"Impact is a Two-Way Conversation"

Exploring knowledge mobilisation (KMB) practices, support and expectations for environmental sustainability researchers

Edward Dickinson

Supervisor

Matthias Lehner

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Take care and all the best,

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Edward Dickinson, IIIEE, Lund University

Abstract

Sustainability researchers are facing increasing pressure to improve their scientific communication and to achieve impacts in wider society with their research. Knowledge mobilisation (KMB) is a key component of both challenges, as it relates to efforts undertaken by researchers to achieve impacts with their research. This study seeks to identify some of the KMB practices being undertaken by experienced researchers, the types of support that they are receiving from their organisations and what matters they think need to be included in debates going forward about KMB and research impact. For this study, experienced sustainability researchers, KMB experts and funding assessors based in the United Kingdom and Canada were interviewed. These two countries were chosen as the UK was the first to include research impact within its national assessment of research funding, whilst the KMB sector has witnessed rapid growth in Canada. Interviewee transcripts were subject to a content analysis, the results of which were then compared against survey data provided by Springer Nature, who circulated a survey in June 2019 to researchers who had published at least 3 papers in the last 5 years, asking them for their views on research impact. Across the interviews with sustainability researchers, 65 different KMB practices, grouped into 10 categories, and 26 different types of potential support grouped into 11 categories were identified. With respect to KMB practices reported, the study provides a detailed qualitative synthesis of all interviewees' experiences and views on a range of KMB practices, including research design, stakeholder engagement, networks, open access issues, researcher attributes and tailored communications. In addition, a detailed synthesis of support for KMB is provided, covering organisational culture, reflective spaces and fora, incentives, training, external communications, dedicated KMB personnel, time and interdisciplinary teams. Interviewees views on other matters to consider, such as the advocacy dilemma, competing interests, resistance to sustainability, possible implications for certain types of sustainability research and possible changes needed at research organisations and funding agencies are also provided. The study concludes by contending that KMB is far more complex and diverse that has traditionally been conceived, requiring key parties to investigate what is working and what is not (with respect to KMB) and that KMB is the responsibility of everyone, not just researchers and their organisations. Finally, the study offers nine recommendations for those interested in improving the KMB of sustainability research.

Executive Summary

The Intergovernmental Panel on Climate Change has identified the need for "rapid and far-reaching transitions" in our economies and societies (IPCC, 2018). Sustainability research conducted by sustainability-focussed organisations, including universities, professional bodies, think-tanks and non-governmental organisations, will be crucial in supporting policymakers, businesses and civil society (i.e. research users) to steer these transitions. In this thesis, sustainability researchers are defined as individuals employed at purpose-built knowledge organisations or departments, either in academia or beyond, that conduct research into areas aligned directly or indirectly with the nine planetary boundaries as determined by the Stockholm Resilience Centre. Environmental sustainability research, as a profession, faces a number of daunting challenges, including a need to improve the translation of complex scientific knowledge into action and to demonstrate the benefits of research for wider society, commonly referred to as "research impact", as part of a movement known as the "impact agenda". Central to both challenges is the concept of knowledge mobilisation (KMB), which is concerned with the actions taken by researchers in order to have their research used across society and thus achieve research impact.

If sustainability researchers can identify best practices for KMB and organisations can identify how best to support KMB, then both parties will be better positioned to pursue effective KMB strategies which can increase the chances of achieving research impact. However, a review of the literature indicates that there is a knowledge gap with respect to KMB practices currently being employed by researchers and types of support being provided by organisations to researchers. Furthermore, the voices of sustainability researchers appear to be largely absent from the wider, ongoing discussion about KMB and research impact. Therefore, this thesis has sought to address these knowledge gaps and increase our understanding of the level of knowledge that exists regarding sustainability KMB. In particular, the thesis aims to provide insights into current KMB practices, reveal knowledge about related principles, processes and barriers, and also generate recommendations to advance sustainability KMB. The thesis sought to answer three research questions:

1. How is knowledge being mobilised by members of the sustainability research community in order to achieve societal impact?
2. What processes and types of infrastructure exist to support sustainability researchers in order to mobilise knowledge?
3. What matters need to be considered when promoting and evaluating KMB?

In order to close the knowledge gap identified, a literature review was conducted alongside interviews of 11 experienced sustainability researchers, 3 KMB experts and 2 agencies which fund sustainability research, in the United Kingdom (UK) and Canada. These two countries were chosen as the UK was the first to include research impact within its national assessment of research funding, whilst the KMB sector has witnessed rapid growth in Canada. The transcripts from these 16 interviews were then subject to two types of analysis. Firstly, a content analysis sought to create codes and categories in an attempt to capture the diversity of KMB activities and types of support available reported by interviewees (both in terms of what is currently provided to researchers and in terms of support that is sought). This analysis is exploratory in nature and has then been triangulated against survey data provided by Springer Nature, the academic publishing company, who circulated a survey in June 2019, asking

experienced researchers[1] for their practices and views on matters relating to KMB and research impact. The survey data was filtered in order to focus only on respondents based in the UK or Canada, currently employed at a research organisation and who identify as working in 'social sciences' or 'earth and environmental sciences'. This process left 88 respondents. Finally, using the same interview transcripts, a qualitative analysis was performed, synthesising the most relevant and interesting answers provided by interviewees, in accordance with the three research questions. This analysis enabled a more detailed and nuanced investigation of interviewees views and experiences, as interviewees often provided arguments for and against particular KMB practices and supports, alongside practical considerations. With respect to RQ3, this analysis enabled interviewees views on KMB and research impact to be reported and thus contribute to the wider debate.

The 11 sustainability researchers interviewed reported 65 specific types of KMB practice, which were grouped into 10 categories, 7 of which mirrored categories identified in the literature review. The categories of KMB practice most commonly cited within the interviews were 'Tailored Communications', 'Research Design' and 'Stakeholder Engagement'. The range of practices mentioned hints at the diversity of approaches available to sustainability researchers more broadly. It is apparent that, in the context of the interviewees experience, KMB is more than just dissemination, communications are becoming increasingly important to the research process, KMB practices should be included from the beginning of the research process, stakeholder engagement is important but complex and networks can help share and generate knowledge when they are flexible and responsive to the needs of researchers.

As far as the *existing* infrastructure to support sustainability researchers for KMB, the thesis has identified 26 different types of support grouped into 11 categories. The categories most commonly cited within the interviews were 'training', 'spaces and fora' and 'external communications'. Furthermore, in the Springer Survey, the most common support identified was 'support from colleagues/team members' (37 responses) ahead of 'support from part of my institution/university' (35 responses). It is notable that a quarter of respondents to the question stated that they receive 'no support' for activities intended to increase the social impact of their work. In addition, 43 responses were provided to the request for a detailed description of the type of support that researchers receive. These responses were then categorised by the author. The most popular support categories were 'external communications' (20 responses), 'funding' (13 responses) and 'culture' (5 responses). The most commonly cited categories of KMB support *sought* by researchers were 'training', 'time' and 'dedicated KMB and impact personnel'.

For some researchers interviewed, the organisational culture at their organisation is becoming more open to supporting KMB but for other researchers, this is not the case, with one researcher even referring to there being "anti-support". Furthermore, only a minority of researchers interviewed referred to there being clear incentives in their organisation to conduct KMB activities. For many, bibliometrics still dominate. Similarly, a common complaint amongst the UK-based researchers interviewed was a lack of time and funding for KMB activities, with all five UK researchers referring to time pressures. Many interviewees spoke favourably of the influence that dedicated KMB and impact personnel at their organisations have had on their work, whilst others without access to personnel spoke of their desire to have such support. Many interviewees also referred to the creation of interdisciplinary teams at their organisations in order to research sustainability problems, with numerous institutes and networks being established. However, one KMB expert expressed a concern that such teams are being assembled via a "Tinder approach", where CVs are being used to match researchers, rather than

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[1] Defined as either having published three or more primary research publications in the last five years or occupying a senior managerial position at a research organisation

personalities and values, to the detriment of such teams. A common theme across the interviews, which connects RQ1 and RQ2, is the role of researchers' motivations. Several researchers highlighted their motivation, in the form of a desire to achieve societal impact, as a particular factor in driving them to partake in KMB practices. Furthermore, a KMB expert identified approaches which are built upon researchers' intrinsic motivations as being central to a healthy organisational impact culture.

Finally, the thesis has revealed various *critical matters that are needed to be considered when promoting and evaluating KMB*. RQ3 originally identified two possible barriers to KMB and research impact that were to be raised with interviewees, being the existence of competing interests that may seek to stifle or undermine sustainability research within wider society, and the advocacy dilemma, whereby researchers might feel restricted in their ability to engage in KMB without perceived threats to their objectivity and independence. With respect to competing interests, interviewees acknowledged that this was sometimes a challenge, however, many highlighted other powerful interests that were seeking collaborations with researchers, and the existence of strategies to navigate around this obstacle. In terms of the advocacy dilemma, the interviewees were consistent in stating that they were comfortable with advocating positions, provided it was based upon strong evidence. Separately, many interviewees noted that certain types of sustainability research (e.g. blue-skies research, research over long time frames etc) might be endangered by an increased focus on KMB and research impact. Furthermore, interviewees identified the need for changes to be made within research organisations and funding agencies themselves, to aid effective KMB and research impact. In the Springer Survey, a majority of respondents agreed with the statement 'The funding of research should be more strongly linked to demonstrable societal impact', indicating support amongst some researchers for the impact agenda. Finally, the interview with the Natural Environment Research Council in the UK revealed that, in their view, research is going to become increasingly managed in the future, with impact-related activities and reporting requirements attached to future funding.

Conclusion

The traditional, linear view of KMB, focussed on dissemination via journals and conferences, is no longer suitable for the current research climate. Rather, KMB is more complex and diverse, with researchers having a range of practices available to them, and organisations able to provide support in a variety of ways. What KMB practices and supports work will depend on the research context, as best practice cannot be templated. However, it can be better understood if the main parties involved (researchers, research organisations, funding agencies and research users) help support more follow-up work to gauge what works and what does not. Researchers will play a central role to KMB and there are positive ways to encourage researchers to embrace KMB practices, by appealing to their intrinsic motivations and providing them with appropriate support. However, researchers cannot be expected to carry the burden for KMB and research impact on their own. Instead, KMB requires all of the main parties to join the conversation and accept shared responsibility for KMB and research impact.

Nine recommendations to improve KMB

This report offers nine recommendations for those interested in how to improve the KMB conducted by sustainability researchers and research organisations. The recommendations are based on limited data and would benefit from being challenged and subject to further investigation. As such, these recommendations do *not* offer a view on what sustainability researchers or organisations *should* be doing, in terms of *specific* KMB practices or supports (with the exception of recommendation 6). The data and recommendations reflect only some of the voices in the wider sustainability research community and no claim is made that they are

representative of the wider community. Instead, these recommendations offer suggestions, following input from experienced researchers, funding agencies and KMB experts based in two countries that are leading the way when it comes to the impact agenda and KMB. These recommendations can help to illuminate where the reader might focus internally (either as a researcher or as an organisation), what matters they should consider in conversations going forward (including with funding agencies and research users) and who should be involved in those conversations.

1) An approach to KMB and research impact may be more effective if it engages with, appeals to and builds upon researchers' intrinsic motivations, rather than being imposed from above;

2) If KMB is being sought, then a holistic approach, which acknowledges that KMB applies to the entire research process, should be adopted - including funding calls and follow-up work;

3) Researchers, research organisations, funding agencies and research users should seek to adhere to the principles of humility, openness, cooperation and flexibility when conducting KMB;

4) Researchers, research organisations, funding agencies and research users are *all* responsible for KMB. KMB is a conversation that requires at least two active participants and corresponding commitments. A failure by one party to engage can negate the best efforts of the other party;

5) Researchers and organisations should be wary of attaching too much importance to making research open access, in the context of KMB and research impact. It may help but it is only one of many KMB practices;

6) Researchers, with the support of their organisations, funding agencies and research users, in the form of time, funding and cooperation, should seek to conduct more follow-up work, following the completion of a research project, to assess what worked well and what did not, in terms of KMB;

7) Research organisations and funding agencies should ask themselves whether their public commitments to KMB and research impact (and the demands they make of their researchers) are matched by similar levels of commitment to the types of support that can assist researchers undertaking KMB activities;

8) Given the range of practices available, researchers should consider whether they could more to tailor their communications, and organisations should also investigate whether they can do more to support researchers in this regard. However, both researchers and organisations should be wary of the incentives that exist within the current media landscape (which can encourage sensationalism and populism) which could endanger the high levels of trust and regard amongst the general public that the research community has acquired; and

9) An increased focus on KMB and research impact may threaten certain types of valuable sustainability research, particularly if research funding becomes increasingly managed (directly or indirectly) by funders and governments. The wider sustainability research community, which is better positioned than most to see the value of these types of research (given their proximity to the research and potential research overlaps), needs to be cognisant of this and, if necessary, advocate for an approach to KMB and research impact that does not undermine vulnerable research.

Table of Contents

List of Figures

List of Tables

1 Introduction

Our daily news cycles are filled with stories covering the sustainability problems our planet faces. Robust fixes to these problems need to come from all areas of society and many societal actors are making efforts to conduct research to identify solutions. However, there is a recognition that scientific knowledge addressing sustainability challenges, is not being communicated effectively. For example, in 2012, over 3,000 climate scientists and important stakeholders declared that there was an urgent need to more successfully translate sustainability knowledge into action (Brito & Stafford, 2012). This study is motivated by the belief that the hard work of the research community is undermined if the solutions generated by research are not subsequently incorporated or implemented within wider society, i.e. there is no 'impact'.

Several countries including the United Kingdom (UK), the Netherlands and Australia have begun to incorporate research impact (the impact research has beyond academia and scientific communities) within their national assessments of research funding (Morgan Jones, Manville, & Chataway, 2017)(KNAW, VSNU, 2015)("Engagement and Impact Assessment | Australian Research Council," 2019). This focus on research impact is also present in other countries such as Canada (Research Impact Canada, 2018) and Sweden (Vinnova, 2017), with funding agencies requiring researchers to articulate or anticipate the intended societal impacts of their research. However, a highly critical issue is the measurement and evaluation of impact (Morgan Jones et al., 2017). This is fraught with complexity and as such, some have advised that, for now, attention is instead given to the first stages in the path that knowledge takes, from researcher to research users (e.g. policymakers and businesses), where impact occurs (Bastow, Dunleavy, & Tinkler, 2014). The process by which knowledge is transferred or exchanged from researchers to research users is referred to as 'Knowledge Mobilisation' (KMB) and it is KMB which is the main focus of this study, within the context of research impact.

KMB and research impact have a causal relationship (Bannister & Hardill, 2013) (M. S. Reed, Stringer, Fazey, Evely, & Kruijsen, 2014). Impact is concerned with *what* researchers want to achieve with their research, whilst KMB is concerned with *how* researchers do it (Bannister & Hardill, 2013). As such, the growing importance and relevance of the impact agenda also elevates the importance and relevance of KMB. This is perhaps best demonstrated by the UK's recent decision to follow its first national assessment of research impact in 2014 with the development of a national Knowledge Exchange Framework (KEF), with a public consultation having concluded in March 2019 (Research England, 2019). The purpose of the new KEF is to "provide institutions with information about their own performance in knowledge exchange in order to facilitate improvement" (Hill & McAlpine, 2019).

However, despite the importance of KMB, a knowledge gap exists within the literature. There is a lack of information as to what practices experienced sustainability researchers are currently undertaking to mobilise their knowledge and a lack of information as to what support they are receiving. In addition, this thesis will seek to address a perceived absence of sustainability researcher voices within the wider debate about what should be expected from researchers concerning the impact agenda and KMB. This study seeks to narrow these knowledge gaps. Before these knowledge gaps are elaborated in more detail, several terms about research impact that are used throughout this thesis need to be provided to assist the reader's understanding (

Table 1). Furthermore, a Glossary is provided at Appendix 1.

Table 1- Key terms and definitions

Term	Definition	Source
Experienced researchers	An academic researcher who has published three or more primary research publications in the last five years or, for those researchers outside of academia, a person who occupies a managerial or equivalent senior research position at their organisation	Author
Impact	An effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia	(Research England, SFC, HEFCW, & DfE, 2019)
Impact agenda	The movement by governments and funding agencies in several countries to understand and articulate the societal benefits of research which is publicly funded	(Morgan Jones et al., 2017)
Impact pathways	The routes or mechanisms through which research passes from researchers to research users, where the impact occurs	Author
Knowledge Mobilisation (KMB)	An umbrella term encompassing a wide range of activities relating to the production and use of research results, including knowledge synthesis, dissemination, transfer, exchange, and co-creation or co-production by researchers and knowledge users	(Social Sciences and Humanities Research Council, 2018)
Research user	Those who are expected to benefit from research. Includes policymakers, regulators, funding agencies, businesses, the general public, charities and the media	Author
Sustainability researcher	Individuals employed at purpose-built knowledge organisations or departments, either in academia or beyond, that conduct research into areas aligned directly (e.g. climate change) or indirectly (e.g. sustainable cities) with the nine planetary boundaries as determined by the Stockholm Resilience Centre	(Stockholm Resilience Centre, n.d.)

1.1 Problem definition

The problem definition is presented in terms of two key challenges facing sustainability research, being a need to communicate sustainability more effectively and the impact agenda. These problems are presented below, followed by an explanation as to how these challenges share knowledge gaps which this study seeks to address.

Challenge 1: Communicating sustainability

In the last year, the scientific community has released numerous dire warnings about the direction that society and the planet is heading in. For instance, the Intergovernmental Panel on Climate Change (IPCC) called for "rapid and far-reaching transitions" in our economies, energy systems and society to limit the risks and impacts associated with climate change (IPCC, 2018) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services warned policymakers of the risks of mass species extinction (Ngo et al., 2019). Knowledge generated from sustainability research can help society navigate this urgent transition by providing "concrete, politically acceptable and directly implementable solutions to pressing socio-environmental problems" (Rau, Goggins, & Fahy, 2018, p.266). It is therefore important that societally beneficial sustainability knowledge (whilst acknowledging that some sustainability knowledge can have negative impacts/unintended consequences upon

society) is mobilised successfully, being implemented as widely and rapidly as possible. However, there is reason to believe that sustainability knowledge is not being mobilised as effectively as is required.

In early 2012, prior to the United Nations (UN) Sustainable Development Conference, the 'London Planet Under Pressure' conference was held. The conference brought together 3,000 of the leading experts and decision makers to discuss the challenges facing the planet and discuss possible solutions (Brito & Stafford, 2012). The conference resulted in the first 'State of the Planet Declaration'. Within the declaration, Clause 10 called for "a new contract between science and society in recognition that science must inform policy to make more wise and timely decisions" (Brito & Stafford, 2012, p.7). This new contract was to include a focus on interdisciplinary, policy-relevant research and a call for new mechanisms to facilitate communication between stakeholders and policymakers (Ibid). Furthermore, Clause 13 called for "a new strategy for creating and rapidly translating knowledge into action" (Brito & Stafford, 2012, p.9). Elsewhere, the UN Global Sustainable Development Report 2016 Edition emphasised the need for increased collaboration and engagement between researchers and external stakeholders in order to facilitate the mobilisation of scientific knowledge (United Nations, 2016) to address the UN Sustainable Development Goals (UN SDGs). However, before we look to improve the KMB of sustainability research, we must first look at how it is being currently practiced.

Challenge 2: The impact agenda

The call for new and improved ways of communicating sustainability research has coincided with a drive for sustainability researchers to identify and demonstrate the societal benefits of their research (Gunn & Mintrom, 2018). Many OECD countries have experienced prolonged budget deficits which have prompted the implementation of austerity policies which seek to limit public spending (Morgan Jones et al., 2017). Within the general requirement to demonstrate 'value for money', public policy has therefore increasingly begun to focus more on measurable effects and outcomes, such as impacts (Power, 2018). In recent years, governments and funding agencies in several countries have increased their efforts to assess the degree to which academic research (including sustainability research) is contributing to wider society, commonly referred to as the "impact" of academic research (Rau et al., 2018). This movement to evaluate and promote the impact of academic research is known as the "impact agenda".

As the first country to include research impact as part of its national assessment of research, via the Research Excellence Framework ("UK REF") in 2014, the United Kingdom is at the forefront of the impact agenda (Morgan Jones et al., 2017). Those behind the assessment claimed that it was intended to inform the allocation of grants for research, provide public accountability for public investment in research and provide benchmarking information, via publicly available case studies submitted by Higher Education Institutions (REF, 2014). In the Netherlands, the societal impact of research is included within the Standard Evaluation Protocol, the national assessment of the quality and relevance of research being conducted (KNAW, VSNU, 2015). In Australia, on 1 November 2017, the Government announced the creation of the Engagement and Impact Assessment Framework (Birmingham, 2017) to be overseen by the Australian Research Council ("ARC"), which will *assess the engagement of researchers with end-users, and show how universities are translating their research into economic, social, environmental and other impacts* ("Engagement and Impact Assessment | Australian Research Council," 2019). Against this backdrop, it has been argued there are a growing number of countries where it is no longer viable for sustainability researchers within academia to make claims about the benefits of their research without supporting evidence (Khazragui & Hudson,

2015). With these developments often mirrored in requirements imposed by funding agencies, the same situation may apply to sustainability researchers outside of academia.

Researchers face a challenging task in responding to the impact agenda, due to a historical over-reliance on the traditional and narrow confines of bibliometric data as a measure of research quality (Khazragui & Hudson, 2015). However, the impact agenda also represents an opportunity for researchers to move away from the culture of 'publish or perish' whereby researchers face pressure "to develop and sustain a research career by disseminating research findings in peer-reviewed journals" (Doyle & Cuthill, 2015). It is therefore important to understand how sustainability researchers are responding to the impact agenda (in terms of KMB practices) what support they are receiving and what is to be expected of them.

Two challenges facing a shared knowledge gap

A common problem within both these challenges is a lack of literature as to what sustainability researchers and their organisations are currently doing with respect to KMB, which is summarised via a problem definition flowchart at Figure 1 and explained in more detail below. The existing literature is predominantly focussed on specific KMB practices, including: stakeholder engagement (Jolibert & Wesselink, 2012), knowledge co-production (Trencher et al., 2017), and communications (Huang, Clarke, Heldsinger, & Tian, 2019), or specific case studies (Cvitanovic, Mcdonald, & Hobday, 2016) in the context of sustainability research. Often the focus of the literature is on evaluating these approaches and considering the potential implications of their wider use. However, there is very little literature which seeks to understand the extent to which these various practices are being employed by sustainability researchers (i.e. which practices are being prioritised by sustainability researchers and how are they implemented?). The few notable exceptions, which are discussed in more detail in the literature review section of this study, are a study by M. S. Reed et al., (2014), which was restricted to environmental management researchers in the UK and Marshall et al., (2017) whose focus was solely on how researchers are trying to influencing environmental policy. The absence of literature looking at the types of support provided by research organisations to their researchers and the type of supports that they may require is even more noticeable.
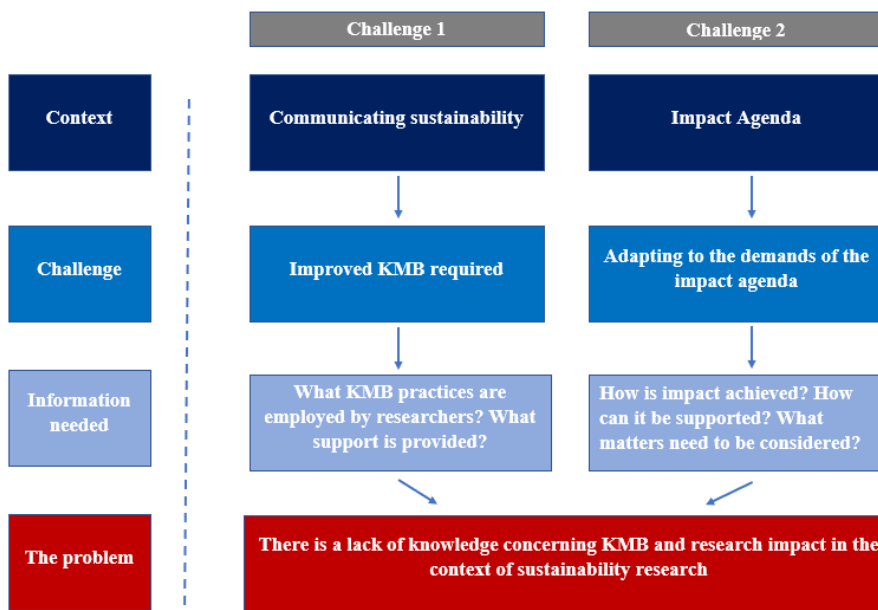
Figure 1- Problem definition flowchart showing how two challenges facing researchers, share a common problem

1.2   Aims and objectives

This research aims to contribute to and expand the level of knowledge that exists regarding sustainability KMB. This aim is to be achieved via three objectives which are influenced by the status of the current literature. Firstly, because there is a lack of literature looking at the KMB practices being employed by sustainability researchers, one objective is to provide an insight into current practices used by experienced researchers. Secondly, because the literature is less developed with respect to the types of support provided to and needed by sustainability researchers, another objective is to identify types of support that constitute good practice for organisations conducting sustainability research who wish to enhance their KMB efforts. Finally, because there appears to be uncertainty as to what should be expected from researchers concerning KMB, the research seeks to add to the current debate by highlighting key matters for consideration from the perspective of sustainability researchers.

This study was prompted by the realisation that many in the sustainability research community appear to be unprepared for the increasing demands imposed upon them by the impact agenda. Whilst the impact agenda asks tough questions of researchers, there is a danger that such questions come to be perceived as undermining the valuable work that sustainability researchers are already engaged in. It is therefore important to reiterate that this study is borne out of a desire to explore, understand and ultimately assist sustainability researchers to amplify their findings.

1.3   Research Questions

The research at hand is guided by three research questions, which are as follows:

1. How is knowledge being mobilised by members of the sustainability research community in order to achieve societal impact?
   a. What practices are sustainability researchers currently employing in order to mobilise knowledge?
   b. How do these practices compare with the expectation of funding agencies and recommendations of KMB experts?
2. What processes and types of infrastructure exist to support sustainability researchers in order to mobilise knowledge?
   a. What type of support is currently provided to researchers?
   b. What support do sustainability researchers need?
3. What matters need to be considered when promoting and evaluating KMB?
   a. To what extent do competing forces limit research impact?
   b. How do sustainability researchers balance KMB efforts with advocacy concerns?

These research questions are related to one another but address different core issues. In order to answer them, a literature review was conducted in order to generate an analytical framework upon which to build pre-determined codes and categories for a deductive content analysis that would be applied to transcripts of interviews conducted. In addition, the findings from a survey circulated by Springer Nature, the academic publishing company, were used to triangulate the data from the interviews. Finally, the interviews were subjected to qualitative analysis, synthesising interview comments in alignment with the analytical framework, complemented by additional matters raised in the interviews but not included in the analytical framework. A more detailed discussion of the methodology used can be found in Section 3 of the study.

1.4   Scope

This study has been scoped to focus on three professional occupations (funding assessors, KMB experts and sustainability researchers) in two countries (the UK and Canada). The UK was included within the scope because it was the first country to perform a national assessment of research impact (Morgan Jones et al., 2017), whilst Canada has been included as it has witnessed a rapid growth in the KMB sector (Ward, 2017), with investments made at a national level to support its development (Networks of Centres of Excellence of Canada, 2019). Overall, 16 interviews were conducted.

1.5   Limitations

Whilst the number of interviews selected was determined with the purpose of collecting sufficient data in order to achieve theoretical saturation, there is evidence from another study from the United Kingdom (Grant, 2015) to suggest that, with respect to RQ1, the diversity and scale of impact pathways is such that saturation could not be reached without conducting a significantly higher number of interviews. Furthermore, of the 11 researchers interviewed, ten interviewees were from a social sciences background, with one from the natural sciences. As such, the ability of the study to represent the different types of sustainability researcher is limited and therefore does not seek to make claims that can be generalised for all sustainability researchers. However, it is noted that with respect to RQ2, the categories of support identified by interviewees and the literature review comprehensively covered all categories of support identified in the responses to a separate survey used to triangulate the data, indicating that data acquired for RQ2 is closer to saturation point.

Within the literature, it has been noted that there is an argument that competing or vested interests, combined with the dominance of particular ideologies mean that a focus on KMB as a means to encourage the implementation of sustainable solutions, might be ineffective (O'Brien, 2012). Whilst I think it is important to acknowledge that KMB attempts do not exist in a vacuum and will depend on the political, power and cultures that exist, investigating these factors thoroughly is beyond the scope of this paper.

1.6   Ethical considerations

The study is heavily reliant upon interviews and therefore a number of ethical matters needed to be considered. Interviewees needed to understand the purpose of the interview, had to provide information voluntarily and had to be given the right to withdraw from the interview, or withdraw responses, should they feel it necessary. Therefore a number of precautionary steps were taken, including circulating an interview guide to interviewees in advance of the interview which explained the purpose of the interview and the research, the definitions being used and how data was to be collected and disclosed; taking a precautionary approach to any quotes that might require anonymity or additional clarification, and interviewees being given the opportunity to preview comments attributed to them in the draft version of the thesis, prior to publication.

