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Do policy questions match up with research questions?

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Executive Summary

Objectives: The aim of this research is to examine the types of questions that policy professionals ask, and to compare this with the questions that researchers address that have policy relevance. By looking at both sets of questions, it is possible to see if there is a match between the two, and where there isn't, where better efforts are needed to bring both into alignment.

Analytic/Methodological Approach: Each department within the UK Civil Service has generated a document (N=18) detailing its areas of research interest (ARIs) and research questions (N=2105). The UK Data Service—supported by UK Research Innovation (UKRI) via the Economic and Social Research Council (ESRC)—publishes case studies (N= 249) of impactful research, many of which include the research questions that were addressed (N= 152). To analyse the ARI questions and impact case study questions, a Taxonomy of Policy questions was used.

Key Findings: The analysis reveals that the most common structure of questions that policy professionals generate—instrumental/procedural/enablement questions—are not directly aligned with the most common type of research question that researchers set themselves—causal analysis questions. Regarding the content of the questions, the analysis also reveals that several government departments, agencies, and public bodies generate questions that converge on the same theme.

Conclusions: The common structure of questions that policy professionals generate, that are designed to engage researchers are not the common structure of questions that researchers themselves attempt to address. This suggests some misalignment between policy and academia.

Recommendations: One way to improve the alignment between policy and academia is to revise the structure of questions published in ARIs to include those which academics are more commonly familiar with addressing, which are causal analytics questions. Questions of this type provide deep rooted answers around the causes and consequences of policy issues would help provide contextual details for identifying where and what policies could be implemented.

Abstract

In order to map the relevance of research to policy, one starting point is to examine the types of questions that policy professionals ask and compare them to the questions that researchers use to frame their research. To do this, this paper uses two sets of data to examine the relationships between questions generated by both groups of experts. Each department within the UK Civil Service has generated a document (N=18) detailing its areas of research interest (ARIs) and research questions (N=2105). The UK Data Service—supported by UK Research Innovation (UKRI) via the Economic and Social Research Council (ESRC)—publishes case studies (N= 249) of impactful research, many of which include the research questions that were addressed (N= 152). To analyse the ARI questions and impact case study questions, a Taxonomy of Policy questions was used. In short, the analysis reveals that the most common structure of questions that policy professionals generate—instrumental/procedural/enablement questions—are not directly aligned with the most common type of research question that researchers set themselves—causal analysis questions. Regarding the content of the questions, the analysis also reveals that several government departments, agencies, and public bodies generate questions that converge on the same theme. These findings suggest that there could be efforts to better utilise research generated by researchers to serve the purposes of multiple governmental departments, agencies, and public bodies, in order to maximize the impact of that research.

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1. Background

The start of any research project typically involves identifying a question, since it is not only important to investigate a particular phenomenon, but to know *how* to approach investigating it. A research question orients one's research in relation to one's chosen phenomenon, thereby framing it in a particular way.

In analysing the impact of questions upon research framing, two important criteria are subject matter and 'question-style'—the structure of the information sought[1] . The subject matter of a research question provides an indication of what the subsequent research will examine. The style of a research question indicates the *type* of answer that will be generated[2,3], and *how* it will be qualified. For instance, the question "do behavioural change interventions work to improve healthy eating behaviours?" has a style which implies that the answer is either yes or no, with some qualification of that answer. Furthermore, this question's style implies that a sincere answer's qualification will be generated via an examination of evidence regarding the causal relationship between behavioural change interventions and healthy eating behaviours. By contrast, the question "which behavioural change intervention works best to improve healthy eating behaviours?" has a style which implies that the answer is the actual behavioural change intervention that works best, with some qualification for how this has been shown. Furthermore, this question's style implies that a sincere answer's qualification will be generated via a comparison of a variety of behavioural change interventions in order to uncover the one that achieves the most positive behavioural change in the context of healthy eating. Thus, both subject matter and question-style impact research framing.

Typically, the types of research questions that are generated are derived from theory. However, question generation is not exclusively done in this way. This is often because the motivation to conduct research isn't only to support, or disprove, a theory. Research can have an applied dimension; the questions that a researcher identifies—which are generally (though not exclusively) empirical —shape their research, so that the findings are of practical value.

The goal of applied research goes beyond investigating a particular phenomenon, it is to understand what aspects of the phenomenon are of use in solving a practical problem. Often–

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[1] Graesser, A.C., McMahen, C.L., & Johnson, B.K. (1994). Question Asking and Answering. In M.A. Gernsbacher (Ed.), *Handbook of Psycholinguistics* (pp. 517–538). San Diego: Academic Press.

[2] Pomerantz, J. (2005). A Linguistic Analysis of Question Taxonomies. *Journal of the American Society for Information Science and Technology*, DOI: 10.1002/asi.20162
https://onlinelibrary.wiley.com/doi/10.1002/asi.20162

[3] Graesser, A.C., McMahen, C.L., & Johnson, B.K. (1994). Question Asking and Answering. In M.A. Gernsbacher (Ed.), *Handbook of Psycholinguistics* (pp. 517–538). San Diego: Academic Press.

– as in the case of social psychological research—the solution of a practical problem is merely instrumental to a more fundamental goal: improving the human condition[4].

