliometrics – studies have reported significant gaming efforts where publications and traditional bibliometrics are concerned (Neff 2017). For example, self-citation in papers by individual researchers or

research groups has been identified as a practice (Catlin et al. 2009). It is hard to consider a research evaluation process which does not use some level of quantifiable indicators – thus, like others we would argue that the question is not what can we replace these metrics with, but rather how can we responsibly use these metrics so that they are useful and valuable, but also that we recognise their fallibility in certain settings and the point at which their purpose is served.

It is acknowledged that quantitative indicators such as citations and altmetrics are not reflective of the complex processes and pathways involved in bringing research from the academic setting to societal impact (Morton 2015; Robinson-Garcia et al. 2017). Robinson-Garcia et al. (2017) highlighted how theories of innovation have shown that research rarely brings about change on its own but rather it contributes as part of complex social networks and interactions, and often involves a process lasting many years. It is from this perspective that the argument is proposed not to focus on the end product of impact, but to acknowledge and reward the actions which can lead to impact; a process-oriented model of impact evaluation (Morton 2015). It is argued that impact assessment should focus on identifying and evaluating processes of interaction between researchers and societal actors given that these interactions are the mechanisms which will ultimately lead to societal impact (Allen et al. 2013; Robinson-Garcia et al. 2017). Such models would likely be welcomed by those researchers in our study who indicated that communication and engagement are important aspects of the academic identity. Raising awareness was viewed by some as a form of impact in itself, whilst for others it was a necessary step on the pathway to impact. For these participants, altmetrics thus acted as a reward for such activities. However, other participants were concerned that altmetrics are not useful as an indicator of ‘real’ societal impact. Robinson-Garcia et al. (2017) proposed that altmetrics can be useful if we change how ‘altmetrics’ is defined and deployed. They argued that by using network analysis or other

visualization methods, social media data can be analysed to demonstrate the social interactions between academics and non-academics, thus giving a more nuanced insight than the current use of altmetrics focusing primarily on counting mentions, downloads, shares etc. This approach has merit from the perspective of not only telling us *how much* discussion a research study is getting online; but also *who* is discussing it. It is assumed that altmetrics offers a measure of non-academic, public interest in science. However, in reality we don't know if diverse audiences are using these platforms to discuss science, or whether academics are simply moving their conversations to a new platform (Haustein et al. 2015). Further critical thinking on how altmetrics are defined and employed will be central to their future use and acceptability and will help to address concerns such as those cited by our participants regarding both their robustness and their ultimate value.

Research policies which support and reward the processes involved in generating impact (e.g. outreach and communication activities, multi-actor approaches) rather than focusing on endpoints (e.g. paper or patent counts) are likely to have more success in encouraging researchers to assume the new roles and responsibilities outlined in research governance policies such as RRI (Neff 2017; Von Schomberg 2013). The changing policy landscape means that researchers are now urged to not only produce 'good science' in terms of academic quality, but also 'useful science' (Henkel 2000). The question of who decides how 'useful' is defined and measured is one of importance in the current evolving landscape of science governance and policy. To date, the dominant approach of research evaluation via peer-review has meant that scientific self-governance has been the norm (Neff 2017). However, when it comes to evaluating the importance and value of science within society, the judgements of a much wider array of societal actors comes into play. In line with the principles set out in RRI, the process of capturing the wider impact of one's work is important for encouraging scientists' to think reflexively about their research, acting as a

‘stopping point’ for the researcher to reflect on the place and purpose that their research has within society (Von Schomberg 2013). Altmetrics could have a role in this regard, for example indicating the degree of interest in certain research areas from wider members of the public; however they will serve science best if embedded within a broader model which recognises the value of participatory approaches which truly engage and involve the end-user as a legitimate actor in the research process from the beginning. Governance approaches such as RRI encourage researchers to embrace processes of upstream engagement and responsiveness with different actors in undertaking research and innovation (Khan et al. 2014; Owen et al. 2012; Von Schomberg 2013). Process-oriented research impact models can not only reward these roles and responsibilities but could also act as helpful tools in participatory, co-design research settings (Morton 2015). These models consider the complex pathways involved in bringing research to societal impact. They could be used to great effect from the start of a research project to facilitate thoughtful consideration and reflection of where the research is headed, how it is meeting the needs and values of research users, the processes which need to be put in place for impact to be generated, and what should ultimately be measured as a marker of success for that project. Altmetrics could be a useful tool to support such models.