Finally, whilst the majority of interviewees were identified via internet searches and introductions by networks, one interviewee (Dr Philip Johnstone) was already known to the researcher in a personal capacity. However, because the research is not seeking to evaluate KMB practices employed by sustainability researchers, the risks associated with any possible bias are minimal.

1.7   Disposition

This study comprises six chapters. Chapter 1 presents the problem that is being addressed, being a lack of literature as to the KMB practices employed by sustainability researchers, the support provided to them by their research organisations, and the need for the views of sustainability researchers to be included in the debate regarding the impact agenda and KMB. Three research questions are identified to address these knowledge gaps, with limitations and ethical considerations highlighted.

In Chapter 2, a literature review is conducted. It begins by defining the characteristics of sustainability research before explaining the challenge of evaluating research impact and the relationship between KMB and research impact, in order to justify the focus of the paper on KMB, in the context of the impact agenda. The chapter goes on to highlight existing frameworks and literature concerning good KMB practices, the types of support for KMB advocated in the literature and matters to consider which might restrict the extent or success of researchers' KMB efforts. The chapter concludes by presenting the analytical framework developed by the author, based on a synthesis of existing frameworks and principles identified in the literature.

In Chapter 3, the methodology used in the paper is explained in detail. The Chapter begins by explaining a two-stage approach adopted for literature review, then talks the reader through the interviews conducted in terms of the research design, data collection, sampling method, data analysis and data validation.

Chapter 4 begins by presenting the results of the content analysis performed on interviews with sustainability researchers, revealing which practices are most commonly employed and what supports are most frequently available to and sought by researchers. Following the content analysis, the findings from a survey circulated by Springer Nature, the academic publishing company, are presented in order to facilitate data triangulation. The remainder of the Chapter talks the reader through the findings from the interviews, which are synthesised and presented in accordance with the themes and categories identified by the literature review and additional matters raised by interviewees. The Chapter relies heavily on quotes from the interviews, alongside analysis by the author, in order to properly capture the experiences and opinions of the interviewees.

In Chapter 5, the findings in Chapter 4 are discussed in terms of their consequences for sustainability researchers, research organisations and the existing body of knowledge.

In Chapter 6, the conclusions of the study are discussed with reference to the research questions, with answers to the questions presented, knowledge gaps requiring additional research highlighted and nine recommendations offered, for those seeking to improve the KMB of sustainability research.

2 Literature Review

The literature review begins by establishing what is meant by 'sustainability research' and discussing some key characteristics relevant for the study. Then, the review provides some background to the challenges that exist with respect to evaluating and measuring impact. This was considered necessary in order to explain to the reader why this paper has not focussed on research impacts per se; why KMB has instead been selected as the area of investigation; and why researchers and organisations have a similarly restricted understanding as to the success of KMB efforts. As this paper seeks to address three different but interrelated research questions, the literature review then proceeds with three corresponding sections. The literature review finishes with a synthesis of the literature to create an analytical framework to inform the methodology adopted. This process is summarised in Figure 2 below:

Background	RQ1 - How is knowledge being mobilised?		RQ2 - How is KMB supported?		RQ3 - What matters need to be considered?	
Heading	*Heading*	*Subheading*	*Heading*	*Subheading*	*Heading*	*Subheading*
Characteristics of sustainability research	**Existing frameworks**	Sustainability literature	**Support for KMB**	Existing frameworks	**Matters to consider when assessing KMB efforts**	Competing interests
The challenge of impact evaluation		Non-sustainability literature		Research training		The values and expertise of research users
The relationship between research impact and KMB	**KMB practices**	Incorporating KMB into the research design		Incentives		The temporal challenge
		Stakeholder engagement and co-production		Knowledge brokers		Advocacy dilemma
		Tailored communication		Institutional points of contact		
		Networks		Financial support		
		Researcher attributes		Organisational culture and norms		
		The role of research quality				

Analytical Framework

Figure 2 - Chart summarising literature review

The majority of literature included in this Chapter originates from studies related to sustainability research. However, in some instances, literature comes from studies originating from national reviews or consultations with respect to academic research as a whole, or with respect to the social sciences. Where necessary, these studies have been highlighted so that the reader understands the context to which sources relate.

2.1 Background

It is important to first define what we mean by sustainability research within this study, to discuss the challenges in evaluating impact and explain the relationship between impact and KMB.

2.1.1 Characteristics of sustainability research

Defining what constitutes sustainability research is challenging because the term 'sustainability' is used broadly, with different meanings attached to the term dependent on the context (Becker, 2012). The literature establishes that sustainability research is often applied, concerned with the "production of knowledge for immediate, practical use" (White, 2013, p.169). It is interdisciplinary, incorporating knowledge from various areas of academia (e.g. economics, business management, law etc.) and involves scientific and non-scientific actors (Rau et al., 2018). Furthermore, interdisciplinarity has been described as vital for addressing sustainability challenges (Mark S Reed & Meagher, 2019). Applied sustainability research places an emphasis

on researchers to collaborate with a variety of stakeholders (e.g. policymakers, communities) at different stages of the research process, including the research design, fieldwork and dissemination (White, 2013). Such an approach is often referred to in terms of the "co-production" of knowledge (Cornell et al., 2013).

It is worth noting that, as a field of research, sustainability is relatively new. For instance, the most common definition of sustainability comes from the Brundtland Commission Report of 1987 (World Commission on Environment and Development, 1987). The UN SDGs, which have raised the profile of sustainability as a field of research, were only adopted in 2015 (United Nations, n.d.). Because of this, it would seem reasonable to expect that, in contrast to more well-established fields of research, sustainability research will have less well-established networks and channels for the mobilisation of the knowledge that it generates.

The literature review also reveals that some authors see sustainability research as including normative assumptions which makes it difficult for the discipline to occupy the position of neutrality that academics and scientists often seek (Becker, 2012). By adopting conventional apolitical and technocratic positions, sustainability research (in particular climate change science) finds itself vulnerable to politically-motivated attacks (Steinberger, 2019).

2.1.2 The challenge of impact evaluation

Because the impact agenda is both new and complex in nature, it's perhaps unsurprising that comprehensive approaches to assessing impact are very rare (Rau et al., 2018). There are several reasons why measuring impact is such a challenge for academics and those tasked with assessing impact.

Time lags present one of the clearest problems in evaluating impact. The time it takes for the benefits of research to become observable in society can vary significantly (Morgan Jones et al., 2017). This makes it difficult for any evaluation exercise to capture all of the impacts attributable to research and to establish causation, given the amount of time that has elapsed. The same problem of time lags has been identified in a study looking at KMB processes used by environmental researchers and subsequent outcomes (M. S. Reed et al., 2014).

To complicate this further, the process from research to impact is non-linear, with a diverse range of direct and indirect impacts potentially arising from the original research (Morgan Jones et al., 2017). The non-linearity of this process is being exacerbated by the increasingly interconnected and globalised nature of research entities (Khazragui & Hudson, 2015). Therefore, understanding both the attribution and contribution of research to impacts can be challenging (Morgan Jones et al., 2017). This especially applies to policy, which is rarely influenced by a single piece of research, instead relying upon a range of research known as 'the commons' (Khazragui & Hudson, 2015).

Many impacts can be unanticipated and arise outside of the researcher's target area, with impacts often having a global dimension (Bornmann, 2013). This is often because many of the factors that determine whether a research result leads to an impact are beyond the influence of researchers (KNAW, 2018). Researchers themselves can pose a threat to the evaluation of impacts, as it can often not be possible to evaluate impacts objectively (KNAW, 2018). It has also been argued that researchers have an incentive to overestimate the short and medium-term impacts of their research (Khazragui & Hudson, 2015).

Because the limitations in evidencing impact are well known, it is argued that researchers only needed to be concerned with the "first step on this causal path" from research to

impact, as anything more would be too difficult (Bastow et al., 2014, p.22). This quote has guided the research focus of this paper, as KMB efforts represent the first step on the "path" towards evaluating research impact. As such, they offer a tangible and immediate activity that is under the influence of a researcher or research organisation, but which is also directly connected to the goal of research impact. A similar argument was advanced when Australia launched a consultation process prior to establishing a new national assessment of research funding, which sought to include research impact considerations. Many academic organisations argued that assessors should look at the level of 'engagement' by academia, which is defined in similar terms to how KMB has been defined in this study, rather than impact due to its complexity, thus arguing for a focus on the 'means' rather than the 'ends' of achieving research impact (Gunn & Mintrom, 2018). The Australian 'Engagement and Impact' assessment conducted in 2018 eventually incorporated both concepts, to capture the two "different, but obviously related phenomena" (Gunn & Mintrom, 2018, p.13) whereas the UK REF is only concerned with impact.

2.1.3 The relationship between research impact and KMB

The decision to focus on KMB within the context of the impact agenda means that it is important to explain the relationship between them. The research impact process is built upon engagement, it is dependent on researcher's using KMB techniques to communicate their research findings and that even "measurement of impact demands an appreciation of the 'pathways' to impact" (Bannister & Hardill, 2013, p.170). This echoed by M. S. Reed et al., (2014) who state that the extent to which research achieves impacts is ultimately dependent on how and with whom the research is shared. KMB seeks to both address calls for evidence-based policy making and concerns that research is lacking impact due to inadequate knowledge transfer (Buchanan, 2013).

2.2 The mobilisation of sustainability knowledge

KMB has many aspects. Because RQ1 of this study is concerned with KMB activities being undertaken by sustainability researchers, this subsection focusses on highlighting frameworks, principles, guidance and established practices within the literature for effective KMB.

2.2.1 Existing frameworks

The literature was reviewed for examples of frameworks and principles already created to help guide the review of KMB in the context of sustainability research. Due to the relative lack of frameworks available, this review was supplemented via the review of KMB frameworks that exist in the wider literature, beyond sustainability research.

Sustainability literature

In their essay 'A roadmap for knowledge exchange and mobilisation research in conservation and natural resource management' (Nguyen, Young, & Cooke, 2017) proposed a 'knowledge-action framework' to provide a guideline for future conservation researchers seeking to engage in KMB. Whilst this framework was developed with a particular branch of environmental sustainability in mind, it nonetheless provides a useful overview of the path that knowledge follows and the key stages in KMB. These stages are (Nguyen et al., 2017, p.792):

1. Knowledge production (e.g., academia and government);
2. Knowledge mediation (e.g., knowledge networks); and
3. Knowledge-based action (e.g., policies, changes in behaviours).

One issue identified with knowledge-action framework is the absence of funding agencies in this process. Given that agencies funding sustainability research are seeking evidence for the effectiveness of research (Wiek, Talwar, O'Shea, & Robinson, 2014) it would seem reasonable to expect that this would have for consequences for the choices made by knowledge producers (stage 1) regarding the knowledge to be generated, who is to be involved and to whom knowledge is to be directed, as these choices will influence the effectiveness and impact of their research.

Separately, the study 'Five principles for the practice of knowledge exchange in environmental management' performed an empirical analysis of 32 interviews with researchers and stakeholders in the field of environmental management in the UK (M. S. Reed et al., 2014). It identified 48 themes, categorised into five principles, for the effective practice of knowledge exchange in environmental management. These principles, with summary descriptions taken from the paper, are (Reed et al., 2014, p.341):

1. Design
   a. Know what you want to achieve with your knowledge exchange and design knowledge exchange into environmental management research from the outset
2. Engage
   a. Systematically represent research user knowledge needs and priorities in environmental management research
3. Represent
   a. Build long-term, trusting relationships based on two-way dialogue between researchers and stakeholders and co- generate new knowledge about environmental management together
4. Impact
   a. Focus on delivering tangible results as soon as possible that will be valued by as many of your stakeholders as possible
5. Reflect and Sustain
   a. Monitor and reflect on your knowledge exchange work, so you can learn and refine your practice, and consider how to sustain a legacy of knowledge exchange beyond project funding

Because of the relationship between KMB and research impact, it is important to note the existing literature concerning frameworks for understanding research impact within sustainability research. In the paper 'Toward a methodological scheme for capturing societal effects of participatory sustainability research' Wiek et al., (2014) identified four categories of societal effect that researchers could expect to achieve, being: usable products, enhanced capacity, network effects and structural changes and actions. These categories are broadly consistent with the examples of impact provided by the UK REF, which provided examples of impact for each four 'panels' under which academic disciplines ("Units of Assessment") are grouped (REF, 2019). Panel C concerns Units of Assessment within the social sciences (Terämä, Smallman, Lock, Johnson, & Austwick, 2016), which for this study, is considered to the Panel most closely aligned with interdisciplinary sustainability research, as it includes subjects such as environmental studies, politics, law, economics, sociology and architecture. Within the Panel C guidance, 56 examples of impact were provided, grouped into 6 categories, being: Impacts on creativity, culture and society; Economic, commercial, organisational

impacts; Impacts on the environment; Health and welfare impacts; Impacts on practitioners and professional impacts and Impacts on public policy, law and services (HEFCE, 2012).

Non-sustainability literature

A review of 86 academic and non-academic publications advising academics on how they can influence policy was conducted by (Oliver & Cairney, 2019). This review condensed the literature into eight key tips for academia to follow, being:

1. Do high-quality research;
2. Communicate well: make your research relevant and readable;
3. Understand policy processes, policymaking context, and key actors;
4. Be 'accessible' to policymakers: engage routinely, flexibly, and humbly;
5. Decide if you want to be an 'issue advocate' or 'honest broker;
6. Build relationships (and ground rules) with policymakers;
7. Be 'entrepreneurial' or find someone who is; and
8. Reflect continuously: should you engage, do you want to, and is it working?

The review found that the advice given in the literature has been consistent over time and consistent over academic disciplines (Oliver & Cairney, 2019). Furthermore, the study argues that the volume of advice that has been published has reached a saturation point, yet still remains broad and vague (Oliver & Cairney, 2019).

2.2.2 KMB practices

The literature review identified a number of KMB practices for sustainability researchers, including research design, stakeholder engagement, tailored communications, networks, developing particular researcher attributes and producing high quality research. These practices are discussed in greater detail below.

Incorporating KMB into the research design

The need to incorporate KMB within the research design is repeatedly stressed by UK funding agencies. In the UK there are 9 major public research funding agencies, comprising of seven Research Councils, Innovate UK and Research England (UK Research and Innovation, n.d.). Applications for funding to any of the Research Councils must include a 'pathways to impact' document whereby researchers explain how they intend to achieve impact with their proposed research (UKRI, n.d.). As part of this process, researchers are required to articulate at the research design stage, the planned scope and timing of stakeholder and research user engagement, as well as consider the ways the research can meet their needs. Thus, the requirement for a 'pathways to impact' document both reinforces the connection between KMB and research impact and alerts researchers to the role that the research design plays.

Each Research Council provides its own specific guidance as to what a "good" pathways to impact statement should include. Research Councils are separated according to clusters of disciplines that they support (Mark S Reed & Meagher, 2019). The two Research Councils most relevant to sustainability research, in the UK context, are the National Environment Research Council (NERC) and the Economic and Social Research Council (ESRC). The guidance from NERC draws attention to the need for researchers to explain what activities will be done during and after a research project to improve the chances of impact being achieved, whilst also stressing the need to understand the context and needs of research users (National Environmental Research Council, n.d.). The guidance provided by the ESRC

emphasises the importance of stakeholder engagement, tailored events and workshops for specific audiences, preparation for unanticipated opportunities and for researchers to commit time to KMB activities (Economic and Social Research Council, n.d.). Following the REF 2014, a study was commissioned to perform an initial analysis and found "3,709 unique different ways that the research to impact pathway take" (Grant, 2015, p.38) which underlines the diversity of potential impact pathways. However, this study did not perform analysis of these impact pathways beyond representing the connections between impact pathways, fields of research, units of assessment and topics in a diagram format.

In Australia, a Research Impact Pathway Table has been created by the ARC to provide examples of outputs and outcomes. However, only minimal detail is provided, with the document only being a single page, with only ten, one-line examples of impacts (Australian Research Council, 2018) which highlights the lack of formal guidance as to how sustainability researchers actually mobilise their knowledge for impact.

The need to consider KMB activities and opportunities for impact from the outset, combined with the need to develop a research design which is flexible to allow for researchers to leverage such opportunities, was highlighted in the study of environmental management researchers in the UK (M. S. Reed et al., 2014). In their study, Cvitanovic et al., (2016), respondents cited the co-development of research questions between researchers and research users as a vital factor in determining the success of KMB.

Stakeholder engagement and co-production

Stakeholder engagement and the importance of co-producing research is highlighted repeatedly in much of the literature, particularly with respect to sustainability research. Stakeholder engagement can take many forms and involve numerous varied parties. For social scientists, a six-stage process for developing sustained links with external organisations is provided by (Bastow et al., 2014, p.108) and is summarised below:

1. Identifying potentially interested external organisations;
2. Connecting with an external organisation;
3. Identifying a quid pro quo in applying research;
4. Finding traction for applying research within the organisation;
5. Building and extending a relationship; and
6. Demonstrating specific benefits to the organisation.

These steps were found to be consistent for different categories of research user, including business, policymakers and civil society (Bastow et al., 2014).

Researchers should seek to maximise opportunities for stakeholder engagement by identifying opportunities throughout the research cycle and incorporating them into the research design (M. S. Reed et al., 2014). Engaging potential research users early on in the research process (e.g. by giving input into the research question) can increase impact for researchers (KNAW, 2018). Respondents in a case study of knowledge exchange in an environmental research program in Australia echoed this point, by emphasising the importance of identifying all relevant stakeholders and research users as quickly as possible in the research process, so as to ensure their interests and values were reflected (Cvitanovic et al., 2016). Stakeholder engagement then needs to be maintained via regular dialogue (McKean, 2016). Engagement with stakeholders over time is considered necessary if researchers aim to have their research moderate or overcome deeply held values of stakeholders (Everard, Reed, & Kenter, 2016).

An analysis of case studies looking at the methods by which social impact occurs showed that interactions between science and society help to generate impact (Bastow et al., 2014).

Further recommendations related to stakeholder engagement identified in the literature include the need for researchers to understand what motivates research users (M. S. Reed et al., 2014). In their empirically derived guidance for social scientists to influence environmental policy (Marshall et al., (2017) advise researchers to be aware of political and policy realities that their research users operate in, particularly with respect to the difficulties that policy-makers face. When stakeholder engagement takes the form of treating stakeholders as equal partners in the research process and ideas are developed jointly with researchers, the research process can be described as being one of "co-production" (Mark S Reed & Meagher, 2019). In the context of sustainability research, co-production processes have been advocated as a way to generate research and mobilise knowledge that can resolve highly contested issues (Mark S Reed & Meagher, 2019).

An example has been identified of funding agencies in the sustainability field recognising the importance of stakeholder engagement as a means for researchers to achieve societal impact. BiodivERsA is a network of national funding organisations in the EU, concerned with research that seeks to enhance conservation and sustainability with respect to biodiversity and ecosystem services (Durham E., Baker H., Smith M., 2014) BiodivERsA released their 'Stakeholder Engagement Handbook' in 2014 to help researchers adopt suitable methods of stakeholder engagement (Durham E., Baker H., Smith M., 2014). The Stakeholder Engagement Handbook identifies four types of engagement (inform, consult, involve and collaborate), each type representing a deepening level of engagement. In addition to the recommendations made elsewhere in the literature, the Stakeholder Engagement Handbook advocates that researchers make sure to manage stakeholder expectations, tailoring engagement to the practical and cultural needs to stakeholders and providing feedback to stakeholders (Durham E., Baker H., Smith M., 2014).

Despite the various arguments in favour of stakeholder engagement, it is important to note that there are limitations. It can be time-consuming, costly, make research projects more complex, can perpetuate power imbalances and lead to unrealistically high expectations on behalf of stakeholders (Durham E., Baker H., Smith M., 2014). Furthermore, bringing together researchers and non-researchers can present a number of "considerable conceptual, epistemic and practical challenges that require careful moderation" (Rau et al., 2018, p.268).

Tailored communication

Another key consideration for achieving research impact is the need for tailored communication. In the Stakeholder Engagement Handbook, the importance of avoiding using technical or complex language is emphasised as a part of successful stakeholder engagement (Durham E., Baker H., Smith M., 2014). This can be achieved by having researchers work with stakeholders in the interpretation and communication of the research results in a format that is usable and understandable (Mark S Reed & Meagher, 2019). Furthermore, it is advised that social scientists avoid using the language of neutrality when engaging the public on issues which are not inherently neutral (Marshall et al., 2017). Additionally, researchers are advised to use comparisons and rankings, and to provide their data in accessible forms such as narratives, info-graphics and scenarios to help engage research users (Marshall et al., 2017)

A common request from the business sector is for researchers to develop an ability to operate beyond the confines of their academic disciplines when communicating the relevance of their work (Bastow et al., 2014). A reminder of how different audiences respond differently to

certain messaging has been provided in a recent report by the think tank New America, which found that the communication of climate change solutions has to alter significantly depending on whether the audience is conservative or liberal (Hurlburt, Byrd, & Souris, 2019). However, despite the apparent need for researchers to reframe their work to reflect the political context of researcher users, there is little evidence of this being done (Marshall et al., 2017).

Networks

Several sources cite the importance of networks in helping to improve the impact of research. Networks are viewed as being able to reduce barriers between disciplines and improve collaboration amongst researchers (McKean, 2016). For instance, networking with policymakers was cited in the study by Bastow et al., (2014) as being crucial in convincing policymakers of the merits of research expertise within the social sciences. For sustainability research, networks allow for different forms of knowledge to be exchanged, it enhances capacity, relationships and creates reinforcing feedback loops (White, 2013).

Given that impact is not generated in a linear fashion, it's perhaps unsurprising to learn that the new knowledge is similarly dynamic, iterative and reliant upon cooperation between various stakeholders in society (KNAW, 2018). In this sense, the importance of stakeholder engagement and networks is interrelated. For instance, in their study of environmental management researchers, M. S. Reed et al., (2014) advocate for researchers to target the involvement of certain stakeholders who are well-placed to assist the mobilisation of knowledge arising from a research project, via the positions and networks that they occupy. An example provided by (Bastow et al., 2014) are charities, who are often well-positioned to help share knowledge, as they often seek to locate themselves at the centre of policy networks and advocacy coalitions.

Researcher attributes

Underlying many of the recommended techniques and approaches for sustainability researchers is the need for researchers themselves to possess or develop attributes that would commonly be referred to as 'soft skills'. In their guidance for influencing policymakers, Oliver & Cairney, (2019) remind researchers of the need to be humble, respectful and courteous. Similarly, in their guidance Marshall et al., (2017) point out that social scientists are more likely to be included in decision-making processes by policymakers if the researchers are empathetic and understand the competing goals that policymakers are seeking to address. In addition, researchers need to have a heightened sense of self-awareness, understanding their own strengths and weaknesses, so that they are able to offer their services in a targeted manner to researcher users/other stakeholders (Marshall et al., 2017).

The role of research quality

Whilst this paper focusses on KMB and research impact, it is vital that we acknowledge the continued importance and prominence of research quality, particularly as evidence suggests the two are strongly correlated. Multiple studies have found that academic/scientific quality and impact are aligned. The recent study by the Royal Netherlands Academy of Arts and Sciences claim that both scientific quality and societal impact go "hand in hand" (KNAW, 2018, p.11). In the UK, one study found that units of assessment with high-quality scores also score highly in impact (Terämä et al., 2016), whilst another found that a high number of citations (one of the conventional measures of research quality) was a "strong predictor of external impacts" (Bastow et al., 2014, p.81). In their advice to social scientists seeking to influence environmental policy, Marshall et al., (2017) note that policy-makers commonly prefer to engage with policy-makers who are well-established in their field.

2.3 Support for KMB

The KMB activities researchers are advised to undertake will require a significant time commitment that might conflict with or undermine other research or organisation priorities (Marshall et al., 2017). Asking researchers to navigate these trade-offs and perform additional KMB activities risks being burdensome and unreasonable, with many already feeling under pressure, with limited time available, prior to additional demands being made of them by the impact agenda (Bastow et al., 2014). Therefore, KMB activities have to be accompanied by changes within, and increased support from, the organisations where researchers are based (Marshall et al., 2017). The types of support that might assist sustainability researchers are discussed in greater detail in the following section.

2.3.1 Existing frameworks

A search for studies that looked at support for KMB identified the article 'Knowledge Mobilisation Practices of Educational Researchers Across Canada' (Cooper, Rodway, & Read, 2018). This study looked at how universities in Canada support educational researchers in their KMB efforts, based on the premise that researchers cannot be expected to pursue KMB activities without support from funders and/or their universities (Cooper et al., 2018). The analytical framework 'KMb efforts of Canadian researchers' developed by the authors identified two categories of support, being:

1. **'Institutional supports'** - the use of special personnel to support KMB, funding for KMB work, the inclusion of KMB activities within promotion assessments, awards for KMB activities and initiatives for multidisciplinary teams; and

2. **'Communication supports'** - training to use technology for dissemination, writing support to increase accessibility, support to create executive summaries, a communications department and training to deal with media (Cooper et al., 2018, p.6).

Many of the examples of support provided within these two categories are discussed in greater detail in this section.

In 2017, the UK Parliamentary Office of Science and Technology circulated an online survey which garnered 1,162 responses, to gauge perceptions of barriers to engaging with policymakers ('Parliament'), within academia (Parliament, n.d.-a). Many of these barriers could be construed as arising from a lack of support within research organisations. For instance, 66% of respondents agreed that there was a lack of guidance on how to engage with Parliament and 44% of respondents admitted to having a lack of confidence to engage with Parliament. Furthermore, 43% of respondents cited a lack of time to engage with policymakers, which was frequently related to lack of institutional support.

2.3.2 Researcher training

In-line with the framework outlined by Cooper et al., (2018) it would appear that there is scope for research organisations to provide training to help overcome these barriers. Training can be targeted, according to the existing skill set of research personnel. The ESRC in the UK recommends that research organisations applying for funding perform skills checks of their research teams and provide access to training (Economic and Social Research Council, n.d.). However, instead of just providing training in a reactive way when skills gaps are identified, there are also calls for training programmes that are more proactive, providing training to researchers early on in their careers, before deficiencies are identified. For instance,

respondents to the study by (Cvitanovic et al., 2016) stressed the need for research organisations to provide KMB training to researchers towards the beginning of their careers. KMB-related training is important because some of the KMB activities recommended can be challenging for researchers. For instance, in terms of stakeholder engagement and tailoring communications for research users, "Communicating effectively with several different audiences requires a degree of 'upskilling'" (Rau et al., 2018, p.268).

2.3.3 Incentives

Research conducted in both Canada (McKean, 2016) and the Netherlands (KNAW, 2018) advocates for evaluations of researchers to include an assessment of a researcher's effort and performance with respect to achieving impacts. In terms of sustainability research, the study by Marshall et al., (2017) calls for researchers to be rewarded for KMB activities alongside traditional measurements of performance, such as bibliometrics. This is echoed by Cvitanovic et al., (2016) who also call for KMB activities to be explicitly recognised within job descriptions. In the UK Parliament survey referred to above, 30% of respondents cited a lack of incentive and/or a lack of recognition as being a barrier to engagement with policymakers (Parliament, n.d.-a). However, interestingly, the research from the Netherlands is very clear in warning the Minister of Education, Culture and Science (the body responsible for deciding research assessment policy) "Do not link measurement of the societal impact of research to research funding, given that doing so will create undesirable incentives to maximise the value of these indicators" (KNAW, 2018, P.9). As such, the advice given appears contradictory, advocating the use of incentives at a researcher level whilst warning against such an approach at an institutional level.

2.3.4 Knowledge brokers

Knowledge brokers are commonly identified in the literature as an important component of KMB, as often "the messenger can be more influential than the message" (Marshall et al., 2017, p.5). In their categorisation of advice to academics seeking to influence policy, Oliver & Cairney, (2019, p.4) highlighted a need for academics to "be 'entrepreneurial' or find someone who is" with this "someone" often taking the form of a knowledge broker. This is echoed by (Durham E., Baker H., Smith M., 2014) who identify knowledge brokers as a means to facilitate successful stakeholder engagement when research teams lack the necessary expertise.

In Canada, one think-tank has argued that universities need to invest in institutional support for social sciences like they do for STEM subjects, for instance by hiring dedicated knowledge brokers (McKean, 2016). In the context of sustainability research, a knowledge broker helps to act as an intermediary, allowing for different perspectives and making sustainability knowledge relevant for different contexts (Wittmayer & Schäpke, 2014). In their 2014 study, (M. S. Reed et al., 2014) environmental management researchers highlighted the need for knowledge brokers to be well-established and trusted by multiple groups. In a more recent article looking at the use of evidence in environmental and sustainability issues, Mark S Reed & Meagher, (2019, p.154) claim that researchers are increasingly collaborating with "boundary organisations and knowledge intermediaries" who perform the role of mediating between various stakeholders (e.g. researchers and research users). The need for such personnel, in the absence of in-house capacity, is echoed by Rau et al., (2018, p.274) who state that, with respect to interdisciplinary sustainability research, "Dedicated outreach roles and well-resourced support systems for tailored communication and dissemination of research to policy-makers and wider communities are urgently needed". However, the authors do not explore where the funding for this additional investment will come from.