1.1. Motivation to devise research questions for impact

In undertaking applied research, one method is to map the phenomenon of interest to a policy theme, so that the findings from one's research can inform a policy agenda, or inform the effectiveness of a policy intervention. This increases the probability that one's research will have an impact on society. For instance, the ESRC defines impact "…as the demonstrable contribution that excellent research makes to society and the economy"[5]. This definition is in keeping with the 'impact stories' published by the other UK research councils—the Arts and Humanities Research Council (AHRC)[6], the Biotechnology and Biological Sciences Research Council (BBSRC)[7], the Engineering and Physical Sciences Research Council (EPSRC)[8], the Economic and Social Research Council (ESRC)[9], Innovate UK (IUK)[10], the Medical Research Council (MRC)[11], the Natural Environment Research Council (NERC)[12], Research England (RE)[13], and the Science and Technology Facilities Council (STFC)[14].

Since 2005, the UK Data service—supported by UK Research Innovation (UKRI) via the ESRC––has published case studies (N= 249) of research that has been identified as illustrative of impact. The presentation of many of these impact case studies includes rhetorical research questions as well as the specific research questions addressed by the researcher(s) (N = 152). These case studies would typically be funded by the ESRC, so the general themes of the impact cases are: Business and Economy, Environment and Sustainability, Health and Wellbeing, Learning and Skills, Science and Technology, and Social Policy and Communities[15].

In analysing the impact of research, the most obvious approach would be to attempt to find reliable impact metrics. Yet, considering how researchers style their research questions regarding themes that have the potential for policy impact is also a useful exercise. From this, it is possible to see how the styles of researchers' questions match up to the styles of research questions generated by government bodies, agencies, and public bodies. Why would this be useful? The outcome of comparing the styling of research questions generated by researchers versus policy professionals, is to determine whether the questions are aligned, such that the

[4] Trafimow, D., & Osman, M. (2022). Barriers to Converting Applied Social Psychology to Bettering the Human Condition, Basic and Applied Social Psychology, DOI: 10.1080/01973533.2022.2051327 https://www.tandfonline.com/doi/full/10.1080/01973533.2022.2051327
[5] https://www.ukri.org/councils/esrc/impact-toolkit-for-economic-and-social-sciences/defining-impact/
[6] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/ahrc/
[7] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/bbsrc/
[8] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/epsrc/
[9] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/esrc/
[10] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/innovate-uk/
[11] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/mrc/
[12] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/nerc/
[13] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/research-england/
[14] https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/stfc/
[15] https://ukdataservice.ac.uk/impact/case-studies/

same theme is being interrogated in the same way. As indicated in the illustration in section 1, how research questions are styled impacts the types of findings that are generated. Thus, it is not only important that one's research topic is of interest to a wider academic community and to policy; it is also important *how* that research topic is investigated.

1.2. Motivation for Policy to publish research questions

The 2015 Nurse review[16] (of the UK's research councils) made recommendations to research councils regarding how they might improve their support of research—with an eye to increasing the relevance and impact of the research they fund. However, it also made recommendations to *government*. An important recommendation—designed to encourage greater engagement between government and research conducted in academic institutes and universities—was to for government departments to maintain "…'statements of need', in terms of the most important research questions…" that they face—in other words, they should clarify their ARIs.

In response, since 2017, the UK Government has published ARIs from many different government departments (N = 19), agencies, and public bodies (N = 4)[17]. The style of these reports varies from department to department. Some focus on identifying specific research themes, whereas others include a list of specific research questions (N = 2105). In principle, the questions that are published also give a good indication of the *types* of evidence that researchers are invited to contribute. This information is relevant to policy professionals and, in turn, can affect how the ESRC—and UKRI in the main—characterise 'impactful research'.

2. Study: Analysis of research questions from researchers and policy professionals

This study has two aims. The first is to examine—by classifying questions based on the structure of the information sought—the potential correspondence in question-styles from two expert groups: researchers and policy professionals. The questions examined are drawn from the impact case studies generated by researchers, as well as the ARI research questions generated by policy professionals from UK government departments, agencies, and public bodies.

To this end, two types of classification systems were used: a basic one which examines question stems (such as "what is…?", "how are…?", "what might…?", etc.) and the Taxonomy of Policy Questions (Osman & Cosstick, 2022).

The second aim is to examine the research questions based on subject matter and style. This incorporates understanding the patterns in the subject matter of questions generated by researchers versus policy professionals

[16] https://www.gov.uk/government/collections/nurse-review-of-research-councils
[17] https://www.gov.uk/government/collections/areas-of-research-interest

These aims will be achieved if answers can be provided to the following questions.

1. Is there a correspondence between the style of research questions generated by *researchers* versus *policy professionals*?
2. What patterns are there in the questions posed by research theme, and are they typically the same for both researchers and policy professionals?
3. If there are differences between researchers and policy professionals regarding the styles of questions they generate, what explains this difference?

The concluding section will revisit these objectives to provide broad conclusions based on the analysis conducted, and to provide some potential avenues for future efforts to improve the basis on which evidence generated by researchers generates impact in the guise of informing the evidential needs of policy.

3. Methodology

At the time the analysis of the research questions was conducted there were a total of 2105 questions sampled from the ARI website. Only ARIs published from UK Government departments, agencies, and public bodies that listed research questions were included. Of the 24 published ARI statements, a total of 18 included listed research questions from the period 2017 to 2021. For the impact case studies, of the 249, only those that included a research question—either in the title or in the made body of the impact case description—were included (N = 125). This generated a total of 152 research questions.

Corresponding to each question were the following details[18]: (1) a *unique number* to identify it (for the ARIs: 1 to 2105; for the impact case studies: 1 to 152), (2) which government department/agency/public body the ARIs were published by or the research area the impact case study was assigned to, (3) the *year* that the ARI was published or the year the Impactful research was conducted, (4) the *word length* of each research question.