5. Final Remarks

The evolving science governance and policy landscape expects researchers to take on new roles and responsibilities (Henkel 2005; Ylijoki and Ursin 2015). Policies aimed at research evaluation will likely influence how the scientific community adapts to these new roles and identities. Our study supports a view that research evaluation is an essentially contested concept (Ferretti et al. 2018); we therefore acknowledge the challenge of renegotiating definitions of research impact and embedding an evaluation system within the scientific

institution which will address the many different concerns and opinions held by different actors. Despite this difficult task, we argue that it is imperative to ensure that all voices are heard within this debate. The very essence of approaches such as RRI and Public Engagement is to ensure that contested issues are resolved through participatory efforts and inclusivity (Felt et al. 2013). In the current study, participants voiced their differing thoughts on the introduction of altmetrics into research evaluation. Some viewed threats; others viewed opportunities. The issues raised by our participants mirror the current internal narrative in the scientometrics community; for example, our empirical findings support a recent desk-based SWOT analysis which listed the integrity and quality of altmetrics as a challenge and the potential of altmetrics to incentivise a new culture of engagement and downstream impact as a strength (OpenUp 2016). Identifying such issues is the first step; the true value of participatory approaches is in having the end-user take co-ownership of the developed solutions to address these issues (Felt et al. 2013). There is particular value in ensuring that a diverse group of researchers, in particular drawing from different disciplines, are involved in co-creating research evaluation policies. Discipline has been found to be a central defining context within which academic identities are shaped and constructed (Blackmore and Kandiko 2011; Henkel 2000). Discipline was a consideration for our participants' sensemaking around altmetrics – participants identified how definitions of research impact vary across different disciplines and the metrics and approaches used to measure this impact should be adjusted accordingly. Previous research has also cautioned against using the same approach to research evaluation for all disciplines (Eisen et al. 2013; Ferretti et al. 2018; Neff 2017). To borrow a term from Neff (2017) used to describe traditional bibliometrics, but which can also be applied to altmetrics, these indicators are “mechanically objective yet systematically biased” – the application of quantitative measures will be more or less appropriate in different settings and contexts and must be interpreted

with this understanding. It is from this standpoint that it is important to ensure that as research evaluation approaches are renegotiated and redeveloped, the scientific community are a legitimate partner in this process (Ferretti et al. 2018). Central to this will be ensuring that the scientific community is not viewed homogeneously, but as a collection of different people, working in different contexts, making different contributions to society (Eisen et al. 2013). Just as participatory processes with society are encouraged within research projects (Stilgoe et al. 2013), there is value also in engaging the scientific community to understand their thoughts and views in relation to new processes for evaluating research.

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Table 1: Sample characteristics ($n = 80$).

| Demographic | $n = 80$ |
|---|----------|
| <i>Country</i> | |
| Republic of Ireland | 34 (43%) |
| United Kingdom | 46 (57%) |
| <i>Gender</i> | |
| Males | 33 (42%) |
| Females | 46 (58%) |
| <i>Age</i> | |
| 18-35 | 28 (35%) |
| 36-55 | 42 (52%) |
| 56+ | 10 (13%) |
| <i>Career Level</i> | |
| Early-career researcher (ECR) | 25 (31%) |
| Mid-career researcher (MCR) | 45 (56%) |
| Senior-career researcher (SCR) | 10 (13%) |
| <i>Discipline</i> | |
| Science, Technology, Engineering and Mathematics (STEM) | 60 (75%) |
| Arts, Humanities, and Social Sciences (AHSS) | 20 (25%) |

Table 2. Social media use amongst the sample ($n = 80$).

| Social Media Platform | Frequent user ^a | Moderate user ^b | Infrequent user ^c | Non-user |
|-----------------------|----------------------------|----------------------------|------------------------------|----------|
| Research Gate | 13% | 54% | 24% | 9% |
| YouTube | 17% | 53% | 20% | 10% |
| LinkedIn | 9% | 40% | 29% | 22% |
| Facebook | 43% | 24% | 5% | 28% |
| Twitter | 30% | 15% | 6% | 48% |
| Blogs | 1% | 18% | 21% | 60% |
| Academia.edu | 5% | 17% | 14% | 64% |
| Instagram | 13% | 10% | 8% | 69% |

^a Use it several times a day. ^b Use it once a day or several times a week. ^c Use it several times a month or several times a year.

Table 3: Respondents' awareness, understanding and appreciation of altmetrics ($n = 80$)

| | Yes | No | I already use them |
|--|------------|------------|--------------------|
| Are you familiar with altmetrics? ¹ | 35 (44%) | 45 (56%) | - |
| Do you think altmetrics are a good way of evaluating the impact of scientific research? ² | 55 (69%) | 25 (31%) | - |
| Would you consider using altmetrics to demonstrate the impact of your own research? ² | 54 (67.5%) | 16 (20%) | 10 (12.5%) |
| In what context might you consider using altmetrics? ² | | | |
| When writing new funding proposals | 54 (67.5%) | 26 (32.5%) | - |
| When applying or interviewing for a new job or a promotion | 57 (71%) | 23 (29%) | - |
| When writing up progress reports or final reports for research funding bodies | 65 (81%) | 15 (19%) | - |
| Do you think that altmetrics would be widely accepted in the scientific community? ² | 30 (37.5%) | 50 (62.5%) | - |

¹ Question asked *before* participant exposure to explanation of altmetrics concept; ² Question asked *after* participant exposure to explanation of altmetrics concept.