2.3.5 Institutional points of contact

In the UK, several initiatives have been established to facilitate the exchange of information between academia and policymakers. The UK Parliament has established the 'Knowledge Exchange Unit' (KEU) which provides a first point of contact, online resources and training for researchers wanting to work with the UK Parliament (Parliament, n.d.-b). In Scotland, the Scottish Parliament Information Centre (sPICE) began their Academic Engagement project in 2016 to enable parliamentarians to better access academic research and experts (The Scottish Parliament, 2018). Their project includes a knowledge exchange network, PhD placements and a framework agreement for academics to provide expert advice (The Scottish Parliament, 2018). An online search has not identified an equivalent organisation in Canada.

The value in having an established point-of-contact to help external parties navigate large organisation is relevant for researchers not just in terms of providing them with a starting point for engagement with policymakers (as with the examples of KEU and sPICE) but also for facilitating collaborations with external parties. Many private sector participants in the study of Bastow et al., (2014) claimed that knowing who to speak to at research organisations and how to connect with them was a challenge.

2.3.6 Financing support

Establishing an infrastructure within a research organisation which can provide the types of support identified by the literature will require investment and it is unclear from a review of the literature as to how this will be funded. In their study of environmental management researchers, M. S. Reed et al., (2014) interviewees highlighted the need for sufficient funding to be included in a research design to enable researchers to react to opportunities to undertake activities that might generate impact.

2.3.7 Organisational culture and norms

In the UK, the ESRC emphasise within their 'pathways to impact' guidance that the most robust research proposals reveal a culture where KMB, research and impact are intertwined (Economic and Social Research Council, n.d.). Similarly, interviews with environmental management researchers identified a need for a culture of KMB to be promoted in order to achieve long-term impacts (M. S. Reed et al., 2014). However, there are competing forces which mean that establishing such a culture within research organisations can be difficult. Participants in the study of Cvitanovic et al., (2016) stated that the dominance of bibliometric data has helped to create a 'publish or perish' culture which can undermine knowledge exchange activities, as researchers prioritise publications over KMB activities such as stakeholder engagement. The same study cited research funding itself as often creating another cultural barrier to effective KMB, claiming that researchers must often 'follow the funds' to the detriment of stakeholder engagement following the conclusion of a research project (Cvitanovic et al., 2016). Cultural differences between researchers and policy-makers are identified as helping to create specific problems for developing research projects and long-term collaboration (Bastow et al., 2014).

2.4 Matters to consider when assessing KMB efforts

Attempts to mobilise sustainability research within wider society do not operate in isolation and as such there are often factors outside of the immediate control of researchers which nonetheless will influence the impact of their research, even if the best KMB practices are adopted. The final research question, which asks what matters need to be considered when seeking to assess KMB efforts, focusses on a few specific factors, being the existence of

competing interests and temporal challenges faced by researchers, before looking at how the demands for KMB might conflict with researchers concerns regarding advocacy.

2.4.1 Competing interests

As discussed earlier in the literature review, sustainability research is often focussed on addressing real world problems. Often the solutions to these problems (e.g. switching our energy supply to renewable energy sources) either explicitly or implicitly call for the taxation, exclusion or curtailment of current practices (e.g. the extraction of fossil fuels) which, if implemented, would threaten the profits, viability of even existence of powerful corporations that are currently benefitting from the status quo. As such, it is perhaps not surprising that these incumbent organisations with vested interests that run counter to the recommendations of sustainability research, may seek to undertake activities that limit, spread doubt or negate the impact of sustainability research. There is evidence that such activities have been ongoing for decades (Oreskes & Conway, 2010). In addition, competing interests may seek to shape how sustainability problems are conceptualised and promote alternative data to create confusion (Mark S Reed & Meagher, 2019). Such tactics can be particularly effective in the context of sustainability problems, where few actors have a sufficient level of technical knowledge to comprehensively understand and challenge the arguments presented (Mark S Reed & Meagher, 2019). In their study, Marshall et al., (2017) claim that these vested interests can often have greater influence over the policy process than researchers. Taken to its extreme, Alex Steffen, the American futurologist, argues that researchers operate under a politics of "predatory delay" whereby policies remain designed to prevent the level of disruption required, in order to protect the very dominant institutions, corporations and systems which are creating sustainability problems (Steffen, 2016).

Besides those actors whose wealth and power are threatened by sustainability problems, competing commitments will often exist. These may arise from the fact that many actors (be they countries, corporations, municipalities or individuals) are committed to fighting other problems first (e.g. poverty), are too focussed on short-term goals or are locked-in to growth models that are inherently unsustainable (O'Brien, 2012). Given the existence of these competing interests, it is important to consider what can be reasonably expected of researchers with respect to the impact of their research and in what ways their KMB activities may need to adapt.

2.4.2 The values and expertise of research users

Research users themselves can also present a challenge to researchers seeking to successfully mobilise their knowledge. Researcher users often already have their preconceived values, making it easier for research which is aligned with these values to be successful (Marshall et al., 2017) as users will often select research which affirms their particular worldview (Bastow et al., 2014). Furthermore, research users sometimes lack sufficient expertise to assimilate research knowledge communicated to them. In their study, (Cvitanovic et al., (2016) found that a failure by researchers to tailor their communication towards the needs of research users was compounded by decision-makers lacking the necessary expertise to understand and implement research findings. To remedy this situation, one possible option suggested is for researchers to target those policymakers who do have the necessary expertise or to try and develop the capacity of research users via offering training (Marshall et al., 2017).

2.4.3 The temporal challenge

In seeking to mobilise research to achieve impact, researchers must deal with several temporal challenges. Firstly, there is the timing mismatch between the length of time that researchers

require to undertake their research and the amount of time that policymakers have between identifying an issue and requiring a solution (Durham E., Baker H., Smith M., 2014). A similar mismatch is noted between researchers and the business sector, with private firms often operating with very limited time horizons (Bastow et al., 2014). Secondly, the lack of time available to policymakers to engage with and critically evaluate research can mean that less robust research receives more attention (M. S. Reed et al., 2014). Finally, research can become relevant years after it is produced. This raises a question as to who bears responsibility for monitoring opportunities for mobilising research, how such a task can be effectively performed and supported, and for how long such monitoring should be performed.

2.4.4 Advocacy dilemma

In the 2017 UK Parliamentary survey, 24% of academic respondents cited that concerns about political biases were a barrier to engagement with policymakers (Parliament, n.d.-a). It's not clear if, by referring to biases, respondents were referring to biases held by policymakers or, instead, the fear as to how they themselves would be viewed, were they perceived to be engaging in advocacy work. Despite this uncertainty, the latter possibility is worth discussing.

In their overview of the literature advising academics on how to advise policymakers, Oliver & Cairney, (2019) identify the need for academics to determine whether they want to be 'honest brokers', whereby their role is purely to disseminate research, or be advocates, where commentary is provided by academics, tying research to policy decisions. This dilemma is understandable, given that academics may fear that undertaking advocacy work can endanger their perceived independence and objectivity (Bastow et al., 2014). However, it is argued that there are instances where it is the duty of researchers to be engaged in advocacy work when there is clear evidence that a particular course of action is in the public interest (Bastow et al., 2014). Furthermore, it is argued that sustainability researchers, in their role as creators of knowledge relevant to addressing sustainability problems, must share responsibility for the implementation of this knowledge, alongside other key stakeholders such as policymakers, civil society and businesses (Cornell et al., 2013). Some even argue that researchers should be ready to engage in non-violent civil disobedience to help fight the climate crisis (Gardner & Wordley, 2019).

One compromise is to employ the services of experts in stakeholder engagement who can undertake the work of advocating particular positions, based on the research generated (Durham E., Baker H., Smith M., 2014). Alternatively, academic researchers may seek to collaborate with organisations within the third sector, who frequently participate in advocacy coalitions in order to strengthen the scope of their influence (Bastow et al., 2014). For instance, some social scientists looking to influence environmental policy making have successfully used Non-Governmental Organisations (NGOs) to advance their message (Marshall et al., 2017).

2.5 Analytical framework

To address RQ1 and RQ2, an analytical framework has been developed, incorporating supports and practices identified in the literature (Figure 3).
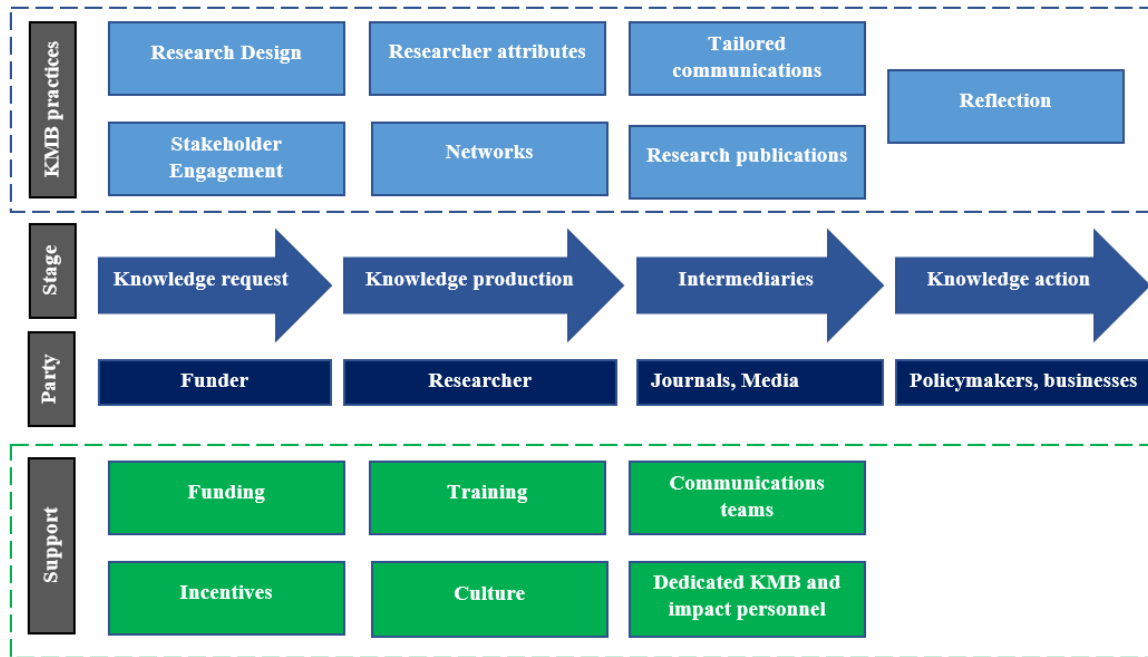
Figure 3 - Analytical framework for the mobilisation of sustainability knowledge

It was important to attempt to establish an overall, simplified structure for understanding how knowledge flows from a researcher to a research user. The framework therefore incorporates, as represented by the blue arrows, the Knowledge Action Framework created by (Nguyen et al., 2017) where research flows from producers (i.e. researchers) via intermediaries (e.g. the media) to research users, where knowledge action occurs. However, this framework has been adapted by the author to also include an extra stage at the start of the process, to reflect the influence that those requesting knowledge (e.g. funding agencies) have on the research and its pathways (Rau et al., 2018) (Power, 2018). Whilst the literature review has shown that impact pathways are both more diverse and complex (Grant, 2015), and less linear (M. Reed, 2018) than is shown in the analytical framework, it is nonetheless useful to have a basic structure that captures the direction and key stages of sustainable research KMB.

Having established this structure, the framework builds two groupings of concepts relevant to the individual research questions. With respect to RQ1 and the types of KMB practices employed by sustainability researchers, seven categories of KMB practice are included in the analytical framework, being research design, stakeholder engagement, researcher attributes, networks, tailored communications, research publications (a proxy for research quality) and reflection. These categories mirror the relevant subheadings in the literature review, with the exception of 'reflection', which lacks a heading but for whose importance is highlighted by both M. S. Reed et al., (2014) and Oliver & Cairney, (2019).

With respect to RQ2 and the support provided to researchers, the study relies upon the institutional and communicational supports identified by Cooper et al., (2018). A review of the literature was unable to find an existing framework which addresses the types of support provided to sustainability researchers by research organisations. Although the study by (Cooper et al., 2018) focussed on the practices of educational researchers, their conceptual framework was deemed to provide a solid starting point to help inform the subsequent interviews. Because of the open-ended nature of RQ3, there is no specific literature that has chosen for the purpose of the analytical framework.

3 Methodology

This methodology section begins by explaining the literature review, which contains two stages. First research was undertaken to identify what the impact agenda means for sustainability research and the challenges associated with evaluating impact. This then formed the foundation for the second stage of the literature review, whereby a deeper understanding of KMB, in the context of sustainability research, was sought. Due to the limited time and resources available for this literature review, a systematic review of the literature has not been conducted. Instead a narrative review has been performed, so as to provide an overview via "a reasonably comprehensive assessment and critical reading of the literature" (Bryman, 2012, p.102). Following a description of the literature review, the methodology for the interview process is detailed.

3.1 Literature review

3.1.1 Literature review stage one – the impact agenda

The first stage of the literature review sought to identify what the impact agenda is, in terms of its origins, drivers, challenges and features, and what it means for sustainability research. This work was conducted across four steps, being:

1. Speaking to senior academics with experience of the impact agenda, who identified leading researchers in the field and flagged for attention certain issues;
2. Reviewing literature generated by impact agenda debates in the UK, Australia, Sweden, Canada and the Netherlands;
3. Reviewing a sample of 15 case studies from the UK REF 2014 which related to sustainability research undertaken by social sciences researchers; and
4. Conducing Boolean[2] searches, using search terms generated from steps 1 and 2, to identify further literature of relevance to sustainability research in particular. See Appendix 2 for a breakdown of the search terms used.

3.1.2 Literature review stage two – KMB

The second stage of the literature review sought to look at the impact agenda and sustainability research through the lens of KMB. This process consisted of three steps being:

1. Speaking to two senior academics with experience of KMB, who helped to identify relevant issues and literature. These academics are:
   a. Dr David Phipps, Executive Director of Research & Innovation Services at York University, Canada. Dr Phipps has received honours and awards for his KMB work from the Canadian Association of Research Administrators and, in Europe, the Knowledge Economy Network ("David J. Phipps | CARA 2017," 2017); and
   b. Dr Vicky Ward, Reader in Management, School of Management, St Andrews, UK. Dr Ward is a co-director of the Research Unit for Research Utilisation at the University of St Andrews (University of St Andrews, n.d.)
2. Reviewing KMB and research impact literature collated in the 'KMb Journal Club' on the website maintained by Research Impact Canada (Phipps, 2019). This website monitors relevant journal articles being published and provides summaries, accompanying discussions and links to the underlying articles; and

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[2] A way for a user to connect their search words together to either narrow or broaden the set of results from a search

3. Conducing Boolean searches, using search terms generated from steps 1 and 2, to identify further literature of relevance to sustainability research in particular. See Appendix 2 for a breakdown of the search terms used.

3.1.3 Literature review – both stages

Whilst the literature review conducted is not comprehensive, the first steps in both stages ensure that the process is informed by experienced academics and prominent institutions in the relevant areas of research. It is important to highlight a key assumption made concerning step three within stage two of the literature review and its basis in the literature. Because the literature concerning KMB and sustainability research is either fragmented (e.g. KMB practices) or very limited (e.g. support for KMB) it has been assumed that findings in the literature, looking at best practice for KMB in other disciplines, are relevant to sustainability research. This is based on the study conducted by Oliver & Cairney, (2019) which found that advice given to academics was consistent across academic disciplines. However, the majority of the literature highlighted in the literature review comes from studies which looked at the topic within the context of environmental sustainability. With respect to the Boolean searches conducted, literature was sought amongst the following online databases, using the same search terms:

1. Lub search (Lund University's literature search tool); and
2. Google Scholar.

The searches were restricted to look only at English-language literature produced after 2007 (when the UK REF effectively began) and only the first 50 documents returned by each search were reviewed, as the relevancy of documents declined amongst the larger search responses. It is important to note that the spelling of KMB differs depending on whether British or American English is used. For this study the British English version is used, however for the literature search, both the British and American English (i.e. mobilization) versions were used. The search terms used are detailed in full in Appendix 2. No coding of the literature has been performed.

During the course of some interviews, additional literature was identified that was relevant to the study. This literature has been included within the findings section of the study. This is in order to properly reflect the chronological nature of the work and to avoid inconsistencies between the literature review and the analytical framework created from it, as the analytical framework was formalised before commencing with the interviews.

3.2 Interviews

Following the conclusion of the literature review, it was possible to begin the interviews, asking questions generated by the key topics and themes identified in the literature and crafted with the research questions in mind. The research design adopted for the interviews is summarised in Table 2 below, with the methods detailed under each heading discussed in greater detail in the following sub-sections.

Table 2 - Summary of data collection for each research question

#	Research question	Data collection	Sampling	Data analysis	Validity strategies
1	How is knowledge being mobilised by members of the sustainability research community in order to achieve societal impact?	Interviews (open ended questions)	Purposive and snowballing sampling	Deductive content analysis + Qualitative analysis (synthesising interview findings)	i. Survey data provided by Springer Nature ii. Member checking iii. Presenting discrepant information iv. Peer debriefing
2	What processes and types of infrastructure exist to support sustainability researchers in order to mobilise knowledge?				
3	What matters need to be considered when promoting and evaluating KMB?				

3.2.1 Geographical scope

As the development of the impact agenda and KMB is quite fragmented and because this research is exploratory, a wide geographical scope has been selected. Interviewees operating in the following two countries were sought, with justifications provided:

1. United Kingdom
   a. Was the first country to perform a national assessment of research impact (Morgan Jones et al., 2017)
2. Canada
   a. Has witnessed a rapid growth in the KMB sector (Ward, 2017), with investments made at a national level to support its development (Networks of Centres of Excellence of Canada, 2019)

Whilst Canada has not yet incorporated research impact into a national research assessment exercise (Phipps, 2018), there is evidence that the impact agenda is becoming a matter of importance for organisations conducting research in Canada. Examples include the creation of Research Impact Canada, a "a pan-Canadian network of universities committed to maximizing the impact of academic research for the public good in local and global communities" whose membership includes 16 Canadian universities and 1 UK university (Research Impact Canada, n.d.). Furthermore, the Federation for the Humanities and Social Sciences, a network of 91,000 researchers and graduate students across Canada (Federation for the Humanities and Social Sciences, 2019) published a report in 2017 titled 'Approaches to Assessing Impacts in the Humanities and Social Sciences' to provide recommended approaches for assessing research impact (Federation for the Humanities and Social Sciences, 2017). It is important to note that, despite the focus on two different countries, this study will make no attempt to compare the two countries. This is for a number of reasons. Firstly, any differences or similarities that are noted will be due to a range of political, economic, cultural etc factors which are beyond the scope of this study. Secondly, the sample size chosen means that any findings cannot be said to be generalisable for a country as a whole. However, it is envisaged that by including interviews with researchers in both the UK and Canada, this paper will help highlight the diversity and popularity of KMB practices in different contexts.

3.2.2 Data collection

Sampling

Two different sampling approaches have been selected for the research. To begin with, purposive sampling was chosen, as particular criteria for the selection of interviewees (see below) and a practical number of interviewees had been established. This purposive sampling is summarised in Table 3 below:

Table 3 - Purposive sampling overview

Interviewee status	United Kingdom	Canada
Funding agencies	1	1
KMB experts	2	1
Sustainability researchers	5	6
Subtotals	**8**	**8**
Total	**16**	

The total number of interviews was chosen on the basis of being achievable in the time frame available, whilst still offering hope of reaching saturation with respect to codes, categories and themes pertinent to the research questions. The slight mismatch in the number of KMB experts and sustainability researchers eventually interviewed in each country was due to ad-hoc opportunities becoming available to conduct additional interviews beyond the original sample size that had been chosen. The decision to include interviewees from three different professions at different stages of the flow of knowledge (from inception to dissemination), was in-part motivated by the Knowledge Action Framework (Nguyen et al., 2017) discussed in the literature review, adapted by the authors and included within the analytical framework developed for this study. A brief summary as to how suitable interviewees were identified and their relevance to the study is provided below.

3.2.2.1.1 Funding agencies

The McConnell Foundation was chosen as the Canadian funding agency to be interviewed. The McConnell Foundation funds, invests and advocates for systems change in Canada (McConnell Foundation, 2019a). The McConnell Foundation funds seven initiatives, three of which can be classified as relating to sustainability research, being their 'Cities for People' (resilient and liveable cities), 'RENEW' (supporting national and regional climate and energy policies) and 'Sustainable Food Systems' initiatives (McConnell Foundation, 2019b). For the UK, the NERC was chosen as the appropriate funding agency to interview, as it is responsible for publicly funding environmental science research in the UK (NERC, 2019).

3.2.2.1.2 KMB experts

Dr David Phipps and Dr Vicky Ward were chosen as the KMB experts to interview for the study. Their profiles are explained earlier in the literature review part of this section. In addition, Professor Mark Reed, Professor of Socio-Technical Innovation and Director of Engagement & Impact in the School of Agriculture, Food & Rural Development at Newcastle University, UK, was interviewed towards the end of the study in order to provide expert commentary on some of the findings of the study.

3.2.2.1.3 Sustainability researchers

To identify early participants, a definition of who met the definition of 'sustainability researcher' was provided. For the purposes of this study, relevant sustainability researchers have been identified as those engaged in research that is either directly or indirectly related to the nine planetary boundaries as identified by the Stockholm Resilience Centre (slogan/tagline "Sustainability Science for Biosphere Stewardship") (Stockholm Resilience Centre, n.d.). Although it is acknowledged that the planetary boundaries framework has been criticised (Rockström, Richardson, & Steffen, 2017), it has nonetheless been chosen as the reference point because it is well-established globally (e.g. over 18,000 results in Google Scholar for "planetary boundaries") and relates specifically to the environmental aspects of sustainability, whereas other concepts such as the UN SDGs include economic and social aspects. The nine planetary boundaries are Stratospheric ozone depletion, Loss of biosphere integrity (biodiversity loss and extinctions), Chemical pollution and the release of novel entities, Climate change, Ocean acidification, Freshwater consumption and the global hydrological cycle, Land system change, Nitrogen and phosphorus flows to the biosphere and oceans and Atmospheric aerosol loading (Stockholm Resilience Centre, n.d.). However, because this could be conceptually different for some participants, the following definition was provided:

Because 'sustainability' is such a widely used term, this study defines sustainability research as focussing on climate change, water scarcity and efficiency, renewable energy, resource efficiency, public transportation, sustainable agriculture, corporate sustainability and urban governance (e.g. sharing economy, nature-based solutions and smart cities).

This definition meant that it was possible to interview sustainability researchers from a wide range of academic fields and disciplines. Furthermore, early participants in the study were asked to identify additional participants, reflecting a snowballing sampling approach. In total 19 research organisations and 31 researchers were contacted to see if they would be willing to participate. Because RQ1 involved asking researchers about their KMB practices, it was decided that interviewees must have sufficient experience. This was defined as follows:

1. Researchers in academia
   a. Have published three or more primary research publications in the last five years.
2. For those working outside of academia (e.g. research institutes, NGOs professional bodies)
   a. Occupy a managerial or equivalent senior research position at the organisation.

Furthermore, because RQ2 asked interviewees to describe the types of support provided by their organisation, it was decided that researchers must have worked at their current organisation for at least a year. Whilst this threshold is an arbitrary cut-off, it was decided that it constituted a sufficient amount of time to have enabled interviewees to have discovered and become familiar with the various types of support available to them at their organisations. Interviewees' university profiles were inspected to help establish whether they had spent more than a year with their current organisations and in those instances where the information was not available, interviewees were asked to confirm the information at the start of their interview. However, in one instance this question was not asked, and it was subsequently established during the interview that the interviewee (Jessica Blythe, Brock University) had been with their current organisation for less than a year. As such, Ms Blythe's responses are excluded from the content analysis of support currently provided to researchers. However, all other responses

provided by Ms Blythe are included in the findings of this study, as these responses are not affected by the length of time Ms Blythe has spent at her organisation.

Data gathering

Three interview plans were created, one for each type of profession interviewed. This was to ensure consistency in the types of questions asked to interviewees for each profession, whilst providing flexibility to ask different, targeted questions when required. For the content analysis, the same relevant questions were asked in each interview with sustainability researchers. However, some questions not relevant to the content analysis (particularly those questions concerning RQ3) were changed during the course of the interviews, as certain questions received the same responses each time (thus achieving saturation), whereas new questions arose as a result of the answers received in the interviews. A detailed breakdown of the questions asked in each interview is provided at Appendix 7.

Once potential interviewees had replied to initial requests for interview, an interview guide was circulated, prior to the interview. The interview guide explained the background to the research, the purpose of the interview, key definitions being used and how data was to be collected (i.e. recorded) and disclosed (i.e. quotes to attributed to named sources), pending the consent of interviewees. The interview guide alerted all interviewees to their right to request a preview of any comments to be attributed to them in the thesis, prior to publication. At the beginning of each interview, interviewees were asked for their consent for the interview to be recorded. All interviewees who expressed a desire to see a preview were sent via email a document containing the quotes and accompanying commentary taken from their interview.

Of the 16 total interviews, 12 were conducted online via Zoom or Skype, 2 interviews were conducted in-person (Dr David Phipps and Davinder Valeri) and 2 interviews were conducted via email (Dr Georgina Santos and Paul McArthur). Given that the interview questions and area of research are not particularly contentious, the different types of interview format are not considered to have had an influence on the answers provided.

3.2.3 Methods of data analysis

After the completion of each interview, the recording was transcribed using an online automatic transcription software called 'Transcribe' by Wreally. The transcription of each interview was then reviewed by a research assistant. The transcripts were then subject to two forms of data analysis, being a directed/deductive content analysis and a qualitative analysis.

For the content analysis, relevant sections from interviews with sustainability researchers were coded and categorised, building upon pre-determined codes and categories based on the literature and identified in the analytical framework. The content analysis was performed using Nvivo, the qualitative data analysis computer software package. Because of time constraints, and confidence that coding would not bias the identification of relevant text (Hsieh & Shannon, 2005) the coding exercise began whilst some interviews were still to be conducted. To facilitate the content analysis, and in keeping with the guidance of Hsieh & Shannon, (2005) open-ended questions were asked in the interviews, followed by targeted questions in-line with the pre-determined codes and categories. Data that didn't fit into these pre-determined codes or categories were identified and added as new categories or as new codes within existing categories. These codes and categories are included in Appendix 3, with new additions flagged, so that the reader can see the evolution of the codes and categories from the conclusion of the literature review to the end of the data analysis. In addition, a coding protocol was established in order to improve consistency of the coding. This protocol is provided at Appendix 4.

For the qualitative analysis, a number of synthesis matrices were created to identify key topics and common themes amongst the interviewee responses. These interviewee comments are then presented in the findings section, as well as the discussion section, in order to provide a greater level of detail to the issues identified in the content analysis and to enable issues relevant to RQ3 to be covered.

3.2.4 Validity strategy – data triangulation

Data triangulation is defined as the "use of more than one method or source of data in the study of a social phenomenon so that findings may be cross-checked" (Bryman, 2012, p717). In order to triangulate the data accumulated from the interviews, other sources of similar data were sought. In line with the timing of this study, Springer Nature, the global academic publishing company, circulated a survey via email and social media on 5 June 2019 asking researchers to help them to optimise research impact. The Springer Survey also contained a screening question so that only researchers who had published least 3 papers in the last 5 years could continue with the main survey. The data from the Springer Survey is to be made publicly available at a future date. However, to assist this study, Springer Nature arranged for the data to be provided in advance to enable triangulation to occur. A reconciliation between the relevant questions asked in the Springer Survey and the research questions of this study in provided below.

#	Research Question	Springer Nature Survey Question
1	How is knowledge being mobilised by the sustainability research community in order to achieve societal impact?	Q4.1 For your most recent publication, which of the following have you done (or do you plan to do) to increase the societal impact of the research - as opposed to increasing awareness with your peers? Q4.2 Of these activities, which one do you believe is likely to have the greatest effect on increasing the societal impact of the research?
2	What processes and types of infrastructure exist to support sustainability researchers in order to mobilise knowledge?	Q4.5 What support do you get, if any, for activities that are intended to increase the societal impact of your research? Q4.7 Please describe the type of support you have received in increasing the societal impact of your research.
3	What matters need to be considered when promoting and evaluating KMB?	Q5.7: To what extent do you agree or disagree with the following, "The funding of research should be more strongly linked to demonstrable societal impact" Q5.9 Do you feel there has been a change from funders, institutions or researchers in attitudes to societal impact over the last 5 years? If so, please explain: Q46 If you have any further thoughts on this topic, please provide them here.

The Springer Survey generated 9,265 responses, as at 12 August 2019. The data was then filtered to include only researchers who marked their area of interest as being 'social sciences' or 'earth and environmental sciences' and living in Canada or the UK. Any researchers who classified themselves as being independent, not currently employed or self-employed were removed, as they would not be able to comment on the types of support they receive from their organisations. Furthermore, a researcher whose job title was recorded as 'Physician/Clinician' was removed from the sample. This resulted in a sample population of 88 researchers.

4 Findings

This section begins by presenting the findings from the content analysis exercise performed, followed by a deeper exploration of the insights and experiences shared in the interviews, in alignment with the three research questions.