3.1. Taxonomies: Two taxonomies were used to classify all of the research questions. The first was based on a basic system developed by Bloom *et al*.'s (1956)[19] 'Taxonomy of Educational Objectives', which outlines five basic types of questions: Synthesis (e.g. "what would…?", "how would…?"), Evaluation (e.g. "how should…?", "how effective…?"), Analysis (e.g. "how is…?", "how does…?"), Application (e.g. "could this…?", "how can…?") and Knowledge (e.g. "what…?", "how…?", "why…?", "*w*here…?"). Bloom *et al.*'s (1956) taxonomy is typically applied in the education sector, and has been substantially revised in the years

[18] For full access to all the raw data see: https://osf.io/rk42z/

[19] Bloom, B., Englehart, M. Furst, E., Hill, W., & Krathwohl, D. (1956). Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive domain. New York, Toronto: Longmans, Green

since its creation[20]. However, for the purposes of this analysis, the basic taxonomy was used, given that it is still captured by most of the later revisions of it.

The second classification system was developed by Osman and Cosstick (2022), and is referred to as the 'Taxonomy of Policy Questions'. It was adapted from Graesser, Person, and Huber's (1992)[21] 'Taxonomy of Question-Styles', and specifically developed to classify questions that are research-oriented and policy-related. The questions can be classified according to superordinate categories—Bounded (i.e. closed questions) and Unbounded (i.e. open ended questions)—and subordinate categories—Verification/Qualification, Comparison, Forecasting, Example/Explanation, Causal Analysis, Instrumental/Procedural/Enablement, Explaining/Asserting Value Judgments[22].

To ensure that the questions were classified appropriately, each was classified by two coders: the main author, and a second independent coder. Applying a stringent process for agreement—with only exact matches recorded—both coders agreed on 73.11% of the ARI questions. There is likely to be ambiguity in the classification of the questions because some questions incorporated several sub-questions and/or clarifications. In these cases, both coders examined the questions for which there were divergences in classification, and settled on an agreed system for interpreting these questions to then form the final classification of all questions.

3.2. Content Analysis: To examine the relationship between the style of questions generated by researchers and policy professionals by theme, the candidate themes were based on the impact case studies. The reason for generating the themes from the impact cases was that the research was explicitly identified as impactful, which implies that it ought to be of policy relevance. Thus, the aim was to find common themes and then explore the question-styles generated for those themes to see if they matched (in any way) the styles of the ARI questions that were also related to the same themes. The 152 research questions from the impact case studies revealed seven main themes: Business and Economy, Education, Employment, Energy, Environment, Health, and Transport.

The associated terms for each of the seven main themes were used to sort through the ARI research questions to identify any question that broadly corresponded to each theme. For example, Employment included 24 associated terms (such as 'pay gap', 'employment', 'unemployment', 'national living wage', 'minimum wage', 'retirement', and 'poverty') each of which was derived from the terms contained in the research questions from those impact

[20] Saxton, J., Miller, C., Laidlow, L., & O'Mara, J. (2018). *Asking Better Questions: Teaching and Learning for a Changing World.* Ontario: Pembroke Publishers Limited.

[21] Graesser, A.C., Person, N., & Huber, J. (1992). Mechanisms that Generate Questions. In T.W. Lauer, E. Peacock, & A.C. Graesser (Eds.), *Questions and Information Systems* (pp. 167–187). Hillsdale, NJ: Erlbaum.

[22] Osman, M., & Cosstick, N. (2022). A Taxonomy of Policy Questions: Examining Style of Policy Inquires https://psyarxiv.com/8k6jy/

case studies associated with the general main theme of Employment. The same process was used to generate associated terms for all of the seven main themes.

Therefore, along with the four details corresponding to each research question (unique number, organization/research area, date, and work length) the questions were also coded by subject matter, along with the classification of the question by style.

4. Results and Discussion

4.1. Styles of questions generated

The first classification system applied to the research questions was Bloom *et al.*'s (1956) taxonomy. The limitation of this classification system is that, since it was designed for educational purposes, it is not completely able to capture the full range of questions generated by both groups of experts (researchers and policy professionals).

Table 1. Percentage of research questions by Question Stem Type based on Bloom et al's (1956) Taxonomy

Question Stem Type*[23]	ARIS N = 2105	Impact case studies N = 152
Analysis	4.34	0.74
Synthesis	0.55	0
Application	5.24	0.74
Knowledge	11.91	8.72
Evaluation	0.73	0.11

Given that the first taxonomy applied to classify the research questions was limited in fully capturing all the questions, the second taxonomy was used and formed the basis of all other subsequent analyses of the styles of the research questions generated.

Table 2 indicates that Osman and Cosstick's (2022) Taxonomy of Policy Questions was able to fully classify all the ARI research questions and those from the impact case studies. The highlighted cells with emboldened text indicate the three most frequently occurring question-styles generated by each group. When considering the at the pattern of findings revealed in Table 2, three are of particular note. First, at the superordinate level of analysis, there were more Bounded (close answers) questions generated in the impact case studies (by researchers) than there were from the ARIs (generated by policy professionals). Questions that invite bounded answers are typically ones which invite a *specific* type of answer, either by providing a forced choice (yes/no), a future state of the world, or the outcome of a

[23] This is not a completely accurate number, as a single question may fall into more than one classification—so this is only broadly indicative of the proportion of questions captured by the classification system.

comparison. Of the questions generated by researchers, here we see that the most common style of question inviting a bounded answer was the Verification/Qualification style.

Second, as indicated in Table 2, there are also differences between the two groups of experts according to the subordinate styles of questions generated. The most common style of question generated by researchers was Causal Analytic. Such questions typically address factors associated with mechanisms, explanatory factors contributing to the generation of an outcome, and/or explain the possible outcomes that might follow from a specific intervention. In contrast, the most common research question generated by policy professionals was the Instrumental/Procedural/Enablement type. Such questions typically invite answers which outline types of strategies, interventions, and/or methods of measurement that could be implemented.