4.1 Content analysis

This subsection provides an overview of the findings from the content analysis, with particular attention paid to the variety and frequency of KMB practices and supports cited by interviewees.

4.1.1 How is knowledge being mobilised?

Before the interviews were conducted, seven categories of KMB practices were identified via the literature review. The content analysis identified an additional three categories, being 'Events', 'Seizing Opportunities' and 'Teaching'. Across the 11 interviews, the most commonly cited KMB practices involved tailoring communications, stakeholder engagement and research design approaches. The extent to which various KMB activities were mentioned in interviews is shown in Figure 4 below:
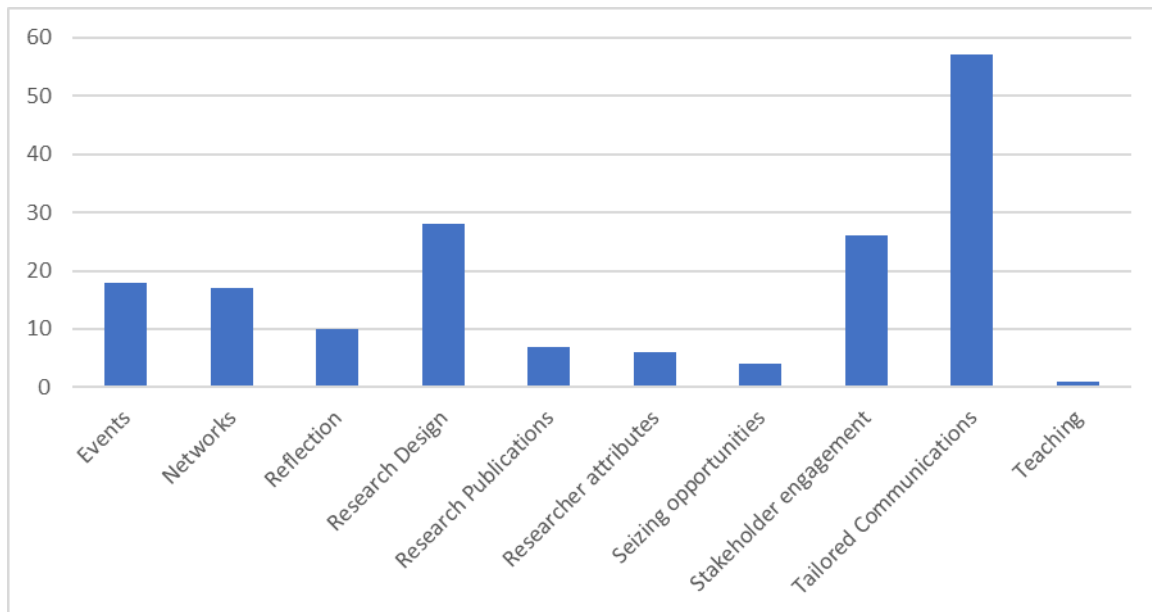
Figure 4 – Overall frequency of KMB practices cited, by category

Within each of these categories are a number of codes created to capture specific KMB practices. In total 65 different specific KMB codes were recorded. The top ten specific KMB practices cited are summarised in Table 4 below, with the most commonly cited practices being 'Using networks to build capacity', 'Co-production of research design', 'Hosting workshops' and 'Using simple language', which were all cited in 7 of 11 interviews.

Table 4 - Most popular specific KMB practices cited

#	Specific KMB practice	Category	Number of interviewees citing KMB practice
1	Using networks to build KMB capacity	Networks	7

2	Co-production of research design	Research Design	7
3	Hosting workshops	Events	7
4	Using simple language	Tailored communications	7
5	Adjusting language for different audiences	Tailored communications	6
6	Conferences	Events	5
7	Designing a KMB plan	Research Design	5
8	Getting feedback	Reflection	5
9	Early engagement with stakeholders	Stakeholder Engagement	5
10	Frequent engagement with stakeholders	Stakeholder Engagement	5

Finally, a comparison was performed between the number of KMB practices cited per researcher. Because this research is not seeking to rank researchers or make a comment on their level of effort, the researchers names are anonymised. Figure 5 shows that the number of specific KMB practices cited by researchers in the UK and Canada ranged from 25 to 9 practices.
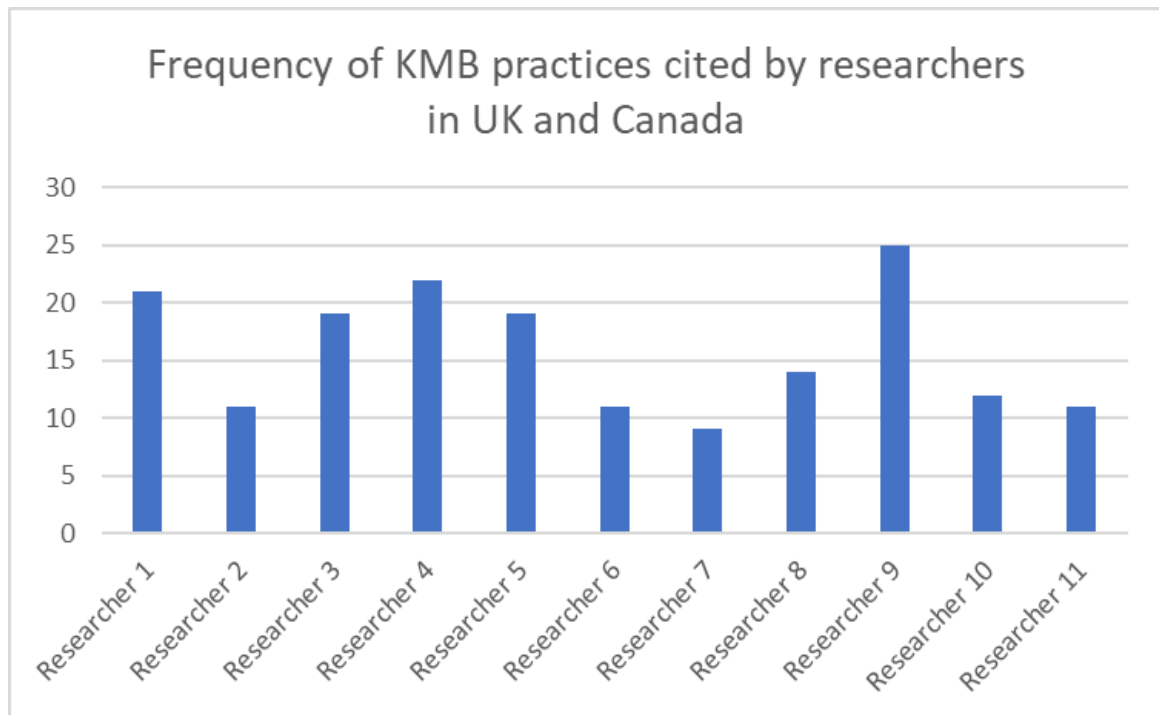
Figure 5- Frequency of KMB practices cited by UK and Canadian researchers

4.1.2 How is knowledge mobilisation being supported?

Before the interviews were conducted, six categories of organisational support for KMB were identified via the literature review. The content analysis identified an additional five categories, being 'Time', 'Interdisciplinary teams', 'Secondments and Exchanges', 'Spaces and Fora' and 'Improved metrics for tracking engagement'. Across the 10 interviews (because Jessica Blythe's interview was omitted from this analysis), the most commonly cited forms of KMB support currently provided by research organisations were 'Training', 'Spaces and Fora', 'Incentives' and 'External Communications' as is shown in Figure 6.
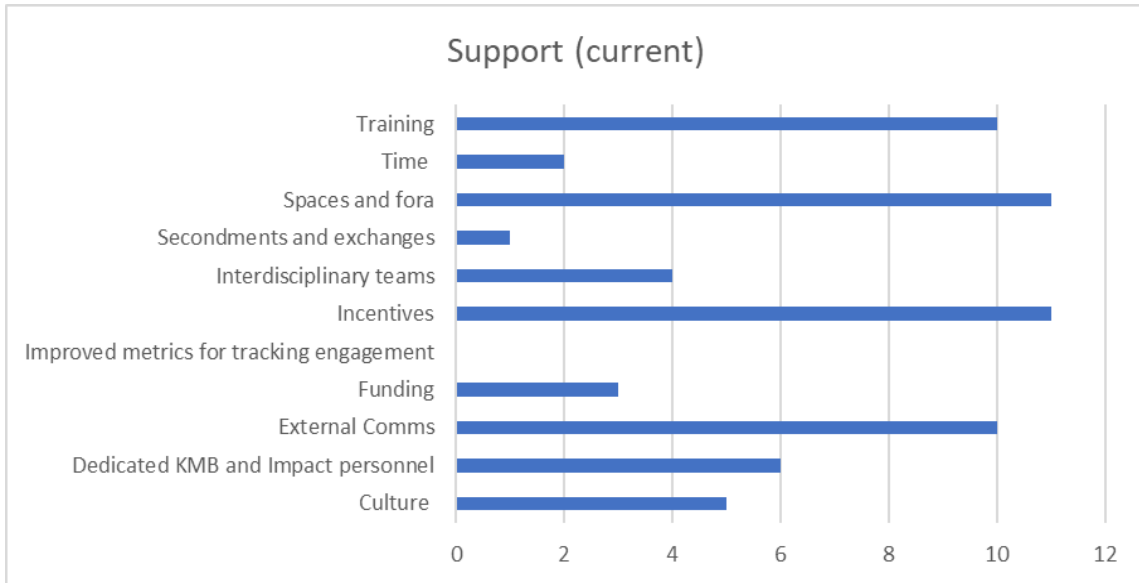
Figure 6 - Categories of support currently provided by research organisations

The most commonly cited categories of KMB support sought by researchers were 'Training', 'Time', 'Funding' and 'Dedicated KMB and impact personnel' as shown in Figure 7.
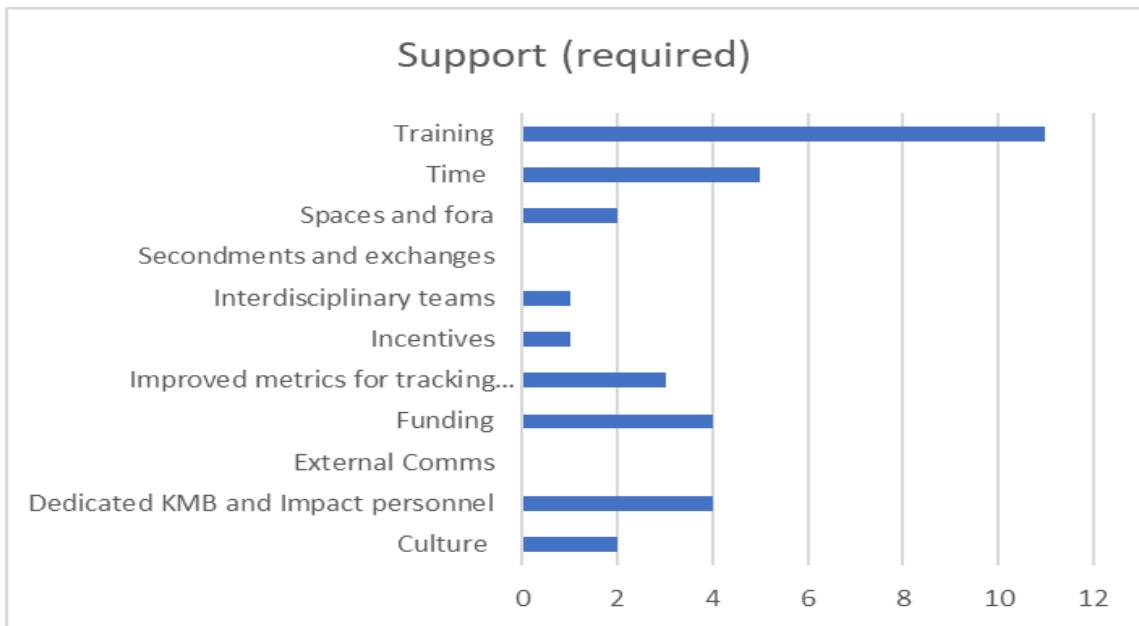
Figure 7 - Categories of support sought by researchers

However, if we look at the most common specific types of support provided to and sought by researchers a slightly different picture emerges. With respect to support currently provided, 'External communications teams' emerge as the most commonly cited specific type of support, followed by 'Internal spaces and fora' and 'Culture'. With respect to support required, 'Time' was the most commonly cited specific type of support sought by researchers, followed by 'Funding' and 'KMB personnel'. These findings are shown in Table 5 below.

Table 5 - Most common types of specific support provided or sought

#	Support (current)	Number of interviewees	Support (required)	Number of interviewees
1	External communication teams	7	Time	5
2	Internal spaces and fora	7	Funding	4
3	Culture	6	KMB personnel	3
4	Media training	5	Improved metrics	3
5	External spaces and fora	5	Early career training	3

The level of support provided to each researcher by their organisations was found to vary significantly. In the UK and Canada, the different types of support provided to a researcher ranged from 1 to 15. In total, 21 different types of support (i.e. codes created) provided to researchers and 15 different types of support sought by researchers were identified via the content analysis. In total, 26 potential types of support were identified (after removing duplicates).

4.2 Survey data

Because the Springer Survey data is only being used for the purpose of data validation, only the key findings are summarised here. However, a detailed analysis of the Springer Survey data for the seven relevant questions identified in the methodology section is provided at Appendix 8.

4.2.1 How is knowledge being disseminated?

With respect to knowledge dissemination activities employed by sustainability researchers, 14 possible pre-determined responses were provided to respondents. The most popular responses were 'Presented at a conference' (53 responses), 'Promoted the research on a scientific social networking site (e.g. ResearchGate, Academia, Mendeley)' (44 responses), 'Promoted the research on a professional page (e.g. university profile page)' (38 responses) and 'Promoted the research on social media' (38 responses). However, when asked which of the 14 options was likely to have the greatest impact, the most popular response was 'none of the above' (29 responses), followed by 'Published the paper open access' (14 responses) and 'Engaged in media coverage' (13 responses).

4.2.2 How is knowledge mobilisation being supported?

With respect to the support that researchers have received, nine pre-determined answers were provided to respondents. Of these options, the most popular responses were 'Support from colleagues/team members' (37 responses), 'Support from part of my institution/university' (35 responses) and 'Support from my department' (28 responses). In addition, 22 respondents stated that they received 'no support'. Furthermore, the Springer Survey asked respondents to describe the type of support that they received, which resulted in 43 responses. These responses were then categorised by the author. The most popular support categories were 'External communications' (20 responses), 'Funding' (13 responses) and 'Culture' (5 responses).

4.2.3 What other matters need to be considered?

Respondents were asked the extent to which they agreed or disagreed with the statement "The funding of research should be more strongly linked to demonstrable societal impact". Overall, 51 respondents (58%) either strongly or somewhat agreed with the statement, whereas 20 respondents (23%) strongly or somewhat disagreed with the statement, with the remaining 17 respondents (19%) neutral. With respect to the question, "Do you feel there has been a change from funders, institutions or researchers in attitudes to societal impact over the last 5 years?", 49 respondents (56%) provided a positive responses whilst 10 respondents (11%) replied in the negative. Finally, researchers were asked to provide further thoughts on the topic. All 25 responses are provided in full in Appendix 8. Although the comments are varied, common themes included a criticism of focussing too much on social media as a measure of impact, the value of making research open access and a fear that the discussion and the research itself is being simplified.

4.3 Interviewee insights on KMB and research impact (Qualitative)

This subsection is used to highlight some of the most pertinent views and experiences shared by the interviewees in the study, with respect to the three research questions.

4.3.1 How is knowledge being mobilised?

The findings from the content analysis provided above show that researchers are employing a diverse range of practices and approaches to mobilise knowledge. In this subsection, the study seeks to provide further detail via the use of relevant quotes from the interviewees, categorised in accordance with the literature review and content analysis.

KMB has typically been linear and focussed on dissemination

A number of interviewees explained that historically, the approach to KMB within academia has been linear and focussed on knowledge dissemination via journal publications and conferences. As explained by Jessica Blythe in her interview (Interview 14):

"I guess I've been involved with research projects that take two different models or approaches to knowledge mobilisation. The first is probably the classic which you'll run into, which is you conceive of an important, according to you, research question, you design your methodology, you conduct data collection and analysis and then at the end you think about okay now, how can I effectively share and disseminate the findings of this research. So there's a little bit of a probably like a more traditional approach where it's [KMB] a bit of an afterthought and so, in addition to the classics, which every researcher has been trained in the last hundred years is publish a paper, which isn't very effective and then the only other really traditional mechanism is go to conferences and share your findings with other academics."

The problematic nature of this "traditional approach" to KMB was explained by Professor Charles H. Cho (Interview 15):

"the research that we publish in academic journals is not only difficult to access in terms of understandability, but it's also not even accessible - period - because it's protected by libraries and journals and copyrights and whatnot. So, that causes a problem because all of the research that we have published is actually reaching a very small audience"

The idea that KMB has to go beyond just looking at conventional forms of knowledge dissemination was furthered by Professor Jouni Paavola, who explained that, in the context of

creating a research plan "If you have dissemination strategies as your main way of trying to secure impact you will not get very far with that" (Interview 4).

Research design

As discussed in the literature review, the UK's Research Council's require researchers to include Pathways to Impact statements in their research proposals but provide little detail as to what constitutes best practice. However, Professor Jouni Paavola explained what he considered to be five key features of a strong pathways to impact statement (Interview 4):

"[1]You do need to carefully indicate who your stakeholders are, [2] you need to characterise the ways in which you are going to engage with them and, like I said that will mean, designing your research processes so that you can actually meaningfully and substantially either co-produce or at least engage to finalise your research design. [3] You do need to have also typically an audience analysis, so what are your audiences beyond direct research users, and have [4] different strategies of communication and dissemination towards those, and then [5] you typically do need to include monitoring."

In Canada, Dr David Phipps explained that as part of his role at York University (Interview 9):

"I first say, 'Who are the people you're listening to? And what are they telling you is important? What are their goals? And how do they align with yours?' And then I say, 'Who are the people you're working with? Your co-production researchers?' Not everyone does co-production co-producer research, but we encourage it. And then the third type of person is, who are your audiences for your dissemination? So, you've got stakeholders you listen to, co-producers you work with and audiences you disseminate to"

The value of stakeholder mapping, where relevant stakeholders are identified from the early stages of the research onwards, was often highlighted. For instance, Dr Philip Johnstone explained (Interview 5):

"the whole stakeholder mapping, it has been a really important part of the process. Just keeping on top of who we're in contact with, who are we emailing, and it takes up a lot of time as well to be emailing all these people, but it's been a really important part of it"

Once relevant stakeholders have been identified, a common KMB feature of research design mentioned by interviewees was the co-production of research questions with stakeholders. As explained by Jessica Blythe "you would start with sort of focus groups meetings or just Community meetings to sort of get a sense for what are the issues here? What would be useful research question here?" (Interview 14).

Aligned with this point, Stephanie Cairns provided an example highlighting the need to incorporate research users' concerns and understand their contexts in the early stages of a project (Interview 16):

"I had a research paper that I worked on. It was for municipal governments and it was about user fees for stormwater utility, and we ended up completely reframing the whole paper based on feedback we got from our first round of external reviewers, who said that we weren't connecting to the anxieties of the municipalities by the way that we were presenting this. And we needed to really tie into things that were key policy concerns, policy drivers for them. So, you want to bring that in really early"

Similar to stakeholder mapping and referred to in the quote from Professor Jouni Paavola above, is the importance of conducting an audience analysis. An example of how this can be quite strategic was provided by Davinder Valeri who explained that "we also follow who is willing to be a friend or a foe, right? So, when we do research… so if someone is willing to help us move research along, it actually helps us to actually expand upon that" (Interview 13).

Another common feature of research design is to develop a communications strategy. As explained by Stephanie Cairns, "We have a mid-sized communication team. Typically, if you're going to be publishing a major paper, you'll be consulting with them early on about framing the narrative, making sure that you're working to compelling communication messages" (Interview 16).

The benefits of developing a KMB plan as part of the research design, which incorporates these kind of approaches and principles, were articulated by Daniel Henstra (Interview 12):

"it really does get you thinking about how the research will be used… who will use the research findings and what value it is going to have. It really makes you sort of think through that. Now, you probably lose sight of that once the grant is funded and you dive into the research, but at that early stage, it really does for me, anyway, make me think really carefully about, okay, 'Who's going to be using this? What kind of impact would it have? And how do we ensure that the rest of the way we're designing the research actually would align with that?'"

However, he further explained that KMB plans weren't without their difficulties (Interview 12):

"It's aggravating writing a knowledge mobilisation plan because, I'm sure this is a universal joke, but by the time you've written a grant application, you almost have to have done the research to be able to predict what all of these things are going to be"

Stakeholder engagement

Overlapping with research design considerations is the importance of stakeholder engagement. Dr David Phipps stated that, as a knowledge mobilisation expert, "the most important principle that I talk about is understanding the needs of your stakeholders before, during, and after the research project and engaging them along the way" (Interview 9). The importance of stakeholder engagement is apparent in the interviews with both funding agencies, with NERC stating that research projects need to (Interview 3):

"there are a lot of places where they [researchers] would be expected to speak to [stakeholders] and be working alongside them on the project. And it can make a difference to whether the project gets funded or not, because if they are talking to the right people it will all help towards research excellence…Making sure that the involvement with the stakeholders is a real collaboration and not a kind of, well, we'll just tell them what we did at the end"

The changing and multi-faceted nature of stakeholder engagement was commonly raised by interviewees. Dr Georgina Santos summarised the changing situation stating, "Engaging with stakeholders nowadays entails much more than interviewing them or visiting them, it usually entails asking them to contribute with ideas or say what they would like to see researched" (Interview 6). The importance of engaging stakeholders was affirmed by Dr Elena Bennett who stated that "one of the things that I kind of came to, I guess a while ago now, was that anything after the research was done, was at least for me far less effective than engaging

stakeholders somehow in the process" (Interview 11). A possible reason for this was elaborated by Daniel Henstra in his interview (Interview 12):

"They're [stakeholders] contributing to it and therefore building a greater stake in the outcomes of the research and I think that makes, and this is a theory, that probably makes them more likely to use that knowledge once it's there."

However, for stakeholder engagement to be effective, many interviewees stated that it must begin early, be frequent and long-term, seek to avoid conflict and be inclusive of a diversity of views. In her interview, Dr Georgina Santos emphasised the importance of early engagement stating "if you want any stakeholder to actually use your research/your results/your findings and change something they have been doing, try to engage with them at the earliest possible stage, for example, when you are preparing your application for funding" (Interview 6).

Several examples of very early engagement were provided in the interviews, with Daniel Henstra explaining that "so, what we did is we started with a workshop. We had a workshop actually before I even applied for the grant" (Interview 12). Daniel Henstra then highlighted the benefits from ensuring that stakeholder engagement continues throughout a research project (Interview 12):

"So, those stakeholders, we wanted them to be involved at various points throughout the research, and there's three reasons [why]…One, to do some more data collection. But also, the second one was to build trust ties...the third thing that we wanted to get from the stakeholders all the way along is to validate the accuracy and the reliability of the data we we're collecting. Are we interpreting it properly? Are we missing whole swaths of documents, are we missing nuance and the political background that kind of thing?"

An example of how frequent, long-term engagement can lead to successful KMB and therefore research impact, was provided by Professor Jouni Paavola (Interview 4):

"my colleagues who are doing consumption-based carbon accounting, they have been able to push the government to actually now in parallel, practice consumption based carbon accounting...it has been sort of quite a long term interaction directly via the relevant government departments, that has been sort of the route that impact."

Another aspect of stakeholder engagement cited by interviewees is that it should be inclusive. Dr Philip Johnstone explained how his research seeks to include a diverse range of stakeholders, often with conflicting views (Interview 5):

"We are thinking all the time about the broad landscape and who are the different actors involved, and that's been key especially with this topic which kind of traverses both the energy domain and the defence domain and we've always sought in dissemination to include everyone, so we send stuff out to industry and people that vehemently disagree with us. But the thing is, these are stakeholders engaged in this and they are included in our research and they have a right to see the research."

However, including opposing views increases the possibility of conflicts arising. Dr Elena Bennett explained how her research addresses this via the use of scenarios (Interview 11):

"we've built couple of different ways to, what's the right word for this? Like to make sure that when we have people in the room who might disagree with one another, that we use different

techniques to make sure that we don't just devolve into arguing...one thing we do a lot of is we do a lot of scenario development. So, if one of the main topics that people want to talk about is some building some bridge that's super controversial, that we instead say, "Well, let's not talk about that bridge, let's talk about what we want the community to look like 50 or 25 years from now", and that just kind of backs off a little bit of the arguing over a particular thing."

Professor Mark Reed argued that "the literature is becoming clearer and clearer" (Interview 2) on what works and doesn't work with respect to engagement. He then explained they four key matters for researchers to consider when engaging with stakeholders (Interview 2):

"[1]I need to understand the context and I need to adapt to that context. [2] I need to understand the role of powers and [3] I need to pay attention to representation. [4] I need to pay attention to scale. Those are the four things. But when I pay attention to those four crucial things, I can pretty much forget everything else and chances are it's going to work"

Despite the merits of stakeholder engagement identified in the literature review and its extensive use by interviewees, some barriers and limitations were also mentioned. Professor Stewart Barr commented that (Interview 7):

"I think there's lots of challenges with it. The most notable one we found is that co-production is very good for identifying issues and for, perhaps, making certain kinds of knowledge more visible than others. What I have found much more problematic is moving to the next stage, which is that there is still, amongst decision-makers, a big reluctance to rely on evidence that is not quantitative. So, the big thing that will happen is if I were to present a set of knowledges about flooding and climate change, and these did actually happen at an exhibition we had in this particular area, the first thing someone from a kind of official position, whether it's a decision maker in the environment agency or central government, is to say: "well, yes, but how many people did you speak to?" Because lying behind that question will be an issue of representativeness, which is that actually evidence that's robust equates to the number of people you've spoken to and how representative they are and which kind of box they ticked on a Likert scale. And so, I think the big challenge is that co-production usually is about working with people's own understandings from their life, which they express in particular ways and that doesn't fit easily into the kind of traditional paradigm that evidence-based policymaking is usually based on numbers"

Flexible networks

During the interviews, interviewees were asked about their experiences in participating in networks, in the context of KMB and research impact. The popularity of networks, and the need to consider what works and what does not, was initially highlighted by Dr Vicky Ward when she stated "People always go "networks ohh that's really shiny and that will be great and it gives us all these things", but a lot of the time no one's really thought about what they want from it" (Interview 1). As such, sustainability researchers were asked their views on what they considered to be key criteria for a network to be effective, offered examples of ways that researchers can engage with networks and identified some of the benefits that they perceive from participating in networks.

A common trait identified for networks to aid KMB is the need for them to be *flexible* and not place too much of a burden on researchers. In her interview, Jessica Blythe explained how, in her view, some networks can be detrimental and how a balance between costs and benefits needs to be achieved (Interview 14):

"I've got a paper in review right now that's arguing that networks when they're imposed as part of a deliverable for projects can be quite damaging because it's often the same people who get voluntold that they're part of a new network and it takes up too much time…one of the really important characteristics of a successful network to me is a balance between how much time is required and how much benefit is received through participation. So how many events are you participating in? Are they required? Can you participate as you need? So, I guess finding that balance between the costs and benefits of participating in the network is really important and I don't think there's a silver bullet for that."

In several interviews, interviewees stated that they found networks to be more effective when they are smaller, informal, purposeful, non-hierarchical and relating to a more niche subject. One example of an effective network, the Nuclear Consulting Group network, was offered by Dr Philip Johnstone in his interview (Interview 5) which was described as:

"a fantastic Network actually because again, it's quite very, very horizontal. It's very, there is a someone who's in charge of the emailing list, but it's very kind of relaxed in a way. There's no pressure to do particular things, but it is just a fantastic knowledge sharing device"

In addition, a key characteristic amongst many responses was the notion that networks were effective when they were based on a sense of shared goals and aims, creating a sense of solidarity amongst members. Echoing one of the findings regarding inclusive stakeholder engagement, one interviewee flagged the importance of ensuring that networks are open and inclusive of a range of views. Davinder Valeri stated (Interview 13):

"there is a drawback sometimes to a network as well because you have to make sure your network is not a closed network. You have to be willing to reach out to those that may be naysayers to the research that you're doing. So, you always have to be open to someone cutting your research off or saying that this is the wrong or you're in the wrong."

Having identified some of the ways that networks can be more effective, some interviewees outlined ways that researchers could increase their participation in them. Daniel Henstra explained how his team seeks to leverage the networks of various stakeholders in order to benefit their research (Interview 12):

"we recognise that all of these stakeholders are involved in their own networks. And so, we're trying to tap that as much as we can just by asking them if they know of other people, either that they work with or come across who might have something to say about the broad research questions that we're using"

These well-connected stakeholders sometimes take the form of boundary organisations, such as the one described by Dr Elena Bennett in her interview (Interview 11):

"we spent about a year with the stakeholders before we started the project. And so that was driven by a local nature centre that had a lot of political connections to other people in the region that could really get people in the room, and kind of get everyone in the room. So, they could get the farmers and the Agricultural Producers Union, they could get the politicians, they could get the land use planners, they could get the Greenies and so they were kind of our boundary organisation"

Tailoring communications

The role of communications appears to be playing an increasingly vital role with respect to the success of KMB efforts and research impact. This change was perhaps most stark in the interview with Stephanie Cairns who explained that "I've done public policy research for 30 years or something. What's really changed I think from what I used to do to what we do now, is at least 50% of a project now is communications and knowledge mobilisation" (Interview 16). Paul McArthur from the McConnell Foundation in Canada reiterated the importance of communications from a funder's perspective, stating that "good practice is when researchers find ways beyond academic publication to communicate their work to relevant audiences, being thoughtful about which parts of the research will be useful for them to know, and how to best communicate to them" (Interview 10).