Third, researchers and policy professionals displayed some overlap in their preference for generating Example/Explanation questions. Questions of this style typically invite answers that provide definitions of an event or entity, or provide an account of existing evidence that supports a claim or supposition. While there is a difference in the proportion of total questions that fell into this type of question—where the ARIs included more of this type than the impact case studies—this type of question was, at least, common for both.

Table 2. Percentage of research questions based on Osman and Cosstick (2022) Taxonomy of Policy Questions

Super-ordinate category	Sub-ordinate category	Abstract specification	ARIS (%) N = 2105	Impact case studies (%) N = 152
Questions inviting bounded Answers	Verification/ Qualification	*Is it the case that X is here? Did X event occur? Are Xs more inclined towards Y? Is X a viable version of Y?*	5.13	**32.24**
	Comparison	*What are the strengths and weaknesses of X? What are the costs and benefits of implementing X?*	2.33	2.63
	Forecasting	*Which areas would you foresee improving in the next X years? How likely is it that X will be popular in the future?*	3.09	0
Total			10.55	34.87
Unbounded Answers	Example/Explanation	*Which X is more like Y? What would be a case where Y is like X? How does X work?*	**26.51**	**17.11**
	Casual Analysis (antecedents or consequences)	*What are the barriers that will prevent X from occurring? What are the effects of X if it is implemented now?*	**17.10**	**28.29**
	Instrumental /Procedural/Enablement	*How can we use X to make Y better? What would need to be incorporated to ensure that X is produced? In what way can we measure X so that it can later be used to support Y?*	**31.54**	9.21
	Explaining/ Asserting Value judgments	*How should the infrastructure available be used to produce X? How should X respond to Y?*	14.30	10.52
Total			89.45	65.13

Through the analysis of the research questions, several other properties of the questions were analysed and are presented in Table 3. Research questions from ARIS were collected from a total of 18 different government departments, agencies, and public bodies. There is considerable variation between different governmental organisations regarding the number of research questions they publish (ranging from 11 to 352, overall *M* = 116.94, *SD* = 106.11). In addition, the average word count of the research questions varies (range from *M* = 14.45 to *M* = 26.13). The overall average of ARI research questions (overall *M* = 18.15, *SD* = 8.00) is longer than the overall average of the impact case studies' research questions (*M* = 14.88, *SD* = 9.01).

While it might be hard to standardise the word length of research questions, given the wide range in the number of research questions published in ARIs, it may be worth generating a manageable number that would make the process of matching relevant evidence to the research needs of government easier to identify. For instance, sifting through over 200 questions of varying lengths—such as those published by Department for Business, Energy, and Industrial Strategy, Department for Transport, and Parliamentary Office of Science and HM Technology—could make it hard for researchers to begin to develop projects to address them, and may feel overwhelmed in any attempts to contribute.

Table 3. Basic details of research questions by average word count and range, frequency and type of question (Bounded, Unbounded) by government department, agency, and public body

ARIS and impact case questions	Year	No. of Qs	Mean word count	SD (word count)	Bounded %	Unbounded %
Cabinet Office	2017	75	20.25	8.57	9.33	90.67
Department for Digital, Culture, Media, and Sport	2018	34	15.53	7.12	17.65	82.35
Department Education	2018	28	20.32	8.89	10.71	89.29
Department Work and Pensions	2018	63	22.52	9.97	11.11	88.89
Ministry of Defence	2018	42	19.88	10.64	4.76	95.24
Ministry of Justice	2018	111	19.94	7.68	10.81	89.19
Cabinet Office	2019	93	20.27	8.42	2.15	97.85
Department for Business, Energy and Industrial Strategy	2020	272	19.69	9.46	15.81	84.19
Department for International Trade	2020	187	17.59	5.55	3.21	96.79
Food Standards Agency	2020	11	18.00	4.38	0.00	100.00
Foreign and Commonwealth Office	2020	40	14.45	7.91	20.00	80.00
Ministry of Justice	2020	166	18.66	6.43	7.83	92.17
National Archives	2020	20	16.95	3.87	0.00	100.00
Department for Environment, Food, and Rural Affairs	2021	166	23.45	10.18	3.61	96.39
Health and Safety Executive	2021	82	26.13	10.83	6.10	93.90
International Trade Committee	2021	39	18.23	7.66	12.82	87.18
Department for Transport	2021	324	18.60	8.32	12.96	87.04
Parliamentary Office of Science and Technology	2020	352	14.63	5.06	16.76	83.24
Total ARIs	2017-2021	M=116.94	M=18.15	SD = 8.00	10.55	89.45
Impact case studies	2005 -2021	152	M = 14.88	SD = 9.01	34.87	65.13

4.2. Analysis of the research questions' subject matter

The second area of analysis was the subject matter of the research questions which were anchored to the research themes of the impact case studies. The content analysis revealed seven main themes: Employment, Transport, Business and Economy, Environment, Education, and Energy and Health. The findings reported in Table 4 give some indication of the popularity of each theme. Research questions from the impact case studies (generated by researchers) were most commonly associated with Health and Employment, whereas research questions from ARIs (generated by policy professionals) were most commonly

associated with Business and Economy. It should be noted that, whilst the seven themes capture the bulk of the questions generated by researchers, they do not adequately capture the research themes that are associated with ARIs. The most common research theme—Business and Economy—only accounted for ~14% of all research questions. Moreover, only ~37% of the ARI research questions could be categorised into one of the seven themed categories. This implies that there were research areas not covered by the research impact cases. However, the inadequacy of the seven themes might be explained by the fact that the research impact cases were based on research funded predominately by the ESRC. Thus, other research projects utilising expertise related to other disciplines (such as medical research, physics, technology, and computing) may have revealed research themes that captured a greater proportion of the ARI research questions.