Professor Mark Reed highlighted the central role that the researcher has with respect to tailoring communications, explaining that (Interview 2):

"only the researcher can open that channel of empathy to understand actually what is going to resonate. Which goes beyond simply what is the form of words and on a much deeper level, I need to understand how these people tick, what keeps them awake at night, what their hopes and fears are so that I can craft a message that will actually resonate with this person beyond even just making it understandable to them"

Within the interviews, a number of approaches to tailoring communications for audiences were highlighted. Most commonly, researchers stressed the importance of using simple language, delivering short messages, being consistent with those messages and being aware of what works with different audiences. In his interview, Professor Charles H. Cho argued that conventional academic research can be inaccessible to many audiences, explaining that, "Journals and the academic world, also have this tendency to have very sophisticated language using very technical jargon, and over theorising. The theory is important, but sometimes it's just way too abstract for a business practice." (Interview 15).

In order to get around this problem, many of the researchers spoke of seeking to use simple language in the communication of their research outside of academia or their organisations. For instance, Dr Philip Johnstone stated "from the beginning building, we were being mindful, maybe without even realising this is our intention, of how to explain this to publics, how to get this thing across in not very jargon-y language" (Interview 5).

Another researcher, Jessica Blythe, spoke of feeling a personal obligation to adapt her communications (Interview 14):

"I'm trying to do that more and more but that's, I suppose, largely out of personal interest in more effective communication. I as a researcher feel responsibility to communicate more effectively than we do. I've sought training that helps me better target messages, think through audiences, design multiple communication techniques beyond just papers and Conference presentations, but that's largely been out of self-interest."

However, adapting communications was identified as being a challenging undertaking, with Daniel Henstra claiming that "it's actually remarkably hard to write in plain language" (Interview 12). Furthermore, Stephanie Cairns referred to the workload involved, explaining that "often if we get an academic paper, there's actually quite a lot of work to translate it, to simplify the language, to use clear English, to structure it in a way that makes sense for that type of audience" (Interview 16).

Another aspect of tailored communications identified by interviewees was the need to shorten messages for audiences. In her interview, Stephanie Cairns explained this approach (Interview 16):

"it's a real challenge as a researcher, you have to just distil, distil, distil into these strong messages, because audiences have very limited attention spans now. And you need to kind of find the balance between your research rigour and yet the sexiness, the bright shiny object that's going to catch people's attention."

Slimmed down research communications can take various forms. In her interview, Davinder Valeri discussed some of the ways that her organisation, the Chartered Professional Accountants of Canada (CPA), have sought to trim their messages to research users (Interview 13):

"We're trying to understand our audience a little bit better in the sense that we're trying to reduce the amount of volume we produce and make it much more focused on the message that's trying to be relayed. So, whether that be in a quick 30 second video or a quick 30 second, email or whatever, we're trying to find we're trying to get bite-sized to our messaging versus large publications"

As well as delivering shorter messages, several interviewees cited the need to be consistent in which messages were delivered. In his interview, Daniel Henstra stated that "you've got to pick a few key messages and hammer them consistently" (Interview 12). This need for consistency over long-time periods was explained in greater detail by Stephanie Cairns (Interview 16):

"As researchers we tend to think you do a piece of research and you move on to your next piece of research, whereas in communications you have to just stick with your messages and do it again and again and again and again and repeat and repeat and repeat. One of the projects I work on, I can go back four years ago and it's true we've got slightly new content coming in, based on the program work that we've been doing, but our core messaging hasn't changed for over four years. And that's what's kind of needed to shift the yardstick on awareness of an issue, because you just have to keep hammering away at the same set of themes and core messages. So that people, once they've seen the core message, they see it once and, it's kind of "Oh, information" and then they forget it a week from now. If they see it two or three times, it's kind of like, "Oh that's interesting, I think something's happening out there." They see it 10 times then it starts to become, "Alright, this is real, this is happening, I'm thinking about this, or I'm thinking about my program development." So, you just need this incredible consistency of messaging over time periods that I think we don't appreciate in research communications. And because of that time frame…. The key is that you have to be leading with consistency all the time. Your kind of secondary messages can vary a little bit, but your headlines have to just be completely consistent."

Although not discussed in the literature review, a number of interviewees referred to the use of social media, video and infographics to help them with KMB. Dr Philip Johnstone highlighted the role of Twitter, stating (Interview 5):

"I'm on Twitter a lot. And, I would include that in actually the knowledge mobilisation process again, a lot of the information that's turned out to be key has been sort of mobilised on Twitter through interactions with a variety of people and so on"

Separately, Stephanie Cairns provided an example of how an infographic created for her research was able to have outsized impact (Interview 16):

"really important nowadays are visuals for social media post cards. I mean that's been a truly humbling experience I'll say for somebody who's a policy wonk like me. One of our reports that we worked on for a year and a half, we also actually put a lot of effort into a really stunning infographic that distilled the whole report. And that infographic five years later is still circulating globally. Every once in a while, somebody says, "Oh we saw it here". The report is long since dead, but the infographic is what really got the legs for communication"

Both Stephanie Cairns (Interview 16) and Davinder Valeri (Interview 13) spoke of the role that videos had in transmitting research to time-poor research users (members of parliament) or younger audiences (young CPA members), respectively.

Those interviewees heavily engaged in communications work also detailed ways that communication can be tailored according to the intended audience. Daniel Henstra spoke of the ways that his messages would be tailored differently for municipalities and governments (Interview 12):

"A lot of our stuff is targeted at municipalities, trying to get them to change their behaviour. There, it's all about communicating to them what others are doing. And even more specifically, to try to think about what their perceived competitors are, because these municipalities are all in competition with one another for economic development and for people to move there and investment and that kind of thing…

…when it comes to higher level governments, it's more about international shaming. To say, Canada's way behind in this area or, Canada is far behind its OECD comparators. Things like that. That seems to resonate."

Separately, Stephanie Cairns highlighted how research communication needs to take into the account the changing nature of journalism (Interview 16):

"So, one of the lessons for me is how much in communications nowadays you're doing almost all the work for journalists yourself. I mean there's not a lot of capacity in the media world to be taking raw material and synthesising it. So, they're working on very tight timelines. So typically, we'll produce a number of types of communication assets, so those would be like pullable [Sic] quotes for them. Those will be like a backgrounder, which is essentially something that they can… that for print media, they can almost just pull directly. If they need to, just do a very quick article, it will be a series of Q and A's for journalists and it will be maybe sometimes a context setting piece. So, we'll do a bunch of, we call them communications assets, that position the piece and simplify it for media."

However, the extent to which researchers are able to implement these good practices, where required, is open to question, with Professor Jouni Paavola highlighting that with respect to tailoring communications "it's not unproblematic because many of us are time constrained and it requires more time and resources to do that. So, it's a constant struggle to actually invest enough in the normal academic communication" (Interview 4).

Open access
Several interviewees talked about the role of open access research in the context of KMB and research impact. For instance, Georgina Santos (Interview 6) stated that she sought to make

her research open access whenever possible. However, others spoke of their frustrations with publishing houses and the charges attached to having research be made open access. For instance, Daniel Henstra explained (Interview 12):

"the problem is with most of the open access is that it's ridiculously expensive...when you've got, say, a $50,000 grant and a journal article is going to cost $3,500 to publish open access, there's a huge opportunity cost, where we could fund a research assistant for the summer and basically we do. So, as much as I, especially some of these articles where I really think we'd get more traffic if it was open access, we just had to decide not to."

Professor Charles H. Cho was also critical of the role of academic publishing companies, stating (Interview 15):

"We are prisoners, you can use that term if you want, of the publishing process. The academic publishing process has completely taken over. When you look at the revenues they generate just by subscriptions of journals, which are less and less relevant in terms of the application itself because of online access…and then all the copyrights belong to them. They don't do any research work whatsoever, but everything belongs to them. I mean, it has become a mafia".

Researchers at the University of Exeter have sought to work around this issue via providing pre-publication articles to the public. Professor Stewart Barr explained this as follows (Interview 7):

"the way most of us get around the issue is that we place the pre-publication accepted article on to our University's institutional repository. So, all of the papers that I've published in recent years are all available. They're just not in the journal formats. They're not public in that sense, but they're a pre-publication, and that seems to be something that the university sector has negotiated with the big publishers. We can have it available; it just isn't as it looks like [when] published. The big challenge there, of course, is that people need to know that those university repositories exist so that they can search them…So that's the way we tend to get around it and it actually makes life much easier for us"

Seizing opportunities to engage research users

Several researchers referred to the role that external events can have in influencing the success of KMB efforts and the extent of research impact that occurs. Dr Philip Johnstone attributed this to the fact that impact often arises in a random or serendipitous way (Interview 5), whilst Daniel Henstra highlighted the role that floods in Quebec in 2017 had in determining the level of traction that his research was able to have, with the floods acting as a "focussing event" which gained the attention of the media, the public and government (Interview 12). Professor Charles H. Cho provided an example of how prior research can be revisited in response to current events, "Like my recent blog post. Those are papers that are published a couple years ago. So, I build on those findings to try to apply to the current situation, the current context" (Interview 15).

Reflection following the completion of a research project

All researchers were asked about the extent to which they conduct follow-up work, following the conclusion of a research project and associated KMB activities, to assess the success of KMB activities undertaken and whether research impact occurred. Professor Mark Reed explained how an increase in investments in impact and monitoring has "has innate value because we are now able to get formative feedback on our engagements and impact and learn from our mistakes" (Interview 2). A number of interviewees provided examples of how

feedback was sought during the course of the research. For instance, Daniel Henstra explained how his team sought to combine seeking feedback with communicating their research, during a project (Interview 12):

"what we're trying to do in the research, is…an iterative type of process where we tell them about what we found in the research so far but also get their feedback. So, what we're trying to do is educate as we go along, just on the things we've already found but at the same time by doing that, what we're doing is validating our assumptions and the findings that we're drawing from interviews"

However, with respect to follow-up work done following the conclusion of research, interviewees explained that they had either attempted the work but lacked the expertise to do it effectively (Interview 11), had not done the work but saw the value in doing so (Interview 5), had done some work but not enough, due to a lack of time and funding, and wished to do more (Interview 7) or lacked access to the information that is needed (Interview 13). Professor Mark Reed explained how this lack of follow-up work represents a missed learning opportunity (Interview 2):

"If we don't follow up and find out what went wrong as well as what went right then we can't course correct when things are going badly wrong and we can't make amends when we make mistakes because we simply don't know that we made a mistake and so for me, it's a moral responsibility that we follow up and find out what happened"

Professor Mark Reed then explained that in his experience, researchers explain their lack of follow-up work on the basis that they lack motivation, believe they lack the skill to do the work or they lack the time (Interview 2). However, in his view, there is a moral argument in response to the first objection (see above). With respect to a lack skills, researchers should (Interview 2):

"start with their disciplinary tools. So what tools do you use what methods do you use in your research day-to-day and now can you create an evaluation design as a research design and when you do that using tools you're familiar with if there are win-wins to your research then you'll spot them".

For those lacking time, Professor Mark Reed suggested that researchers create (Interview 2):

"a back-of-the-envelope version of their gold standard evaluation design, you're cherry-picking elements of them and using the social science conception of triangulation to put together what you have got time to do in a way that then checks different lines of evidence against each other where perhaps one of those individual lines of evidence may not be sufficient to convince an external audience. When you put all three or four together, this now becomes robust enough and now this could be an online survey, a case-study of one organisation, a couple of interviews and you're doing something that is still robust and believable. But that takes you days rather than weeks or months"

With respect to follow-up work undertaken by funding agencies, to confirm whether planned KMB activities had been carried out, some of the Canadian interviewees described current reporting requirements as "quite thin" (Interview 14) with "no back-end accountability" (Interview 12) meaning "no one's going to hold you accountable" (Interview 12).

Researcher attributes

Many interviewees spoke of their own motivations to undertake more KMB activities and for the need to acquire or demonstrate particular attributes to assist with KMB activities. This drive by researchers to engage society is particularly relevant because, as Dr Vicky Ward noted in her interview, stating (Interview 1):

"the societal discourse around academics and researchers is that when boffins who don't really make any difference and we would sit in our Ivory Towers. And the thing is that that rhetoric and that discourse is constantly produced and reproduced in a whole range of different social spheres"

Furthermore, Professor Charles H. Cho explained how, in his opinion, academia tends to disconnect itself from the rest of society (Interview 15):

"As academics, we talk a lot about the "real world", so, by definition we live in an unreal world? We live in virtual world and our own world - and that's a problem, right? That's a problem to see ourselves a bit disconnected and different than the others. And sometimes, it's so refreshing to be around non-academics and forcing myself to explain what I do"

Therefore, in order to try bridge this gap between research and society, Professor Jouni Paavola spoke of the need to conduct work that is respectful and humble (Interview 4). Furthermore, Jessica Blythe talked about finding "like-minded individuals" interested in going the "extra mile" (Interview 14). Daniel Henstra summarised it by stating (Interview 12):

"if you're going to be trying to communicate or mobilise knowledge that is found through this process, like we're doing, really rigorous research that hasn't been done before, but if we want to get that knowledge out and get it used, that people are going to have to trust us as a credible source of information or knowledge and not only that, but *like* us."

Finally, the potential contribution that KMB and impact work can have to a researcher's motivation and well-being was raised by Dr Philip Johnstone (Interview 5):

"I mean the impact work I'm doing at the moment; I'm not paid to do but it's the stuff that is the most meaningful stuff really. It keeps you going as sometimes you think, "what is the point of all this Academia stuff?" but when you're getting out there and you're debating and you're being in the news and things like that, it's really the exciting part of the job as well."

4.3.2 How is knowledge mobilisation being supported?

The findings from the content analysis provided above show that the level of support provided to researchers and types of support sought varies significantly. In this subsection, the study seeks to provide further detail via the use of relevant quotes from the interviewees, categorised in accordance with the literature review and content analysis.

Features of a "healthy" support system – additional literature

In his interview, David Phipps introduced and discussed a workbook that he co-authored titled 'Are you Impact Healthy? Institutional Healthcheck Workbook' (Bayley & Phipps, 2019). This workbook seeks to help organisations support and generate impact by providing them with a self-assessment checklist focussing on five key components, being:

1. Commitment

a. The extent to which the organisation is committed to impact through strategy, systems, staff development and integrating impact into research and education processes

2. Connectivity
    a. The extent to which the organisational units work together, how they connect to an overall strategy, and how cohesive these relationships are

3. Co-production
    a. How clearly staff within the institution understand: impact, how impact extends beyond traditional expectations of academic research, and their role in delivering impact

4. Competencies
    a. The impact-related skills and expertise within the institution, development of those skills across individuals and teams, and value placed on impact-related specialisms

5. Clarity
    a. The extent of, and quality of, engagement with non-academics to generate impactful research and meaningful effects (Bayley & Phipps, 2019)

Organisational culture

All researchers were asked to describe the type of support that they receive from their research organisation. This typically resulted in interviewees discussing specific types of support (e.g. training). However, some interviewees also provided general overviews. One interviewee described the level of support they receive as akin to "anti-support" (Anonymous, 2019) whilst another interviewee stated that their university "does not provide any support for achieving impact" (Interview 6). Conversely, another interviewee claimed that overall "I'm pretty happy with the support I've had" (Interview 5).

At a regional level, Professor Charles H. Cho explained that, "You publish in academic journals to make your promotion and tenure in North America to basically get a permanent job. So, anything that you do besides your efforts to do that is actually almost discouraged" (Interview 15). However, Jessica Blythe observed changes occurring, stating "I've gone from where they don't even want to hear me talk about it to [a situation where] they're actually supportive in principle of for example doing a radio interview or doing an interview with a local newspaper, that kind of thing" (Interview 14). Examples of perhaps a more developed KMB culture were observed elsewhere, with Professor Jouni Paavola, a Department Director, noting that "it's much easier to learn from your colleagues when you are in that kind of a setting [where strategies for knowledge mobilisation exist], and there's quite a lot of openness to do it" (Interview 4). In addition, Davinder Valeri, another Department Director, spoke of leadership's attempts to encourage KMB efforts amongst staff, stating (Interview 13):

"For us research starts with conversations, right? We believe in that strongly, so we create… we always say to everybody, "You have to go to a conference. You have got to go with what's going on. You have got to go talk to folks.""

However, Professor Mark Reed explained that creating a healthy organisational culture is dependent on actions (i.e. support) as well as words (i.e. communications) explaining (Interview 2):

"if as the university management, we don't make space for that, time for that, and put our money where our mouth is, in terms of the structures, the incentives, the workloads, etc, then whatever you're communicating around responsibility for researchers either sounds very hollow or sounds very unrealistic"

Reflective spaces and fora

Dr Vicky Ward identified the existence of shared, reflective spaces as a crucial feature necessary for a strong KMB support infrastructure at research organisations, stating (Interview 1):

"the really, really important thing is having a reflective space that you can actually work out what your approach is, what your understanding is, how you are going to go about your work and for that I think having other people is a key thing. So, for me, it's informal learning spaces, it's informal reflective space, it's peer learning sets where you're not trying to learn theory or practice or whatever but you're sharing experience. That I think is really, really important. There's an issue with that in that that's not necessarily valued as an activity and it's not… people don't necessarily feel that they have the space and the capacity to avail themselves of opportunities like that because you can usually find like-minded people but whether you've got a mission to do that or whether you feel that your organisational structure allows you the permission to do that, is a different matter"

Interviewees talked about spaces and fora to share knowledge in both an internal (within their organisation) and external (engaging parties outside of the organisation) context.

<u>Internal spaces and fora</u>

Several interviewees talked of the importance of internal spaces given that "people are so fragmented a lot of the time even though they're working on similar themes" (Interview 5) and "our tendency always is to be in silos. I mean we only know what we know, we don't know what we don't know right?" (Interview 13). The extent to which organisations help to create such spaces and fora differed amongst interviewees. Dr Elena Bennett stated that "there certainly are researchers who are reaching out to one another, but I don't I guess, feel like there are opportunities that are being provided in an institutional way" (Interview 11). Daniel Henstra spoke how his faculty organises (Interview 12):

"researcher mashups where they'll bring… They'll invite researchers from all the different departments, basically, anyone who wants to come, they just RSVP, to come and talk about one of those challenge areas, or how does their research touch on it. Or could they move into that space. And the hope is to build collaborative space for collaborative research. So, it's a way to learn about what others are doing, but also to in a way, potentially direct them towards something that is a priority for the government."

Dr Philip Johnstone talked about knowledge mobiliser groups operated by his organisation and how he approved of how they operate, stating (Interview 5):

"what I like about the way they've done it actually is that there's a lot of autonomy about what kind of activities you do, because I'm actually always thinking about things instrumentally, like institutions usually do, like we need to get funding. Actually, if you want to get funding, what you actually need is spaces that are a bit more relaxed, a bit more informal, these kind of things are really important to collegiality."

Other researchers spoke of their departments or organisations hosting welcome events where all disciplines are encouraged to attend (Interview 15), creating cross-functional groups (Interview 13) or interfaces to bring researchers together (Interview 4).

<u>External spaces and fora</u>

The importance of having external spaces and fora was articulated by Daniel Henstra when he stated his desire for his organisation to "set up events or opportunities and invite researchers or, work with the local researchers to identify some of these others in other universities in order to facilitate that kind of collaborative space. That would be useful" (Interview 12). An example of an externally facing fora was provided by Professor Jouni Paavola (Interview 4):

"we kind of try to make our research visible, in government bodies and all kinds of other fora. We also quite proactively try to create new fora for engaging with the research. One very big example of that is that we have created climate commission model, which we started on our own home turf in Leeds, and that entailed bringing together the city council, the academics, all stakeholders under the umbrella of a commission, which is effectively leading on and seeking to stimulate action on climate change"

In addition, Stephanie Cairns talked about how such spaces could be used to help direct future policy-relevant research:

"we do a policy symposium with academic researchers and it goes on kind of cycles… Sometimes they're about what are the major research questions that we need to sponsor funding on. And in those meetings, we'll bring together real academic researchers and mainly government people, but also key NGO thought leaders and business thought leaders, to each present, "What do we think the knowledge gaps are? What do we need to be doing more research on?" So, we're trying to influence the line of research by bringing in those policy researchers to make sure that's policy-relevant."

Dr David Phipps helped to outline what in his view constitute key characteristics of a good external facing "mix and mingle research opportunity" as follows (Interview 9):

"One is that we go out to our partners and say, 'What are you interested in?' So, it's not driven by the academy, it's driven by the needs of policy, industry or community. Two is we hold it off campus, not on campus, because we're really good at expecting everyone to come to us. So, we try and get our researchers and students off campus, so it's held in the community…If you want your research evidence to be used, you need to facilitate the uptake of evidence in the context of its use…Three, it is co-hosted by an academic and a non-academic expert. They don't necessarily have ever had to work together, but we have them making presentations. So, it's not all about the university pretending it knows best…The fourth element is 'how do we evaluate it?' The whole point of that is, did you talk to somebody you'd like to talk to you again? So, when we do our evaluation, we have a question that says, 'Is there anyone you'd like us…can we follow up with you in six months…the fifth element is hot food".

Interdisciplinary teams

A number of researchers provided examples of how their organisations had already, or are in the process, of establishing interdisciplinary teams and projects to facilitate knowledge sharing and solving of sustainability problems. Professor Jouni Paavola referred to food, water and earth observation related projects being established (Interview 4), Professor Stewart Barr spoke of three different sustainability-related institutes being created (Interview 7), Davinder Valeri

spoke of a cross-functional group (Interview 13) and Professor Charles H. Cho spoke of centres of excellence (Interview 15) being established within the business school at which he is based. However, Professor Mark Reed was quite critical of some of approaches to interdisciplinarity that he had observed, stating (Interview 2):

"what I think we're seeing is what I call the Tinder approach to interdisciplinarity were universities are recognising that to capture something you have to mobilise interdisciplinary teams, and matchmaking is done on the basis of CVs and expertise, rather than on the basis of personalities and values and when that happens you can have what looks like a marriage made in heaven that becomes instantly dysfunctional and the proliferation then of dysfunctional teams that have been put together on the basis of expertise without any appreciation of the dynamics that it takes to run a successful interdisciplinary project"

Organisational incentives

All researchers were asked whether their organisation provided incentives for engaging in KMB work. Some researchers referred to the existence of prizes in their organisations for researchers achieving impact via their work (Interviews 4 and 7) and KMB and research impact being included in promotion assessments (Interviews 4, 5 and 8). Dr Vicky Ward spoke of how she considered it important that incentive systems are aligned with researcher objectives, saying (Interview 1):

"I think it's about needing to align it [incentives for KMB] with people's own incentive system and own motivations as well. So, if you're motivated around promotion and you want to climb the career ladder, then yeah recognising promotion criteria and actually saying this has to be… this is an important thing. That's a way of doing it. If it's that actually people want to be getting money to do research, then you need to incentivise it within the research funding process"

In terms of annual performance appraisals, interviewees provided a range of experiences. For some, KMB efforts and impact criteria are important, with Dr Philip Johnstone explaining that "that impact work, that is essentially is some of the most important stuff really that I do and that's well recognised" (Interview 5). However, other researchers' experiences were rather different. Both Dr Elena Bennett (Interview 11) and Daniel Henstra (Interview 12) stated that the points based systems in their annual reviews prioritises publishing over KMB work, with Daniel Henstra explaining that "the incentive system is structured such that you spend all your time on trying to get peer reviewed articles and [therefore] knowledge mobilisation is a "nice to have" but not a "must have"" (Interview 12). Furthermore, Jessica Blythe spoke of encountering "disincentives" towards conducting KMB (Interview 14).

A further complication was highlighted by Dr David Phipps who explained that (Interview 9):

"What the problem is, is not the policies, but it's how they're implemented. It's that tenure and promotion committees don't know how to review this stuff. They don't know what the standards of excellence are when they see this. So, researchers don't put it in, and committees don't ask for it. And when they see it, it's not weighted and not ranked"

Training

Whilst many interviewees were able to identify some KMB-related training being provided by their organisations, many also identified the need for additional training. Professor Jouni Paavola spoke of the need for early-career training to be provided, focussing on participatory methods and the need for the training that is provided to be more systematic (Interview 4). Daniel Henstra identified separate training on effective KMB practices (Interview 12) and

Stephanie Cairns supported junior researchers being provided training on how to tailor their communications for policy-makers (Interview 16), whilst Jessica Blythe provided a few examples of questions that training might seek to address, including "How do you engage on social media effectively, for example, how do you engage with members of the public that are not on social media and not in the academy? For example, how do you actually get out and give a good talk to the public that's not an academic talk that is annoying to everybody in there and it's not useful?" (Interview 14). However, Professor Stewart Barr identified a possible complication with providing training researchers, explaining that (Interview 7):

"I think, probably, we are a profession that is not particularly welcoming to being trained, because we're academics. So, we're very protective of our freedom, I think. So, it is there but it's not as systematic as you would find in a commercial company, for example."

External communication

Several interviewees spoke of the support that they received from internal communications teams based at their organisations. This support would often take the form of using social media, newsletters, creating policy briefs, preparing media releases or converting research into more simplified language. However, Stephanie Cairns went on to explain that in certain contexts such communications support can require significant resources (Interview 16):

"we're in a very challenging environment in terms of both the traditional way that we are used to working, but also the resources to do that type of work. Communications work is expensive stuff, you know? I'm always in projects where there's 80% of the project for research and then there will be 20% left over for communication. And we have to kind of go back and say, "If you want to really communicate this, it has to be more like 50/50.""

Several interviewees also spoke of the role that their organisation's website played in helping potential research partners to identify relevant researchers. For instance, Professor Stewart Barr explained spoke of how his organisation's website had helped facilitate introductions (Interview 7) whilst Davinder Valeri spoke of how CPA were undergoing "a huge digital optimisation program right now on how best to make sure our member knows where to get the information that we're working on" (Interview 13).

Dedicated KMB and impact personnel

A number of interviewees spoke of their desire to have dedicated KMB and impact personnel at their departments, whilst others spoke of having already benefitted from their support. Davinder Valeri talked about the need for a coordinating function that could help align the objectives of different departments within the organisation and have them work together to improve KMB efforts (Interview 13). Jessica Blythe identified extra KMB personnel as way in which her organisation could provide additional support, stating that "I know that [at] Brock [University] there's one formal knowledge mobilisation person and she is the only person for us to access at a university that's twenty thousand undergraduate students. So, I would like to see more positions at the University" (Interview 14). Professor Charles H. Cho stated that he would like to see a department established which provided KMB training to researchers and helped tailor communications, stating that such a department would be "revolutionary" (Interview 15). Elsewhere, several researchers spoke positively of the support they have received from such personnel. Professor Stewart Barr explained that at the University of Exeter (Interview 7):

"the university here has changed and reconfigured its research support so that there are now two sort of equally large elements. One of which is called "Research Services" which deals with

the kind of pure research and the other one is called "Innovation Impact and Business" … They also act as good mediators particularly if you're working with businesses. They have the expertise in terms of managing those relationships that someone like me who is an academic, doesn't have"

Similarly, Dr Philip Johnstone explained how an impact officer at University of Sussex was able to support his research team (Interview 5):

"we submitted evidence to the BEIS [Business, Energy and Industrial Strategy] Committee, who are doing an inquiry on financing energy infrastructure, and…basically the impact case has formed into a fully-fledged thing because what happened was we have now an identifiable change [Ministers of Parliament called for an inquiry]…that wouldn't have happened without the evidence [we produced] and that was again [due to] encouragement from Charlotte who is the impact coordinator, who's looking out for opportunities to submit evidence and sort of helping tailor things in the language of impact"

Stephane Cairns provided an insight from someone who performs such a role for researchers, explaining (Interview 16):

"So because we're supporting their longer-term research, if we call them [researchers] up and we say, "We're having a meeting with a minister", or "We're doing it op-ed and we're really looking for a credible academic to be the name on the op-ed even if we're ghost riding it." We have that relationship with them and we're able to call them in and they're really interested in that. For them there's a lot of value for that."