Table 4. Percentage of research questions (Impact case studies, ARIS) that were associated with each of the seven themes.

Research themes	Total UKRI Impact Cases research questions related per theme (%) N = 152	Total ARIs research questions related per theme (%) N = 2105	No. of gov. depts., agencies, public bodies with questions related per theme (%) N = 18
Employment	23.03*[24]	3.57*	88.89
Transport	5.26	7.61	27.75
Health	28.95	4.48	66.67
Environment	16.45	2.35	33.33
Education	16.48	3.06	38.85
Business & Economy	17.76	14.43	83.25
Energy	7.24	1.69	33.33

The full data set (see https://osf.io/rk42z/) contains a comprehensive list of all ARI research questions per theme. For instance, the majority of questions associated with Employment were generated by the Department for Work and Pensions, the majority of questions associated with the Environment were generated from the Department for Environment, Food and Rural Affairs, and so on. Thus, consistent with what would be expected, for each theme the government departments, agencies, and public bodies most likely to be associated with that theme also generate the most research questions related it.

The second noteworthy finding revealed from the analysis of the research questions' content is that a number of government departments published research questions related to a single theme. Moreover, nearly all of the government departments, agencies, and public bodies published at least one research question associated with the themes of Employment and Business and Economy. The fact that many government departments, agencies, and public

[24] It should be noted that the values presented in each column are not independent, given that a research question can contain more than one theme. Thus, the percentages do not refer to absolute values, but are generally indicative of the proportion of all research questions generated associated per theme.

bodies converge on the same themes suggests that there may be a need for some form of coordination between them, even if they apply their findings for different purposes. This issue is explored in the next section in more depth with some examples.

4.3. Examples of correspondence between ARI research questions and impact case study research questions by theme

As mentioned in section 4.2, one could predict in advance which government departments, agencies, or public bodies would generate the most ARI research questions related to each of the seven topics based on the domains they develop policies for. Furthermore, as revealed in the full data set, there is a correspondence between the government bodies that generate the most ARIs related to the topic in the impact cases. For instance, the Department for Transport generated the most ARIs related to the theme of Transport.

To illustrate, there was an impact case study published in 2011 with the research question "Free bus pass policy: Does it keep our senior citizens slim?" This focuses on buses as the transport mode, and concerns their use and impact on senior citizens, specifically healthy lifestyles. Since the records have been published (from 2002 to date) those aged 50+ that use bus services typically make up about 30% of trips given all ages using bus services[25], therefore the findings are relevant for a considerable sector of the population that uses this service.

In 2021, the Department for Transport published 324 research questions[26], of which seven concern buses. At least three of these seven could utilise the research highlighted in the free bus pass policy impact case: "How can we invest in rail, cycling, walking and an improved bus network to improve connectivity within small towns and cities, and enable access to economic opportunities by connecting people with employment centres and key services at a local level?", "Where have bus services been a success (either in the UK or internationally) and why were they successful? How is it related to history, socio-economic and demographic factors, alternative travel modes and financial and other incentives?", and "What digital and cashless payment methods are feasible on different modes and services including bus, coach, metro and train and how do we minimise exclusion during a transition?". The findings from this research would also be relevant to some of the research questions which are not directly related to buses, such as "What is the lived experience of users of transport based on protected characteristics; gender, age, ethnicity, physical & mental disability? How do these categories interact? How will future transport demand vary in different demographic groups?".

The free bus pass policy impact case does not explicitly connect to the subject matter of other Department of Transport research questions, but could still be relevant if some lateral

[25] https://www.gov.uk/government/statistical-data-sets/nts03-modal-comparisons#mode-by-age-and-gender

[26] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009521/areas-of-research-interest-2021.pdf

thinking is applied. For instance, if services are to be improved and modernised, then it is worth considering a population of service users, with mobility issues, who gain health benefits from greater access to them—because using bus service encourages older adults toward greater socialising and mobility (since they benefit from the exercise gained via walking to, and from, bus stops). Understanding how the elderly use bus services would also be instrumental to the task of prioritising bus service improvements in a way which benefits this community. The original work from the impact case was published in 2011, and so, over 10 years on, the findings may not be directly applicable. Yet, it would be of interest to see how much does still apply, and where there are differences. Such research focuses on only one type of user, and so not all of the work would generalise across time or to other types of users of bus services. Nonetheless, the evidence it yields would still likely be of value.

Another topical area for which there has been considerable interest is whether there are inequalities concerning wages—for instance if there is an ethnicity pay gap, or gender pay gap. There are at least two impact cases that relate to this issue. An impact case study published in 2011 included the question "Why does the work women do pay less than the work men do?". A 2020 research question, published by the Department for Business, Energy, and Industrial Strategy, relates to this: "Does gender pay gap reporting lead to a narrowing of gender pay gaps and, if so, through what channels does this work?". Even though there is a decade that separates these research questions, clearly there is a close match between the focus of the questions from both expert groups.