However, Dr Vicky Ward highlighted concerns with having knowledge brokers (Interview 1):

"I think that we need to take out the middle people a lot of the time because I think it does often put in another barrier and can see the people not as people who are helping are kind of brokering knowledge, but people who are helping other people to broke their own knowledge. So, I think that there is a massive risk with the whole brokering rhetoric and in having designated brokers"

Time availability

A key barrier to engaging in KMB activities identified by many interviewees was the lack of time available. When asked what her organisation could do to support her more, Dr Georgina Santos answered (Interview 6):

"By reducing our teaching load, but Cardiff University is in debt so instead of hiring people they are making redundancies. Those left have to teach more and there is no time for research, let alone for impact. In other universities the story is not too different, to achieve impact one needs time and time is what we don't have with teaching and administration/service"

The need for more time for KMB activities was echoed by Dr Philip Johnstone (Interview 5):

"I have applied to have 10% of my workload from September to be impact. That's something they've brought in just in the last year after kind of a lot of kickback from academics saying, we don't have time to do all this impact, we need some time. So, the thing that is missing is dedicated time in the workload model to be able to do it because ultimately, that's kind of the most important thing is that everyone's overloaded"

Linked to the time issue is an apparent increase in the number of responsibilities that researchers are expected to carry out, with researchers expected to perform a number of roles to a high standard, with Tom Hargreaves explaining that "I think there needs to be less of an emphasis on everybody doing everything" (Interview 8). When asked what additional supports his organisation could provide, Professor Stewart Barr highlighted the interplay between the time available to researchers, organisational culture, the current incentives and expectations that exist (Interview 7):

"I would say that probably the best support that you can have is probably not to be encouraged to continually apply for more and more grants and do more and more projects, but actually to focus in a more dedicated way on a smaller number of ideas and projects, but to do so in a much deeper way, because I think that the kind of support I would like is for somebody to say: 'actually, take another year over this, we will work with you on that one project. We don't expect you to run off and generate another 200,000 pounds, but just slow down and do the thinking and the impact that's required to make this a much richer project.' Because I think that what the mistake people make is that they believe that activity is equivalent to impact. I think most of us working in the area of sustainability would probably admit that we very rarely get time to think about what we're doing because we're under a great deal of pressure to publish, to publish quickly, to generate more research income. So, what happens is the ideas are never that original. They're never that stunning, because you don't really get the time to cultivate them. So, I think actually, a bit like slow travel, slowing down, thinking a lot more, perhaps fewer outputs, but better outputs, and less volume of impact, but better quality of impact. I think that's where I'd like the support more than anything really, is to be given permission to do that"

However, Professor Mark Reed offered a different view of the time pressure often cited by researchers, stating (Interview 2):

"I'm going to take a very controversial approach to this because this is the number one barrier that I'm going to call an excuse rather than a barrier okay? I'm not going to overplay my hand here because I accept that none of us have this time and none of us have enough time to generate all of the impacts that we might want to however, I think that we have a lot more agency than we think when it comes to time. So yes, it is important that there is a certain level of support but for me that doesn't have to be that high a level…

…I would say that the ultimately then you are in charge of your own time academics love to complain that they're too busy. They love to complain about the number of hours that they work but most people looking in would die to have the level of flexibility and freedom that we have in Academia and I would argue that whilst we may be more caged-in than we've ever been before, that we still have more freedom and flexibility for the vast majority of other people and so my questions to researchers who say that they don't have time is, well how big a priority is impact to you?"

4.3.3 What other matters need to be considered?

The final questions asked in each interview centred around matters interviewees thought needed to be raised and considered when discussing KMB and research impact. A selection of the most frequent or relevant comments are documented below.

Forming expectations

Several UK researchers, who are working in an academic environment where the impact agenda has existed in a formal way, via the REF, expressed concerns about what is expected of researchers. For instance, Dr Georgina Santos stated that (Interview 6):

"I think that we have gone too far. Too much is being asked from researchers. Publishing the papers and getting them on open access for the world to see should be more than enough. There is too much pressure on researchers to cause impact and demonstrate that impact"

Dr Philip Johnstone appeared to echo this, stating (Interview 5):

"I think it's getting a bit out of hand because ultimately the problem pervading all of this and, with knowledge mobilisation academics being more in public or tweeting or blogging or whatever it is, is that the downward pressures from how universities are changing and just the bureaucracy and the daily struggle to find any time. Unless you kind of address that systemic problem, you can't just keep on having more and more metrics of impact or mobilisation because people will get ground down and they are. So, there's a cultural problem certainly in British universities of overwork and that will ultimately be to the detriment of knowledge mobilisation."

Looking forward, Professor Jouni Paavola raised his concerns that uniform benchmarks might be applied (Interview 4):

"what I would find problematic is if there's a uniform expectation that everybody is measured on the impact side and there's some kind of common benchmark that people have to try and aim for because people are very different. I'm not myself a person who is best placed to have significant impact and I don't see myself as somebody who's going to the extreme to try and have it, and I'm kind of grateful that I do have colleagues who do that because the kind of level of the institute/the school there is enough of that going on so that we can collectively-speaking demonstrate evidence, significant activity and real impact but on the other hand it is unevenly distributed"

The need to acknowledge the different conditions under which different researchers operate under was echoed by Daniel Henstra in Canada, who stated (Interview 12):

"I would say what we would probably find if we did some kind of [KMB] assessment is high variability between fields, between types of research topics, disciplines maybe, and that you could do a more targeted approach to levelling up so to speak for those disciplines or researchers who aren't doing very well with knowledge mobilisation, or maybe where it's not part of their research tradition, you can try to level them up to a more acceptable standard"

Elsewhere in Canada, Jessica Blythe pointed out that this variability was already considered at her organisation "within the Academy, we acknowledge that there are different levels of time and effort required for different disciplines" (Interview 14).

Resistance to sustainability

In two of the interviews with Canadian researchers it was explained that the word "sustainable" was limiting researcher's ability to engage with potential stakeholders and research users. Stephanie Cairns explained that (Interview 16):

"we actually rebranded the whole name of our organisation a few years ago. We used to be Sustainable Prosperity and after we had… a lot of communications research was done, and we

had some polling done for us and we found that…. we got told pretty clearly that… and for me it was unbelievably offensive but anyway…. that we were shutting off a whole audience just by saying the term 'sustainable'. And that if we were really trying to influence a primarily non-environmental audience, like a mainstream policy business community, we ended up choosing the term 'Smart Prosperity' instead. Because we could still make this 'to be smart is to be sustainable' [pitch]. But we pulled them in with the term 'smart' whereas the term 'sustainability' branded us as green right out of the gate and we weren't even into the conversation."

Similarly, Davinder Valeri explained encountering resistance in her role, explaining that messages had to be framed differently in order to remove the "stigma" (Interview 13) associated with discussing the environment, in the context of her organisation's members/research users, explaining that (Interview 13):

"For us sustainability was not something that people could get behind easily. Number one they could not understand what it was and two, when you're trying to put research dollars on something, there was zero support, because there are other issues that are much more important, they take a higher priority"

Competing interests

A number of interviewees acknowledged that sustainability research often encountered competing, vested interests, as summarised by Dr Philip Johnstone who argued that "addressing issues of power in sustainability research in general of absolutely crucial and it is because you've got huge, powerful vested interests that stand to lose from, different ideas of sustainability" (Interview 5).

Many interviewees were able to share such strategies for dealing with the challenge of competing interests. Professor Jouni Paavola explained that (Interview 4):

"It's probably true [that there are challenges for sustainability researchers with respect to competing interests]. But then again, it just means that you have to think harder what you are doing, how you are doing, with whom you are doing we are doing [research]…So you can always choose with whom you are playing the game…[researchers therefore need to] find your collaborators and work with those who are more willing to take your message home or who might benefit from [you] helping [them]. If you want to really have an impact and you are basically delivering a difficult message you have to be quite clever about how you do [it]."

Other interviewees referred to there being a number of companies wanting to be "green" (Interview 11) or at least trying to acquire a public relations image that makes them appear to care about sustainability (Interview 6) and who are therefore seeking to engage with researchers. Alternatively, researchers could seek to conduct "some salesmanship or some marketing to try to persuade that there is a better way of doing things" (Interview 12).

Finally, Stephanie Cairns explained that one central strategy was for researchers and campaigners to connect their research and messages to "mainstream imperatives", stating that (Interview 16):

"The world is facing an absolute crisis and we need to act very quickly. At the same time my experience has been, in the way of where our organisation has ended up going, is that we need that in the public discourse and it's mobilising a lot of individuals. It's certainly nipping at the heels and putting pressure on corporates, some governments, in terms of behaviour, but it's

not likely to be the conversation that's going to lead to the constructive engagement you need. Because even if people are sympathetic to you, they get end up being pinned between, what I call the kind of mainstream imperatives that are deeply embedded and that are very difficult to overturn. And it's very hard for them to just kind of, step completely out of that space and get a mandate to work very hard on something that's not connected to those deep imperatives. So, the space that we work on is a space where we are really trying to connect that urgency narrative to those deep narratives"

The question of whether sustainability research has it harder or easier than other fields of research was discussed with Professor Mark Reed, who stated that "every discipline has its own sob story as to why it's harder for them to generate impact than anyone else and the reality is it's hard for us all and as easy for us all, it just depends on context" (Interview 2).

Research threatened by the impact agenda

Several interviewees provided examples of research that have the potential to be adversely affected by an increased focus on KMB and research impact. Dr Georgina Santos stated in her interview that in her experience "some splendid research grant applications don't get funded because the applicant did not provide enough specific detail of how his research was going to cause impact" (Interview 6). Professor Mark Reed explained that, with respect to the UK, he is (Interview 2):

"concerned about research quality as well as concerned about conflicts of interest as researchers are increasingly expected to work hand-in-hand with government and business…

… the latest funding streams that we see, that may offset what we [UK researchers] lose, if we lose access to EU funding, is highly instrumental and with political strings attached and never before have we seen such politically motivated funding streams"

Professor Jouni Paavola acknowledged that "there are messages that are more difficult to sell than others" (Interview 4) and gave the example of de-growth research, which is an important field of research but which for obvious reasons might struggle to achieve impact in our existing growth-orientated economic and political system. Professor Jouni Paavola went on to explain the dangers that therefore arise as a result of the impact agenda and KMB focus (Interview 4):

"there is a limit after which you could say that if that is all that we do, I think something is going to be lost. So I don't think everybody needs to be interdisciplinary, not everybody has to do kind of impact-relevant research because there is also, critical research and kind of blue sky stuff kind of work which might not have great potential for having impact but it might nevertheless be very, very valuable and needed"

This concern, that some types of research might be side-lined as a result of a focus on KMB and impact, is perhaps ever greater given that research funding may be increasingly prescriptive in the future. Avril Allman, NERC, explained that (Interview 3):

"The funding we are giving out is getting much more targeted towards certain questions…

…More and more of the grants and funding we are giving out now are very much managed and will be a lot more managed in the future. Including ensuring impact is coming out from those grants…

…There will be various governance boards, program executive boards, that will meet with the grant holders to ensure that everyone is doing what they say they were going to do. And there will also be a program level knowledge exchange plan for example, and there might be interim workshops and final events to make sure that the outcomes get out to policymakers and everyone else. So, they are much more managed, and we are moving much more down that route of more and more managed programs. And impact is a very, very important part of that"

Advocacy dilemma

A majority of interviewees were asked about the advocacy dilemma and their responses were consistent, with one minor exception, such that the question was not asked in later interviews. For Dr Philip Johnstone, the advocacy dilemma "is the one we've encountered time and time again" (Interview 5) leading to situations where engagement can cause hesitation, for instance stating "I do think sometimes when I'm doing these tweets and so on is that, how am I going to appear?" (Interview 5). However, the view shared by Mr Johnstone and many others is that advocacy is legitimate when based on evidence. As explained by Jessica Blythe (Interview 14):

"My perspective is advocacy that is based on a factual base and based in research is absolutely part of what our role is as scientists and particularly as science becomes more critiqued and less trusted, that scientists, particularly sustainability scientists, are very vocal about what we're doing, about what the challenges are, about what the opportunities are, to me that's sort of how I define advocacy and I think that absolutely part of our role"

Furthermore, Professor Jouni Paavola explained how he felt a certain degree of advocacy was difficult to avoid and that having an agenda can be beneficial or necessary (Interview 4):

"My take on it is that you actually do need to be committed, you need to have an agenda to do good research, I mean, that's what mobilises you and motivates you to do research and if you find impartial "cool cookie" sustainability research, that's quite a marvel. It doesn't mean that you bend your research. You still have to do your research to high academic standards and the academic peer review processes and other quality processes, making sure that your research can stand up to scrutiny."

However, Stephanie Cairns did explain that from her experience that being an advocate can still be seen as harmful to a researcher's credibility, explaining "when we engage with public policy decision makers, we're seen to be both more credible, but also safer. Even if our message is the same, we're more credible, therefore we're suspected less of being advocates, as opposed to researchers" (Interview 16).

Research organisations

The way that research organisations are structured and operate was raised by several interviewees as something that will need to be reassessed as a result of the focus on KMB and research impact. This was summarised by Professor Charles H. Cho who stated (Interview 15):

"I think if we're going to rethink our job description, sort of, not rethink fully, but reconsider or revise it, then maybe the structure of a business school should be rethought as well. Because maybe we should have a different organigram. A different structure. The leadership or the staff, what kind of people should we hire? Should we hire those experts in communication full time to do that for us?"

This is particularly important because the changing political and cultural context is now exposing limitations in the traditional model that research organisations have operated under. Stephanie Cairns shared her observation of changes in the Canadian context (Interview 16):

"I think a lot of our research organisations are based on a model of influencing that's starting to fragment. At one point or another I've worked with most of the major environmental think tanks in Canada. And they've all been formed from their initial thinking model. It has always been that, you do good research, you have strong networks with a small group of decision-makers, and if you can kind of be a trusted advisor to those decision-makers you're going to be able to influence policy that way. So, a very elite backroom model of thinking about how public policy changes. And clearly what's happening right now is, as we move to a lot more populist models of how big issues are shaped, that elite model just doesn't have as much potential. And I think it's a real issue to grapple with. I don't have the answer, but as policy institutions, how do you engage in that more populist communication, including the fact that a lot of it isn't evidence-based anyway?"

Funding agencies

Some interviewees were asked how they think funding agencies could adapt in order to help researchers' KMB efforts. Professor Stewart Barr explained his concern that funding agencies understanding of KMB and impact was too limited, stating that (Interview 7):

"sometimes the research funders have a linear view of the impact, which is that you come up with a world-class idea, you get the money to do the research, you publish the research, and then you go out and you produce impact. On a given day, the impact ends, and the whole thing is over, because the world doesn't work like that. I think that that again is something that culturally needs to probably change"

Furthermore, Jessica Blythe added that "research funding agencies are still kind of grappling to get their head around how you fund interdisciplinary research and how you track the performance and impact of it" (Interview 14).

5 Discussion

This section seeks to integrate the literature review and analytical framework with the findings from the analysis of the interviews and the Springer Survey. In doing so, it identifies key themes, areas of focus and potential pitfalls for future approaches to KMB.

5.1 How is knowledge being mobilised by the sustainability research community in order to achieve societal impact?

The KMB practices reported by sustainability researchers were broadly consistent with the literature review and the analytical framework. However, the interviews revealed matters that need to be considered concerning their effective use. These are discussed below.

Acknowledging that KMB is more than just dissemination

It is apparent that for many interviewees, the way KMB is both perceived and conducted within sustainability research is changing. KMB has often traditionally been viewed in a linear way, with research conducted and the results disseminated to research users at the end. However, as Dr David Phipps explained (Interview 9):

"it's a very simplistic understanding of how to make impact…if you want to maximise the opportunity for your research to have an impact, you do that by working in collaboration, not by just disseminating it…it's the predominant paradigm because it's what people can understand. But it maintains the silos of research evidence creation and the use of evidence."

Instead, what this study has shown is that KMB is hugely diverse, complex and occurs at all stages of the research process, from research design to post-completion, with some KMB practices specific to stages, whereas others apply to all stages (Figure 8). This represents a challenge to researchers and organisations, as it highlights the need to incorporate KMB best-practices and types of support in a comprehensive and coordinated manner, otherwise poorly executed KMB activities could undermine good practice elsewhere in the research process.
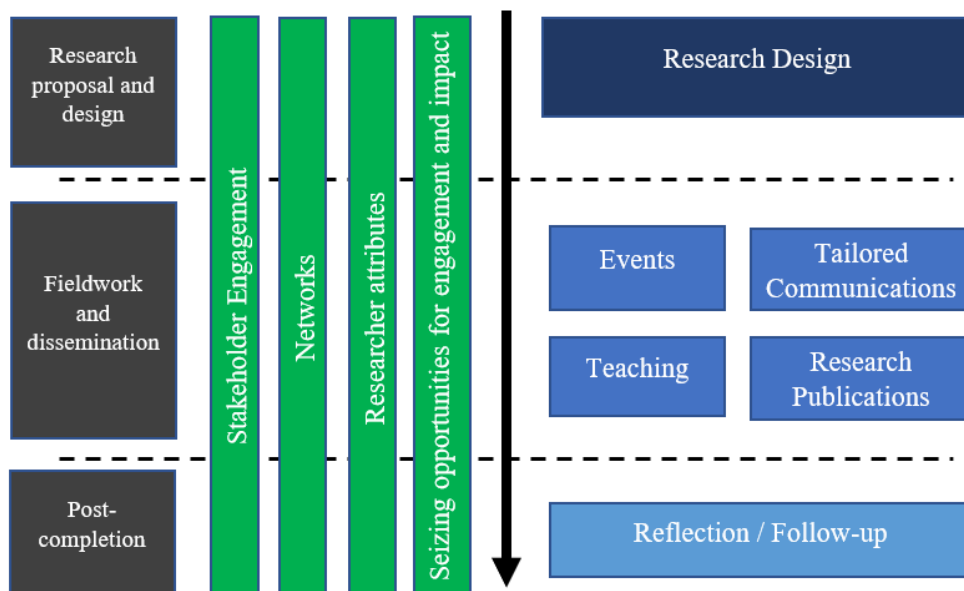

Figure 8 - Categories of KMB practices identified in interviews in accordance with relevant stages of the research process

Responding to the growing importance of communication

The interviews and content analysis revealed the importance of tailored communications amongst those interviewed, whilst also highlighting the diverse range of practices available to researchers seeking to tailor their communications, with 21 different practices identified. Interviewees claimed on average to employ 5 practices[3] that would be categorised as tailored communications, whilst the comparable average from The Springer Survey was 3[4]. However, the interviews also highlighted the challenge for researchers in tailoring their communications, with even seemingly straightforward practices like using simple language identified as being difficult (Interview 12) and time-consuming (Interview 16). Furthermore, particular aspects of communications work (e.g. infographics, videos, press releases etc) require skills that one would expect go beyond the typical skill set of a researcher and point to the involvement of other personnel in the communications process. In addition, several interviewees flagged the importance of repeating messages over long periods. The extent to which this is actually possible, when researchers operate in a system which encourages researchers to chase new funding and move onto new research projects (Chubb & Watermeyer, 2017), is open to debate.

Some interviewees warned that communications are becoming increasingly important and demanding larger shares of research budgets (Interview 16). In fact, the variety and complexity of tailoring communications may point to the need for researchers to be provided with support from their organisations, in the form of training and assistance from dedicated external communication teams. However, there is the possibility that, even if large resources are devoted to the communication of research, this KMB approach may be unsuccessful. As pointed out by Tom Hargreaves, "we can mobilise knowledge until we're blue in the face, but if people don't want to listen to it or hear it, it's irrelevant" (Interview 8). As such, when we speak of the need for researchers to tailor their communications, we need to also consider what those on the other side of the conversation are doing to engage with the communication. The literature review identified the values and expertise of research users as a factor that can influence the success of KMB efforts. Whilst it is important that researchers tailor some communications for the audience they have, rather than the audience they want, it would seem fair to also demand high standards from the audience themselves, in terms of their openness to research recommendations, their ability to understand and value the science involved (even if it's at a high-level) and a willingness to question their values.

Furthermore, it is reasonable to question whether tailoring communications beyond a certain point actually dilutes the quality of the conversation that the underlying research is seeking to contribute to. For instance, one common approach for tailoring communications is to simplify the language used, sometimes referred to as "dumbing down" content (Hyland & Salager-Meyer, 2008). There is a risk that if such an approach is pursued, it could eventually lead to a loss of nuance and detail from a debate that should not be reduced to slogans and soundbites. This is a particular concern given the crisis that modern-day journalism is facing, with many media outlets increasingly unable to devote sufficient time and resources to interrogate claims and increasingly dependent on material provided by public relations teams and outside sources (Davies, 2009). Whilst the causes of the crisis in journalism are numerous (Zelizer, 2015) one cause which is relevant to this discussion is the loss of trust in journalism that has occurred as a result of sensationalised coverage and 'clickbait' stories geared towards attracting clicks from online audiences in order to boost metrics necessary for online advertising income (Brants,

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[3] 56 examples of tailored communications /11 interviewees = 5.09

[4] 291 responses less 6 responses marked 'None of the above' less 46 responses relating to open access research / 88 respondents = 3.3

2013, as cited in Fink, 2019). Given the importance of the media in the communication of research and that many incentives for impact are currently imposed from above, there is a risk that researchers and organisations succumb to the same pressures and fall into the same traps, undermining research quality and crucially, trust in researchers as a profession. One study looking at the UK and Australia has already claimed that "the hyper-competitiveness of the HE [Higher Education] market is resulting in impact sensationalism and the corruption of academics as custodians of truth" (Chubb & Watermeyer, 2017, p.2360). This is particularly worrying because a recent UK poll (Ipsos MORI, 2018) shows that professors and scientists are amongst the most trusted professions in the country, whereas journalists were towards the bottom of the rankings, with advertising executives the least trusted professionals. In a Canadian survey (Insights West, 2018) scientists and teachers (which as a category appears not to have been separated from academia within the survey) were listed as some of the most trusted professionals. As such, researchers occupy a privileged position in society in the UK and Canada that they must be careful of protecting when conducting KMB activities.

Including KMB practices from the beginning

Another category of KMB activities identified in the analytical framework and shown to be popular amongst the researchers interviewed, was the inclusion of KMB within the design of research projects. Both the literature and interviews reveal practices which researchers can seek to implement in order to follow best practice. Particularly popular activities were co-producing the research design (e.g. co-creating research questions), developing KMB plans, conducting audience analysis, stakeholder mapping and creating communication strategies. A common theme amongst all these activities is the involvement and consideration of stakeholders, who need to be identified, included and listened to. This is apparent if we look at the guidance for proposals to the European Commission's Horizon 2020 programme, referred to by Professor Jouni Paavola as the "gold standard" (Interview 4) with respect to research impact. The guidance provided by M. Reed, (2017) for submitting a Horizon 2020 proposal identifies three criteria for a good proposal, two of which relate to stakeholders, being the need for well-targeted stakeholders and credible impact plans which can be pursued with stakeholders. As such, good practice could perhaps best be framed in terms of inclusivity, respect and humility. As summarised by Dr Vicky Ward, the knowledge mobilisation expert (Interview 1):

"I think that's [humility] really, really important, because otherwise, we're just, we're going for this very push model of knowledge transfer really, where I've got knowledge and you haven't and I'm going to give it to you whether you want it or not and that for me again is not respectful and it's not respecting the different bits of knowledge that people do actually have"

Acknowledging that stakeholder engagement is important but complex

The importance of stakeholder engagement continues after the research design is concluded. Interviewees identified the need for early and frequent engagement, which is inclusive, comprehensive and involves co-production. However, similar to the discussion regarding tailored communications, it is apparent that the effectiveness of this KMB activity can only be partially influenced by researchers themselves and is to some extent also dependent on other parties. As summarised by Tom Hargreaves, "impact is a two-way conversation" (Interview 8). Therefore, researchers may need to be strategic about who to engage with. With this in mind, Professor Mark Reed has pinpointed four key matters researchers should consider when seeking to engage. However, these good practices and the strategic thinking discussed may in fact represent a significant amount of work on their own (for instance ensuring that research is suitably representative and understanding the power relationships that can exist may be very

complicated) and the skills necessary to it need to be taught to researchers and then supported if it is to occur.

Creating and engaging in networks which assist KMB

Although the literature advocates for the role of networks in aiding KMB, there was often little accompanying detail as to how a network can be effective. The interviews managed to identify key characteristics of networks and examples of networks that they valued, to the extent that the capacity building feature of networks was cited as the joint most popular KMB practice. However, many interviewees also gave examples of networks that they had participated in which were not valued. As such, whilst the potential of networks to assist KMB is apparent from interviewees experience, we need to be careful when advocating for the use of networks and devote time and consideration to how the network should be structured and operate in each situation, whilst allowing the network in question to change over time in response to the needs of the researchers who are members of it.

Understanding that the importance of open access is overstated

Several researchers expressed dissatisfaction with the cost of providing open access to academic research. Their dissatisfaction appears to be shared more widely, as academic consortiums in Germany and Sweden chose not to renew their subscription contracts with Elsevier, the global publishing company, when they expired on 30 June 2018 (Kwon, 2019). Furthermore, in 2019, Norway also cancelled its subscription with Elsevier due to open access concerns (Qureshi, 2019). The decisions taken in these countries might be a sign of things to come in the UK and Canada. However, although increasing the number of open access research articles might increase the likelihood of research impact, by increasing the likelihood that research reaches intended research users, we can question how beneficial this will be, from a KMB perspective. As shown in both the literature review and in the interviews, KMB goes far beyond just research dissemination, and as such making research open access will not address the other issues raised (e.g. research design, stakeholder engagement). Furthermore, a common critique of academic journals is that the language used is too complex and contains too much jargon. If the research that is made available via open access is not amended or tailored to the communication needs of research users (i.e. it retains the existing, opaque journal format and terminology) then this problem will remain and thus any increased research impact will be limited.

5.2 What processes and types of infrastructure exist to support sustainability researchers in order to mobilise knowledge?

The study began by asking what types of support is currently provided to researchers and what types of support do researchers need. The interviews identified a range of answers which were largely consistent with both the categories of potential support identified in the literature review (although often relating to non-sustainability fields of study) and the types of support identified in the Springer Survey. The consistencies noted and the absence of a framework in the literature, enable us to propose a new framework for capturing types of support provided to sustainability researchers. These supports are framed in terms of whether they are primarily internal to the research organisation or are externally facing (towards research users and funding agencies), whilst three categories of support in particular appear suited to bridging the gap between academia and research users. This framework is shown in Figure 9 below:

Internal	**External**
Culture Funding Incentives Internal spaces and fora Time Training	Secondments and exchanges External spaces and fora

Connecting researchers with research users

Communications teams
Dedicated KMB and impact personnel
Interdisciplinary research teams
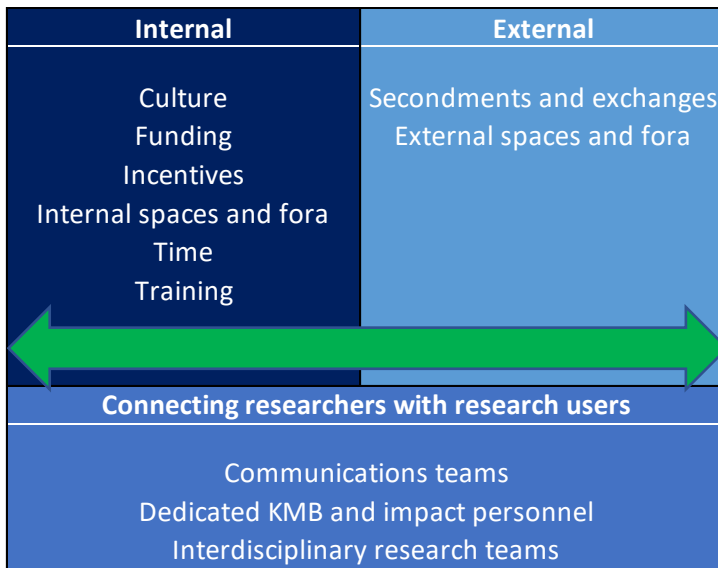
Figure 9 – Framework of organisational support for sustainability researchers

As stated in the methodology section, the approach taken to the content analysis means that it is likely that the results presented understate the level of support sought by researchers, as only explicit requests were recorded. However, the need for greater support for researchers is evident in both the responses to The Springer Survey, where 22 respondents (25%) stated that they receive no support from their organisations (Appendix 8) and a recent study (based on a survey circulated to over 600 established researchers across various academic fields) which found that "institutional recognition of engagement activities is perceived to be undervalued relative to the societal benefit of those activities" (Singh et al., 2019, p.1).

Providing time and alleviating pressure

As shown in Table 5, additional time was the most commonly recorded type of specific support sought. However, this perhaps does not illustrate the severity of the issue, particularly in the UK. All five UK researchers referred to not having enough time to perform all of the tasks demanded from them. These concerns are borne out by a troubling recent study released by the Higher Education Policy Institute which found "an escalation of poor mental health among university staff in the period 2009 to 2016" with the main causes including "excessive workloads and workload models which frequently under-count time necessary for fulfilling tasks" (Morrish, 2019, p.9) and that "audit and metrics dominate the working lives of academics. These are driven by the need to comply with external nationwide audits, such as the Research Excellence Framework" (Morrish, 2019, P.10). However, we also heard from Professor Mark Reed that in his view, claims of a lack of time are often more an excuse than a barrier. As such, it is important that we learn to distinguish between genuine complaints and those which are less justified. Therefore, whilst this study has identified a number of KMB activities that researchers could potentially undertake to increase the chances of achieving impact with research, any steps taken by funders or organisations to encourage the uptake of these activities have to be accompanied by a supportive environment that prioritises researchers' well-being and acknowledges the level of demands already being made upon researchers' time.

Allocating funding

In addition to time concerns, several interviewees cited the need for funding to be provided in order to pursue KMB activities. Funding touches upon all categories of potential support

identified in the study. This study has not sought to assess whether university resources might be better allocated towards particular types of KMB-related support for researchers and as such, it is not possible to make recommendations as to how universities limited resources should be allocated. However, this study should nonetheless help future discussions between researchers and organisations regarding their approaches to KMB. Firstly, it can outline the types of support potentially available and highlights examples of how researchers are already benefitting from those supports. Secondly, in outlining the extent of activities and support necessary for a high-quality KMB environment, the study is showing the scale of the investment that may be required. The level of investment required may well be beyond what organisations have budgeted for or anticipated. However, we have to acknowledge that the funding available to organisations is to varying degrees determined by political, economic and cultural forces outside of their control. As such, KMB support will often require a cooperative and constructive dialogue between research organisations and funders, as explained by Paul McArthur from the McConnell Foundation (Interview 10):

"I think both the producer of knowledge and the funder are responsible for KM[B]. Producers of knowledge need to design this into their approach and advocate for its importance. Funders need to understand the importance KM[B] to the change they are looking to support, and need to be aware that this should be built directly into the funding from the start"

Prioritising support

As highlighted by the literature review and interviews, there are various types of support that organisations could look to provide or enhance, beyond additional funding and time to conduct KMB activities. The most common type of specific support cited in the interviews was assistance from external communications teams (see Table 5) and the same was true in the Springer Survey (Appendix 8). Given that the study was able to identify 21 different types of tailored communication practices and identify the increasing importance of communication with respect to research impact, it is perhaps not surprising that external communications teams can play a vital role in KMB and research impact. However, this study does not explore what constitutes a competent communications team and what degree of support from such teams could be considered sufficient. Furthermore, we need to remember that communication involves multiple parties. In simple terms, there is the speaker and the listener. This study has predominantly looked at what researchers and their organisations (i.e. the speaker) can do to adapt and improve their message. However, there is a risk that that, even if KMB best practice were followed and large investments were made, messages would fail to have an impact if researcher users (i.e. the listener) lack the necessary competence or are not willing to engage with open minds and in good faith. Furthermore, there is a need to consider the role that the media plays, as a powerful communications intermediary, in selecting and framing what messages are delivered to research users (Burchell, Franklin, & Holden, 2009).

An alternative form of support identified by interviewees is dedicated personnel to help with respect to KMB and impact. Only four interviewees stated that they receive the support of dedicated KMB and impact personnel but three of those interviewees spoke positively about the role that these employees had played, with one interviewee (Interview 5) claiming that an impact officer had been critical to the impact that his team's research had achieved. Perhaps crucially, given the time pressures discussed above, these employees present an opportunity to lighten the burden being placed upon researchers, whilst enabling the involvement of specialists who can be expected to perform strongly in an area where researchers might lack the relevant skills required. However, employing such personnel will add to the cost pressures that research organisations face.

Finally, one form of support likely to include fewer financial resources, but which can assist KMB, is the creation of spaces and fora, both within an organisation and between an organisation and external parties. Interviewees highlighted a number of initiatives in operation to help bring together researchers from multiple disciplines to engage in discussions about sustainability problems. Furthermore, Dr David Phipps identified five key steps to follow for organising external-facing events. Such initiatives can require little up-front funding (as no additional staff need to be hired) and can look to leverage existing, in-house resources (i.e. researchers themselves), whilst also providing researchers an opportunity to share their knowledge and an increased sense of collegiality (Interview 5). Such a type of support is particularly relevant and well-suited to sustainability research, given that the problems it seeks to address so often require interdisciplinary solutions. However, in order to increase their chances of success, attempts at building interdisciplinary teams must incorporate a thorough consideration of researchers' respective personalities and outlooks, rather than focussing only on their CVs and skills.

Appealing to the intrinsic motivations of researchers

A fundamental question that underpins both RQ and RQ2 is "why should we care about KMB?". It is a particularly pertinent question given all of the pressures and demands that are already made of researchers and their organisations. Much of this study has been framed in the context of the growing impact agenda, thus addressing the question posed with the argument "because you have to, be it now or in the future [to get funding]". However, it is apparent from the interviews and literature review that such a top-down imposed rationale is in limited and may, in fact, generate unintended consequences (Singh et al., 2019). Instead, organisations need to encourage researchers to explore their own motivations, listen to them and develop an approach to KMB and research impact which is built upon the motivations of researchers. As explained by Professor Mark Reed (Interview 2):

"If you start from the bottom up, then you start with the intrinsic motivations of researchers. [In the] sustainability arena, as with most other applied disciplines, you have people who are intrinsically motivated to do something with their research even if that is just simply to prove for curiosity sake that their bright idea actually works in the real world"

5.3 What matters need to be considered when promoting and evaluating KMB?

Escaping the ivory tower

There is an oft-repeated narrative that academics have been comfortable to isolate themselves from society and occupy 'ivory towers', to the extent that academia is used as the example in the definition provided by the Cambridge Dictionary (Cambridge Dictionary, n.d.). However, this study has shown that there are researchers who are actively seeking to increase their engagement, apply good KMB practices and achieve impact via their research. In addition, the Springer Survey revealed that the majority of respondents agreed that research funding should be more closely linked to demonstrable impact, and 66 respondents (75%) provided a range of answers when asked to explain "Why is it important to you that your research has some societal impact beyond academia?" including wanting to make the world a better place, to do meaningful work and to provide value to taxpayers. This is welcome, given the view of Dr Vicky Ward that "it's everyone's responsibility to be mobilising and sharing knowledge" (Interview 1). However, whilst the stereotype of academics in ivory towers may remain true for some, it is also apparent that it is inaccurate for others and that to perpetuate the stereotype is counterproductive when applied to an entire profession. Furthermore, the stereotype can

lead us to perceive KMB and research impact as the sole responsibility of researchers. However, as Paul McArthur explained "the capacity of academics to lead effective knowledge mobilisation activities is in general limited. This is perpetuated by both the incentive system within academia, as well as the limited attention by funders to build KM[B] into budgets" (Interview 10).

Responsibility for KMB is shared

Given that responsibility for KMB can be viewed as being shared by every party at each stage of the pathway of knowledge identified in the analytical framework adopted for this study, one of the key matters to consider when seeking to assess researcher efforts is the extent to which other parties are co-operative, supportive and receptive of researcher efforts. It is evident that those researchers interviewed appear to be comfortable with navigating the challenge posed by competing interests and that in fact, many powerful interests exist which can support sustainability research. Furthermore, the interviewees did not see the advocacy dilemma as a major obstacle. This is supported by a recent study which found that "climate scientists who wish to engage in certain forms of advocacy have considerable latitude to do so without risking harm to their credibility, or the credibility of the scientific community" (Kotcher, Myers, Vraga, Stenhouse, & Maibach, 2017)(Gardner & Wordley, 2019, p.415). Central to interviewees positions was the ability to be strategic as to the parties whom researchers' partner with, and the continued importance of basing one's findings upon solid evidence. However, this does raise the question as to how researchers acquire this strategic acumen? This study has identified a number of skills (e.g. tailoring communications, stakeholder engagement) that researchers should ideally possess, from a KMB standpoint, but organisations have a responsibility to help researchers acquire these skills via training, after all, "Scientists are finely honed specialists trained to create new knowledge, but they have little training in how to communicate to broad audiences, even less in how to defend scientific work against determined and well-financed contrarians" (Oreskes & Conway, 2010, p.263).

However, any attempt to improve KMB and research impact at a regional or national level cannot only focus on researchers and their organisations. Interviewees have highlighted the influence that a number of other parties have on the process, often being viewed as barriers to effective KMB. In terms of research users, both Davinder Valeri and Stephanie Cairns explained how merely mentioning "sustainability" would be enough for many potential research users in the business community to not engage with research. Given the importance of sustainability to wider society, we have to question whether such attitudes amongst potential research users are acceptable, because they have consequences for us all, and to debate what can be done at a regulatory or societal level to push these actors to be more open and receptive to research. Whilst this study has identified many ways that research communication can be improved via the adoption of certain practices, we cannot expect researchers to exhaust themselves in efforts to reach hard-headed audiences. Those audiences have a responsibility to meet them half-way. Similarly, attention should be paid to how policymakers engage with and use research. The literature review highlighted how the UK and Scotland have set up organisations to act as points-of-contact and sources of guidance for researchers wishing to engage with policymakers and this appears to be a positive development by policymakers which Canada and others may wish to follow. However, more can be done to understand, question and improve how evidence is used by policymakers in the context of KMB and research impact. As summarised by Tom Hargreaves (Interview 8):

"I think there's a lot of pressure placed on academics to make their research relevant, to do more and more and more impact. But if you have got policymakers who think they already know the answers, that aren't actually interested in the dissenting voices or whatever, the

diversity of views, etc. then you're fighting a losing battle…I think there's a lot of pressure placed on academics to make their research impactful but it seems there's not an equivalent amount of pressure placed on decision-makers to actually look at, take account of, and respond to the range of research that's out there"

Impact rankings

So far in this study, governments and funding agencies have been presented as the main drivers of an increasing focus on KMB and research impact. However, it is possible other societal actors might influence KMB and research impact debate. For instance, in 2019 the Times Higher Education (THE) published their first 'THE University Impact Rankings' which seeks to "measure global universities' success in delivering the UN SDGs" (Times Higher Education, 2019b). In the first year, 500 institutions from 75 countries submitted data for the rankings (Times Higher Education, 2019a). This could be a particularly important development for organisations conducting sustainability research for a number of reasons. Firstly, THE Rankings are held to be the second most influential global higher education rankings in the world (Marginson & Van Der Wende, 2006). Secondly, sustainability research itself is clearly strongly aligned with the UN SDGs and as such these researchers have an opportunity to place themselves at the forefront of their organisations' attempts to perform well in the rankings. Thirdly, this may be an indicator that students are beginning to attach greater importance into universities' impacts when choosing which university to apply to. Dr David Phipps noted the potential of THE University Impact Rankings to influence universities, stating "I think that will be an external pressure that universities will respond to... So, I think that impact has the potential to become a differentiator for universities" (Interview 9).

Consequences for future research

One possible outcome raised by many interviewees is that certain forms of valuable research may be discouraged. The impact agenda encourages collaboration with external parties but to do so may be harder when the research itself critiques established ways of operating. The impact agenda requires researchers to identify and articulate impacts, yet some sustainability research can take decades to have an impact. Because research funding is being increasingly linked to impacts, there is potentially an increased risk associated with conducting blue-skies research, where impacts are less predictable. Finally, if research becomes increasingly managed and prescriptive, and the sources of funds become increasingly concentrated, then the independence of research might be threatened because funders stand to have a greater say over what is researched and how it is researched. Therefore, the danger that valuable research might be undermined has to be acknowledged. The research community can look to influence the application of KMB and impact requirements going forward such that vulnerable research is protected, as it may well be that the undermining of research is an unintended consequence that can be avoided via constructive debate.

5.4 Reflecting on the study itself

Methodology

It was apparent early on in the interview process that the degree of flexibility applied to the interview questions would have consequences for the content analysis and the depth of the responses provided by interviewees. The decision was taken that, in order to facilitate the content analysis, certain questions had to be asked in every interview with sustainability researchers. However, in order to make interviewees feel comfortable and able to share their views and experiences unencumbered, a flexible approach was taken to the order and nature of the other questions asked. Whilst it is believed that this approach helped to capture the

detailed and diverse range of researcher experiences, it was nonetheless inconsistent and as such is likely to have influenced the results of the content analysis to some extent. Furthermore, the approach to the content analysis itself was subjective, representing a further limitation.

Generalisability

It was expected that the snowballing approach to identifying willing interviewees would lead to a diverse and random sample of researchers representing different levels of experience and engagement with KMB and the impact agenda. However, based on their positions and online biographies, it would appear that the majority of researchers interviewed are highly experienced and engaged with these issues, to the extent that many could be considered experts in the sustainability field, with respect to KMB and the impact agenda. For instance, one interviewee in the UK is based at a research unit dedicated to research impact and has had their research chosen for the next UK REF (Interview 5), whilst another is the Director of Research at their university and the Director of an interdisciplinary research centre established by the ERSC (Interview 4). In Canada, one interviewee is a Research Chair and able to direct funds towards KMB projects at their discretion (Interview 15), whilst another is the Director of an organisation whose remit is heavily orientated towards the communication of sustainability research and who has 20 years consulting experience (Interview 16). The consequence of this is that the interviews are more likely to have identified best-practice with respect to KMB activities. However, it also means that the study and its findings are less likely to be generalisable, as interviewees may not be representative of the sustainability researchers as a whole in the two countries. Furthermore, the majority of sustainability researchers interviewed (10 out of 11) come from the social sciences which limits the ability of the research findings to be generalised for other disciplines (e.g. natural sciences). Finally, because a purposive sampling method was used in combination with the snowballing method, the study is prevented from being able to generalise for all sustainability researchers (Bryman, 2012).

In contrast, with respect to RQ2, the data triangulation conducted suggests that the themes and categories of support identified in the literature review and interviews are more comprehensive and generalisable. The Springer Survey included an open-ended question allowing respondents to describe the type of support they receive. These 43 responses were categorised, and no discrepancies were found between these categories and those identified via the literature review and interviews. Similarly, with respect to RQ3, the comments provided by respondents to the Springer Survey when asked to contribute further thoughts on the topic, mirror the findings from the interviews in particular, with similar concerns, criticisms and requests articulated.

Legitimacy

A number of incidents occurred during the research period which helped provide assurance as to the need for the research and the legitimacy of the research. Firstly, the circulation of the Springer Survey, just after the research period started, asking many questions that are closely linked to the RQs in this study, demonstrates the demand for such knowledge. Secondly, the publication of the paper 'Researcher engagement in policy deemed societally beneficial yet unrewarded' (Singh et al., 2019) on 30 July 2019, halfway through the research period, demonstrates the legitimacy of RQ2, as contemporaneous studies are showing that support for researchers is not perceived as adequate. Finally, seven of the ten sustainability researchers interviewed in person complimented the questions being asked (based on a search of interview transcripts for the phrase 'good question') (Interviews 5, 7, 8, 11, 12, 13 and 15).

6 Conclusions

This study began by presenting two challenges that sustainability researchers are facing, namely the need to improve scientific communication and the impact agenda. A knowledge gap identified was the lack of information regarding what researchers and organisations are currently doing to mobilise sustainability knowledge in wider society. Via interviews with 11 sustainability researchers, 3 knowledge mobilisation experts and 2 funding agencies in the UK and Canada, combined with a literature review and the results of the Springer Survey, this study has identified and categorised a wide variety of KMB activities and types of support available.

The research has shown that KMB goes well beyond the traditional, linear view, whereby knowledge is disseminated via publications and conferences. The content analysis of interviews revealed 65 specific KMB practices, across 10 categories, with tailored communications, stakeholder engagement and research design the most commonly cited categories of KMB practice. The range of practices mentioned hints at the diversity of approaches available to sustainability researchers more broadly. It is apparent that, from interviewees experience, communications are becoming increasingly important to the research process, KMB practices should be included from the start of the research process, stakeholder engagement is important but complex and that networks can help share and generate knowledge when they are flexible to the needs of researchers. Furthermore, we must remember that what works in one situation may not work in another. As such, this study has not sought to make any assessment of researchers' efforts. The need to understand and adapt to the research context was emphasised by David Phipps when he explained that "We know that there are broad principles that apply across the board, but then the implementation of those principles needs to be specific to each case and that's where you can't template impact" (Interview 9).

The importance of context in shaping what KMB practices might be most appropriate leads us to seek information on what practices work well for sustainability researchers. However, it is clear from the interviews that in many cases, follow-up work to gauge the effectiveness of KMB activities is only done partially or not at all. In addition, several researchers expressed a desire for more follow-up evaluations to be conducted, if the time and resources were made available. Conducting more follow-ups appears to be a logical area for sustainability researchers and organisation to focus upon for a number of reasons. Firstly, seeking feedback from research users is consistent with the principles of stakeholder engagement and research humility, by acknowledging that KMB may need improvement and can benefit from the input of others. Secondly, feedback can help inform future KMB practices such as tailored communications and research design. Finally, in acquiring feedback, the organisation gains a deeper understanding of its impacts and help it to develop more robust KMB plans and Pathways to Impact statements, which can help to secure future funding.

However, once appropriate KMB practices are identified, researchers will require support from their organisations. This support can take many forms, with the literature review, interviews and Springer Survey identifying 11 categories of types of support that can be provided to researchers. The most commonly cited categories of support currently provided were 'Training', 'Spaces and Fora' and 'External Communications' whilst the most commonly cited categories of KMB support sought by researchers were 'Training', 'Time' and 'Dedicated KMB and impact personnel'. The consistency amongst the interviews and the Springer Survey, combined with a lack of literature on the support available to sustainability researchers, has motivated the creation of a new framework, the 'Organisational support for sustainability researchers framework'. Organisations can use this framework to guide their internal discussions as to how they might increase their support for KMB. This study does not seek to

determine what support should be prioritised, but it does reveal what some organisations are already doing and where additional investments might be made. The most commonly cited type of specific support sought by interviewees was increased time to conduct KMB activities. Different views were offered on this topic, with all UK researchers citing a lack of time, whereas a UK KMB expert warned that, whilst time pressures were real, some researchers tended to use it as an excuse for a lack of KMB. Developing a strong KMB support infrastructure is challenging and will depend on context. However, if researchers can be encouraged to see impact as a central part of their work, for reasons that resonate with their own motivations (rather than just being another requirement) the conversations about KMB that follow, between researcher and research organisation, can benefit.

The third RQ of this study asked what matters need to be considered when promoting and evaluating KMB in the context of sustainability research, with particular attention paid to competing interests and the advocacy dilemma. Encouragingly, researchers were consistent in offering strategies to combat these obstacles. Whilst the existence of competing interests was acknowledged, researchers explained some parties are willing to assist and partner with sustainability research and thus boost its chances of achieving impact. However, overlapping with matters raised in RQ2, there is a question as to how researchers are expected to acquire the skills and strategies in order to successfully handle the challenge of competing interests. With respect to the advocacy dilemma, all researchers questioned on the matter responded with variations of the same answer - they were happy to engage in advocacy if it was based on solid evidence. Separately, in the UK it appears that research funding may become increasingly politicised and managed by funders in the future. There are valid concerns that should this trend continue, certain types of valuable research, such as blue-sky research or research that challenges dominant political or economic paradigms, could be threatened.

Whilst the ability of researchers and their organisations to conduct successful KMB will be influenced by the practices and systems that they employ; these efforts will also depend on the cooperation of other parties. At several stages of the research process, KMB practices will be conducted in vain if other parties do not themselves engage with the research. We've noted the importance of stakeholder engagement, yet if policymakers prioritise quantitative research then the impact of qualitative research may be limited. Furthermore, research can be tailored to the precise needs of research users and include infographics, press releases and social media, but if policymakers or businesses approach the research with their own strongly held beliefs, then research impact may be limited. As such, an important area of future research could be to look at how policymakers, the private sector, NGOs and civil society are engaging with research. There is a gap between researchers and the rest of society, but we cannot only focus on what one side is doing if we are to bridge it.

This study has shown how some of the parties involved in the research process can take steps to aid KMB. Sustainability researchers can see that there are a variety of activities that they should consider when designing and conducting their research. The research organisations at which they are based can see that there are many ways they could provide support to their researchers which are likely to improve the chances of impact occurring. With this new knowledge, it is hoped that these two parties can cooperate to make improvements which lead to increased KMB of sustainability research. Making these changes will not be easy and a variety of competing factors are likely to restrict what is possible. However, this study at least provides a menu from which these parties can consider their options and a framework upon which productive conversations can be undertaken. Furthermore, researchers can only partially determine the impact of a research project via their KMB efforts. The reality is that anyone who is involved in the research process can influence the success of KMB efforts.

This report offers nine recommendations for those interested in how to improve the KMB of sustainability research. The recommendations are based on limited data and would benefit from being challenged and subject to further research.

1) An approach to KMB and research impact may be more effective if it engages with, appeals to and builds upon researchers' intrinsic motivations, rather than being imposed from above;

2) If KMB is being sought, then a holistic approach, which acknowledges that KMB applies to the entire research process, should be adopted - including funding calls and follow-up work;

3) Researchers, research organisations, funding agencies and research users should seek to adhere to the principles of humility, openness, cooperation and flexibility when conducting KMB;

4) Researchers, research organisations, funding agencies and research users are *all* responsible for KMB. KMB is a conversation that requires at least two active participants and corresponding commitments. A failure by one party to engage can negate the best efforts of the other party;

5) Researchers and organisations should be wary of attaching too much importance to making research open access, in the context of KMB and research impact. It may help but it is only one of many KMB practices;

6) Researchers, with the support of their organisations, funding agencies and research users, in the form of time, funding and cooperation, should seek to conduct more follow-up work, following the completion of a research project, to assess what worked well and what did not, in terms of KMB;

7) Research organisations and funding agencies should ask themselves whether their public commitments to KMB and research impact (and the demands they make of their researchers) are matched by similar levels of commitment to the types of support that can assist researchers undertaking KMB activities;

8) Given the range of practices available, researchers should consider whether they could more to tailor their communications, and organisations should also investigate whether they can do more to support researchers in this regard. However, both researchers and organisations should be wary of the incentives that exist within the current media landscape (which can encourage sensationalism and populism) which could endanger the high levels of trust and regard amongst the general public that the research community has acquired; and

9) An increased focus on KMB and research impact may threaten certain types of valuable sustainability research, particularly if research funding becomes increasingly managed (directly or indirectly) by funders and governments. The wider sustainability research community, which is better positioned than most to see the value of these types of research (given their proximity to the research and potential research overlaps), needs to be cognisant of this and, if necessary, advocate for an approach to KMB and research impact that does not undermine vulnerable research.

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Appendix 1 – Glossary

Term	Definition
ARC	Australian Research Council
CPA	Chartered Professional Accountants of Canada
ESRC	Economic and Social Research Council
KEF	United Kingdom Knowledge Exchange Framework
KEU	United Kingdom Parliament's Knowledge Exchange Unit
KMB	Knowledge mobilisation
NERC	National Environment Research Council
NGOs	Non-Governmental Organisations
NSERC	Natural Sciences and Engineering Research Council of Canada
sPICE	Scottish Parliament Information Centre
SSHRC	Social Sciences and Humanities Research Council of Canada
THE	Times Higher Education
UK REF	United Kingdom Research Excellence Framework
UN SDGs	United Nations Sustainable Development Goals

Appendix 2 – Literature review search terms

Literature review stage one – the impact agenda

#	Boolean
1	"impact pathway" AND "sustainability research"
2	"impact agenda" AND "sustainability research"
3	"impact pathway" AND "environmental research"
4	"impact agenda" AND "environmental research"
5	"environmental research" AND "societal impact"
6	"measuring impact" AND "sustainability research"
7	"evaluating impact" AND "sustainability research"
8	"measuring impact" AND "applied research"
9	"evaluating impact" AND "applied research"
10	"measure impact" AND "applied research"
11	"evaluate impact" AND "applied research"

Literature review stage two - KMB

#	Boolean
1	"sustainability research" AND "impact" AND "methodology"
2	"sustainability research" AND "impact" AND "KMB"
3	"sustainability research" AND "impact" AND "knowledge mobilisation"
4	"sustainability research" AND "impact" AND "knowledge mobilization"
5	"sustainability research" AND "impact" AND "framework"
6	"knowledge dissemination" AND "sustainability research"

7	"impact pathways" AND "theoretical framework"
8	"Research effectiveness" AND "sustainability"
9	"research impact assessment"
10	"impact pathways" AND "sustainability"
11	"knowledge action gap"
12	"impact pathways" AND "content analysis"
13	"research impact" AND "knowledge transfer" AND "conceptual framework"
14	"research impact" AND "knowledge transfer" AND "conceptual framework" AND "sustainability research"
15	"research impact" AND "knowledge transfer" AND "conceptual framework" AND "environmental research"
16	"knowledge mobilisation" AND "engagement" AND "research impact"
17	"knowledge mobilization" AND "engagement" AND "research impact"
18	"barriers" AND "sustainability research" AND "policymaker"
19	"knowledge mobilisation" AND "training" AND "sustainability research"
20	"knowledge mobilization" AND "training" AND "sustainability research"
21	"advocacy dilemma" AND "sustainability research"
22	"advocacy risk" AND "sustainability research"

Support for KMB

#	Boolean
1	"Knowledge mobilisation" AND "sustainability research" AND "support"
2	"Knowledge mobilisation" AND "sustainability research" AND "institutional support*"
3	"Knowledge mobilisation" AND "sustainability research" AND "organisational support*"

4	"Knowledge mobilisation" AND "sustainability research" AND "communication support*"
5	"knowledge mobilization" AND "sustainability research" AND "support"
6	"knowledge mobilization" AND "sustainability research" AND "institutional support*"
7	"knowledge mobilization" AND "sustainability research" AND "organisational support*"
8	"knowledge mobilization" AND "sustainability research" AND "communication support*"
9	"knowledge exchange" AND "sustainability research" AND "institutional support*"
10	"knowledge exchange" AND "sustainability research" AND "organisational support*"
11	"knowledge exchange" AND "sustainability research" AND "communication support*"
12	"knowledge transfer" AND "sustainability research" AND "institutional support*"
13	"knowledge transfer" AND "sustainability research" AND "organisational support*"
14	"knowledge transfer" AND "sustainability research" AND "communication support*"
15	"supporting knowledge exchange" AND "sustainability research"
16	"supporting knowledge transfer" AND "sustainability research"
17	"supporting KMB" AND "sustainability research"
18	"supporting knowledge mobilisation" AND "sustainability research"
19	"supporting knowledge mobilization" AND "sustainability research"

Appendix 3 – Pre-determined categories for content analysis plus new categories identified

Activities undertaken to mobilise knowledge (RQ1)

#	Category	Codes
1	Networks	Boundary Organisations Building relationships Capacity building Leveraging stakeholder networks Knowledge dissemination (NEW) Senior role in other organisations (NEW)
2	Reflection	Evaluation Feedback Monitoring (NEW)
3	Design	Budgeting for KMB Co-production KMB plan Opportunities for impact Stakeholder mapping Understanding research user context Stakeholder Participation Audience analysis (NEW) Communication strategies (NEW) Identifying mutually beneficial research (NEW)
4	Research publications	Citations Highly ranked journals Maximising volume of publications (NEW) Open access research (NEW) Prominent publications (NEW)
5	Researcher attributes	Responsiveness Humility Reputation Empathy (NEW) Researcher motivation and commitment (NEW) Self-development (NEW) Trustworthiness (NEW)
6	Stakeholder Engagement	Co-production Early engagement Frequent engagement Managing contested issues Managing expectations Research accessibility Engagement with policymakers (NEW) Inclusive and comprehensive engagement (NEW) Research Partnerships (NEW)
7	Tailored communication	Adjusting language for different audiences Blogs Executive Summaries

#	Category	Codes
		Guides and workbooks
		PowerPoint
		Simple language
		Social Media
		Videos
		Websites
		Complimentary projects (NEW)
		Connecting to economic issues (NEW)
		Consistent messaging (NEW)
		Infographics (NEW)
		Mainstreaming ideas (NEW)
		Media interviews (NEW)
		Media releases (NEW)
		Policy briefs (NEW)
		Press release (NEW)
		Scenarios (NEW)
		Shorter or fewer messages (NEW)
		Submissions to policymakers (NEW)
		Webinars (NEW)
8	Seizing moments of opportunity (NEW)	Seizing moments of opportunity (NEW)
9	Events (NEW)	Workshops (NEW)
		Conferences (NEW)
		Public seminars and lectures (NEW)
		Appropriate locations (NEW)
		Roundtables (NEW)
		Sponsor conferences and consortiums (NEW)
10	Teaching (NEW)	Teaching (NEW)

Types of support provided to researchers (RQ2)

#	Category	Codes
1	Culture	Culture
2	Dedicated KMB and Impact personnel	Knowledge broker
		Impact officer
		Knowledge mobilisation expert (NEW)
3	External communications teams	Communication teams
		Newsletter (NEW)
		Social media support (NEW)
4	Funding	Budget allocation
		Additional funding
5	Training	Media
		Social media
		Tailoring communication
		Guidance for researchers regarding KMB (NEW)
		Early career training (NEW)

#	Category	Codes
		KMB practices and strategies (NEW)
		Language education (NEW)
		Public engagement (NEW)
6	Incentives	Annual reviews
		Promotion criteria
		Prizes
		Research funding
7	Interdisciplinary teams and projects (NEW)	Interdisciplinary teams and projects (NEW)
8	Secondments and staff exchanges (NEW)	Secondments and staff exchanges (NEW)
9	Spaces and Fora (NEW)	External spaces and fora (NEW)
		Internal spaces and fora (NEW)
10	Time (NEW)	Time allocated for KMB
		Adjusted and tailored expectations (NEW)
11	Improved metrics for tracking engagement (NEW)	Improved metrics for tracking engagement (NEW)

Appendix 4 – Coding Protocol

1. KMB practices and KMB supports were only coded the first time they were mentioned, in order to avoid double-counting. For instance, if an interviewee made repeated references to having received funding specifically for KMB activities, only one 'hit' would be registered, rather than multiple. This is because the content analysis is seeking to identify the types of KMB activities and support provided to researchers, rather than to identify their scale or frequency.