It might be argued that the examples given so far are problematic, as they only show a correspondence between current areas of research interest (for policymakers) and *dated* research. However, such a correspondence can also be seen between current areas of research interest and more *recent* impact case studies. For example, in 2020, an impact case study included the following research question: "How does the minimum wage impact on employment and hours?". Again, another relevant question as part of the Department for Business, Energy, and Industrial Strategy's ARIs in 2020 is "Does a rising minimum wage create incentives for businesses to make productivity enhancing-investments?". In 2018, the Department for Work and Pensions published this research question: "How is the labour market evolving, including the demand for, and supply of, skills, and how should [the Department for Work and Pensions] respond to improve outcomes for individuals, employers and the economy? For example, how might the labour market change because of technological changes, economic and demographic trends, leaving the EU, changes in trade and migration, and other policy developments such as the National Living Wage?". In 2020, the Department for International Trade published this research question: "What is the effect on wages, employment and survival on UK exporters versus non exporters?". Moreover, in 2021, the Department for Transport published this research question: "What is the wage elasticity of labour supply and what factors affect this?".

In considering this case, there are two important matters that are worth highlighting. The first is *timing*. The Department for Work and Pensions published their research question in 2018, and the Department for Business, Energy, and Industrial Strategy published their question in 2020. The research outputs were presented on the UK Data site of research funded by the ESRC (UKRI) in 2020. This means that the research findings were still of relevance at the time of presentation. In addition, for the Department for Transport and the Department for International Trade, research questions related to the topic of wages are even more timely as this theme coincides with current issues. Second, this is a good example of how the core theme of a research project is relevant to several research questions that government bodies generate, and that several government bodies converge upon the same research topic—in this case on minimum wage (and by association the national living wage). Such convergence means that they could, if they were aware of the commonality in their research questions, coordinate across the different bodies to maximise the outputs of future research by sharing the findings across government departments—rather than operating in silos and likely expending considerable effort on replication.

4.4. Analysis of themes of research by styles of research questions

Table 5 presents the proportion of research questions generated by each group—researchers (impact case studies) and policy professionals (ARIs)—classified according to the seven classes of question-styles from the Taxonomy of Policy Questions (Osman & Cosstick, 2022). The highlighted cells and emboldened text indicate the most frequently occurring question-styles generated by each group for each of the seven themes.

Table 5. Percentage of types of research questions (Impact case studies, ARIS) that were associated with each of the seven themes.

		Years	Verification/ Qualification	Comparison	Forecasting	Example/ Explanation	Casual Analysis	Instrumental /Procedural/ Enablement	Explaining/ Asserting Value judgments
Employment	Impact	2010 - 2020	25.71	5.71	0.00	14.29	**40.00**	5.71	0.00
	ARI	2017 - 2021	2.63	0.00	5.26	26.32	**31.58**	23.68	10.53
Transport	Impact	2011 - 2019	**37.50**	0.00	0.00	**37.50**	0.00	0.00	0.00
	ARI	2017 - 2021	5.56	4.32	2.47	24.07	19.75	**32.10**	11.73
Health	Impact	2009 - 2019	**50.00**	2.27	0.00	13.64	27.27	4.55	0.00
	ARI	2018 - 2021	6.93	0.00	4.95	17.82	19.80	**36.63**	13.86
Environment	Impact	2012 - 2020	25.00	0.00	0.00	**37.50**	25.00	12.50	0.00
	ARI	2017 - 2021	2.00	2.00	4.00	22.00	20.00	**48.00**	2.00
Education	Impact	2011 - 2020	**52.00**	0.00	0.00	12.00	28.00	8.00	0.00
	ARI	2018 - 2021	7.69	1.54	3.08	**26.15**	21.54	24.62	15.38
Bus & Econ	Impact	2008 - 2020	22.22	0.00	0.00	11.11	**29.63**	18.52	0.00
	ARI	2017 - 2021	4.23	1.95	1.95	25.41	21.50	**28.66**	16.29

Energy	Impact	2014 - 2019	18.18	0.00	0.00	0.00	**45.45**	36.36	0.00
	ARI	2017 - 2021	5.56	0.00	5.56	**33.33**	19.44	16.67	19.44

It is clear from the patterns revealed in Table 5's highlighted cells that the most frequently generated question-styles vary by expert group. As with the general analysis the research questions—in impact case studies versus ARIs—by style (see Table 2 in section 4.1), Instrumental/Procedural/Enablement along with Example/Explanation-style questions were most commonly generated by policy professionals (in the ARIs), whereas Causal analytic and Verification/Qualification-style questions were most commonly generated by researchers (in the impact case studies).

Some caution needs to be taken regarding any inferences concerning the question-styles commonly associated with a theme, because the sampling of the research questions that researchers generated was based on the impact case studies. This is not a complete reflection of the full range of empirical questions that the projects addressed, which are likely to be found in the published academic outputs from the research projects. Nonetheless, the questions presented in the impact case studies give a *general impression* of the attempts that researchers took to style the research in ways that would be appealing to audiences—such as policy professionals. and would help in providing some definitive answers. It is perhaps for this reason that, for many of the themes, efforts were taken to generate questions that provided bounded (closed) answers. For example, the questions "Does broadband access make UK firms more successful?", "Do higher wages come at a price?", and "Do higher energy prices affect international trade?" invite yes or no answers, which are later qualified with reference to specific findings generated in the research.

Health (total = 44(29%)/152) and Education (total = 25(16%)/152) were the themes that generated the most Verification/Qualification type questions in the impact case studies. This was, perhaps, because they were also the most frequently occurring themes addressed by the impact case studies. To give an indication of popularity, other popular themes addressed by the impact cases were Employment (total = 35(23%)/152) and Business and Economy (total = 27(18%)/152).

The most common style of research question published in ARIs was Instrumental/Procedural/Enablement. This was the most common question-style within the Transport, Health, Environment, and Business and Economy themes. For Education and Energy, the most frequently occurring research question-style in ARIs was Example/Explanation. Employment was the only theme for which there was a match between the most common style of question in both the ARIs *and* the impact case studies: Causal Analysis. With the latter exception, it is clear that the common type of questions posed by researchers for all other themes were not aligned with the common types of question published in ARIs.

Is it the case that certain themes lend themselves to particular question-styles? Alternatively, is it the case that, for certain themes simply have a greater volume of questions from which it is possible to detect common question-styles? It is hard to answer this question given that the sampling of the research questions from the impact cases was fixed by what was identified as impactful research. Therefore, this sample cannot be a complete reflection of the full range of research that is being conducted in UK research institutions. Thus, any inferences based on the analysis presented here need to be caveated, because of the data that was included. Future work would be needed, which would sample from a wider pool of questions that researchers generate to frame their research, and then examine the types of questions by the same themes to determine if the findings here generalise. Yet, it is worth highlighting the value of looking at the questions presented in the impact case studies. These are questions framing work that is specifically identified as impactful, with the aim that it has applicability to policy. Therefore, taking these caveats into account, what this analysis shows is that whereas policy professionals typically invite answers to questions around what to do (i.e. ask Instrumental/Procedural/Enablement questions) on the themes of Transport, Health, Environment, and Business and Economy, researchers do not typically generate answers of this kind—Transport (0%), Health (~5%), Environment (~13%) and Business and Economy (~19%).

5. General Discussion

The aim of the work presented in this paper was to address the following three main objectives. In this section, each one is taken in turn, to provide general insights regarding what the findings revealed.

1. Is there a correspondence between the style of research questions generated by *researchers* versus *policy professionals*?

In general, the answer to this question is no. It is clear from the classification system (the Taxonomy of Policy Questions) that the common question-styles that policy professionals utilise are not aligned with the common question-styles that researchers pose, and try to address.

2. What patterns are there in the questions posed by research theme, and are they typically the same for both researchers and policy professionals?

At a general level, researchers frame their research in ways that provide specific answers (Bounded: ~35%) more often that questions that policy professionals invite (Bounded: ~11%). Moreover, on average the research questions that researchers generate (M =14.88, SD = 9.01) are shorter than those generated by policy professionals (M = 18.15, SD = 8.00). This strongly suggests that researchers ask more succinct questions, at least for the purposes of inviting interest to their work.

The most common style of research questions that policy professionals pose invites solutions or recommendations for what to do (i.e. Instrumental/Procedural/Enablement questions) (see Table 2 in section 4.1). The second most common style of research question posed by researchers invites answers which define, give examples of, or explain a particular phenomenon (i.e. Example/Explanation questions) (see Table 2 in section 4.1)..

The most common style of research question that researchers pose invites specific answers (i.e. Verification/Qualification questions) (see Table 2 in section 4.1). The second most common style of research questions posed by researchers invites answers which outline the factors that might explain the occurrence of, or mechanisms behind, a phenomenon, or the consequences which will result from some event (i.e. Causal Analysis questions). When examining each question according to common themes that the impact case studies addressed, these two question-styles remained the most common.

3. If there are differences between researchers and policy professionals regarding the styles of questions they generate, what explains this difference?

The method of classification is the first obvious potential explanation for the difference between the common styles of research questions generated by researchers versus policy professionals. The Taxonomy of Policy questions was designed specifically to capture the question-styles that policy professionals (in public and private sector organisations). generate. However, the origins of the taxonomy upon which it was based—Graesser, Person, and Huber's (1992)[27] Taxonomy of Question-Styles—suggest that it has far more general applications. The Taxonomy of Question-Styles has been applied to classifying questions generated in the educational sector[28,29,30,31] . It has also played an applied, foundational, and/or supplemental role in studies analyzing web search strategies[32,33,34], consumer health-

[27] Graesser, A.C., Person, N., & Huber, J. (1992). Mechanisms that generate questions. In T.W. Lauer, E. Peacock, & A.C. Graesser (Eds.), Questions and information systems (pp. 167–187). Hillsdale, NJ: Erlbaum.
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[31] Veerman, A., Andriessen, J., & Kanselaar, G. (2002). Collaborative Argumentation in Academic Education. *Instructional Science*, DOI: 10.1023/A:1015100631027 https://doi.org/10.1023/A:1015100631027
[32] Ulyshen, T. Z., Koehler, M. J. & Gao, F. (2015). Understanding the Connection Between Epistemic Beliefs and Internet Searching. *Journal of Educational Computing Research*, DOI: 10.1177/0735633115599604 https://journals.sagepub.com/doi/10.1177/0735633115599604
[33] Lavender, K., Nicholson, S. & Pomerantz, J. (2005). Building Bridges for Collaborative Digital Reference Between Libraries and Museums Through an Examination of Reference in Special Collections. *The Journal of Academic Librarianship*, DOI: 10.1016/j.acalib.2004.12.013 https://doi.org/10.1016/j.acalib.2004.12.013
[34] White, M. D. & Iivonen, M. (2001). Questions as a factor in web search strategy. *Information Processing & Management*, DOI: 10.1016/S0306-4573(00)00043-1 https://doi.org/10.1016/S0306-4573(00)00043-1

related inquiries[35], interpersonal exchanges[36], and interview settings[37]. Moreover, the main category structure in the Taxonomy of Policy Questions retains many of the basic categories included in the Taxonomy of Question-Styles; in this regard the system of classification is still generalisable to domains outside of policy. Also, even if the taxonomy used to classify research questions is specific to policy, it gives some indication of the extent to which researchers generate questions that map onto those posed by policy professionals.