2. The boundaries between some code categories are not distinct, with overlaps noted. For instance, a researcher might speak of working with stakeholders to develop a research question for a research project. Arguably this could be coded within the categories 'Research Design' or 'Stakeholder Engagement'. As such there is a degree of subjectivity in the categorising of codes. For the example given, the activity was coded as 'Research Design – Co-production of RQ'. It is hoped that the individual codes provided in Appendix 3 help provide an audit trail as to how distinctions were made between codes.

3. Another area of subjectivity relates to what constitutes a KMB support. In some instances, interviewees would mention that some semblance of a support existed (for instance, the inclusion of KMB and impact criteria within an annual performance review). However, if that support was then criticised to the extent that it appeared that the support was not performing its purpose (E.g. if the interviewee states that the criteria had no bearing on their annual performance review) the decision was taken to not record the support.

4. With respect to additional support sought by researchers, only additional support explicitly mentioned and sought by researchers was included. Support that appears to be absent or perhaps insufficient was recorded as therefore being sought by researchers, if the description was accompanied by a statement explicitly stating that it is needed. For instance, a researcher might be asked about the training provided to researchers with respect to KMB and research impact and answer that no training is provided. Without any additional information, the need for training would not be included within the coding. However, if the researcher was then to state "we need to have training" this would then be recorded as an instance of additional support sought. As such, it is likely that the volume of supports sought reported in the findings section, is understated.

5. In some cases, a KMB activity (e.g. sending media releases containing research) was discussed by interviewees in the context of the support from their organisation that enabled that activity to occur (e.g. having a communications team that had established relationships with journalists to whom the media release could be sent). In these instances, where the KMB practice appears to be strongly connected to the support, two codes have been recorded, for both the practice and the support.

6. The codes applied do not seek to make an assessment as to the quality of the activity conducted or support provided. As such, they capture a range of effort by researchers and their organisations. For instance, several examples of a supportive culture for KMB have been reported by different interviewees. However, upon closer scrutiny, it is apparent that the extent of this support differs between organisations. For example, in

one interview, the interviewee referred to their organisation as having been focussed on research impact from its inception, suggesting a deeply ingrained culture supportive of KMB, whereas another interviewee talked about their organisation being "supportive in principle" of specific KMB activities, indicating that the culture at that organisation is less developed. The content analysis on its own does not capture this variation, only confirming the existence of some form of supportive culture in both organisations. However, the synthesis and analysis of the interviews that follows the content analysis does go into further detail on many of the relevant topics highlighted by the content analysis.

7. In a few instances, researchers mentioned ways that their research has benefitted from processes or support which is outside of their control or their organisation. For instance, one researcher talked about how external organisations have approached him to collaborate on research after having found his research online. Another researcher spoke of how some international organisations had shared his research without his knowledge. Because this research focusses on KMB practices that researchers and organisations have control over, these examples have not been recorded, despite the fact that they represent ways in which successful KMB has occurred

8. Before the interviews were conducted, interviewees were provided with an interview guide that included definitions of KMB and sustainability research. However, there are likely a large number of terms, used by both the interviewee and interviewer that would benefit from having a precise definition provided, particularly for the purposes of achieving the most accurate content analysis possible. Whilst every effort was made to ensure consistent coding, it is possible that interviewees used terms in ways that differed from the study. For instance, it is possible that some interviewees might have used terms describing KMB practices, such as "workshops", "public lectures", "conferences" and "roundtables" interchangeably, whereas the study has treated these terms as relating to four distinct types of KMB practice within the "Events" category.

Appendix 5 - List of interviewees

United Kingdom

#	Name	Role	Organisation	Online Biography
KMB experts				
1	Dr Vicky Ward (VW)	Reader in Management	University of St Andrews	[Link]
2	Professor Mark Reed (MR)	Professor of Socio-Technical Innovation and Director of Engagement & Impact in the School of Agriculture, Food & Rural Development	Newcastle University	[Link]
Funding Agency				
3	Avril Allman (AA)	Head of Research and Funding Operations	Natural Environment Research Council	Not available
Sustainability researchers				
4	Professor Jouni Paavola (JP)	Professor of Environmental Social Science	University of Leeds	[Link]
5	Dr Philip Johnstone (PJ)	Research Fellow (SPRU - Science Policy Research Unit, The Sussex Energy Group)	University of Sussex	[Link]
6	Dr Georgina Santos (GS)	Senior Lecturer, School of Geography and Planning	Cardiff University	[Link]
7	Professor Stewart Barr (SB)	Director of Education and Professor of Geography	University of Exeter	[Link]
8	Tom Hargreaves (TH)	Lecturer in Env. Science & Policy, School of Environmental Sciences	University of East Anglia	[Link]

Canada

#	Name	Role	Organisation	Online Biography
KMB experts				
9	Dr David Phipps (DP)	Executive Director, Research & Innovation Services	York University	[Link](#)
Funding Agency				
10	Paul McArthur (PM)	Knowledge Manager	McConnell Foundation	Not available
Sustainability researchers				
11	Dr Elena Bennett (EB)	Associate Professor, McGill School of Environment & Department of Natural Resource Sciences	McGill University	[Link](#)
12	Daniel Henstra (DH)	Associate Professor: Senior Fellow, Centre for International Governance Innovation	University of Waterloo / Marine Environmental Observation Prediction and Response Network	[Link](#)
13	Davinder Valeri (DV)	Director of Strategy, Risk and Performance	Chartered Professional Accountants of Canada	[Link](#)
14	Jessica Blythe (JB)	Assistant Professor, Environmental Sustainability Research Centre	Brock University	[Link](#)
15	Professor Charles H. Cho (CHC)	Professor of Accounting; Erivan K. Haub Chair in Business & Sustainability	Schulich School of Business	[Link](#)
16	Stephanie Cairns (SC)	Director, Circular Economy	Smart Prosperity Institute	[Link](#)

Appendix 6 - Interview guide

A one-page document was provided to interviewees explaining the background to the research, some of the key definitions used and specific requests from the researcher, concerning the recording of the interview and attribution of quotes. The document is provided in full detail below:

Transcript

Thank you for attending this interview. This interview is on behalf of my master's thesis for the Environmental Management and Policy programme at Lund University, Sweden. I have chosen to investigate the methods by which sustainability researchers are attempting to mobilise the knowledge that they have generated, what support research organisations provide to researchers and what expectations exist with respect to Knowledge Mobilisation (KMB) activities.

In order to avoid confusion and ensure consistency between interviews, the following definitions are used:

- KMB is defined as "an umbrella term encompassing a wide range of activities relating to the production and use of research results, including knowledge synthesis, dissemination, transfer, exchange, and co-creation or co-production by researchers and knowledge users."

- Sustainability research has been defined with reference to research directly or indirectly related to the nine planetary boundaries identified by the Stockholm Resilience Centre. Examples of research areas include climate change, ecosystem services, water scarcity and efficiency, renewable energy, resource efficiency, public transportation, sustainable agriculture, circular business models, sustainable reporting/accounting and urban governance (e.g. sharing economy, nature-based solutions and smart cities).

For this study, I am planning to interview sustainability researchers, KMB experts and a funding agency in both the United Kingdom and Canada.

It is hoped that this research will identify current practices in the field; the level of support that is provided for KMB and the expectations involved.

Before we begin, I need to quickly check with you some arrangements for the interview.

- I would like to record the interview so that it can be transcribed and a content analysis can be performed. At the beginning of the interview I will ask you to confirm your consent to this. Please let me know if you do not wish the interview to be recorded.

- The interview should not last longer than an hour.

- I plan to include quotes from interviews, attributed to their source, within my thesis paper. If you require your quotes to be anonymised, then please let me know. Each interviewee will have the opportunity to request a preview of quotes that I intend to use in the final thesis paper.

- The thesis will be submitted for grading on 20 September 2019 and a final amended version will be uploaded on 25 October 2019. It is anticipated that the thesis will be publicly available before the year-end.

- I'll begin by asking you to confirm a few questions regarding your position and experience and then move onto the main questions.

Please feel free to ask for any clarifications during the interview. We can pause the interview at any time.

Appendix 7 – Interview questions

Knowledge mobilisation experts

RQ	#	Questions	VW	DP	MR
1	1	How would you explain the relationship between KMB and research impact?	Yes	Yes	
1	2	To what extent do you think KMB best practice and advice for practitioners in one discipline (e.g. healthcare) is applicable for practitioners in other disciplines (e.g. sustainability)?	Yes	Yes	
1	3	Given that we know that sustainability research has certain features (it's often applied, normative, participatory, interdisciplinary) what principles of KMB can be said to apply most to it?		Yes	
1	4	In your experience, what are the features of a good research design for the purposes of achieving KMB and research impact?		Yes	
1	5	What are some of the key differences for researchers to consider, when seeking to mobilise their knowledge for different audiences?	Yes		
1	6	In your opinion, how to researchers reach disenfranchised groups who normally get missed out from stakeholder engagement exercises?	Yes		
1	7	What are some examples of best practices that researchers can undertake, following the conclusion or publication of their research, in order to assist KMB and understand the likely impact of the research done?	Yes	Yes	
1	8	In your view, who has responsibility for knowledge mobilisation and how can these responsibilities be more clearly delineated?			Yes

RQ	#	Questions	VW	DP	MR
1	9	There appears to be a heavy emphasis on stakeholder engagement and partnerships. What limitations do you see to this approach? Are there matters that need to be flagged?			Yes
1	10	A common theme in interviews is that follow-up activities (to evaluate the success of KMB efforts) are not being conducted as much as researchers would like, due to no funding or time being set aside to conduct such work. What value do you see in supporting and conducting more follow-up assessments?			Yes
1	11	What importance do you attach to having research be made open access? Many researchers appear to attach a high level of importance to it.			Yes
1 & 2	12	In your view, what are the characteristics of an effective network, for the purposes of helping to share and mobilise sustainability research?	Yes	Yes	
2	13	In your experience, what are the features of a good KMB support infrastructure within an organisation?	Yes	Yes	
2	14	Do you see value in having individuals or teams acting as a "first point of contact" when dealing with external requests?	Yes	Yes	
2	15	In your experience, how are KMB activities currently being funded at organisations?	Yes	Yes	
2	16	In your view, does the existence of a specialist team, focussed on supporting and achieving KMB, create a risk that sustainability researchers abandon their responsibilities with respect to KMB?	Yes		
2	17	How can organisations help researchers avoid some of the temporal challenges associated with impact?	Yes	Yes	

RQ	#	Questions	VW	DP	MR
2	18	How can organisations help to create spaces in which researchers are able to share their knowledge, whether its within their departments, across disciplines or with those external to the organisation?		Yes	
2	19	In your view, what are some of the more practical approaches (i.e. low hanging fruit) organisations can take to help researchers who want to undertake more KMB activities but feel pressured and short of time?			Yes
2	20	One interviewee shared her experience of how massive investment in communications was often needed in order to have a wider impact and that the reality as to the level of investment needed had not sunk in with many research organisations, researchers and funders. What is your view on this?			Yes
2	21	Many of the interviewees I have spoken to have talked about how their organisations are establishing sustainability-focussed interdisciplinary centres of excellence. In your view, what are the benefits and limitations associated with this approach, in the context of KMB and research impact?			Yes
2	22	Do you think the Times Higher Education Impact Rankings are going to influence HEI decisions? Please explain your answer.		Yes	Yes
2	23	What are the features of a good training programme for researchers which helps enhance their ability to mobilise knowledge?		Yes	
3	24	What are the most pertinent external factors that you think limit practitioners, ability to mobilise their knowledge for impact?	Yes	Yes	
3	25	What are some of the KMB techniques or approaches that you would recommend when seeking to achieve impact, but you are faced with competing, incumbent or even hostile interests?	Yes	Yes	
3	26	What matters do you think need to be considered when discussing what constitutes an acceptable level of engagement by researchers with respect to KMB activities?	Yes		

RQ	#	Questions	VW	DP	MR
3	27	What advice would you give to sustainability researchers who wish to mobilise their research to achieve impact but feel uncomfortable or wary of being perceived as advocates (i.e. the advocacy dilemma)?	Yes	Yes	
3	28	How to you maintain relationships between research organisations and stakeholders when there is a continuous changing and moving of personnel?	Yes		
3	29	I've been told that funding of grants is likely to become increasingly managed by funding agencies. Are there any concerns that you would raise about this approach? E.g. will this threaten certain types of research (e.g. blue-skies research, research critical of the status quo)			Yes
3	30	In What Works Now [a book the interviewee contributed to], you talked about the presence of powerful, vested interests who will seek to shape how sustainability problems are viewed. How much of a barrier to research impact do you think this is?			Yes
3	31	Given that, in your view, the KEF has a "clear bias towards economic impact" do you think some types of sustainability research will be undervalued?			Yes
3	32	Do you think there needs to be more of a focus on how research users (e.g. policymakers, businesses, civil society) are themselves engaging with research?			Yes

Sustainability researchers

RQ	#	Questions	Sustainability Researcher Initials
1	1	If we look at your research from the design stage to the final time spent working on it, can you talk me through the knowledge mobilisation activities have you undertaken in order to enhance the impact of your research?	JP, EB, PJ, DH, DV, GS, JB, CC, SC, SB, TH
1	2	Are there any KMB activities that you wish you could do (or do more often) but which you feel prevented from doing due to a lack of support, time or financial resources?	CC
1	3	How do external organisations find you in order to discuss potential research collaborations?	DV, SB
1	4	When you are designing research, to what extent are knowledge mobilisation and research impact considerations incorporated? What are the features of a strong research proposal?	JP, EB, PJ, DH, DV, GS, JB, CC, TH
1	5	How do you identify the relevant people to engage with on a research project?	DH
1	6	In your research, what is your approach to stakeholder engagement?	EB, PJ
1	7	What challenges have you experienced with stakeholder engagement? What limitations are there?	SB, TH
1	8	Once your research is concluded, do you tailor the communication of your research findings for different audiences? [Y/N] If Yes, in what ways do you do this?	JP, GS, JB, CC, SC, SB, TH
1	9	In terms of KMB, what do you consider to be features of an effective network?	JP, EB, PJ, DH, DV, GS, JB, CC, SB
1	10	Do you undertake any follow-up activities after your research has been published to gauge the views and responses of research users with respect to the research and any specific knowledge mobilisation activities that were undertaken (e.g. workshops)?	JP, EB, PJ, DV, GS, JB, CC, SB, TH, SC

RQ	#	Questions	Sustainability Researcher Initials
1	11	Do you seek to make your research open access? What is your view of the role of publishing houses with respect to the impact agenda and knowledge mobilisation?	DH, CC, SC
1	12	Do you conduct an audience analysis when developing or dissemination research? If so, what does this process involve?	DV
1	13	What is your view on the role of social media with respect to KMB?	DH
2	14	In what ways does your organisation provide support to researchers who are seeking to mobilise their research in order to achieve research impact?	JP, EB, PJ, DH, DV, GS, JB, CC, SC, SB, TH
2	15	In what ways could your organisation provide more support to researchers to improve knowledge mobilisation and the impact of their research?	JP, EB, PJ, DH, DV, GS, JB, CC, SC, SB, TH
2	16	Does your research organisation provide any spaces or forums to encourage the sharing of knowledge between researchers and with those in other departments or outside of the organisation?	JP, EB, PJ, DH, DV, GS, JB, CC, SC, SB, TH
2	17	Does your organisation allocate funding specifically to help with knowledge mobilisation activities? If so, please can you describe what activities are supported?	EB, DH, GS
2	18	What training is provided to researchers in relation to KMB, tailoring communications etc?	JP, EB, PJ, DH, DV, CC, SC, SB, TH
2	19	Does your organisation provide any incentives to researchers to undertake knowledge mobilisation activities?	JP, EB, PJ, DH, DV, GS, JB, CC, SC, SB, TH
2	20	In your experience, are bibliometrics still dominant when it comes to assessing and incentivising researcher performance?	EB, DH, JB

RQ	#	Questions	Sustainability Researcher Initials
2	21	Do you see the communications playing a greater role in KMB and research impact? Do organisations need to alter redirect resources or restructure in order to accommodate a greater focus on communications?	SB
2	22	Do you receive any help from your organisation with tailoring communications?	JP, PJ, DH
2	23	Do you think organisations can help foster collaboration between researchers and research users by providing a point-of-contact for external parties wishing to collaborate?	SC
2	24	How can organisations help researchers monitor and identify moments of opportunity to use their research to have an impact?	DH
3	25	In your view, what matters do you think need to be considered when seeking to assess researcher's knowledge mobilisation efforts?	JP, EB, PJ, DH, DV, GS, JB, CC, SB, TH
3	26	How do you see the role and structure of research organisations changing in response to KMB and the impact agenda?	JB, CC, SC, SB, TH
3	27	To what extent do you think opposing or competing interests have an effect on the level of impact/successful knowledge mobilisation that sustainability researchers are able to achieve?	JP, EB, PJ, DH, DV, GS, JB, CC, SC, SB, TH
3	28	Does an increasing emphasis on stakeholder engagement make it harder for sustainability researchers to conduct research which is critical of others (including research partners)?	JB
3	29	Have you encountered there being a "Stigma" associated with the word "sustainability" when seeking to engage stakeholders or research users?	TH

RQ	#	Questions	Sustainability Researcher Initials
3	30	Within the context of sustainability research, what advice would you give to researchers who wish to mobilise their research to achieve impact but feel uncomfortable or wary of being perceived as advocates (i.e. the advocacy dilemma)?	JP, EB, PJ, DH, DV, GS, JB
3	31	Some of the literature argues that sustainability researchers need to focus more on the implementation of existing knowledge, rather than the discovery of new knowledge. What is your view on this?	SB, TH
3	32	It has been argued that some researchers undervalue the knowledge that they already have. What are your thoughts on this?	JP
3	33	As a researcher, how do you navigate the temporal challenge presented by researchers and research users operating on different time scales?	DH

Funding Agencies

RQ	#	Questions	AA	PM
1	1	In your view, what is the role of KMB and research impact with respect to the initiatives that your organisation supports?	YES	YES
1	2	What processes and activities does your organisation undertake to help mobilise knowledge generated by the initiatives that your organisation funds?		YES
1	3	With respect to the proposals that your organisation receives, do you apply any knowledge mobilisation or research impact criteria in the evaluation of these proposals? What do you consider represents best practice within the proposals that you receive?	YES	YES

RQ	#	Questions	AA	PM
1	4	With respect to follow-up activities undertaken after a research project has concluded - What does your organisation do to check that knowledge mobilisation activities were actually performed? Is the effectiveness of these activities reviewed? What do you consider to be good practice by researchers?		YES
1	5	What is your view on the role of knowledge brokers/ knowledge intermediaries and boundary organisations in terms of knowledge mobilisation and research impact?		YES
1	6	Given the lack of external follow-up to check whether KMB activities were undertaken, is there a danger that researchers don't perform KMB activities that they included in their proposals	YES	
1	7	What does it meant by the reference to research grants becoming increasingly "managed"?	YES	
2	8	How does your organisation fund knowledge mobilisation in grants?		YES
2	9	Does your organisation look at the support infrastructure for knowledge mobilisation available at organisations, when they apply for funding?	YES	YES
2	10	Does your organisation provide spaces or forums to help researchers and practitioners share their knowledge?	YES	YES
2	11	In your opinion, who has responsibility for knowledge mobilisation on a project?		YES
3	12	Within the NERC guidance, there are references to economic and social impacts, but actually no of mention environmental impacts. Is that because such impacts are assumed to occur, or is that a reflection of government priorities?	YES	
3	13	What matters do you think need to be considered when discussing what constitutes an acceptable level of engagement by researchers with respect to knowledge mobilisation activities?	YES	YES

RQ	#	Questions	AA	PM
3	14	Is there recognition within your organisation that some projects or initiatives it funds might face greater obstacles, resistance or barriers than others when it comes to mobilising knowledge and achieving impact? If so, is this reflected in any of the processes of procedures that your organisation has? E.g. project evaluations, funding provided etc.	YES	YES
3	15	It has been suggested in the academic literature that conventional research institutes within academia may have to change how they operate, in order to more effectively generate solutions which can have a societal impact. Do you agree with this view? Please explain your answer. What lessons do you think your organisation can provide other organisations, with respect to how it operates?		YES
3	16	What trends or emerging developments are you aware of with respect to the criteria attached to the funding of projects? E.g. is there are an increased focus on interdisciplinary research?		YES

Appendix 8 – Analysis of Springer Nature Survey Data

RQ1

Question 4.1: For your most recent publication, which of the following have you done (or do you plan to do) to increase the societal impact of the research - as opposed to increasing awareness with your peers? Mark all that apply

Question 4.2: Of these activities, which one do you believe is likely to have the greatest effect on increasing the societal impact of the research?

Knowledge dissemination activity	Number of responses to Q4.1	Number of responses to Q4.2
Presented at a conference	53	5
Promoted the research on a professional page (e.g. university profile page)	38	2
Promoted the research on a scientific social networking site (e.g. ResearchGate, Academia, Mendeley)	44	7
Promoted the research on social media	38	8
Uploaded my findings to a repository	27	1
Promoted the research on a personal website, including blogs	26	1
Made my research data openly accessible	20	2
Published the paper open access	32	14
Took part in public engagement activities on my research	24	4
Engaged in media coverage	24	13
Emailed a subject-specific mailing list	9	0
Promoted the research via a podcast or video	4	0
Other	4	2
None of the above	6	29
Total		***88***

RQ2

Question 4.5: What support do you get, if any, for activities that are intended to increase the societal impact of your research?

Types of support provided	Number of responses
Support from part of my institution/university	35
Support from my department	28

Types of support provided	Number of responses
Support from colleagues/team members	37
Support from publishers	12
Support from funders	25
Support from professional agencies/consultancies/services	19
Support from bibliometrics providers	5
Support from others (please specify)	3
No support	22

Question 4.7: Please describe the type of support you have received in increasing the societal impact of your research.

Type of support - description	Category 1 [determined by author]	Category 2 [determined by author]
Funding from the department	Funding	
Shared promotional activities for the work such as sharing on social media and presenting at conferences.	External Comms	
Moral support.	Culture	
Funding, time.	Funding	Time
Encouragement to produce impact and dissemination plan and activity.	Culture	
Paying for OA Gold	Open access	
Media relations	External Comms	
funding	Funding	
Publishing a summary of my work on social media to boost awareness of my findings	External Comms	
Departmental support to attend non-scientific conferences and outreach events.	Culture	
Guidelines from funder on sharing work via social media. Support from colleagues in marketing to share this work through our organisation's social media pages.	Training	External Comms
Teachers writing with me	Networks	
funds to present research findings at conferences	Funding	
Permission to use social media Encouragement/help to use publisher's site for lay summaries	Culture	External Comms
Funding agencies and industrial partners assist.	Networks	
A budget for research desemmination, meeting with policymakers, etc.	Funding	
publicise results in the rmedia with the highest impact	External Comms	
My library has a fund that will cover open access publishing charges.	Funding	
i donate receive this because i donít need it since i am nit interested in societal impact.	N/A	

Type of support - description	Category 1 [determined by author]	Category 2 [determined by author]
Promote through university announcements and funder promotion on their website	External Comms	
I am involved in 2 Social Sciences and Humanities Research Council Partnership grants. Partners are community organisations and municipal governments. They are involved in the development of the research. There is also a small infrastructure to produce plain language online summaries, but they are not "pushed out".	Stakeholder engagement	External Comms
They draft a press release and disseminate them.	External Comms	
Lots of discussions with coauthors about where to publish.	Research Publications	
Communications support such as featuring work in newsletters / websites.	External Comms	
I was given some help in publishing an 'op-ed' report in a newspaper.	External Comms	
'- Time allocation - Travel expenses - money for hosting a seminar and tracking impact	Time	Funding
open access fees, media releases, website profiles	Open access	External Comms
Most of it has come from engaging with conversations with peers and practitioners who deal directly with the public regarding areas of my research.	Networks	
Website, social media	External Comms	
The articles were on publisher websites.	Research Publications	
institutional? PR.	External Comms	
Support to hold events locally Funding to hold international collaborators meetings Support from research staff in building an interactive website designed to be accessible on slow internet connections and smart phones	Funding	External Comms
The article about my recent publication will be published in local newspaper.	N/A	
Research funding; design of related graduate coursework (PhD) and research projects in process.	Funding	
help with engagement with the media	External Comms	
financial for attendance of events, publication fees	Funding	
The publisher has allowed a view only version of the paper with no open access	Open access	
Communications team are able to reword/re-present findings to be more accessible.	External Comms	
The University publicizes our research on internal and external reports/newsletters.	External Comms	
Funding from government	Funding	
Assistance from our communications department.	External Comms	

Type of support - description	Category 1 [determined by author]	Category 2 [determined by author]
encouraged and financial	Culture	Funding
Funding, web page support, press releases	Funding	External Comms

RQ3

Question 5.7: To what extent do you agree or disagree with the following: "The funding of research should be more strongly linked to demonstrable societal impact"

Response option	Number of responses
Strongly agree	22
Somewhat agree	29
Neither agree nor disagree	17
Somewhat disagree	12
Strongly disagree	8
Total	**88**

Question 5.9: Do you feel there has been a change from funders, institutions or researchers in attitudes to societal impact over the last 5 years? If so, please explain:

Response option	Number of responses
Yes	49
No	10
Don't know	7
Blanks	22
Total	**88**

Question 46: If you have any further thoughts on this topic, please provide them here.

#	Further thoughts
1	It is important to help researchers find extra funding
2	Iím not sure methodology, tool and time wise how to do this
3	I think that research should be driven by natural curiosity.
4	It's difficult for researchers who do more theoretical rather than applied research to demonstrate impact. I don't know if the right thing to do is to slightly change what I study in order to try to have

#	Further thoughts
	a greater impact; ignore impact like many senior people in my field seem to do without any negative result for their careers; or thread some sort of middle path.
5	I am the commodity!
6	Take down paywalls! This is the most important thing you can do in the journal industry.
7	No
8	This is a great survey, it made me think about societal impacts, and I will change the way I think about sharing and conducting my research. I think it has made a positive change in my own attitudes.
9	It seems there is a tendency to now equate social media dissemination (and related altimetrics) with societal impact. In my opinion, mentions of research on media platforms (traditional and social) seem to have become one of the primary indicators of "impact" (second only to citations); this is probably because it is easier to do. Why doesn't Springer (or other publishing houses), hire someone to track paper citations in policy documents? This seems to me to be a much more useful and meaningful metric of societal impact.
10	should be a scoring that include a clear societal impact criteria
11	Sometimes, it forces oversemplifications of research
12	The publishers should write feature articles and publish them in venue readily accessible by journalists.
13	Not applicable.
14	I have lots of thoughts on this, butI'm a slow typist. So, if you are really interested, we should fund a time to talk. Richard Wassersug, PhD 604-563-9915 (in Canada)
15	There is an important distinction between research focused on "innovation", which most often has potential economic benefits for a small number of stakeholders, and "societal benefits" that have broader benefits. The general trend has been to emphasize the former. Your survey does not reflect this important distinction.
16	It can be difficult to demonstrate societal impact in terms of direct causation. Metrics can help but citations are not, in themselves, an indicator of actual impact just readership. The achievement of a change of some kind is more challenging to demonstrate given timeframes, pathways of change, etc. I would be concerned if there were efforts to reduce societal impact to metrics that count things but do not recognise these complexities.
17	Not at this time.
18	There is currently an expectation that each researcher spent a substantial amount of time on small commentaries etc on social media. It is my experience that a lot of valuable time is lost on that account and I have recently witnessed how an organisation with a professional press office with a few hours of work could make a common research story go world wide covered on +30 countries and most large English newspapers in Europe, America and Australia. This is not the first time I

#	Further thoughts
	have seen this happen From that point of view it would more efficient to have a few more press officers writing the good stories and this seems to create a much larger impact compared to relying on that scientist try to produce the stories themselves
19	I think, any real research activity eventually contributes to societal development. That is why I found the Springer Survey rather populist and dull. I lost my time. I am sorry, but let me be frank! I am sick and tired of those overly enthusiastic people that reign nowadays.
20	While it is probably a good idea to get scientists to communicate to wider audiences, good researchers are not necessarily the charismatic individuals who can make a great impact. There is too much pressure to be all things to all people: great research, great teaching, admin, and now impact.
21	I would really appreciate if public funders were very careful with the destination of the research funds, the topic and the need of some research
22	Social media metrics are the worst way to track societal impact of research because of the simplicity in manipulating them, and their inclusion as an assessment criteria in any research evaluation exercise or funding decision would be a disaster because of the Goodhart's law.
23	From the previous statement this pressure to show societal engagement forces researchers to make up public engagement impacts in their research proposals that are rarely achieved, its a farce.
24	While we talk a lot about impact now, I don't think we have developed good ways of measuring this. My research may influence a large number of people to make a small change, or a small number of people to make a large change. My research may impact people I've never met, or only people who take part in my experiments and their friends and family. How do we measure this? How can we track our impact properly?
25	Academic peer review should constitute a large portion of funding decisions rather than political leanings of funders