A deeper explanation for the misalignment between the question-styles of researchers and policy professionals stems from investigating the styles of questions commonly posed by each group, to find clues as to their motivations. It is unsurprising that researchers try to answer questions that look at mechanisms, and therefore—by their very nature—are going to be styled in ways that invite a causal analytic approach. In order to understand a phenomenon, not only is there a need to characterise it, but also explain it. This typically entails uncovering its causes and associated effects.

Providing evidence that addresses these matters is of epistemic value, and in the direct jurisdiction of scientific research. It is only of relevance to look at what one can do with this evidence—by supporting interventions informed by the evidence—if one is concerned with applied research. Though even there, there is work to suggest that researchers are often nervous about making proposals and recommendations for what ought to be done, for fear of veering into the realm of advocacy[38]. Advocacy is not within the typical jurisdiction of science, because scientific research is designed to explain phenomena and offer solutions to technical issues, rather than propose policy interventions. Even applied researchers do not––and some would argue should not—advocate for a particular policy, because their research is designed to examine what types of interventions *work* successfully, not what interventions should be used, given a particular policy agenda.

As a result, it should not be a surprise that overall, in a like-for-like comparison, less than 10% of all research questions that researchers generated were directed towards answering questions that were Instrumental/Procedural/Enablement, whereas over 30% of questions that policy professionals generated, were of this type. By the same token, while researchers were commonly generating questions that addressed Causal analytic aims, far fewer questions of this type were generated by policy professionals. This indicates that policy

[35] White, M. D. (2000). Questioning Behavior on a Consumer Health Electronic List. *The Library Quarterly: Information, Community, Policy*, DOI: 10.1086/603195
https://www.journals.uchicago.edu/doi/10.1086/603195

[36] Huang, K., Yeomans, M., Brooks, A. W., Minson, J. & Gino, F. (2017). It Doesn't Hurt to Ask: Question-Asking Increases Liking. *Journal of Personality and Social Psychology,* DOI: 10.1037/pspi0000097

[37] White, M. D. (1998). Questions in Reference Interviews. *Journal of Documentation*, DOI: 10.1108/EUM0000000007177
https://www.emerald.com/insight/content/doi/10.1108/EUM0000000007177/full/html

[38] Trafimow, D., & Osman, M. (2022). Barriers to Converting Applied Social Psychology to Bettering the Human Condition, Basic and Applied Social Psychology, DOI: 10.1080/01973533.2022.2051327
https://www.tandfonline.com/doi/full/10.1080/01973533.2022.2051327

professionals are asking more questions that involve solutions regarding what to do, and less about understanding the causal facts that underlie their instrumental concerns. This may place undue responsibility on researchers, who may consider it not within their purview to provide such evidence for policy professionals. This speaks to a broader issue regarding the kind of evidence that ought to be sought out by policy professionals. There is a need for a clearer demarcation between scientific evidence to inform policy, and the use of evidence by policymakers to determine what policies to implement. Whilst it isn't surprising that policymakers also frequently ask questions that are of a practical nature—given their focus on practical issues—this may not be the optimal approach to take when styling questions to invite researchers to contribute to.

Moreover, while not common, policy professionals published questions in ARIs that invited responses from researchers which Explained/Asserted Value Judgments. In the same vein as the discussion on inviting answers to Instrumental/Procedural/Enablement questions, it is worth considering how appropriate it is to invite researchers to make value judgments. The evidence provided to policy professionals is often conceived of as independent and value free. Making value judgments, even if they are justified and explained, may also veer into the territory of opinion, when instead the evidence that is provided is likely to be of value because it is impartial.

Finally, outside of the main objectives that the analysis aimed to address, one other finding is worthy of discussion. Many government departments, agencies, and public bodies generated research questions that converged on the same topic. For some topics, nearly all of the governmental organisations generated research questions. There is likely a complete lack of coordination of the research questions across government organisations. Generating research question to publish in ARIs requires considerable effort, even within a single government analytics team that is at the coalface of providing evidence—since they have to coordinate with other teams to ensure the research questions are of relevance across the board. It is even harder to then coordinate these efforts with other government departments, agencies and public bodies. It is likely that the analysis provided in this paper is the first attempt at curating all ARI research questions into one database, given that currently all ARIs are published in separate individual documents per government department, agency, and public body. By collating all the questions into one resource, it is possible to determine where there are overlaps across governmental agencies in the types of questions they ask around a single theme. In order to maximise research impact, a useful and practical step could be to commission research projects where the evidence can be utilised for more than one governmental organisation. Moreover, this would be one way to reduce replication of effort.

6. Conclusions

This paper has presented the findings from analysis of research questions generated by researchers and policy professionals. Researchers' questions were published in impact case studies, which are identified as example of research that is of relevance to policy. Policy professionals' questions were published in documents that indicate ARIs, in which evidence is invited to address the needs of policy for a government department, agency, or public body. The findings reveal that the research questions posed by researchers and policy professionals—even if they are designed to generate evidence to address the same theme—are typically misaligned. Researchers typically ask questions which invite Causal Analytic answers. In contrast, policy professionals typically ask questions which invite practical solutions. In order to improve the engagement between researchers and policy professionals, there may need to be a reformulation of the styles of research questions that policy professionals generate, thereby bringing them closer to the styles of questions that researchers pose. The reason for this is that—as shown in the impact case studies—generating impactful research generally involves asking questions that are answered with respect to understanding the phenomena of interest to policy. It does not generally involve proposing a particular policy approach that could be taken. Researchers are likely to see the former as a task they are trained to address; whereas, the latter is likely to be seen as something that is within the jurisdiction of policymakers.